Ministry of Environment
Republic of Korea

ORIENTAL STORK

(*Ciconia boyciana*)

SPECIES CONSERVATION PLANNING WORKSHOP (SCP|PVA)

5– 7 February 2023

Final Report

국립생태원 2013-2023 anniversary

IUCN SSC Species Survival Commission

CONSERVATION PLANNING SPECIALIST GROUP

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Workshop facilitators and modeller: Onnie Byers and Caroline Lees (CPSG), Moonhyun Shin and Hakbong Lee (NIE)

PVA data collection: (see PVA report, page 23)

Translator: Seongeun Yang

A full list of workshop participants is provided in Appendix I of this document and all are thanked for their contributions. **This document was compiled and edited** with help from Moonhyun Shin, Onnie Byers and Caroline Lees.

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INTRODUCTION

The Oriental stork, (*Ciconia boyciana),* is a wetland species that spends time foraging in rice fields and riversides. Currently listed as 'Endangered' by the IUCN (IUCN Red List of Threatened Species 2015), the global population of Oriental Storks is estimated to be around 3000 individuals (BirdLife International 2023) and is distributed across Southeast Asia including Russia, China, Korea, and Japan. These birds were once common in the Korean peninsula, but during the 1950s through to the 1970s, the population declined to extinction due to destruction of nesting sites, food shortage and the use of pesticides (Park et al. 2017). A reintroduced population of birds now resides in the Korean peninsula, threats to which include electrocution and collision with power lines, poisoning through pesticides, loss of habitat, and predation (by native predators).

In 2021, the IUCN SSC Conservation Planning Specialist Group (CPSG) was invited to work with South Korean experts and stakeholders, to help to plan a future for this species. Due to covid 19 restrictions, the face-to-face workshop had to be postponed but the communications, logistical preparations, and initial planning process steps continued, including a population viability assessment held in June 2023.

The Oriental stork species planning project is part of a larger, three workshop collaboration between IUCN and the South Korean Ministry of Environment. In addition to this project, planning processes took place in February 2023 for the Korean Stumpy bullhead *(Pseudobagrus brevicorpus)* and the Korean green spotted pond frog *(Rana chosenica)*. Importantly, this collaboration includes a capacity building element. Through an increasingly intensive series of training, mentoring and coaching sessions, the intent is to develop a South Korean team capable of conducting CPSG-style species conservation planning processes.

THE WORKSHOP

In September 2023, at the invitation of the National Institute of Ecology, more than 40 delegates gathered for three days in Cheongju-Si, South Korea to build an Oriental stork Conservation Action Plan. In attendance were representatives from 10 organizations including IUCN, National Institute of Ecology, Cultural Heritage Administration, Eco-Institute for Oriental Stork, Yesan Oriental Stork Park, Korea Electric Power Corporation, Honam National Institute of Biological Research, Kongju National University, Jeonbuk National University, and Center for Anthropcene Studies. (See page 71 for the complete list of participants.)

The event was organised by Ministry of Environment, co-hosted by National Institute of Ecology, and facilitated by the IUCN SSC Conservation Planning Specialist Group (CPSG).

The workshop began with a series of presentations including an introduction to CPSG and the Species Conservation Planning workshop process, two presentations to clarify the current state of knowledge of the Oriental stork, and a report on the Population Viability Analysis process and results. Participants then worked collaboratively to agree what successful conservation of the Oriental stork could look like in 2050 (see **BOX 1**). This vision for the future served as a guide for the development of the rest of the species conservation action plan.

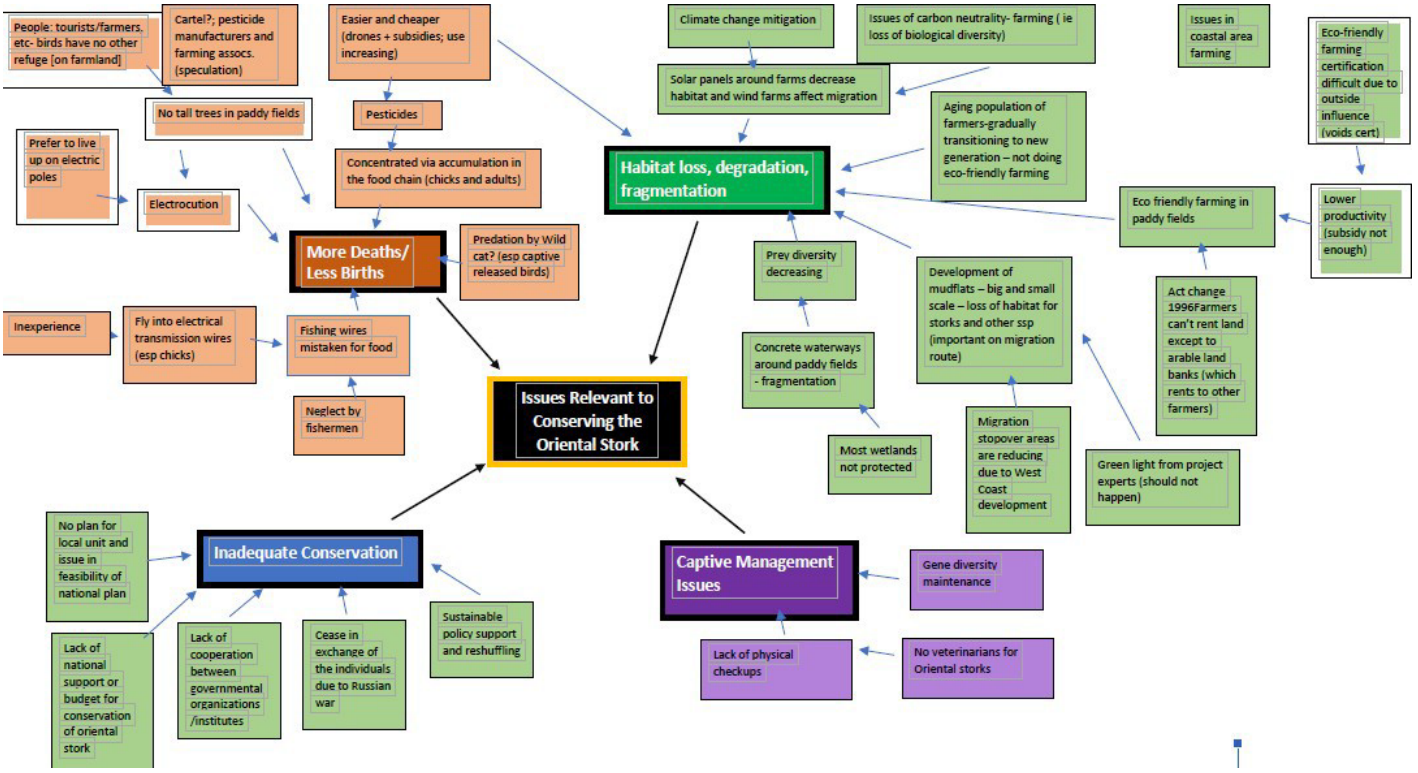
BOX 1. Vision for the Oriental stork

2053년 황새 복원이 성공적으로 이루어져 유전적 다양성을 유지하는 안정적 개체군이 500개체 1,000개체로 자체적으로 유지되고 있다. IUCN 한국 적색목록 멸종위기종 등급은 해제 혹은 하향 조정되었다. 개체군 복원이 성공적으로 이루어져, 이제 지속가능한 서식지 관리를 위한 전담 기구가 활동하고 있다. 2053년 황새가 이용가능한 건강한 서식지가 한국 전역에 확대 및 유지되고 있으며, 이에 따라 황새의 분포가 도서 지역을 포함한 한국 전역으로 넓혀졌다. 특히 한국 전역에 친환경 농업의 비율이 확대되어 국민의 건강한 식생활에도 큰 진전을 이루었다. 각 지역마다 황새가 안정적으로 번식할 수 있는 여건이 확대되었다. 친환경 농업과 생물다양성 증진의 상징으로서 황새에 대한 대중 인식이 확대되었으며, 대한민국의 상징 새로 여겨지고 있다. 해외에도 성공적인 야생동물 도입 사례로 유명해졌으며 국제적인 생태 관광의 상징이 되었다. 황새 복원 관련 국제 협력이 성공적으로 이루어져 동북아 황새 생태축 복원에 기여하고 있다.

In 2053, stork restoration is a resounding success, with a stable population of 500 to 1,000 individuals maintaining genetic diversity, thus ensuring self-sustainability. The IUCN Red List of Threatened Species in Korea is either removed or downgraded. Population restoration has been so successful that there is now a dedicated organization for sustainable habitat management. By 2053, the amount of healthy habitat available to storks has expanded and is consistently maintained throughout the country, including on the islands. Moreover, the proportion of eco-friendly agriculture has significantly increased across the nation, leading to considerable improvements in people's diets. In each region, the conditions for storks to breed steadily expand. Public awareness of the stork as a symbol of eco-friendly agriculture and biodiversity has grown, and it is now proudly recognized as the national bird of Korea. Internationally, it has gained fame as a successful example of wildlife introduction and serves as a global symbol of ecotourism. International cooperation in stork restoration has proven highly successful, contributing to the restoration of the Northeast Asian stork ecological axis.

Next, workshop participants described the challenges to the Oriental stork's recovery and conservation. On days two and three, participants identified clear goals for addressing these challenges and recommended agreed-upon actions to achieve the goals. Discussions were supported by population simulation models that helped to quantify the relative risks of known threats to Oriental stork and the relative benefits of proposed conservation strategies (See page 23 for the complete PVA report).

CHALLENGES TO RECOVERY & CONSERVATION OF THE ORIENTAL STORK



These issues relevant to successful recovery and conservation of Oriental stork were condensed into three working group themes:

- **PVA and captive populations**
- **Impacts of farming, fishing and energy generation**
- **Governmental legislation and cooperation**

Within each theme, participants worked to describe each challenge, including a description of its causes and impacts, the facts and assumptions around it, and existing data gaps that need to be filled (see working group notes, page 71). Then, goals for addressing these challenges were identified and prioritized.

GOALS TO ADDRESS THE ISSUES FACING ORIENTAL STORK CONSERVATION AND RECOVERY

The following goals were identified to address the issues and then prioritized by all participants on the basis of importance, urgency and feasibility.

#	Goal Prioritization Table	Achievability	Importance	Urgency	Total
1.	Eco-friendly agriculture increased up to 10% by 2030	0	5	8	13
2.	Completion of Material Cycling farming in local areas	1	2	2	5
3.	Designation of nature reserve in Yesan-gun	0	7	4	11
4.	Improve awareness of resident people	6	2	3	11
5.	Research core habitats of Oriental Stork	5	3	0	8
6.	Research impact of drone pest control on eco-friendly farming lands	0	0	0	0
7.	Assessment of ecological crop damage in the region due to drone pesticide application	0	0	0	0
8.	Status assessment of drone pest control	3	1	0	4
9.	Improvement of Environmental Impact Assessment for mudflat reclamation lands	1	4	2	7
10.	Improvement of certificate systems for eco-friendly agricultural products	4	4	2	10
11.	Input of responsibility of government officers with conservation education	0	3	0	0
12.	Establishment of exchange programs between professionals and amateurs	1	3	0	4
13.	Reinforcement of Environmental Impact Assessment in solar power industries	0	0	0	0
14.	Change in EIS from qualitative to quantitative ways	1	7	0	8
15.	Expansion of civil exchange (facilitating public cooperation internationally)	7	6	1	14
16.	Installing a device to prevent bird crashing near the oriental stork's habitat in Yesan area until 2028	6	3	2	11
17.	Establishing an artificial tower near the habitats to replace telephone pole (for rest and breeding purposes)	6	2	1	9
18.	When government-owned farms practice eco-friendly farming the difference in farm profits is compensated	2	5	1	8
19.	Development of an appropriate natural adaptation training program [for release birds?] (training content, period, facilities, pre-release evaluation, etc)	1	6	0	7

20.	Creation and operation of a natural adaptation training center	0	2	0	2
21.	Create guidelines for creating rice field landscapes suitable as stork habitat	8	1	0	9
22.	Expand the installation of ecological corridors in concrete rice paddy waterways near stork habitats	2	5	0	7
23.	Expand education and publicity to prevent human disturbance activities (collection of water after fishing activities etc)	10	1	0	0
24.	Establish a compensation system for the collection of waste such as fishing nets and lines (main subjects: Ministry of Environment or local government)	0	1	0	0
25.	Development of local stork ecotourism content and sharing of benefits with local residents	2	4	0	0
26.	Expand the positive public awareness in local community.	0	4	2	6
27.	Modify the shape of the transmission tower to prevent storks from using it	7	5	5	17
28.	Artificial nesting towers for storks are installed near the transmission tower where they next to encourage their migration	5	4	2	11
29.	Retention of more than 95% wild source gene diversity in both captive and wild populations and maintenance of mean wild/captive population inbreeding below F=0.125	10	9	2	21
30.	Establishment of a health care system for storks.	11	5	1	17

The Oriental stork conservation and recovery top priority goals, in order, are:

	HIGHEST PRIORITY GOALS				
#		Achievability	Importance	Urgency	Total
29.	Retention of more than 95% wild source gene diversity in both captive and wild populations and maintenance of mean wild/captive population inbreeding below F=0.125	10	9	2	21
30.	Establishment of a health care system for storks.	11	5	1	17
27.	Modify the shape of the transmission tower to prevent storks from using it	7	5	5	17
15.	Expansion of civil exchange (facilitating public cooperation internationally)	7	6	1	14
1.	Eco-friendly agriculture increased up to 10% by 2030	0	5	8	13
3.	Designation of nature reserve in Yesan-gun	0	7	4	11
4.	Improve awareness of resident people	6	2	3	11

Group Name: PVA and captive populations
Group Members: Seokhwan Cheong, Sungyeon Yoo, Seonju Lee, & Sukyung Kim (Facilator: Caroline Lees)

GOAL 1: Retention of more than 95% wild/captive source gene diversity, Maintenance of mean wild/captive population inbreeding below 0.125(F)
야생/사육 개체군의 유전적 다양성 지수 95% 이상/근친도지수(F) 0.125 미만의 개체군 유지

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1	1-5	5-10
1	해외도입 및 교환을 통한 사육 개체군의 유전적 다양성 증진 Improve the genetic diversity of captive population through the import of new founders from Russia and Japan	사육개체군 (Captive population) 유전적 다양성 지수 95% 이상/근친도지수(F) 0.125 미만 Genetic diversity ≧95% F < 0.125	황새생태연구원 (KNUE ECOSOS) 문화재청(Cultural Heritage Administration; CHA) 환경부(MOE)			
2	재도입 개체군 유전적 다양성 목표지수 달성여부에 따라 사육 개체군 방사 Run releasing program depending on the level of progress in achieving the goal (95%) of genetic diversity index after reintroduction	야생방사 개체군(Wild population) 유전적 다양성 지수 95% 이상/근친도지수(F) 0.125 미만 Genetic diversity ≧95% F < 0.125	황새생태연구원 (KNUE ECOSOS) 문화재청(CHA) 환경부(MOE)			
3	황새 둥지탑 추가 설치로 월동 야생 황새 정착 유도 Encourage the wintering population to pair with reintroduced population by installing artificial nesting poles in wintering sites	10년 3개 (3 nests per 10 year) 20년 5개 (5 nests per 20 year) 30년 10개 (10 nests per 30 year)	황새생태연구원 (KNUE ECOSOS) 문화재청(CHA) 환경부(MOE)			
4	유전적으로 우수한 개체군 확립을 위한 번식프로그램 운영 Run the breeding program targeting a higher genetic diversity	프로그램 개발 완료 여부 (yes or no) Improved breeding program for higher genetic diversity 연 1회 번식프로그램 평가 Evaluation of the breeding program once per year	황새생태연구원 (KNUE ECOSOS) 문화재청(CHA) 환경부(MOE)			

GOAL 2: 황새 건강관리 시스템 확립

No.	Action description	Success Indicators	**LEAD** (Collaborators)	0-1 year	1-5 years	5-10 years
1	질병 및 건강관리 매뉴얼 보완 Improve the manuals on avian diseases and health care	매뉴얼 보완 여부 (yes or no) Revision of the manuals	황새생태연구원(KNUE ECOSOS) 국립야생동물질병관리원 (NIWDC) 충남/충북야생동물구조센터(Chungcheong wildlife rescue center) 환경부(MOE)			
2	황새 담당 수의사 양성 프로그램 운영 Run the stork veterinarian training program	연 2회 two times per year	황새생태연구원(KNUE ECOSOS) 수의학대학 (Veterinary college) 서식지외보전기관(동물원) 교육부(The Ministry of Education) 환경부(MOE)			
3	황새 담당 수의사 연계 사업 및 국내외 네트워트 활성화 Activate the network of national and international Oriental Stork vet. system	네트워크 구성여부 (yes or no) Establishment of the vet. network 국내/국외 네트워크 회의 1회(1년) Held the network conference once per year	황새생태연구원(KNUE ECOSOS) 수의학대학(Veterinary college) 서식지외보전기관(동물원) 환경부(MOE)			
4	황새 건강관리 프로그램 운영 Run the program of a health care for storks	연 1회 건강관리 프로그램 평가 Evaluation of a health care program once per year	황새생태연구원(KNUE ECOSOS) 국립야생동물질병관리원 (NIWDC) 충남/충북야생동물구조센터 (Chungcheong wildlife rescue center) 환경부(MOE)			
5	야생 방사 개체군의 전염병 연구 및 대응 체계 구축 Research on the infectious diseases in the reintroduced population and action system to prevent to spread of the diseases	전염성 질병 기초연구 수행유무 질병모니터링(연 2회) 대응체계 구축유무 (yes or no) Research on	황새생태연구원(KNUE ECOSOS) 국립야생동물질병관리원 (NIWDC) 환경부(MOE)			

		the infectious disease of reintroduced population Monitoring the infectious diseases (2 times per year)				

Establishment of a health care system for storks

Group Name: Impacts of farming, fishing and energy generation

Group Members: 주용기, 성한아, 문성채, 김경희, 윤형기, 김상화, 신문현, 최진

GOAL 1: 예산 지역의 황새 서식지 근처 전선에 2028년까지 조류 충돌 방지 표식을 부착한다.(전선에 택 부착 등)
Bird collision prevention signs will be attached to electric wires near stork habitats in the Yesan area by 2028 (attachment of tags to electric wires, etc.).

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	조류 충돌 방지 표식을 부착할 범위를 분석하고 설치 후 효과 점검 To analyze, install, and perform effectiveness checks after attaching bird collision prevention tags.	설치 지역의 사고 건수 The number of accidents in the installation area	한국전력공사 황새생태연구원 지역 주민 KEPCO Eco-institution of oriental stork Local people	표식 설치, 범위 분석	설치 및 효과 점검	설치 및 효과 점검

GOAL 2: 황새 서식지 인근에 전봇대를 대체할 휴식용, 번식용 둥지탑을 설치한다.
Nest towers for resting and breeding will be installed near stork habitats to replace electric poles.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	휴식용, 번식용 둥지탑 설치 범위를 분석하고 설치 후 효과 점검 To analyze nesting tower coverage for resting and breeding birds and check post-installation effects	설치된 둥지탑의 이용률 Utilization rate of installed nest towers	한국전력공사 황새생태연구원 지역 주민 국립생태원 KEPCO Eco-institution of oriental stork Local people NIE	설치 범위 분석 To analyze installation coverage	설치 및 효과 점검 To install and evaluate effects	설치 및 효과 점검 To install and evaluate effects

GOAL 3: 관행농업 농가가 친환경농업을 할 때 농가수익의 차액을 보전한다.
When government-owned farms practice eco-friendly farming, the difference in farm profits is compensated. (Increase economic income through eco-friendly farming.)

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	관행농업과 친환경 농가의 수익 차액을 분석하고 예산 확보, 지급	관행농가와 친환경농가의 수익	농림부 환경부	분석	예산 확보 및 제도	지급

	To analyzing, budget and pay the difference between conventional and eco-friendly farmers' profits	Revenue from conventional and organic farmers	NGO 국립생태원 Ministry of Agriculture, Food and Rural Affairs Ministry of Environment NGO, NIE	To analyze revenue difference	개선 To Secure budgets and improve systems	Payment

GOAL 4: 적절한 자연적응훈련 프로그램 개발(훈련 내용, 기간, 시설, 방사 전 평가 등)
Development of an appropriate natural adaptation training program (training content, period, facilities, pre-release evaluation, etc.)

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	황새 자연적응훈련 프로그램 개발 To develop an oriental stork wild-adaptation program	프로그램 매뉴얼 Program Manual	황새생태연구원 국립생태원 예산군 Eco-institution of oriental stork NIE Yesan gun	예산 확보 To secure budget	연구 수행 및 매뉴얼 발간 To conduct research and publish manuals	

GOAL 5: 자연적응훈련장 조성 및 운영
Creation and operation of a natural adaptation training center

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	자연적응훈련장 조성 및 운영 To create and operate a wild adaptation training facility	운영되는 자연적응훈련장 수 Number of operational a wild adaptation training facility	예산군(지자체) 문화재청 황새생태연구원 Cultural Heritage Administration Eco-institution of oriental stork	예산 확보 To secure budget	조성 To install	운영 To operate

GOAL 6: 황새 서식지 인근의 콘크리트 논 수로에 생태통로 설치를 확대한다
Expand the installation of ecological corridors in concrete rice paddy waterways near stork habitats.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	설치 지역 및 범위 분석, 설치 후 효과 점검 To analyze the installation area and scope, and to check for	설치 개수 A number of installation	환경부 국립생태원 지자체(예산군)	분석 To analyze	예산 확보 및 설치 To secure	효과 점검 To evaluate effects

	post-installation effects		Ministry of Environment NIE Yesan gun		and installation	

GOAL 7: 황새 서식에 적합한 논 경관 조성을 위한 가이드라인을 제작한다.
Create guidelines for creating rice field landscapes suitable for stork habitat.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	황새 서식에 적합한 논 경관 조성을 위한 가이드라인 제작 To create guidelines for creating a rice paddy landscape suitable for stork habitat	가이드라인 배포 To distribute guidelines	황새생태연구원 국립생태원 문화재청 환경부 농림축산식품부 Eco-institution of oriental stork NIE Cultural Heritage Administration Ministry of Environment Ministry of Agriculture, Food and Rural Affairs	예산 확보 To secure budget	제작 및 배포 To create guidelines and distribute	

GOAL 8: 적합한 논 경관 조성
Creating a suitable rice field landscape

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	위치 분석, 조성, 효과 점검 To analyze location, composition, and effectiveness	적용 지역 수 A number of applied regions	황새생태연구원 국립생태원 문화재청 환경부 농림축산식품부 지역주민 Eco-institution of oriental stork NIE Cultural Heritage Administration Ministry of Environment Ministry of Agriculture, Food and Rural Affairs Local People	예산 확보 To secure budget	위치 분석 및 조성 To analyze location and install	효과 점검 To evaluate effects

GOAL 9: 인간의 교란활동 예방을 위한 교육, 홍보를 확대한다.(낚시 활동 후 폐기물 수거 등)
Expand education and publicity to prevent human disturbance activities (collection of waste after fishing activities, etc.)

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	교육프로그램 개발, 홍보물 작성 후 적용 및 배포 To develop education programs, create outreach materials, and then adapt and deploy them	교육 및 홍보 횟수 A number of education and promotion	황새생태연구원 국립생태원 문화재청 환경부 어촌계 Eco-institution of oriental stork NIE Cultural Heritage Administration Ministry of Environment Fishing villages	개발 및 작성 To develop and make material	적용 및 배포 To apply and distribute	

GOAL 10: 낚시 그물, 줄 등 폐기물 수거에 대한 보상 제도를 마련한다.(주체 환경부 또는 지자체)
Establish a compensation system for the collection of waste such as fishing nets and lines. (Main subject: Ministry of Environment or local government)

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	관련 시행령 개정 및 지자체 조례 제정, 예산 확보 To revise relevant laws and regulations, enact local ordinances, and secure funding	개정 및 제정 여부 Amendments and enactments	환경부 지자체 낚시 관련 단체 Ministry of Environment Local government Fishing groups	개정안 작성 To create an amendment	개정 및 제정 To ament and enact	

GOAL 11: 지역 황새 생태관광 콘텐츠 개발 및 지역 주민 이익 공유
Development of local stork ecotourism content and sharing of benefits with local residents.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	생태관광 콘텐츠 개발, 생태관광 추진, 수익 분배 To develop ecotourism content, promote ecotourism, and share revenue	생태관광 실행 및 방문객 수 Ecotourism implementation and a number of visitors	지자체 지역 주민 Local government Local people	개발 To develop	관광 및 분배 To implement ecotourism and share revenue	관광 및 분배 To implement ecotourism and share revenue

2	생태관광 지역협의회 구성 및 지원 To organize and support an ecotourism local council	협의회 지속 여부 Council persistence	지역 주민 환경부 지자체 Local people Ministry of Environment Local government	구성 To organize the group	운영 지원 To support the group	운영 지원 To support the group

GOAL 12: 지역공동체 대중인식이 확산되도록 한다.
Spread public awareness in local communities.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	대중인식 현황 분석 및 인식 증진 활동(교육, 홍보, 축제, SNS, 안내방송) To analyze public perception and conduct awareness activities (education, outreach, festivals, social media, announcement)	인식 증진 활동 횟수 A number of awareness activities	황새생태연구원 환경부 문화재청 지자체 Eco-institution of oriental stork NIE Cultural Heritage Administration Ministry of Environment Local government	분석 To analyze public perception	인식 증진 To increase awareness	효과 점검 To evaluate effects

GOAL 13: 송전탑의 형태를 변형하여 황새가 이용하지 않게 한다.
(또는 황새가 안전하게 이용하도록 한다.)
Modify the shape of the transmission tower to prevent storks from using it. (Or let the stork use itsafely.)

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	송전탑 형태 변형 방안 개발, 설치 및 효과 점검 To develop, install, and evaluate the effectiveness of transmission tower shape modifications	황새의 이용 여부 A stork utilization rate	한국전력공사 황새생태연구원 국립생태원 KEPCO Eco-institution of oriental stork NIE	디자인 및 예산 확보 To design and secure budget	설치 To install a modified transmission tower	효과 점검 To evaluate effects

GOAL 14: 둥지를 튼 송전탑 인근에 황새를 위한 인공둥지탑을 설치하여 이동 유도 사업을 확대한다.
Artificial nesting towers for storks are installed near the transmission tower where they nest to encourage their migration.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years

1	성공사례에 기반한 매뉴얼 개발, 송전탑 인근 둥지탑 설치, 효과 점검, 유도 대안 개발 To develop manuals based on best practices, install nesting towers near transmission towers, evaluate effectiveness, and develop inducement alternatives	이주 수 Migration count	한국전력공사 황새생태연구원 NGO 및 전문가 국립생태원 KEPCO Eco-institution of oriental stork NGOs and Experts NIE	예산 확보 To secure budget	설치 및 효과 점검 To install nesting towers and evaluate effects	사업 확대 To expand the installation

Group Name: Governmental legislation and cooperation
Group Members:

GOAL 1: 2030년까지 친환경 농업비율을 10%까지 확대한다.

No.	**Action description**	**Success Indicators**	**LEAD** (Collaborators)	**0-1 year**	**1-5 years**	**5-10 years**
1	Supporting subsidies for producers and expanding the development and dissemination of production technologies (생산자에게 보조금을 지원하고, 생산기술의 개발 및 보급을 확대한다).	Subsidies and development of the technologies	Governmental organizations (e.g., Ministry of Environment, 농진청, 농기원etc.)	생태직불금 지급(public-purpose direct payment system)에 대한 기준 마련	지급 예산(안) 마련 및 예산 확보, 보조금 지급	친환경 농업 생산 기술 개발 및 보급 확대
2	Promoting eco-friendly farming products (친환경 농산물 소비를 촉진한다)	Market for organic agricultural products secured	Local government	농산물의수요기관인 공공기관, 기업 등과 협의	농산물의수요기관인 공공기관, 기업 등과 협의	친환경 농산물 공급 및 유통망 개선
3	생산자와 소비자의 인식(예: 친환경 농산물에 대한 인식, 친환경 농산물을 소비하는 것이 생태 보전	기존 인식 대비 생산자 및 소비자 인식 수준 50% 향상	각 지자체, 친환경농업인(생산자),	친환경 농산물에	생산자와 소비자를	친환경 농산물에

	활동에 참여한다는 것)을 개선한다.		소비자	대한 사전 인식 조사	대상으로 교육 및 홍보(예: 생산자와 소비자 간 방문 등 교류 확대)를 추진	대한 사후 인식 조사

GOAL 2: 물질순환 농업을 확대한다.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	계획적인 농축산 활동을 장려하고, 농경, 축산 시설을 점차 확대해 나간다.	충남지역 내 30% 지자체에 순환농법 보급	지자체, 농림축산식품부, 농촌진흥청, 농기센	농축산 활동 계획 수립	순환적 농업-축산 활동 시범 운영을 통한 세부 운영체계 확립	순환적 농업-축산 활동을 지자체에 보급, 확대

GOAL 3: 예산 지역 내 황새의 핵심서식지를 보호구역으로 설정한다.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	연구, 조사를 통해 황새의 핵심서식지를 식별하고, 핵심서식지 훼손을 최소화하는 행위에 대한 기준을 마련한다.	황새 핵심서식지 식별	황새생태연구원, 국립생태원	황새 서식지 조사	핵심서식지 식별	훼손 최소화 행위에 대한 기준 마련
2	핵심서식지로 식별된 구역 내 주민을 설득한다.	지역 주민 동의	황새생태연구원, 지자체, 문화재청, 환경부	핵심서식지 내 토지 이용 실태 조사	황새 핵심서식지 설명자료 제작 및 주민설명회 개최	주민 동의
3	황새 특별보호구역을 지정하고 관리한다.	예산군 10곳 지정	황새생태연구원, 지자체, 환경부,	1차 보호구역 지정 및	2차 보호구역 지정 및	3차 보호구역 지정 및 주민

			문화재청	주민 설문조사	주민 설문조사	설문조사

GOAL 4: 항공방제로 인한 친환경 농업지역 피해를 최소화한다.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	드론 등 항공 방제가 농업지역에 미치는 영향을 평가한다.	영향 평가 완료	농촌진흥청, 농업기술센터,	연구 용역 발주	용역 결과물 평가	
2	친환경 항공 방제 시 필요한 가이드라인을 만들고, 친환경 방제 기술을 개발한다.	가이드라인, 방제기술 개발	농촌진흥청, 농업기술센터	가이드라인 개발	방제기술 개발	

GOAL 5: 간척지 개발사업을 현실적으로 검토할 수 있도록 환경영향평가 제도를 개선한다.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	환경영향평가법을 개정한다.	법 개정	환경부, 국립생태원	법 개정을 위한 근거자료 마련	법 개정	
2	간척지 개발과 관련된 연안습지 관리 가이드라인을 마련한다.	가이드라인 마련	환경부 지자체	연안습지 기초 현황 조사	가이드라인 마련	

GOAL 6: 친환경 인증제도를 개선한다.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	기존의 친환경 인증제도를 과정 중심의 인증제도로 전환시킨다.	과정 중심 인증제도 정착	농업식품부 농산물품질관리원농업 진흥청	친환경 인증제도 문제점 분석 및 대안 마련	친환경 인증제도 개선	

GOAL 7: 인사이동으로 인한 업무 공백, 장애를 최소화한다.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	중앙/지방정부의 책임자, 실무자를 대상으로 주기적인 업무 교육(예: 황새 보전 실무 등)을 실시한다.	중앙/지방정부 책임자, 실무자의 80% 교육 이수	황새생태연구원 지자체, 환경부, 문화재청	중앙/지방 정부 내 관련	연 1회 교육 실시 및 설문	연 1회 교육 실시 및 설문 조사

				책임자, 실무자 식별 및 교육 프로그램 개발	조사	

GOAL 8: 부처간 협력을 증대한다.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	부처간 소통과 의사결정이 가능한 협의체를 구성한다.	협의체 운영(연 2회)	문화재청 환경부 황새생태연구원	협의체 구성원 식별 및 협의체 운영 계획(안) 작성	협의체 운영 및 결과보고	협의체 운영 및 결과보고

GOAL 9: 태양광 발전으로 인한 부정적 영향(즉, 황새에 대한)을 최소화한다.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	태양광 발전소가 시공되기 전에 이루어지는 환경영향평가 제도를 개선한다.	환경영향평가법 개정	환경부 국립생태원	환경영향평 가 제도 문제점 분석 및 대안 제시	환경영향평 가법 개정	

GOAL 10: 황새 이동경로 상에 있는 국가 간 민간교류를 확대한다.

No.	Action description	Success Indicators	LEAD (Collaborators)	0-1 year	1-5 years	5-10 years
1	한국, 중국, 일본 간 민간단체(예: 황새사랑)의 역할을 확대한다.	연간 교류 1회	황새사랑 황새생태연구원	국가 간 민간단체 구성원 및 역할 식별 및 관련 기초 정보	연 1회 교류 및 연간 보고서 발간	연 1회 교류 및 연간 보고서 발간

				공유		
2	한-일 논습지 조사교류회와 같은 민간단체의 역할 및 활동을 촉진시킨다.	연간 교류 1회	한일 논습지 조사교류회, 황새생태연구원	국가 간 민간단체 구성원 및 역할 식별, 관련 기초 정보 공유	연 1회 교류 및 연간 보고서 발간	연 1회 교류 및 연간 보고서 발간
3	친환경 생산자 간의 교류체계를 확립한다.	연간 교류 1회	지역 생산자	국가 간 친환경 생산자 식별 및 생산 현황 공유	연 1회 교류 및 연간 보고서 발간	연 1회 교류 및 연간 보고서 발간

Detailed working group notes, including indicators of success, timelines, and responsible parties for these recommended actions, can be found beginning on page 44.

PRELIMINARY POPULATION VIABILITY ANALYSIS FOR THE ORIENTAL STORK

Natasha Peters, Caroline Lees, Sukyung Kim, Donsoo Ha, Yoon Hyunju, Moonhyun Shin & Shin Yongun.

INTRODUCTION

The Oriental White Stork (*Ciconia boyciana*) is a wetland species that spends time foraging in rice fields and riversides. Currently listed as 'Endangered' by the IUCN (IUCN Red List of Threatened Species 2015), the global population of Oriental Storks is estimated to be around 3000 individuals (BirdLife International 2023) and is distributed across Southeast Asia including Russia, China, Korea, and Japan. These birds were once common in the Korean peninsula, but during the 1950s through to the 1970s, the population declined to extinction due to destruction of nesting sites, food shortage and the use of pesticides (Park et al. 2017). A reintroduced population of birds now resides in the Korean peninsula, threats to which include electrocution and collision with power lines, poisoning through pesticides, loss of habitat, and predation (by native predators).

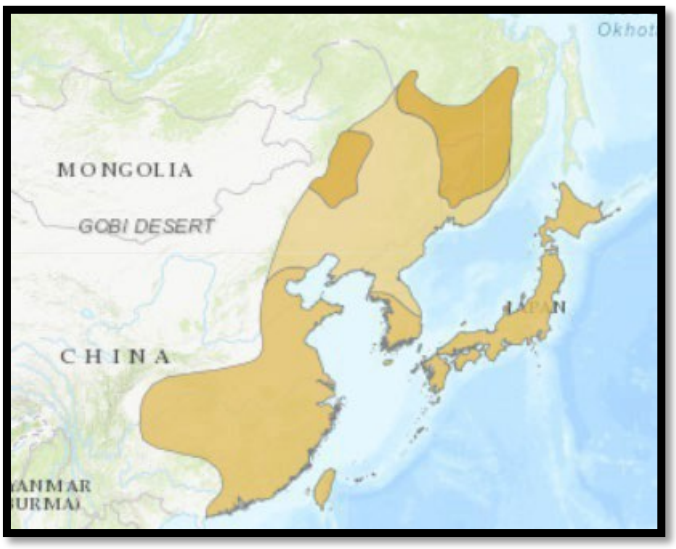


Photo: Oriental White Stork (*Ciconia boyciana*)
Figure 1. Map of Asia, showing range of the Oriental Stork (IUCN Red List of Threatened Species 2015)

BACKGROUND TO THE CONSERVATION PROJECT

THE *EX SITU* POPULATION

From 1996 to 2007, 38 Oriental storks were imported to South Korea: 24 from Russia, eight storks from Japan, and six storks from Germany. The first chicks were born in captivity in 2002 and by 2015 there were 174 individuals (Park and Cheong 2002, Park et al 2017). In 2014, 60 captive storks were transferred to the Yesan Oriental Stork Park for reintroduction. As of 2023, the captive Oriental Stork population in South Korea has reached 170 birds.

RELEASES

Since releases of captive birds began in 2015, 109 birds of variable ages (ranging from 1-16 years old) have been released. The wild/reintroduced population is now 150 individuals strong. A total of 150 birds have been hatched in the wild, and a maximum of 14 pairs have been established. Releases continue with 10-20 birds being released every year across several sites.

VORTEX MODELS

Computer modelling can be a valuable tool for quantitatively assessing risk of decline and extinction of wildlife populations, both free ranging and managed. Complex and interacting factors that influence population persistence and health can be explored, including natural and anthropogenic causes. Models can also be used to assess the relative impact of alternative management strategies, to help identify the most effective conservation actions for a population or species, and to identify research needs.

The software used in these analyses is the simulation program VORTEX. VORTEX is a Monte Carlo simulation of the effects of deterministic forces as well as demographic, environmental, and genetic stochastic events, on small wild or captive populations. VORTEX models population dynamics as discrete, sequential events that occur according to defined probabilities. The program begins by either creating individuals to form the starting population, or by importing individuals from a studbook database. It then steps through life cycle events (e.g., births, deaths, dispersal, catastrophic events), for each individual and typically on an annual basis. Events such as breeding success, brood size, sex at birth, and survival are determined based upon designated probabilities that incorporate both demographic stochasticity and annual environmental variation. Consequently, each run (iteration) of the model gives a different result. By running the model hundreds of times, it is possible to examine the probable outcome and range of possibilities. For a more detailed explanation of VORTEX and its use in population viability analysis, see Lacy (1993, 2000) and Miller and Lacy (2005).

Figure 2. Diagram showing the series of events making up a typical annual cycle or timestep in VORTEX, that result in a simulated change in population abundance from Nt to Nt+1. The enclosed section of the diagram begins with the production of juveniles (J) followed by their transition through Subadult (SA) and Adult (A) life-stages. Mortality is imposed on each age-class cohort (Mx), the severity of which is determined by age-specific survival rates (Sx). On the right of the diagram, processes above the timeline act to increase abundance, while those beneath act to decrease it. The aggregate effect of these demographic processes results in a new population abundance at the end of the timestep.

GUIDANCE FOR PVA MODEL DEVELOPMENT

The demographic and genetic analysis described in this report were developed in close consultation and collaboration with participants of the virtual PVA workshop held 13-15 June 2023 and further analyses were carried out following discussion and input from participants at the in-person conservation planning workshop held September 5-8, 2023 (see the report from the PVA Working Group). The modelling process included the following steps:

1) Building a baseline model representative of the released wild population, to establish a minimum viable population size.
2) Testing the sensitivity of the baseline model to parameter variation, to establish pressure points for the population and key data gaps for further research.
3) Building different model scenarios to test the effects of changes to environment or management on population viability and performance.
4) Interpreting these results.

Model data were largely provided by Drs Sukyung Kim and Dongsoo Ha. Values were captured by questionnaire before the virtual PVA workshop. During the virtual workshops the collective expertise and knowledge of participants was used to:

- Review and agree VORTEX parameters for the *in situ* baseline model including those needed todescribe:
    - Population size and demographics
    - Breeding parameters
    - Mortality rates
    - the biological and human-mediated influences on population dynamics
    - initial ideas about conservation management interventions
    - estimated quantities for these, for inclusion in VORTEX models
- For any uncertain parameters, to elicit best estimates or a plausible range of values for use in sensitivity testing.
- Agree the questions to be pursued using the models (additional questions were added during the in-person workshop).

WILD BASELINE MODELS

The Wild Baseline model is designed to represent a single, healthy population of the Oriental Stork under benign conditions in Southern Korea. All models use an annual cycle of events, the modelling timeframe is 100 years, and each model run includes 500 iterations. Parameters and values included in the baseline models, along with the ranges agreed for sensitivity testing, are shown in Table 7.

With the model values described in Table 7, deterministic projections (i.e., without stochastic influences on reproduction and mortality rates) show a wild population that grows at an annual rate of 0.4% (λ =1.04). Generation time (T) for both sexes is approximately 8.79 years.

With stochastic elements included, instantaneous growth rate is reduced and there is high variability across iterations (stoc-r=0.0351 ± 0.0565). Risk of extinction over the 100-year period is (PE=0.00) for the starting population size and carrying capacity modelled (Ni=K=158). Gene Diversity at 100 years sits at 0.9192 (91.92%) within the internationally recommended thresholds of 90 – 95%. See Figure 3 for an illustration of Wild Baseline model trajectories and Tables 1 and 2 for a comparison of deterministic and stochastic results.

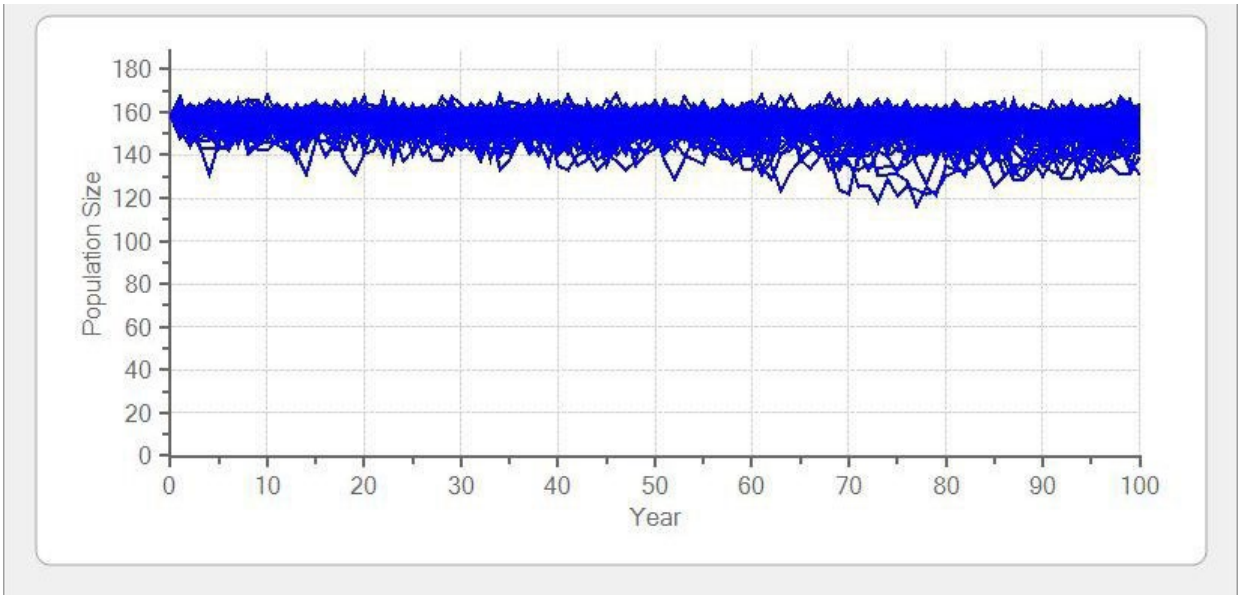


Figure 3. Examples of Wild Baseline model trajectories over 100 years, showing a stable population trend.

1. Deterministic rates	
Lambda (λ)	1.049
Generational growth (Ro)	1.519
Generation time (T)	8.79

2. Stochastic rates	
Instantaneous growth rate (r)	0.0351 ± 0.0565
Gene Diversity (GD) at 100 yrs	0.9192
Extinction Risk (PE)	0
N-Extant	153.09 ± 8.82

Tables 1 & 2. Summary of deterministic and stochastic results for the Wild Baseline model.

Wild Model Sensitivity Tests

Though some of the life history traits and characteristics of this species are well-studied there remain many areas of uncertainty. Some of these will have more influence on population performance than others. Tests were carried out in which each parameter was varied in turn, holding all other parameters constant, to get an idea of which have most influence on key performance measures such as population growth, extinction risk and gene diversity retention. All tests were carried out on the Wild Baseline Model and Table 7 shows both the baseline parameters for this model and the values used in the sensitivity tests. The results of the tests are summarized in Figure 4., which illustrates, for each parameter, the change in growth rate created by moving from the most pessimistic value to the most optimistic. Parameters showing the largest change in r-value are the most influential drivers of population growth. For example, changing the average percentage of females breeding each year from 20% to 40% improves growth by r= 0.02, which can be roughly approximated as an annual increase in birds of 2%.

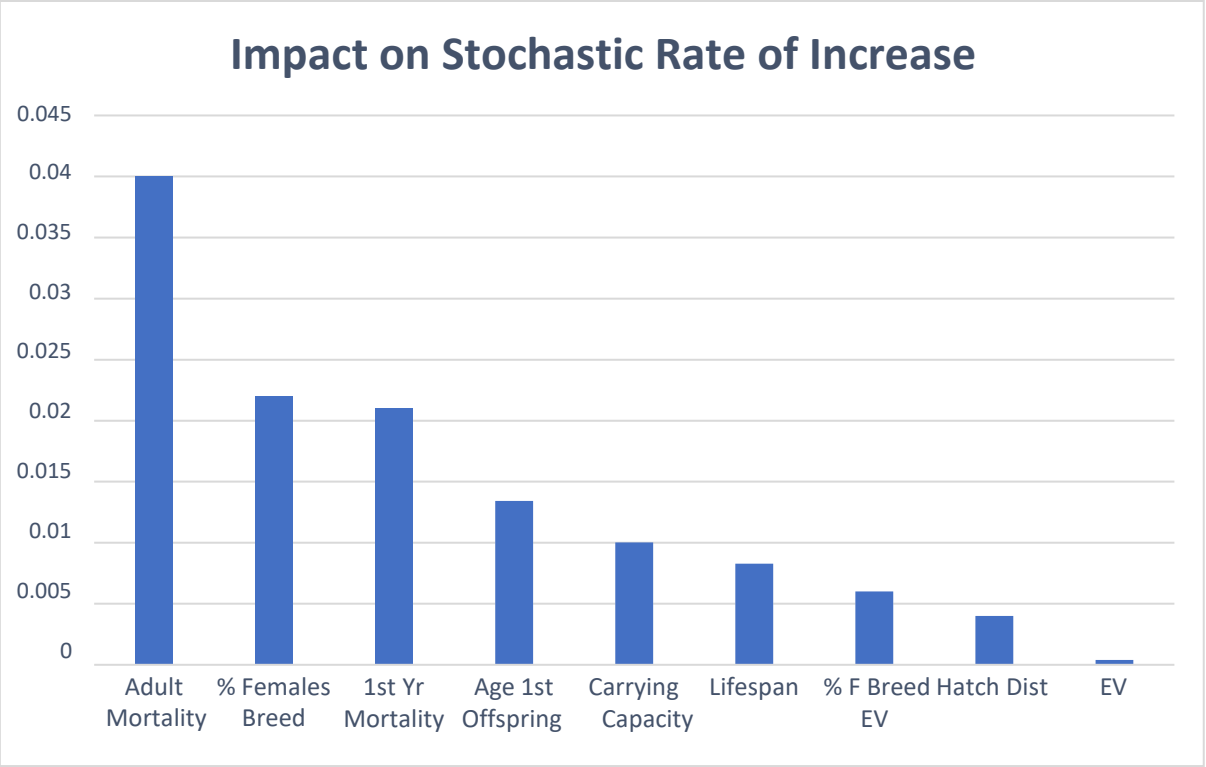


Figure 4. Sensitivity test results showing impact on stochastic growth rate (Stoc-r) of varying each parameter in turn across a plausible range of values.

Low impact factors (relatively small change in growth rate across the range modelled)

- Extent of correlation between good years for breeding and good years for survival (EV: varied from 0-100% correlated)
- Distribution of hatchlings per female per brood (varied from 2.5-4.5)
- Extent of year-to-year variation in the percent of females breeding (applied as a standard deviation about the mean of the normal distribution from which the percentage of females breeding each year is sampled) varied from 5-20%)

Medium impact factors (medium-sized change in growth rate across the range modelled)

- Maximum lifespan of females and males (varied from 14-24 years old)
- Carrying capacity (varied from 20-400)
- Age of first offspring (varied from 2-4 years old)

High impact (relatively large change in growth rate across the range modelled)

- Adult (age 3+ years) mortality (varied from 2-16%)
- Percent of females breeding (varied from 20-40%)
- 0-1 year mortality in both males and females (varied from 20-90%)

High and medium impact factors, where values are uncertain, should be targets for additional data collection (to ensure that the models include representative values). In addition, these are useful targets for planning discussions, as thinking about how these aspects of life history might be manipulated, either in the wild or captivity, may provide useful directions for conservation action.

Wild Model Scenarios

Building from the Wild Baseline, models were constructed to answer specific questions. The results of these analyses are described below.

Question 1: What is the Minimum Viable Population Size (MVP)? Where MVP is defined as the smallest size of population that can persist for 100 years, with an extinction risk of <1% and with >90% gene diversity retained?

Models were built to evaluate the performance of different populations that varied only in their population size. To achieve this, starting size (Ni) and carrying capacity (K) were set to the same value and were varied from Ni=K=20 to Ni=K=400. The timeframe was set to 100 years. The results are shown below:

Ni=K: 20-400	stoch-r	PE	N-all	SD(N-all)	GeneDiv	meanTE
20	-0.01	0.94	0.57	2.23	0.51	58.50
50	0.01	0.06	29.99	15.15	0.75	86.20
60	0.02	0.02	43.11	15.78	0.79	94.10
70	0.02	0.00	57.79	13.92	0.83	81.50
80	0.03	0.00	69.25	13.77	0.85	0.00
100	0.03	0.00	92.38	10.41	0.88	0.00
200	0.04	0.00	196.60	6.58	0.94	0.00
400	0.05	0.00	397.87	7.19	0.97	0.00

Table 3. Results of Minimum Viable Population Size tests for population sizes (and carrying capacities) ranging from 20 – 400, where MVP is defined as <1% extinction risk over 100 years and retention of >90% gene diversity. Orange shading: meets neither criteria; Yellow shading: meets extinction risk but not gene diversity retention criteria; Green shading: meets both criteria.

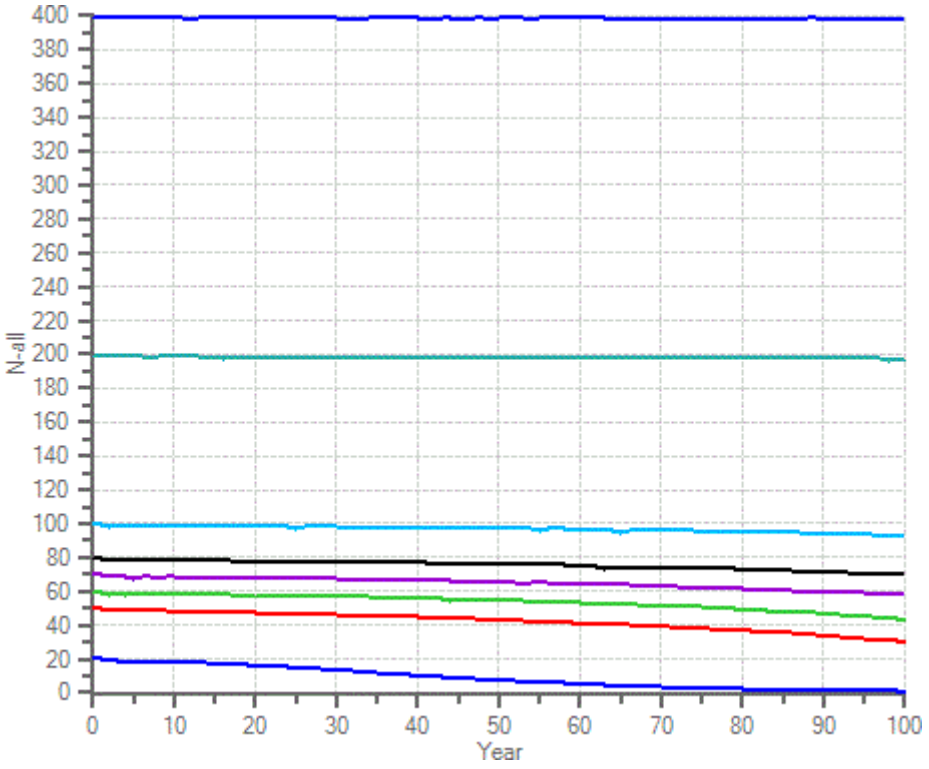


Figure 5a. MVP Tests: graph of average N across all iterations over 100 years, for Ni=K ranging from 20-400.

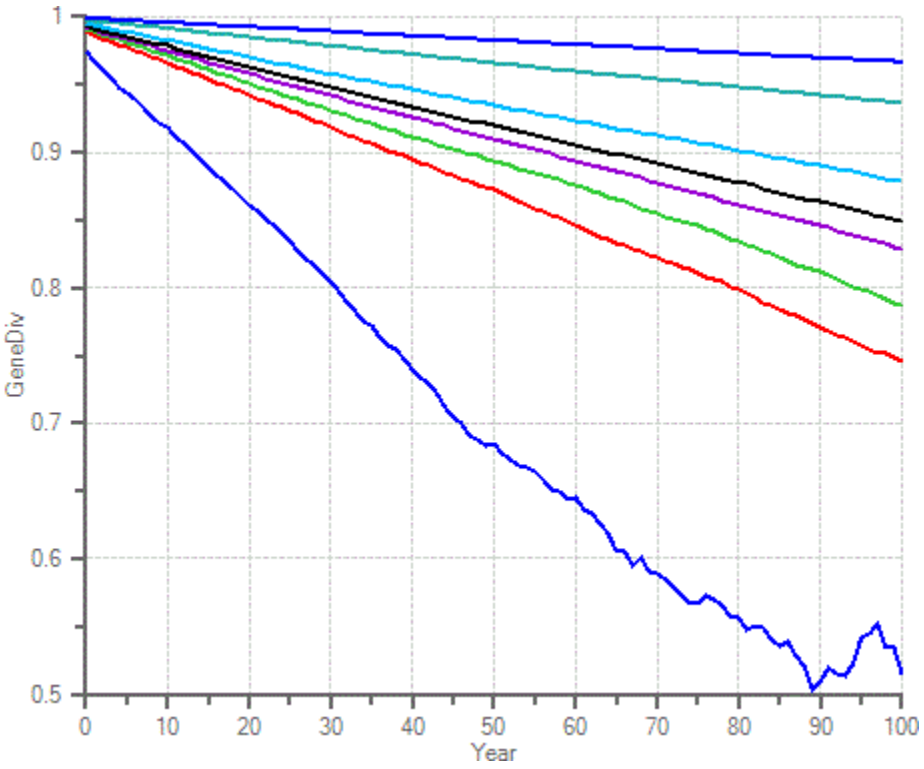


Figure 5b. MVP Tests: graph of average GD across all iterations over 100 years, for Ni=K ranging from 20-400.

- Larger populations show higher average growth rates as small population pressures are decreased.
- For the conditions specified in these models, populations beginning with fewer than 200 individuals and unable to grow larger do not reliably meet the MVP criteria set (<1% extinction risk over 100 years and >90% gene diversity retained).
- Smaller populations (N=20-60) show 100-year extinction risks ranging from 2-94%, and extinctions are usually towards the middle to end of the 100-year period (Mean Time to Extinction ranges from 58 to 94 years).
- NOTE: MVPs in this analysis may be optimistic as no catastrophes are included in the models.

Question 2. What is the expected impact of additional losses of birds from the wild population?

The baseline model describes expected behaviour of the wild population under "normal" conditions. typical average annual mortality and reproductive rates, incorporating a reasonable level of. In addition to the year-to-year variability in vital rates already incorporated into the models, occasional additional removals from the wild population could occur as a result of one or more of the following: disease outbreak, an extreme weather event, or a harvest for translocation or ex situ breeding. The impact of this on wild model performance was tested, to see how much additional removal could be sustained without significant detriment.

Scenarios assumed a starting population of 158 individuals and a harvest of both males and females every 10 years. We tested 15 different scenarios where 4, 6, 8, 10 or 20 adults were harvested, and in which the harvest sex-ratio ranged from parity to 100% of one or other sex.

Harvesting 4, 6 or 8 adults every 10 years, applying harvest sex-ratios of 100% males, 100% females and 50% of each:

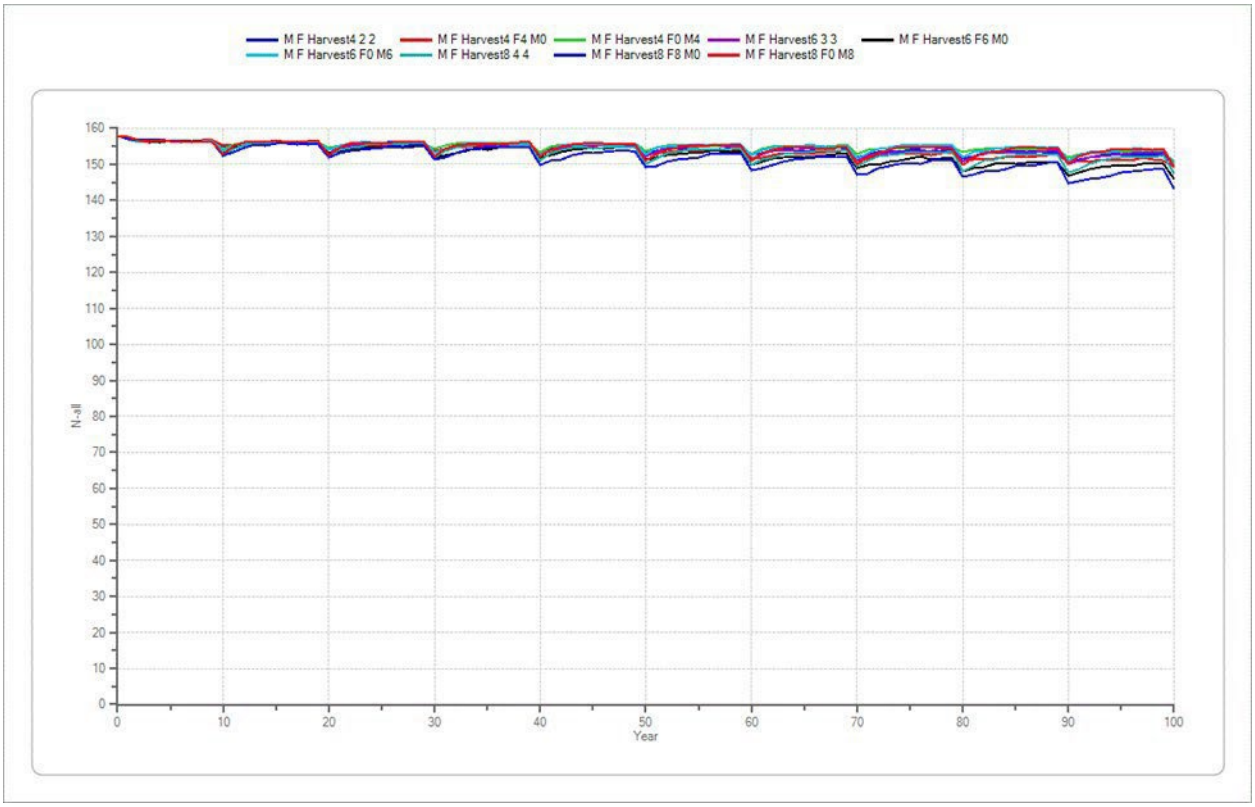


Figure 6. Shows mean wild population size over time, across iterations, for a 100-year period, with a total harvest of 4, 6, and 8 adults every 10 years. Proportion of males to females harvested varies between 0, 0.5 and 1.0.

Harvesting 10 or 20 adults every 10 years, applying harvest sex-ratios of 100% males, 100% females and 50% of each:

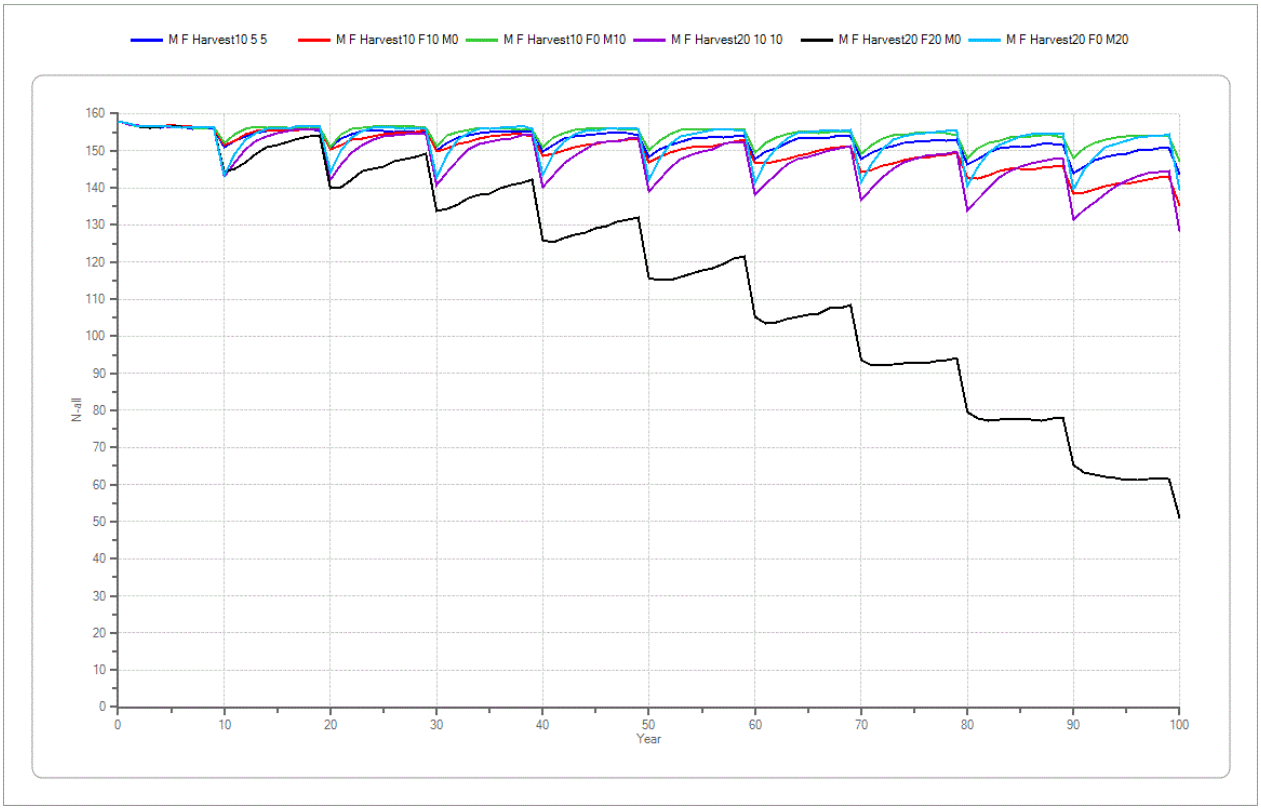


Figure 7. Shows mean wild population size over time, across iterations, for a 100-year period, with a total harvest of 10 and 20 adults every 10 years. Proportion of males and females harvested varies between 0, 50, and 100%.

Number of each sex harvested every 10 years (M=males; F=females)	stoch-r	PE	N-all	SD(N-all)	GeneDiv
F2 M2	0.0327	0	150.15	10.65	0.9177
F4 M0	0.0302	0	148.75	12.23	0.919
F0 M4	0.0351	0	151.77	8.21	0.9182
F3 M3	0.0307	0	148.1	12.48	0.9165
F6 M0	0.0279	0	145.58	15.59	0.9186
F0 M6	0.0342	0	149.21	10.05	0.9183
F4 M4	0.0299	0	146.59	12.6	0.9189
F8 M0	0.0245	0.002	140.25	20.95	0.9181
F0 M8	0.034	0	149.55	9.39	0.9181
F5 M5	0.0284	0	144.46	13.27	0.9166
F10 M0	0.0214	0.008	135.03	27.51	0.9151
F0 M10	0.034	0	146.84	9.99	0.917
F10 M10	0.0213	0.002	129.37	22.81	0.9133
F20 M0	-0.0051	0.392	51.51	53.47	0.8882
F0 M20	0.0315	0	138.47	11.77	0.9135

Table 4. 100-year wild population results for scenarios involving a total harvest of 4, 6, 8, 10 or 20 adults every 10 years with varied proportions of males (M) and females (F) harvested. Criteria that support a viable population (<1% extinction risk over 100 years and retention of >90% gene diversity) are shaded green, and those that do not are shaded in orange.

As shown in figures 6 and 7 and table 4, a harvest or mortality of males and females every 10 years would be sustainable and populations would remain viable (<1% extinction risk over 100 years and retention of >90% gene diversity) and remain around carrying capacity (N=150), except where 20 or more females would be harvested. However, the model assumes that when individuals from breeding pairs are harvested, they are immediately replaced as breeders by other individuals in the population. If this assumption is not correct, we would expect the results to be more pessimistic.

In summary, the population can tolerate the occasional loss of up to 10 females without much detriment as long as any breeding females removed are replaced as breeders by other females in the population. The population can withstand the loss of more than 10 birds where the additional birds are male. These findings will hold true only if the removal of birds does not have an impact on population vital rates not included in the models (such as pair disruption leading to lower reproductive outputs or additional competition-related mortality, or to an overall reduction in the number of active breeders).

Question 3. With no further supplementation from the captive population and with current breeding and mortality rates, how many migrant birds would need to be added to the population and how often, to ensure maintenance of genetic diversity >95% for 100 years?

In 2023 for the first time since the release program began, two migrant birds from Russia/China bred with resident birds potentially introducing valuable gene diversity into this relatively small gene pool. If this gene-flow is continued over time, it could reduce or prevent the accumulation of inbreeding and ongoing loss of gene diversity. A series of models were constructed to investigate the rate and amount of migrant integration required to keep gene diversity above 95%. Supplementation intervals of 5, 7, 9, 12 and 15 years were modelled, and the number of birds added at each supplementation event was 0, 1, 2 or 4 adult birds.

1) With the population maintained at current size (N=157)

Table 5.	Supplementation interval (years)				
No. birds added	5	7	9	12	15
0	0.9222	0.9222	0.9222	0.9222	0.9222
1	0.9316	0.9268	0.9250	0.9256	0.9235
2	0.9391	0.9380	0.9294	0.9292	0.9265
4	0.9544	0.9503	0.9444	0.9372	0.9356

2) With the population allowed to grow to N=700 adults (=approximately 500 adults)

Table 6.	Supplementation interval (years)				
No. birds added	5	7	9	12	15
0	0.9733	0.9733	0.9733	0.9733	0.9733
1	0.9746	0.9744	0.9745	0.9744	0.9743
2	0.9762	0.9753	0.9745	0.9738	0.9746
4	0.9786	0.9766	0.9766	0.9761	0.9751

Two scenarios were considered: one in which the population cannot grow larger than the current size (N=147) and one in which it can grow to N=700 (or approximately 500 adults). The results are shown in Tables 5 & 6. Above. Green shows successful scenarios and orange unsuccessful ones.

With the population remaining at current size, only supplementation rates of four migrant birds every 5-7 years maintained gene diversity above the 95% threshold for 100 years.

Note that the starting gene diversity value for the models was GD=0.9968 (based on 157 "founders"). Starting wild source gene diversity for the current wild population is probably lower than this due to the genetic base of the captive population and the asymmetrical breeding success of the captive founders and the release birds.

Improved estimates of starting gene diversity could be drawn from existing pedigree data and factored into future models to improve this analysis.

Question 4. At current growth rates, how long could it take the population to grow to 500 and to 1000 adult birds?

At the in-person conservation planning workshop, a 2050 population target of N=500-1000 adult birds was set. Models were run to estimate how long it might take the current population to grow to those sizes. The results are shown in Figure 8. Note that these models assume continued supplementation from the captive population at a rate of 5 pairs of adult storks per year for the first 10 years, and then no further supplementation beyond that.

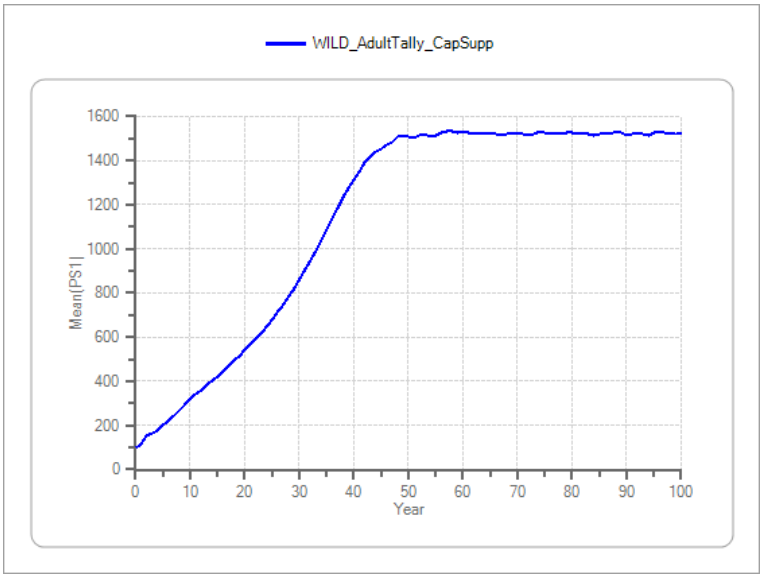


Figure 8. Shows growth in number of wild Oriental Stork adults, with 10 initial years of captive supplementation and an environmental carrying capacity of K=2000 adult birds.

On average, N=500 adult birds is reached after 19 years and N=1000 after 34 years, assuming no other limiting factors.

All the modelling results presented here should be considered preliminary pending further analyses and verification using a combination of wild and captive data.

Table 7. Parameter values used in the Oriental Stork baseline model and in sensitivity tests.

Vortex Parameters	**Wild Base Model**	**Rationale & details: unless otherwise specified, values are based on data from Drs Kim & Ha. Studbook & PMx files include both captive & wild data.**	**Sensitivity Tests for WILD model**
Number of years (timesteps)	100	Run models at 100yrs	-
Number of populations	1	Current situation	-
Species Description			
Inbreeding depression	Yes	-	-
Lethal equivalents	6.29	Vortex defaults based on multi-species vertebrate studies (Ralls et al. 1988; O'Grady et al. 2006)	-
Percent due to recessive alleles	50	Vortex defaults (Lacy et al. 2021)	-
EV correlation between reproduction and survival	0.5	Captive: assumed not correlated; Wild: reports of correlation in other stork spp. (lit. review – NP)	0, 0.5, 1.0
Reproductive System			
Breeding system	Long-term Monogamous	Birds re-pair only after death of partner.	
Age of first offspring (F/M)	3 yrs		2, 3, 4,
Maximum age of reproduction (F/M)	20	Birds aged 18-19 have bred in the wild. These were not born and raised there (releases began 2015) so this may not be representative of wild-born birds.	14, 16, 18, 20, 22, 24
Maximum lifespan (F/M)	20	One captive male is 35yrs old (Japan) but this is a record. Birds may live longer in captivity than in the wild – not enough data yet to measure this (releases began in 2015). Currently there are birds close to 20 in the wild but these were not born there.	14, 16, 18, 20, 22, 24
Maximum number of broods per female per year	1	From studbook data.	
Max. progeny per brood	6	Wild: Mean 4.5, range 3-6. 3.68 eggs hatch on average, 3.36 survive for 2 months – fledge at c. 65 days.	
Sex-ratio at birth in % males	50%	Observed skews are small and not significantly different from 50:50.	
Reproductive Rates (SD due to EV)			
% adult females breeding	25% (E.V. 2.5%)	Calculated from Dr Kim's data, with assumptions (currently 15 prs out of c. 116 adults. Assuming 50:50 sex-ratio in adult birds gives 15 females out of c. 58=25%). Note that we need % of breeding females to be calculated from the total number of adult females, not the total number of birds (Dr Kim has provided annual % breeders out of the whole population. This is useful additional information but we must treat with caution because sample size is very low in the early years, possibly	% females: 20–40 at increments of 5% E.V.: 5 – 20% of % females breeding, at increments of 5%

Vortex Parameters	Wild Base Model	Rationale & details: unless otherwise specified, values are based on data from Drs Kim & Ha. Studbook & PMx files include both captive & wild data.	Sensitivity Tests for WILD model
		creating unrepresentative levels of variability and outlier values). Suggest EV at	
Brood Distribution	0 broods=11% 1 brood= 89%	From 37 wild and 52captive+release cage breeding events (i.e. nest+eggs).	No tests – effect similar to changing % females breeding.
Distribution of number of (hatchlings) per female per brood	1 =6% 2 =15% 3 =25% 4 =28% 5 =23% 6 =3%	Total clutches=89: captive (incl. release cage)=52; wild=37; 14 captive and 18 wild clutches resulted in 0 hatchlings. These are included in the Brood Distribution figures. Only clutches resulting in at least one hatchling are included here. Frequency of hatchling numbers calculated separately for captive & wild (increased stress in captive birds can reduce breeding success).	Tested using Normal Dist. option to simplify illustration.
Use normal distribution	No	Used specified distribution as data do not indicate Normal distribution.	Test mean=2.5, 3.0, 3.5, 4.0, 4.5; test (SD=0)
Mean Standard Dev	No	-	-
Mortality Rates			
Females: mortality rates & (SD in mortality due to EV)			
Age 0 to 1	52% (EV 5.2%)	Includes 14.64% losses of hatchlings pre fledging (c.65 days).	20, 30, 40, 50, 60, 70, 80, 90. 10% EV in each case.
Age 1 to 2	19% (EV 1.9%)	Wild as above	-
Age 2 to 3	9% (EV 0.9%)	Drs Kim & Ha checking age 2-3 figures.	-
Age 3+(wild) – no data after age 2-3 – use this value for all adult age-classes in the baseline.	5% (EV 0.5%) increasing to 25% ≥15yrs	Captive plus wild figures show (roughly) <5% mortality for adult age-classes. Higher rates observed after age 15yrs. Literature on this and other stork species indicates low wild mortality for adult birds. Adult Q(x) values calculated from captive plus wild data may be too optimistic for the wild population (as captive birds can be expected to live longer). However, Q(x) values calculated solely from wild data in Korea may be pessimistic for long-term projections because to date some adult mortality is release-related. Precautionary baseline set here.	2, 4, 6, 8, 10, 12, 14, 16. 10% of Q(x) for EV in each case.
Males (mortality rates and SD in mortality due to EV)			
Age 0 to 1	52% (EV 5.2%)	As for females	AS for females
Age 1 to 2	19% (EV 1.9%)	As for females	-
Age 2 to 3	9% (EV 0.9%)	As for females	As for females

Vortex Parameters	Wild Base Model	Rationale & details: unless otherwise specified, values are based on data from Drs Kim & Ha. Studbook & PMx files include both captive & wild data.	Sensitivity Tests for WILD model
Age 3+(wild) – no data after age 2-3 – use this value for all adult age-classes in the baseline.	5% (EV 0.5%) increasing to 25%≥15yrs	As for females	As for females
Male monopolisation			
% Males in breeding pool	100%	LT monogamous species – assume same as for females.	
Population size			
Starting population size	158		
Carrying capacity	Not known. Set at 158 for baseline and ST tests	58 hectares more or less exclusive per breeding pair (territory is defended and centred on nest). Non-breeding birds use c. 274 hectares (to find food etc) -ranges overlap.	20, 50, 80, 100, 200, 400. Set Ni=K in each case.
Catastrophes included	NONE		

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APPENDIX I. PVA PARTICIPANTS

No.	Affiliation	Title	Name
1	National Institute of Ecology (NIE)	Associate Researcher	Moonhyun Shin
2	Eco-institute for Oriental Stork, Korea National University of Education	Team leader of Oriental Stork reintroduction program	Sukyung Kim
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	Eco-institute for Oriental Stork, Korea National University of Education	Team leader of Oriental Stork population management	Yoon Hyunju
?	Cultural Heritage Administration	Senior officer, Division of natural heritage	Shin Yongun
4	IUCN SSC CPSG	Program Officer, Multi-species Planning	Natasha Peters
5	IUCN SSC CPSG	Director of Science, Multi-species Planning	Caroline Lees

APPENDIX II. SENSITIVITY TESTS

Table 6. Results of Wild Baseline Model Sensitivity Tests (det-r=deterministic growth; stoch-r=stochastic growth; PE=100-year extinction risk; N-extant=mean population size at 100 years for simulations that did not go extinct; N-all=mean population size at 100 years across all simulations; GeneDiv= gene diversity retained at 100 years; nAlleles=number of alleles retained at 100 years; meanTE=mean time to extinction for simulations that went extinct over the 100-year period).

Scenario (500 runs)	det-r	stoch-r	SD(r)	PE	N-extant	SD(N-ext)	N-all	SD(N-all)	GeneDiv	SD(GD)	nAlleles	SD(nA)	medianTE
WILD	0.0479	0.0347	0.0568	0	152.53	9.58	152.53	9.58	0.9176	0.0181	22.35	2.52	0
ST1	-0.2143	-0.2332	0.1967	1	0	0	0	0	0	0	0	0	16
ST2	0.0729	0.065	0.0586	0	149.23	4.19	149.23	4.19	0.9234	0.0152	24.03	2.85	0
EV0	0.0555	0.0312	0.0499	0	154.18	6.24	154.18	6.24	0.9273	0.0155	25.15	2.77	0
EV1	0.0555	0.0321	0.0535	0	154.29	6.87	154.29	6.87	0.9286	0.0133	25.13	2.8	0
Offspring2	0.0458	0.0142	0.0582	0	132.58	25.3	132.58	25.3	0.9071	0.0228	19.94	3.06	0
Offspring4	0.0425	0.021	0.0505	0	150.07	10.4	150.07	10.4	0.9334	0.0125	26.9	2.88	0
Maxlife14	0.0329	-0.0017	0.063	0.01	80.64	39.51	79.84	40.09	0.8851	0.0451	16.29	4.4	0
Maxlife16	0.0434	0.0149	0.0539	0	137.9	23.23	137.9	23.23	0.9148	0.0225	21.85	3	0
Maxlife18	0.0505	0.0247	0.0521	0	150.61	10	150.61	10	0.9233	0.0147	23.63	2.79	0
Maxlife22	0.059	0.0362	0.0511	0	154.92	5.21	154.92	5.21	0.9295	0.0135	26	2.89	0
Maxlife24	0.0616	0.0397	0.051	0	155.78	4.75	155.78	4.75	0.9317	0.0146	26.82	3.07	0
%FBrd20	0.0309	0.0059	0.0513	0	119.2	31.79	119.2	31.79	0.9218	0.021	23.23	3.94	0
%FBrd30	0.0768	0.0521	0.0543	0	156.42	4.41	156.42	4.41	0.9245	0.0143	24.13	2.69	0
%FBrd35	0.0958	0.0705	0.0562	0	157.08	3.65	157.08	3.65	0.9218	0.0166	23.11	2.72	0
%FBrd40	0.1129	0.0865	0.0582	0	157.5	3.91	157.5	3.91	0.9203	0.0161	22.51	2.58	0
%FBrdEV5	0.0555	0.0314	0.0559	0	152.67	7.77	152.67	7.77	0.9261	0.0162	24.83	2.81	0
%FBrdEV10	0.0555	0.0283	0.067	0	149.61	12.11	149.61	12.11	0.9269	0.0142	24.94	2.91	0
%FBrdEV15	0.0555	0.0231	0.0827	0	139.46	22.22	139.46	22.22	0.9265	0.0164	24.6	3.26	0
%FBrdEV20	0.0555	0.0168	0.0954	0	123.76	34.38	123.76	34.38	0.922	0.0218	23.55	3.98	0
NormDist3	0.0365	0.0147	0.0471	0	144.02	15.95	144.02	15.95	0.9314	0.0135	26.94	3.12	0

NormDist3.5	0.0536	0.03	0.0497	0	153.8	6.61	153.8	6.61	0.9303	0.0136	25.95	2.85	0
NormDist4	0.069	0.0439	0.0525	0	155.57	5.11	155.57	5.11	0.9261	0.0161	24.66	2.72	0
NormDist4.5	0.0831	0.0557	0.0559	0	156.37	4.38	156.37	4.38	0.9217	0.0165	23.34	2.73	0
1stYrMort20	0.1183	0.0856	0.0585	0	157.48	4.22	157.48	4.22	0.9109	0.0187	20.34	2.55	0
1stYrMort30	0.1009	0.0708	0.0563	0	156.93	3.85	156.93	3.85	0.9163	0.0161	21.68	2.57	0
1stYrMort40	0.0817	0.0544	0.0538	0	156.42	4.12	156.42	4.12	0.9214	0.0159	23	2.59	0
1stYrMort50	0.0602	0.0356	0.0517	0	154.98	5.52	154.98	5.52	0.9267	0.0158	24.84	2.79	0
1stYrMort60	0.0353	0.0132	0.0511	0	140.43	18.96	140.43	18.96	0.9288	0.0141	25.58	3.01	0
1stYrMort70	0.0054	-0.0219	0.0753	0.096	25.54	20.7	23.2	20.96	0.8369	0.0992	11.76	5.47	0
1stYrMort80	-0.0332	-0.0597	0.1127	0.992	4.75	0.96	0.07	0.48	0.7201	0.0354	4.5	0.58	65
1stYrMort90	-0.0919	-0.1048	0.1304	1	0	0	0	0	0	0	0	0	38
AdMort2	0.0761	0.0537	0.0487	0	157.06	3.52	157.06	3.52	0.9304	0.0139	25.97	2.87	0
AdMort4	0.0624	0.0391	0.0505	0	155.61	5.09	155.61	5.09	0.9286	0.013	25.33	2.87	0
AdMort6	0.0485	0.024	0.0526	0	150.71	9.72	150.71	9.72	0.9253	0.0155	24.52	2.83	0
AdMort8	0.0345	0.0075	0.0569	0	119.58	30.93	119.58	30.93	0.9161	0.0218	21.64	3.71	0
AdMort10	0.0203	-0.0134	0.0749	0.058	45.52	31.67	42.95	32.44	0.8551	0.0763	13.27	5.04	0
AdMort12	0.006	-0.0384	0.1132	0.622	10.43	9.07	4.16	7.44	0.7113	0.1457	5.71	2.94	94
AdMort14	-0.0085	-0.054	0.1301	0.972	4.14	1.96	0.19	0.81	0.5583	0.1329	3.36	1.08	70
AdMort16	-0.0232	-0.0692	0.1428	1	0	0	0	0.04	0	0	0	0	56
CC20	0.0479	-0.0138	0.1595	0.962	7.68	4.3	0.33	1.7	0.3934	0.2552	2.26	1.05	54
CC50	0.0479	0.0089	0.1004	0.134	28.98	14.2	25.22	16.32	0.7289	0.1167	6.3	1.97	0
CC60	0.0479	0.015	0.0881	0.044	40.56	15.49	38.8	17.22	0.7751	0.0878	7.8	1.95	0
CC70	0.0479	0.0202	0.0805	0.014	53.74	16.68	53	17.7	0.8152	0.0593	9.46	2.1	0
CC80	0.0479	0.0241	0.0745	0.004	67.96	14.69	67.69	15.28	0.8405	0.056	11.23	2.1	0
CC100	0.0479	0.0286	0.067	0	90.77	12.05	90.77	12.05	0.8741	0.0332	14.25	2.19	0
CC200	0.0479	0.0373	0.0524	0	196	7.76	196	7.76	0.9343	0.0129	28.18	3.01	0
CC400	0.0479	0.0423	0.0435	0	397.48	7.25	397.48	7.25	0.9663	0.0048	55.28	4.24	0
M F Harvest4 2 2	0.0479	0.0327	0.0573	0	150.15	10.65	150.15	10.65	0.9177	0.0179	22.19	2.73	0
M F Harvest4 F4 M0	0.0479	0.0302	0.0573	0	148.75	12.23	148.75	12.23	0.919	0.0176	22.4	2.65	0
M F Harvest4 F0 M4	0.0479	0.0351	0.0572	0	151.77	8.21	151.77	8.21	0.9182	0.0176	22.5	2.55	0

M F Harvest6 3 3	0.0479	0.0307	0.0579	0	148.1	12.48	148.1	12.48	0.9165	0.0187	22.31	2.84	0
M F Harvest6 F6 M0	0.0479	0.0279	0.0575	0	145.58	15.59	145.58	15.59	0.9186	0.0171	22.25	2.64	0
M F Harvest6 F0 M6	0.0479	0.0342	0.0579	0	149.21	10.05	149.21	10.05	0.9183	0.0166	22.36	2.58	0
M F Harvest8 4 4	0.0479	0.0299	0.059	0	146.59	12.6	146.59	12.6	0.9189	0.0168	22.28	2.63	0
M F Harvest8 F8 M0	0.0479	0.0245	0.059	0.002	140.52	20.06	140.25	20.95	0.9181	0.0173	22.26	2.78	0
M F Harvest8 F0 M8	0.0479	0.034	0.0595	0	149.55	9.39	149.55	9.39	0.9181	0.0174	22.05	2.61	0
M F Harvest10 5 5	0.0479	0.0284	0.0609	0	144.46	13.27	144.46	13.27	0.9166	0.0182	21.83	2.7	0
M F Harvest10 F10 M0	0.0479	0.0214	0.0614	0.008	136.07	25.02	135.03	27.51	0.9151	0.018	21.22	3.12	0
M F Harvest10 F0 M10	0.0479	0.034	0.0609	0	146.84	9.99	146.84	9.99	0.917	0.0173	21.92	2.84	0
M F Harvest20 10 10	0.0479	0.0213	0.0725	0.002	129.63	22.08	129.37	22.81	0.9133	0.0204	21.04	2.98	0
M F Harvest20 F20 M0	0.0479	-0.0051	0.0926	0.392	83.17	46.14	51.51	53.47	0.8882	0.0562	17.58	4.96	0
M F Harvest20 F0 M20	0.0479	0.0315	0.0716	0	138.47	11.77	138.47	11.77	0.9135	0.0181	21.13	2.61	0

Population Viability Analysis Working Group

Group Members: Sukyung Kim, Seokwan Cheong, Sungyeon Yoo, Kaori Ota, SeonJu Lee, Caroline Lees

Introduction

The Population Viability Analysis (PVA) Working Group considered demographic and genetic issues relevant to the conservation of the Oriental Stork. It considered both captive and wild populations. In addition, it considered one issue relevant to captive management.

Long-term population targets (to 2050)

Setting long-term population targets is an important part of planning for threatened species. Long-term targets should consider what "recovery" means for a species, given that for many species landscape changes make return to a pristine former state impossible. In considering targets it can be valuable to consider:

- Future distribution: where the species could and should be in future.
- Viability: in what numbers, with what level of connectivity and with how much gene diversity retained.
- Ecological function: living at what densities, in association with what habitats or ecosystems and with what other species.

On the first day of the workshop, participants created a long-term vision for the Oriental Stork in South Korea which paints a picture of a desired future for the species and which speaks to these elements qualitatively. The PVA group considered the first two of these issues quantitatively, to support monitoring and evaluation and to provide guidance on the definition of "successful scenarios" for future modelling work.

Wild population

Range expansion target

The group considered the past and current range of the Oriental Stork and discussed where its future (2050) distribution should be. Both migratory and resident populations were included. The group recommended that a range expansion be pursued, which would see current breeding range extended along the western and southern sides of South Korea, with the total range extending west to east (see Figure 1).

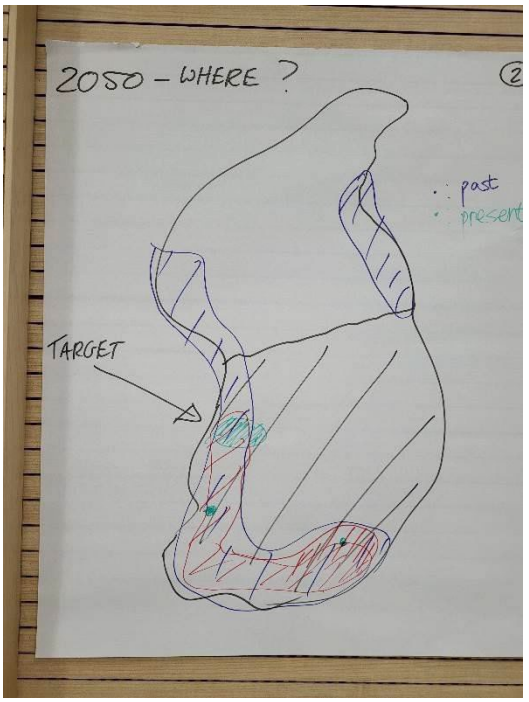

Figure 1. Recommended target range of Oriental Stork in South Korea by 2050 (Past breeding range= blue; current breeding range=green; recommended 2050 breeding range=red. Black indicates total range targeted by 2050.

Viability targets

Wild Population

The aim is to generate a self-sustaining wild population. This has both demographic and genetic implications. Demographically, the population needs to be stable or increasing and large enough to overcome risks from demographic and environmental stochasticity. Genetically, it must be large enough to retain high-levels of gene diversity and avoid deleterious levels of inbreeding.

A target of 500 mature individuals, initiated with ≥ 95%[1] wild source gene diversity was recommended on the basis that:

- it is likely to be feasible within the targeted future range (subject to further calculations)
- it exceeds the number required to overcome demographic and environmental stochasticity (according to current PVA models)
- it should be sufficient to prevent inbreeding accumulations and mitigate long-term genetic deterioration through drift provided that:
- most or all adults are contributing to the breeding pool[2]
- there is periodic introduction of at least unrelated breeders via migration from Russia and China (first instance of this was recorded in 2023)
- the population is established with sufficient genetic diversity from the captive population (95% wild source gene diversity is the target for this).

Note that current PVA models include the following key features:

- Year mortality = 52%
- Adult mortality = 5% (25% after age 14 years)
- 25% adult birds breeding

These parameters generate approximately 3% growth each year. They may be used as part of a range of indicators to monitor population health.

Captive population

The captive population is already established. It numbers approximately 145 birds with around 8 breeding pairs. It generates enough birds for annual releases of 10-24 birds. Gene diversity in the captive population is currently high (96% and 94%) but birds are becoming inter-related and future gene diversity loss and inbreeding accumulation are expected.

Standard genetic targets are recommended as follows:

- Retain 95% wild source gene diversity
- Maintain mean population inbreeding below F=0.125
- Equalise founder representation and maximise genetically effective population size (increase the proportion of adults contributing to the breeding pool, prioritising those with low and similar mean kinship values).

Exit strategy

The captive population's role is to provide birds for the release program and to support gene diversity retention by the wild population while it is growing. Once the wild population has reached the target of N=500 mature individuals and is stable (or increasing), the role and management of the captive population can be reviewed for potential wind-down.

References

Frankham, R., Briscoe, D. A., & Ballou, J. D. (2002). *Introduction to conservation genetics*. Cambridge University Press.

Frankham, R., Bradshaw, C. J., & Brook, B. W. (2014). Genetics in conservation management: revised recommendations for the 50/500 rules, Red List criteria and population viability analyses. *Biological Conservation*, *170*, 56-63.

[1] Internationally applied standards for gene diversity retention range from 90-95% (Frankham et al. 2002)

[2] A genetically effective size of 500-1000 mature individuals, which roughly equates to a breeding population of 250 -500 pairs, should be sufficient to achieve a balance between the rate of gene diversity loss through drift and that accumulated through mutation (Frankham et al. 2014)

WORKING GROUP NOTES:

ORIENTAL STORK ISSUE STATEMENTS

CAPTIVE POPULATION MANAGEMENT WORKING GROUP

Issue 1	유전적 다양성 관리 Genetic diversity management		
Description	황새 사육 개체군의 유전적 다양성을 관리하여 야생 황새 개체군의 유전적 다양성을 증진시킨다 Management of the genetic diversity of reintroduced population with captive population in wild		
Impact	사육개체군과 야생개체군의 유전적 부동으로 유전적 다양성 감소 The decrease of genetic diversity by the gene drift in captive and reintroduced population.		
Causes	특정 번식쌍의 증식 개체수 차이로 가계별 자손 수 불균형 The offspring imbalance of breeding pairs Inbreeding chance is increasing		
Discussion notes			
	Facts & Evidence	**Assumption & Justification**	**Key information gap**
	사육황새 개체군 (Captive population) GD = 96% 야생황새 개체군 (Reintroduced population) GD = 94% 러시아, 중국 황새의번식개체군 유입시작(2023년) Wild storks migrated from Russia or China start to make a pair with reintroduced population,		돌연변이 비율 Mutation frequency 야생에서의 근친도 계산 어려움 Difficulties to calculate the inbreeding frequency in the wild

Goals	Retention of 95% wild source genediversity 야생 개체군의 유전적 다양성 지수 95% 유지 Maintenance of mean population inbreeding below F=0.125 근친도지수(F) 0.125 미만의 개체군 유지 Equalise founder representation, and maximize genetically effective population size 번식쌍 별 자손수 동일, 유전적으로 우수한 개체군 사이즈 최대화
Actions	해외도입 및 교환을 통한 사육 개체군의 유전적 다양성 증진 Management of the genetic diversity of captive population through the import new founders from Russia and Japan 재도입 개체군 유전적 다양성 목표지수 달성여부에 따라 사육 개체군 방사 Run releasing program depend on the goal (95%) of genetic diversity index 황새 둥지탑 추가 설치로 월동 야생 황새 정착 유도 Induce the wintering population to pair with reintroduced population by installing the artificial nest poles in wintering sites 유전적으로 우수한 개체군 확립을 위한 번식프로그램 운영 Run the breeding program with targeting the genetic diversity higher

Issue 2	수의학적인 건강관리 시스템 부족 Lack of veterinary health care system for storks
Description	황새 사육 개체군의 정기 건강관리 및 검사를 하는 수의시스템을 어떻게 마련할 것인가? How to prepare a veterinary system to manage physical treatment, autopsy+check-ups
Impact	야생개체군과 사육개체군의 건강성을 유지하기 위해 필요 유용한 사육개체군 건강관리 프로그램으로 방사 개체군에 적용
Causes	지원 예산 부족(not enough budget), 야생동물 전문 수의사와 연계협력 부족 (Lack of cooperation with wildlife veterinarians) 전염성 질병 확산(외부 기생충, AI, (Chlamydia) Disease of concern: Some parasites (Avian influenza, other avian Diseases (Chlamydia)

Discussion notes			
	Facts & Evidence	**Assumption & Justification**	**Key information gap**
	Japan – annual catch-up only for health check 일본 타마동물원 – 연 1회 건강체크진 행 Yesan stork park – no veterinarians and health management system Knue (Ecosos) - no veterinarians and there is the health management system, but it should be improved		방사 전 황새 건강관리 프로그램 세부 내용 (효고현립 황새고향공원 문의 필요) Need check-up to test for parasites, potentially harmful to humans/other species.
Goals	황새 건강관리 시스템 확립 Establishment of a health care system for storks within one year		
Actions	질병 및 건강관리 매뉴얼 보완 야생동물 수의사 양성 프로그램 연 1회 운영 야생동물 수의사 연계 사업 강화 황새 건강관리 프로그램 운영 및 네트워크 활성화		

Issue 1

Title:	전기시설(전봇대, 전선 Electrical facilities (telegraph pole, electrical wire)
Description:	송전선로 및 송전탑에 의한 황새의 부상 및 폐사 발생 Storks' injuries and electrocution by transmission lines and towers
Impact:	비행 및 휴식 중 고압 송전선로에 의한 감전 및 충돌 Electrocution and collision while flying and resting by high-tension power line
Causes:	서식지주변 전기시설 증가 및 휴식에 적절한 나무 부족 Increase of electrical facilities and lack of suitable trees for resting
What do we know?	비행 중 전선과의 충돌로 인한 부상, 폐사 발생 Injuries and deaths due to collision with power lines during flight 전봇대 이용 중 감전사고 발생 Electric shock occurred while using a power pole 서식지 주변의 전기시설이 증가했다 Electrical facilities around the habitat have increased
What do we assume?	황새가 나무보다 전봇대를 더 선호한다 Storks prefer telephone poles to trees 번식 및 휴식할 나무가 부족하다 There are not enough trees to reproduce and rest on.
What more do we need to know?	황새가 선호하는 번식지 및 휴식지 유형(전기시설 입지) Types of breeding and resting areas preferred by storks (location of electrical facilities) 적절한 번식 및 휴식지 부족 여부 Lack of suitable breeding and resting areas
Discussion notes:	
GOAL 1:	예산 지역의 황새 서식지 근처 전선에 2028 년까지 조류 충돌 방지 표식을 부착한다.(전선에 택 부착 등) Bird collision prevention signs will be attached to electric wires near stork habitats in the Yesan area by 2028 (attachment of tags to electric wires, etc.).
GOAL 2:	황새 서식지 인근에 전봇대를 대체할 휴식용, 번식용 둥지탑을 설치한다. Nest towers for resting and breeding will be installed near stork habitats to replace electric poles.

Issue 2

Title:	농약 pesticide
Description:	농약으로 개체수감소 Reduce of population size
Impact:	농약 사용 증가로 인한 폐사 및 먹이 자원 감소 Individual deaths and decrease of prey resources by increase of pesticide use
Causes:	농촌사회 고령화로 인한 노동력 감소 및 친환경 농가 감소 Shortage of workforce and reduce of eco-friendly agriculture by aging of rural society
What do we know?	농약사용 증가 Increased pesticide use 중독사례 증가 Increase in poisoning cases 먹이자원 감소 Decrease in food resources 농촌사회 고령화로 인한 노동력 감소 Decrease in labor force due to aging of rural society 친환경 농가감소 Decrease in eco-friendly farms
What do we assume?	
What more do we need to know?	친환경 농약(대체제) 개발여부 Whether eco-friendly pesticides (alternatives) are being developed?
Discussion notes:	
GOAL 1:	관농하는 농가가 친환경농업을 할 때 농가수익의 차액을 보전을 강구한다.(친환경농업 시 경제적 수입이 증가하도록한다.) When government-owned farms practice eco-friendly farming, the difference in farm profits is compensated. (Increase economic income through eco-friendly farming.)

Issue 3

Title:	재도입 개체 Reintroduction individuals
Description:	사육개체 방사 시 1 년이내 폐사 발생 Individual deaths after reintroduction
Impact:	방사 후 100 일 이내 폐사원인 중 포식 높음 Reports of high mortality by predation in 100 days after release
Causes:	다년간 사육환경 적응에 의한 야생생존능력 부족 Lack of survival ability by adaption to captive environments
What do we know?	방사 후 100 일 이내 폐사원인 중 포식 높음 Predation is the most common cause of death within 100 days after release. 적절한 자연적응훈련 공간이 없음 There is no appropriate space for natural adaptation training.
What do we assume?	다년간 사육환경 적응에 의한 야생생존능력 부족 Lack of ability to survive in the wild due to many years of adaptation to the breeding environment
What more do we need to know?	적절한 자연적응훈련 공간의 규모, 형태 Size and shape of appropriate natural adaptation training space 자연적응훈련의 폐사율 감소 효과 Mortality reduction effect of natural adaptation training
Discussion notes:	
GOAL 1:	적절한 자연적응훈련 프로그램 개발(훈련 내용, 기간, 시설, 방사 전 평가 등) Development of an appropriate natural adaptation training program (training content, period, facilities, pre-release evaluation, etc.)
GOAL 2:	자연적응훈련장 조성 및 운영 Creation and operation of a natural adaptation training center

Issue 4

Title:	논 경관 Rice paddy landscape
Description:	논 경관이 인간 중심으로 관리 Human-friendly management of paddy field
Impact:	휴식처 및 먹이터 교란 및 감소 Decrease and disturbance of resting and foraging area
Causes:	생산 효율을 높이기 위해 비닐하우스 및 콘크리트 증설, 수목 제거 Making of more vinyl greenhouse and concrete structures to raise the efficiency of production
What do we know?	논 경관이 인간 중심으로 관리 Rice field landscapes are managed with people in mind 휴식처 및 먹이터 교란 및 감소 Disturbance and reduction of resting and feeding grounds 생산 효율을 높이기 위해 비닐하우스 및 콘크리트 증설, 수목 제거 Expansion of greenhouses and concrete, removal of trees to increase production efficiency
What do we assume?	휴식처 및 먹이터 교란 및 감소의 정도 Degree of disturbance and reduction of resting and feeding grounds (과거의 논과 현재의 논 비교) (Comparison of past and current rice fields)
What more do we need to know?	교란 및 감소의 정도 Degree of disturbance and decline
Discussion notes:	
GOAL 1:	황새 서식지 인근의 콘크리트 논 수로에 생태통로 설치를 확대한다. Expand the installation of ecological corridors in concrete rice paddy waterways near stork habitats.
GOAL 2:	황새 서식에 적합한 논 경관 조성을 위한 가이드라인을 제작한다. Create guidelines for creating rice field landscapes suitable for stork habitat.
GOAL 3:	적합한 논 경관 조성 Creating a suitable rice field landscape

Issue 5

Title:	습지 생태계 교란 Wetland ecosystem disturbance
Description:	하천, 연안에서 황새의 서식지 교란 증가 Increased habitat disturbance of storks in rivers and coastal areas
Impact:	하천, 연안을 이용하는 인간의 교란활동으로 인해 황새 스트레스 증가 Increased stress on storks due to human disturbance in rivers and coasts.
Causes:	낚시 폐기물(줄, 찌, 쓰레기) 및 폐그물과 빛 공해, 소음공해로 인한 교란 Disturbance by fishing waste (fishing gut, bait, waste), net waste, light pollution, and noise
What do we know?	하천, 연안에서 황새의 인간의 교란 활동 증가 Increased human disturbance activity of storks in rivers and coastal areas 서식지 환경 질 저하 Deterioration of habitat environmental quality
What do we assume?	하천, 연안에서 황새의 서식지 교란 증가 Increased habitat disturbance of storks in rivers and coastal areas 황새의 스트레스 및 사망률 증가 Increased stress and mortality in storks
What more do we need to know?	황새의 서식지 환경 질 저하가 황새에 미치는 영향(사망률, 스트레스 정도) The impact of the decline in the quality of the stork's habitat environment on the stork (mortality rate, level of stress)
Discussion notes:	
GOAL 1:	인간의 교란활동 예방을 위한 교육, 홍보를 확대한다.(낚시 활동 후 폐기물 수거 등) Expand education and publicity to prevent human disturbance activities (collection of waste after fishing activities, etc.)
GOAL 2:	낚시 그물, 줄 등 폐기물 수거에 대한 보상 제도를 마련한다.(주체 환경부 또는 지자체) Establish a compensation system for the collection of waste such as fishing nets and lines. (Main subject: Ministry of Environment or local government)

Issue 6

Title:	새와 지역주민의 관계 relationship between storks and local residents
Description:	황새에 대한 지역주민의 부정적 인식 증가 Negative thoughts of local residents on oriental stork
Impact:	황새의 주서식지 소실 가능성 증가 및 미래 공존가능성 감소 Increase of possibility of main habitat reduction and decrease of coexistence possibility
Causes:	농가 수익에 부정적 영향 및 친환경 농가 지원 부족 Negative effect on profits of farming and lack of support on eco-friendly agriculture
What do we know?	황새에 대한 지역주민의 부정적 인식 Negative thoughts of local residents on oriental stork 농가 수익 감소 Decline in farm income 친환경 농가 지원 감소 Decrease in support for eco-friendly farms
What do we assume?	부정적 인식증가 Increased negative perception
What more do we need to know?	부정적 인식 비율 정도 Negative perception rate 친환경 농가 지원 감소 비율 Decrease rate of support for eco-friendly farms
Discussion notes:	황새에 대한 긍정적 인식을 지속적으로 전파 필요 There is a need to continue to spread positive awareness about storks. 문제를 표현하는 사람들과 해결하는 사람들이 활동이 그 중심에 황새가 있음 The stork is at the center of the activities of those who express problems and those who solve them.
GOAL 1:	지역 황새 생태관광 콘텐츠 개발 및 지역 주민 이익 공유 Development of local stork ecotourism content and sharing of benefits with local residents

GOAL 2:	지역공동체 대중인식이 확산되도록 한다. Spread public awareness in local communities.

Issue 7

Title	송전탑고장 breakdown of transmission tower
Description:	황새 개체수 증가에 따른 전기시설 고장 건수 증가 Increase of the breakdown cases
Impact:	정전사고 발생 및 시설 고장
	Power outage accidents and facility breakdowns 산업공단에 미치는 영향(정전 시 생산품의 불량률 증가) Impact on industrial complexes (increased defect rate of products during power outage) 단전 시 신재생에너지 이용의 통로가 차단됨 When power is cut off, the path to use renewable energy is blocked.
Causes:	황새의 송전탑 선호도, 이용률 높음(둥지 조성 및 휴식), Stork preference for transmission towers, high utilization rate (nesting and resting); 배설물 증가 Increased excrement
What do we know?	황새가 둥지를 튼 송전탑 고장 건수 증가 The number of breakdowns in transmission towers where storks nest increases. 황새 배설물이 송전탑 고장을 일으킨다 Stork droppings cause transmission tower failures
What do we assume?	둥지 조성 및 휴식 시 황새가 송전탑을 선호한다 Storks prefer power transmission towers when creating nests and resting.
What more do we need to know?	황새가 송전탑에 둥지를 틀지 않게 하는 적절한 시설 Adequate facilities to prevent storks from nesting on power transmission towers
Discussion notes:	
GOAL 1:	송전탑의 형태를 변형하여 황새가 이용하지 않게 한다.(또는 황새가 안전하게 이용하도록 한다.) Modify the shape of the transmission tower to prevent storks from using it. (Or let the stork use it safely.)
GOAL 2:	둥지를 튼 송전탑 인근에 황새를 위한 인공둥지탑을 설치하여 이동을 유도한다. Artificial nesting towers for storks are installed near the transmission tower where they nest to encourage their migration.

Issue 1 Eco-friendly farming practices

Title:	*Eco-friendly farming practice*
Description:	*Eco-friendly farming practice has been decreasing*
Impact:	• *The diminishing availability of suitable habitats for Oriental stork (e.g., rich food sources and absence of toxic substances like pesticides)* • *It leads to the breakdown of the coexistence system or coexistence culture that had been maintained between Oriental stork and local residents.*
Causes:	• *The agricultural population is aging.* • *Applying eco-friendly farming practices is challenging.* • *The changes in land leasing policies make it impossible to lease farmland at the village level, resulting in the disintegration of farming cooperatives.* • *Eco-friendly farming has lower productivity and yields lower income for farmers.*
What do we know?	• *The diminishing availability of suitable habitats for Oriental stork (e.g., rich food sources and absence of toxic substances like pesticides)* • *The agricultural population is aging.* • *Applying eco-friendly farming practices is challenging.* • *Eco-friendly farming has lower productivity and yields lower income for farmers.*
What do we assume?	• *We assume that decrease in eco-friendly farming leads to the breakdown of the coexistence system or coexistence culture that had been maintained between Oriental stork and local residents.* • *We assume that the changes in land leasing policies make it impossible to lease farmland at the village level, resulting in the disintegration of farming cooperatives.*
What more do we need to know?	• *Has the awareness related to Oriental stork-human coexistence changed in regions where eco-friendly farming has decreased?*
Discussion notes:	
GOAL 1:	*2030 년까지 친환경 농업 비율을 10%까지 확대한다.*
GOAL 2:	*지역 내 물질 순환 농업을 완성한다.*

Issue 2 Habitat protection

Title:	*Habitats not protected*
Description:	*Most of the habitats utilized by Oriental stork, including coastal wetlands and nesting sites, are not designated or managed as natural reserve.*
Causes:	• *Coastal areas where Oriental stork utilizes are often extensive, and their management poses challenges, leading to a tendency for them not to be designated as natural reserve.* • *Coastal areas face a conflict between tourism development and conservation, leading to a pending decision on the designation of natural reserve.* • *The policies related to natural reserve are inadequate.* • *The differentiation and management of Oriental stork breeding and wintering grounds necessitate complex considerations, making the designation of natural reserves challenging.*
What do we know?	• *Most of the habitats utilized by Oriental stork, including coastal wetlands and nesting sites, are not designated or managed as natural reserve.* • *Habitat alteration for Oriental stork is taking place.* • *Coastal areas where Oriental stork utilizes are often extensive, and their management poses challenges, leading to a tendency for them not to be designated as natural reserve.* • *Coastal areas face a conflict between tourism development and conservation, leading to a pending decision on the designation of natural reserve.* • *The policies related to natural reserve are inadequate.* • *The differentiation and management of Oriental stork breeding and wintering grounds necessitate complex considerations, making the designation of natural reserves challenging.*
What do we assume?	-
What more do we need to know?	-
Discussion notes:	
GOAL 1:	*황새의 생존과 직결된 핵심서식지에 대한 연구*

Issue 3 Drone pest control

Title:	*Increase in drone pest control*
Description:	*The use of aerial spraying like drones on farmland is on the rise, leading to an increase in pesticide usage (농지를대상으로한드론등항공공동방제가증가하고 있으며, 이로인해농약사용이더증가하고 있음)*
Impact:	*Not only is the quality habitat diminishing, but also the biodiversity of paddy fields is being degraded (질 좋은 서식지가 감소할 뿐만 아니라 논 생물 다양성이 저하됨).*
Causes:	• *Aerial spraying and similar methods are superior to traditional pesticide application in terms of efficiency and effectiveness (항공방제 등이 효율성, 효과성측면에서전통적인 방제보다탁월함).* • *The budget related to aerial spraying has been newly established or significantly increased(관련예산이 신설 또는 대폭 증액되었음).* • *Due to the aging agricultural population, there is a strong preference for convenient pest control method (e.g., drones) (고령화로 인해 편리한 방제를 선호함)* • *The use of drones for pest control is becoming widespread (드론을 이용한 방제가 보편화됨)*
What do we know?	• *The use of aerial spraying like drones on farmland is on the rise, leading to an increase in pesticide usage (농지를 대상으로한 드론등 항공 공동 방제가 증가하고있으며, 이로인해 농약 사용이 더 증가하고있음)* • *Not only is the quality habitat diminishing, but also the biodiversity of paddy fields is being degraded (질 좋은 서식지가 감소할 뿐만 아니라 논 생물 다양성이 저하됨).* • *Aerial spraying and similar methods are superior to traditional pesticide application in terms of efficiency and effectiveness (항공방제 등이 효율성, 효과성측면에서전통적인 방제보다탁월함).* • *The budget related to aerial spraying has been newly established or significantly increased (관련 예산이 신설 또는 대폭 증액되었음).* • *Due to the aging agricultural population, there is a strong preference for convenient pest control method (e.g., drones) (고령화로 인해 편리한 방제를 선호함)* • *The use of drones for pest control is becoming widespread (드론을 이용한 방제가 보편화됨)*
What do we assume?	-
What more do we need to know?	-
Discussion notes:	

GOAL 1:	*국내 항공 방제에 대한 현황을 조사한다.*
GOAL 2:	*항공 방제 지역 내 친환경 농작물 피해에 대한 현황을 조사한다.*
GOAL 3:	*항공 방제가 친환경 농업에 미치는 영향을 입증한다.*

Issue 4 Reclamation

Title:	*Decrease of mudflats in west coast*
Description:	*Mudflats in west coast have been decreasing due to land reclamation project.*
Impact:	• *The suitable winter habitat for Oriental stork (i.e., mudflats) is diminishing (황새의 겨울철 적합서식지 (즉, 갯벌)가 감소한다).* • *The ecological health of the remaining mudflats is deteriorating (남아있는 갯벌의 건강성이 저하된다).* • *The situation where Oriental stork are attracted to poor-quality habitats like reclaimed land, leading to a decrease in their adaptability (i.e., ecological trap), can occur (황새가 간척지와 같은 질 나쁜 서식지로 오히려 유인되어 적응도가 낮아지는 (즉, ecological trap) 상황이 발생할 수 있다).*
Causes:	• *The reclamation project is gaining substantial support from the local residents due to itspositive impact on their income (간척사업은 지역주민의 소득을 올려주므로 많은 지지를 얻고 있다).*
What do we know?	• *Mudflats in west coast have been decreasing due to land reclamation project.* • *황새의 여름철, 겨울철 적합서식지가 감소한다.* • *간척사업은 지역주민의 소득을 올려주므로 많은 지지를 얻고 있다.*
What do we assume?	• *남아있는 갯벌의 건강성이 저하된다.* • *황새가간척지와같은질나쁜서식지로오히려유인되어적응도가낮아지는(즉, ecological trap) 상황이 발생할 수 있다.*
What more do we need to know?	• *Is the ecological health of the remaining tidal flats in the vicinity of the reclamation project area deteriorating? (간척사업이 추진되고 있는 지역 주변에 남아있는 갯벌의 생태적인 건강성이 저하되고 있는가?)* • *Does the reclamation site act as an ecological trap, reducing the fitness of wild birds like Oriental stork? (간척지가 황새와 같은 야생 조류를 생태학적 덫(ecological trap)에 갇히게 하는가?)*
Discussion notes:	
GOAL 1:	간척지 개발사업을 현실적으로 검토할 수 있도록 환경영향평가법을 개정한다.

Issue 5 Eco-friendly farming certification

Title:	*Difficulties in maintenance of eco-friendly farming certification*
Description:	*It is difficult for rice farmers to maintain their eco-friendly farming certification(농사 종사자의 친환경 인증 유지가 어렵다).*
Impact:	*The high-quality habitats for Oriental stork, meaning those with abundant food and free from toxins, are decreasing, and the storks are becoming intoxicated by pesticide(황새를 위한 질 좋은 서식지(즉, 먹이가 풍부하고 독성물질이 없는)가 감소하고, 황새가 농약에 중독된다).*
Causes:	• *Due to the various and unpredictable pathways through which pesticides can enter, including unintentional pesticide runoff, it is challenging to maintain the eco-certifications(농약이 유입될 수 있는 경로가 다양하고 예측불가능하기 때문에 비의도적 농약유입으로 친환경 인증이 유지되기 어렵다).* • *Because the presence of pesticides in the cultivated crops is the criterion for eco-certification, crop management becomes challenging(키운 작물의 농약 검출 여부가 친환경 인증의 기준이 되기 때문에 작물관리가 어렵다).* • *Currently, the eco-certification system is more focused on the outcome rather than the process, making it difficult for farmers to maintain certification(현재 친환경 인증제는 과정보다는 결과에 치우친 제도이기 때문에 농민 입장에서는 인증을 유지하기 어렵다).*
What do we know?	• *논 농사 종사자의 친환경 인증 유지가 어렵다.* • *황새를 위한 질 좋은 서식지(즉, 먹이가 풍부하고 독성물질이 없는)가 감소하고, 황새가 농약에 중독된다.* • *이유입될 수 있는 경로가 다양하고 예측불가능하기 때문에 비의도적 농약유입으로 친환경 인증이 유지되기 어렵다.* • *키운 작물의 농약 검출 여부가 친환경 인증의 기준이 되기 때문에 작물관리가 어렵다.* • *현재 친환경 인증제는 과정보다는 결과에 치우친 제도이기 때문에 농민 입장에서는 인증을 유지하기 어렵다.*
What do we assume?	-
What more do we need to know?	-

Discussion notes:	
GOAL 1:	*친환경 인증 제도 개선*

Issue 6 Reshuffling & lack of corporation

Title:	*Reshuffling issue & Lack of corporation between governmental organizations*
Description:	*Frequent reshuffling within government ministries and a lack of collaboration between ministries (e.g., between the central government and local governments, or between the Ministry of Environment and the Ministry of Maritime Affairs) result in low policy consistency and effectiveness, as well as in adequate budget allocation (정부 부처의 잦은 인사이동과 부처간(예: 중앙정부-지방정부, 환경부-해수부 등) 협업 부족으로 정책의 일관성, 효과성이 낮고 예산배분이 제대로 이루어지지 않는다).*
Impact:	*Delays in designating Oriental stork habitat conservation areas and difficulties in implementing other conservation policies occur due to challenges in inter-ministerial collaboration and frequent reshuffling (부처간 협업 어려움, 빈번한인사이동 등으로인해황새 서식지 보호구역지정이지체되거나기타보전정책의 추진이 어려워진다).*
Causes:	• *The awareness level regarding conservation among personnel in responsible position is low (책임 있는 지위에 있는 인사의 보전 관련 인식 수준이 낮다).* • *In the public sector, personnel reshuffling is entrenched as a customary practice (공무원 사회에서 인사이동이 관행적으로 고착되어 있다).* • *When attempting inter-ministerial collaboration, operational staff tend to avoid it due to the heavy workload burden (부처간협업을 시도하면 실무자는 업무가 과중되는 부담 때문에 기피하는 경향이 강하다).*
What do we know?	• *Frequent reshuffling within government ministries and a lack of collaboration between ministries (e.g., between the central government and local governments, or between the Ministry of Environment and the Ministry of Maritime Affairs) result in low policy consistency and effectiveness, as well as in adequate budget allocation (정부 부처의 잦은 인사이동과 부처간 (예: 중앙정부- 지방정부, 환경부-해수부 등) 협업 부족으로 정책의 일관성, 효과성이 낮고 예산배분이 제대로 이루어지지 않는다).* • *Delays in designating Oriental stork habitat conservation areas and difficulties in implementing other conservation policies occur due to challenges in inter-ministerial collaboration and frequent reshuffling (부처간 협업어려움, 빈번한인사이동등으로인해황새서식지 보호구역지정이 지체되거나 기타 보전정책의 추진이 어려워진다).* • *The awareness level regarding conservation among personnel in responsible position is low (책임 있는 지위에 있는 인사의 보전 관련 인식 수준이 낮다).*

	• *In the public sector, personnel reshuffling is entrenched as a customary practice (공무원 사회에서인사이동이 관행적으로 고착되어 있다).* • *When attempting inter-ministerial collaboration, operational staff tend to avoid it due to the heavy workload burden (부처간협업을 시도하면 실무자는 업무가 과중되는 부담 때문에 기피하는* • *경향이 강하다).*
What do we assume?	-
What more do we need to know?	-
Discussion notes:	
GOAL 1:	*책임인사 교육(보전)*
GOAL 2:	*전문가-비전문가 간 지속적인 교류 시스템 정착*

Issue 7 Solar panel

Title:	*Solar panel around farms*
Description:	*Open spaces, saline land areas, and other non-agricultural areas around farmlands are being utilized for solar power plants, and large-scale solar power generation areas are gradually expanding (농지 주변의 공터, 염전 지역 등이 태양광 발전소로 이용되고 있으며, 대규모 태양광 발전 지역이 점차 확대되고 있다).*
Impact:	• *The habitat area for Oriental stork is decreasing significantly (황새의 서식처 면적이 대폭 감소한다).* • *There is a possibility that solar panels may pose a safety hazard to Oriental stork (태양광 패널로 인해 황새 개체에 안전사고를 유발할 가능성이 있다).*
Causes:	*The country is actively promoting the establishment of renewable energy infrastructure, leading to an expansion of renewable energy utilization, supported by installation subsidies (국가적으로 재생에너지 인프라 구축을 추진하고 있으며, 이로 인한 재생에너지 이용이 확대되고 있고 설치 보조금도 지원되고 있다).*
What do we know?	• *Open spaces, saline land areas, and other non-agricultural areas around farmlands are being utilized for solar power plants, and large-scale solar power generation areas are gradually expanding (농지 주변의 공터, 염전 지역 등이 태양광 발전소로 이용되고 있으며, 대규모 태양광 발전 지역이 점차 확대되고 있다).* • *The habitat area for Oriental stork is decreasing significantly (황새의 서식처 면적이 대폭 감소한다).* • *There is a possibility that solar panels may pose a safety hazard to Oriental stork (태양광 패널로 인해 황새 개체에 안전사고를 유발할 가능성이 있다).* • *The country is actively promoting the establishment of renewable energy infrastructure, leading to an expansion of renewable energy utilization, supported by installation subsidies (국가적으로 재생에너지 인프라 구축을 추진하고 있으며, 이로 인한 재생에너지 이용이 확대되고 있고 설치 보조금도 지원되고 있다).*
What do we assume?	-
What more do we need to know?	-

Discussion notes:	
GOAL 1:	*영향 평가강화*
GOAL 2:	*영향 평가 방법 변화(양적 평가 아닌 질적 평가)*

Issue 8 Carbon neutral-farming

Title:	*Inadequate carbon neutral-farming*
Description:	*The government is experimenting with the application of carbon-neutral farming practices to agricultural households without sufficient discussion and clear definitions and plans regarding carbon neutral farming (정부에서탄소중립농법에 대한명확한정의, 계획 등이충분히논의되지않은채농가에실험적으로 적용하고 있다).*
Impact:	*The decrease in paddy field biodiversity may result in a reduction of food sources for Oriental stork (논 생물다양성이 감소하여 황새의 먹이원이 감소할 수 있다).*
Causes:	*Global efforts to mitigate climate change are being emphasized, and international organizations are urging countries to comply with national carbon neutrality goals (전세계적으로기후변화저감노력이강조되고 있으며, 국제기구에서는 국가별 탄소중립 목표에 대한 이행을 권고하고 있다).*
What do we know?	• *The government is experimenting with the application of carbon-neutral farming practices to agricultural households without sufficient discussion and clear definitions and plans regarding carbon neutral farming (정부에서탄소중립 농법에 대한 명확한 정의, 계획 등이 충분히 논의되지 않은 채 농가에 실험적으로 적용하고 있다).* • *Global efforts to mitigate climate change are being emphasized, and international organizations are urging countries to comply with national carbon neutrality goals (전 세계적으로 기후변화 저감 노력이강조되고 있으며, 국제기구에서는국가별탄소중립목표에 대한 이행을 권고하고 있다).*
What do we assume?	*The decrease in paddy field biodiversity may result in a reduction of food sources for Oriental stork (논 생물다양성이 감소하여 황새의 먹이원이 감소할 수 있다).*
What more do we need to know?	• *Does carbon-neutral farming practices reduce paddy field biodiversity? (탄소중립농법은 논 생물다양성을 감소시키는가?)* • *Does carbon-neutral farming practices ultimately reduce the food sources for Oriental stork? (탄소중립 농법은 궁극적으로 황새의 먹이원을 감소시키는가?)*

Discussion notes:	Indeed, the carbon emissions from the agricultural sector currently stand at 21 million tons, representing only 3% of the nation's total carbon emissions, which is approximately 670 million tons. Moreover, the agricultural population is decreasing, and the vast scale of agricultural land to be managed makes it challenging to achieve the national carbon neutrality goal (실제로 농업 부문의 탄소배출량은 2100 만톤으로 국가 전체 (약 6 억 7 천만톤)탄소배출량의 3%에 그치고 있다. 또한 농업인구는 줄어들고 있고 관리해야 할 농업지역 면적은 규모가 매우 크기 때문에 국가적 탄소중립 목표를 이행하기 어렵다).
GOAL 1:	*지역 내 물질 순환 농업*

Issue 9 International corporations

Title:	*Difficulties in international corporation*
Description:	*The international exchange of endangered species, personnel, and information is diminishing (멸종위기종 개체, 인력, 정보 등 국제적인 교류가 위축되고 있다).*
Impact:	*There are difficulties in managing Oriental stork populations migrating between South Korea, China, Japan, and Russia (한중일 및 러시아를 이동하는 황새 개체군 관리에 어려움을 겪는다).*
Causes:	• *There are variations in the perception of Oriental stork from one country to another (나라마다 황새에 대한 인식에 차이가 있다).* • *The political situation between countries requiring human and material exchange is unstable (e.g., the political situation among East Asian countries, the conflict between Russia and Ukraine, etc.) (인적, 물적교류가이루어져야하는 나라간정세가 불안정하다(예: 동아시아국가간정치적* • *상황, 러시아-우크라이나 전쟁 등).*
What do we know?	• *The international exchange of endangered species, personnel, and information is diminishing (멸종위기종 개체, 인력, 정보 등 국제적인 교류가 위축되고 있다).* • *There are difficulties in managing Oriental stork populations migrating between South Korea, China, Japan, and Russia (한중일 및 러시아를 이동하는 황새 개체군 관리에 어려움을 겪는다).* • *There are variations in the perception of Oriental stork from one country to another (나라마다 황새에 대한 인식에 차이가 있다).* • *The political situation between countries requiring human and material exchange is unstable (e.g., the political situation among East Asian countries, the conflict between Russia and Ukraine, etc.) (인적, 물적교류가이루어져야하는 나라간정세가 불안정하다(예: 동아시아국가간정치적 상황, 러시아-우크라이나 전쟁 등).*
What do we assume?	-
What more do we need to know?	-
Discussion notes:	
GOAL 1:	*Expand private sector exchanges related to Oriental stork conservation (민간 교류 확대)*

APPENDIX I. PARTICIPANTS OF THE 2023 ORIENTAL STORK SPECIES CONSERVATION ACTION PLANNING|PVA WORKSHOP

IUCN 종보전계획수립 황새 PHVA 워크숍 참석자 명단

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※본 참석자 명단은 행사 준비와 함께 추후 IUCN 종보전계획수립 황새 PHVA 최종보고서의 워크숍 참여자 명단 작성과 보고서 공유를 위해 활용됨을 알려드립니다.

PARTICIPANT INTRODUCTIONS: TOPICS OF INTEREST TO PARTICIPANTS

- Long-term planning for Oriental Stork – so far only short-term planning
- Carrying capacity
- How humans and oriental storks can co-exist
- How to increase the genetic diversity of the captive and reintroduced populations of Oriental Stork
- Enhance and review conservation planning for Oriental Stork species
- Research for Black Stork – how this workshop can help with that
- Habitat conservation and what policies are needed to achieve the goals for this, also the incorporation of local ecological knowledge into conservation
- Adoption of CPSG planning culture in Korea
- A successful workshop!
- To learn about conservation of storks in Korea and to understand how Korea and Japan can collaborate on Stork conservation
- A China-Japan-Korea collaborative network for conservation
- Increasing the attention of people on conservation planning for storks
- How to share the benefits from conservation planning with residents in the Province
- To find my own topic for study
- Where to install the nests to better conserve oriental Storks
- Knowledge from experts about improved stork habitats
- Deeper discussions about how to create an environment for storks who prefer to build nests on steel pylons
- How to address fragmentation of paddy fields (major stork habitats) due to irrigation channels
- How to resolve the increasing breakdown of electrical transmission lines due to general avian species (and storks in particular)
- To resolve the escalating problem of Oriental Stork impacts on electrical transmission. There used to be 5.6 breakdowns a year. There have been 37 cases this year already
- How to advance farming related to paddy fields in a way that includes wildlife.
- The decrease in the number of habitats established for Oriental Storks

- Realistic planning for co-existence with humans
- How to integrate planning for the next 50 years – who are the stakeholders, who is leading the project?
- Want to hear ideas from experts about how to ensure sufficient food for Oriental Storks
- Discuss the existing plan for when conservation goals are established
- How to conserve other species alongside the Oriental Stork
- Entering strategy – how can this be of help in establishing conservation planning for habitats around coastal areas
- Encouraging to see number of wild individuals – more than the number released. How to provide additional support for the conservation project.
- How to encourage oriental Storks to build nests in trees instead of on artificial structures.
- To share knowledge
- To learn how to apply conservation planning and how to build consensus among the diverse stakeholders.

APPENDIX II. WORKSHOP HANDBOOK

ORIENTAL STORK (*CICONIA BOYCIANA*) SPECIES CONSERVATION PLANNING |POPULATION VIABILITY ASSESSMENT (SCP|PVA) WORKSHOP

5-7 September 2023, Korea National University of Education, Cheongju-Si, Republic of Korea

WORKSHOP HANDBOOK

*The IUCN SSC Conservation Planning Specialist Group's **One Plan Approach** supports the collaborative development of species conservation plans by diverse communities of stakeholders who are willing and able to act for the species.*

ORIENTAL STORK (*CICONIA BOYCIANA)* SPECIES CONSERVATION PLANNING |POPULATION VIABILITY ASSESSMENT (SCP|PVA) WORKSHOP

5-7 September 2023, Korea National University of Education, Cheongju-Si, Republic of Korea

WORKSHOP ROLES

WORKSHOP FACILITATORS:	Onnie Byers and Caroline Lees (IUCN SSC CPSG) and Mr. Moonhyun Shin and Dr. Hak-bong Lee
WORKING GROUP FACILITATORS:	
TRANSLATORS:	National Institute of Ecology (NIE) (presentations to be written/given in English)
PVA MODELLER:	Caroline Lees (IUCN SSC CPSG)
COMPUTER RECORDERS:	

DESCRIPTION OF PRIMARY ROLES

FACILITATOR	- sets time and tasks - facilitates plenary discussions - encourages equal participation - maintains focus on overall workshop theme - maintains the integrity of the workshop design
WORKING GROUP FACILITATORS	- support working groups to stay on task and on time - encourage equal participation - ensure reports are delivered at the end of each day
PARTICIPANTS	- manage their own working group discussions - provide information, determine issues of concern - create the vision and propose goals and actions
TRANSLATORS	- provide support during plenary and in working groups - interpret for local context - translate written materials and slide content as needed
PVA MODELLER	- elicit participant input to the PVA models - run models in response to working group questions and present results, throughout the workshop - write a modelling report after the workshop
COMPUTER RECORDERS	- record plenary and working group discussions

Working Agreement

Leave all personal and institutional agendas at the door to focus on the task at hand

All ideas are valid

Everything is recorded on flip charts

Everyone participates no one dominates

Listen to each other

Treat each other with respect

Assume good will

Seek common ground

Personal differences and problems are acknowledged - not "worked"

Observe time frames

Complete a draft report by the end of the meeting

ORIENTAL STORK (*CICONIA BOYCIANA*) SPECIES CONSERVATION PLANNING |POPULATION VIABILITY ASSESSMENT (SCP|PVA) WORKSHOP

5-7 September 2023, Korea National University of Education, Cheongju-Si, Republic of Korea

OVERVIEW OF WORKING GROUP MECHANICS

1. Working groups will operate in either KOREAN or ENGLISH – the group can choose.

2. Report-back and other plenary sessions will be held in ENGLISH. Translation support will be provided.

3. The Facilitator will provide each Computer Recorder with a flash-drive containing an electronic template for recording ISSUE Statements, GOALS, ACTIONS and other NOTES.

4. Working groups will record ISSUE STATEMENTS, GOALS and ACTIONS in English or will translate them into English before the end of each day. Translation support will be provided.

5. Where possible, ISSUE STATEMENTS, GOALS and ACTIONS to be presented in PowerPoint or on flipcharts will be translated into English in advance of report-back sessions. Translation support will be provided.

6. Detailed NOTES can be recorded in the language chosen by the group.

7. The full record of the day's discussions will be handed to the Facilitator (on the flash-drives provided) at the end of each day. Flash-drives will be returned to each Computer Recorder at the start of the following day.

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OVERVIEW OF WORKING GROUP PROCESS

Together, participants will generate an inter-connected list of the "Issues" that need to be considered in moving forward with Oriental stork conservation. Working groups will be formed and a subset of these "Issues" will be assigned to each.

TASK I. **Develop "Issue Statements":** for each Issue, write three sentences to describe: 1) what it is; 2) what impact it has on Oriental stork conservation; and 3) why it occurs. Indicate any differences between Sites. Prioritise your Issues. Ideally there will be no more than 5. If you have more, consider grouping them. *This is not the time to develop solutions, actions or research directions. This will be done in later steps.*

TASK II. **Assemble information and identify gaps:** review each Issue Statement and agree: what is FACT, what is ASSUMPTION and what is an important DATA GAP. Amend statements to reflect this and add supporting information or references.

TASK III. **Set Goals in response to each Issue Statement.** Goals describe things we will try to achieve in order to remove or reduce the impact of a particular Issue. Make Goals site-specific where necessary. An Issue may require more than one Goal. *Goals will be prioritised by all workshop participants.*

TASK IV. **Recommend Action steps for each Goal**. Action steps are the things we need to do to achieve our Goals. For each Action step, document WHAT it is that will be done, WHO will do it, WHEN it will be done and HOW progress will be measured. Consider 1, 5 and 10-year timelines. These actions will form the main recommendations from the workshop.

ORIENTAL STORK (*CICONIA BOYCIANA*) SPECIES CONSERVATION PLANNING |POPULATION VIABILITY ASSESSMENT (SCP|PVA) WORKSHOP

WORKING GROUPS: LEADERSHIP ROLES

Each small working group manages its own discussions, data gathering, time, and report production. Here are brief descriptions of the various roles to be played by different people in your group so that you can function effectively during the workshop. Leadership roles can be rotated and the work divided as you wish.

However, remember to assign these roles at the beginning of each working group session.

Discussion facilitator – Ensures that each person wanting to speak is heard within the time available. Keeps track of discussion using flip-charts. Keeps the group task front and centre at all times.

Flip chart Recorder – May be (but does not have to be) a person other than the discussion facilitator. Records ideas using brief phrases to provide group memory and a visible record of issues, ideas, and discussions. Checks with the person speaking that the phrase recorded is an accurate representation of their contribution.

Computer Recorder – Keeps track of group discussion using a computer. This should not simply be a recording of the flip chart points or detailed minutes of the session. Instead, this should be an accurate and clear summary of the group's discussion, including any major viewpoints, information and decisions. It is important for the recorder to ask participants to briefly restate long ideas so that they can be accurately captured. **This computer record will be the basis of the report from the wider workshop.**

Timekeeper – Keeps the group aware of the time remaining for each working group session.

Reporter – Presents the working group report in plenary. It is particularly important that this role is assigned **at the beginning** of each session so that the person has enough time to prepare.

TASKS I: ISSUE STATEMENTS

Purpose: to focus the discussion by clearly describing and prioritising your group's ISSUES, and by identifying the underlying causes of those issues.

STEPS:

1. Assign roles for this session – INCLUDING THE PRESENTER! Record who is in the group.
2. Write the list of issues on a flip-chart.
3. Read them out in turn and check that everyone has the same understanding of each.
4. Add any issues you feel are missing (use brainstorming).
5. Cluster and consolidate issues under headings. Keep a list of the original 'brainstorm' items under each new heading.
6. For each issue, write 3 sentences that will explain, to someone not at the workshop:
    a. what the issue is
    b. what causes it and
    c. why it is a problem for the conservation of the Oriental stork.
7. With reference to each issue, if there are differences between Sites, make sure these are described.
8. Try not to discuss "what needs to be done" – this comes later.
9. As a group, prioritise your issues according to their overall impact on Oriental stork conservation.

THINGS TO CONSIDER:

- Is the issue stated objectively? (i.e. does not include implied solutions – **solutions come later**)
- Is the issue within the scope of the workshop and the people involved?
- Does everyone have the same understanding of the issue?
- Does the statement identify both the impact of the issue and its underlying causes or drivers – have you applied the **"5 WHYS"?**

ISSUE STATEMENT EXAMPLES:

A GOOD EXAMPLE:

Issue: Fire

a) Wild-fires burn through cockatoo habitat periodically.
b) Fires temporarily reduce the productivity of cockatoo food trees and as a result there is not enough food to support a growing population of birds.
c) Fire is a natural part of the ecology of cockatoo habitat but the frequency and intensity of fires is increasing due to the combined effects of introduced weeds (which burn more intensely than native vegetation), loss of traditional burning practices (which restricted the extent and intensity of fires) and climate change.

In the above statement it is clear **what** the problem is, **how** it affects the species and **why** it occurs. This is sufficient for an issue statement.

A POOR EXAMPLE:

Issue: Fire

We need to prevent fire in black cockatoo habitat so that the population can grow.

In the above statement the cause of fire is not clear, “issues” and “needs” are confused, and solutions are implied – this one needs some more work.

TASK II: ASSEMBLE INFORMATION AND IDENTIFY GAPS

Purpose: to clarify, for each issue, what is FACT, what is ASSUMPTION and what are the key INFORMATION GAPS

STEPS:

1. Assign roles.
2. Taking each issue statement in turn, review the text carefully.
3. Discuss what is **KNOWN** about this issue (and how), what is **ASSUMED** (and why), and what more we **NEED TO KNOW**, before effective action can be taken.
4. Make sure that differences between Sites are considered, if appropriate.
5. Where necessary, edit the issue statements to make clear what is FACT and what is ASSUMPTION.
6. List KEY INFORMATION GAPS.
7. Record these discussions carefully, especially information relating to sources of evidence or justification.

INFORMATION ASSEMBLY EXAMPLE

Issue: Hybridisation

Description: *Emydura macquarii* is a common Australian native turtle **known** to have been introduced historically into the Bellinger River (Georges, et al., 2007; Georges, et al., 2011). *E. macquarii* are **known** to hybridise with the Endangered Bellinger River Snapping Turtle - BRST (Georges & Spencer, 2015).

Cause: In the past the two species occupied different areas in the river (Cann, et al., 2015) and hybridisation events are **assumed** to have been rare (Blamires & Spencer, 2013). Following a recent disease outbreak in BRST there is evidence that *E. macquarii* has become the dominant turtle species in the Bellinger River (Chessman, 2015).

Impact: It is **assumed** that the rate of hybridisation could increase under the current situation. It is **assumed** that an increase in the hybridisation rate will result in the BRST becoming rarer.

Key information gap: Is the rate of hybridisation increasing?

TASK III: GOALS

Purpose: to agree what we will try to achieve in order to reduce or remove the issues identified.

STEPS:

1. Assign roles.
2. Review the issue statements and information gaps.
3. Think about the different ways in which those issues could be addressed. Which are most likely to get done? Which do the people in this room have most influence over?
4. With this in mind, develop goals to address each issue. Where relevant, goals should be SITE-SPECIFIC.
5. There can be more than one goal for each issue.
6. Develop goals to fill each information gap *considered to be an obstacle* to Oriental stork conservation.
7. If there is time, include an indication of how progress towards achieving each goal will be measured or evaluated.

GOAL EXAMPLE:

Issue Statement: Fire

a) Wild-fires burn through cockatoo habitat periodically.
b) Fires temporarily reduce the productivity of cockatoo food trees and as a result there isnot enough food to support a growing population of birds.

Fire is a natural part of the ecology of cockatoo habitat but the frequency and intensity of intensely than native vegetation), loss of traditional burning practices (which restricted the extent and intensity of fires) and climate change.

GOAL 1: Supplement food for black cockatoos after fires.

GOAL 2: Restore traditional burning around cockatoo feeding grounds.

TASK IV: ACTIONS (TO BE COMPLETED IN SITE-BASED GROUPS)

Purpose: to recommend action steps that will enable goals to be achieved.

STEPS:

1. Assign roles. Make a list of who is in the group.
2. Take each goal in turn and write it on a flip-chart.
3. Brainstorm actions that could be taken to achieve that goal. Think about which ones will have the most impact on Oriental stork conservation and which are most achievable given the resources available.
4. Recommend one or more actions to achieve each goal.
5. Document details for each action:
    a. a description of WHAT the action is
    b. WHERE it needs to be done
    c. WHEN it should be done (consider 1, 5 and 10-year time-frames)
    d. WHO (which agency or agencies IN THIS ROOM) could lead it, and who the key collaborators could be.
    e. what INDICATORS or MEASURES will be used to track or demonstrate its completion?
6. Check each agreed action conforms to S.M.A.R.T. characteristics (see below).

THINGS TO CONSIDER:

Actions should conform to **S.M.A.R.T** characteristics:

- ***Specific*** – it must be clear what is to be done, by whom, where.
- ***Measurable*** – concrete outcomes or indicators are defined that allow progress to beassessed
- ***Attainable*** – can be accomplished under current conditions
- ***Relevant*** – helps solve the specific issue targeted (i.e. helps achieve one of the associated goals) and needs to be done
- ***Time-bound*** – is grounded in a realistic timeframe

EXAMPLE OF A COMPLETED ACTION STEP (MODIFIED FROM ORIGINAL)

Issue: Habitat Fragmentation

In Singapore, the habitat of Raffles' Banded Langur consists of small forest fragments. This is due to the creation of roads and the removal of forest in some areas to allow for other forms of land-use. As a result, the langur population persists only in small, isolated groups, each one susceptible to significant losses due to chance demographic events and inbreeding depression.

GOAL

Restore connectivity between isolated/fragmented groups of Raffles' Banded Langur in Singapore

ACTION 1.

Details: Identify sites in Singapore where there is a need for human-mediated movement (due to loss of connectivity, lack of canopy cover, obstructions, roads, water bodies etc.) and test the use of rope bridges in appropriate locations.

Responsibility: Raffles' Banded Langur Coordinator.

Timeline: permits and proposal by early 2017 construction of first rope bridge by mid-2017, monitoring till mid-2018

Collaborators: JGIS, MINDEF, Singapore NParks, WRS, and volunteers

Measures: camera trap photos of langurs using the bridges

APPENDIX III.
POST WORKSHOP SURVEY RESULTS (Korean and English)

종보전계획수립 워크샵 설문조사 **2023**

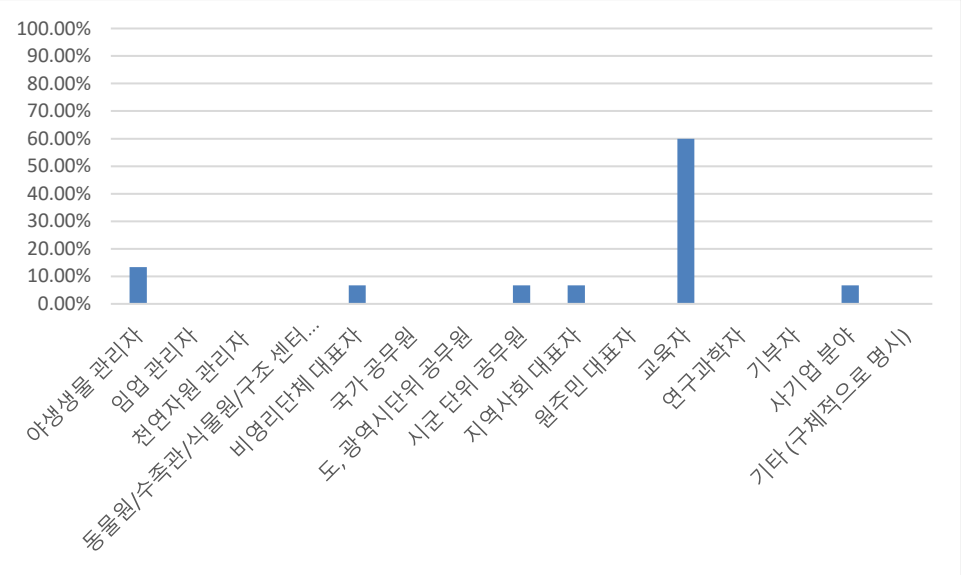
결과 요약

설문조사 질문 **순환:** **응답 수:** ***사람들이 댓글을 제공한 응답 수**	**가중 평균/ % / * 응답 수**
전반적인 평가	
Q1: CPSG 가 위에서 설명한 대로 내 정보를 사용하는 것에 동의합니다. (백분율) 네 아니오	100% 0.00%
Q2: 이 워크샵에 대한 전반적인 만족도는 어떻게 평가하십니까? (1=불만족 7 =매우만족)	6.71
실행을 위한 계획	
Q3: 본인의 워크숍 참여 경험을 기반으로 답변 (1 =부동의 7 =동의) 종의 관리 및 보전 우선 순위가 더 명확해짐. 종의 관리 및 보전에 더 효과적으로 기여할 수 있게 되었다고 믿음. 조언이나 의견을 얻기 위해 연락할 수 있는 사람들의 네트워크가 더 커짐. 종에 대한 보전 활동에 대한 협력이 개선될 것으로 믿음.	 6.47 6.65 6.29 6.60
포용적인 참여 촉진	
Q4: 종 보전에 관련된 주요 전문가 및 이해 관계자(예: 개인, 정부 기관, 단체, 지역 사회 그룹)가 워크샵에 참석했습니까? "모르겠다"는 경우 "N/A"에 표기해 주십시오. (1=아무도 참석하지 않음 7 =모두 참석함	6.00
Q5: 이 워크샵에 참석하지 않았지만 가치 있는 기여를 할 수 있었던 이해 관계자를 나열해 주십시오. (예: 개인, 지역 사회 그룹, 단체, 정부 기관). 세부 정보를 제공해 주십시오.	10 응답(아래)
신뢰할만한 과학 활용	
Q6: 본인 의견으로, 워크샵 중에 (4 는 '의견 없음'을 의미합니다): (1 =매우 부동의 7 =매우 동의) 이용 가능한 최상의 정보를 사용했다. 이용 가능한 정보의 품질을 평가하기에 충분한 시간이 주어졌다. 분석 도구는 주어진 과제 수행에 적합했다. 분석 도구의 결과가 의사 결정에 중요한 역할을 했다. 과학적 개념과 결과물이 효과적으로 활용되었다. 이 종을 보호하거나 관리하기 위해 필요한 지식 가운데 부족한 부분이 파악되었다. 계획수립 과정에서 다양한 출처의 정보와 증거의 활용이 권장되었다.	 6.12 5.82 6.35 6.24 5.94 6.12 5.41
좋은 설계와 중립적인 중재 보장	

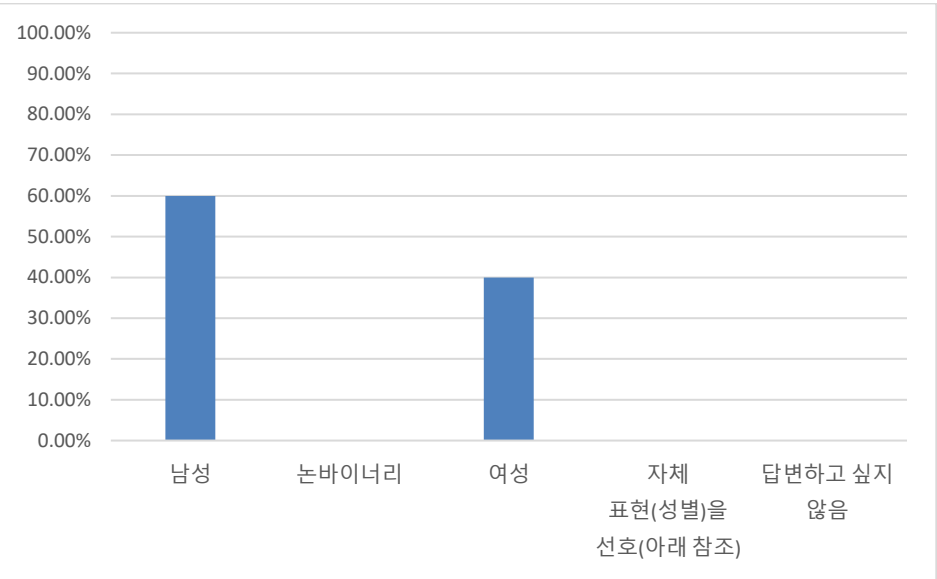
Q7: 다음과 같은 워크샵 요소에 대한 전반적인 만족도 평가:: (1 =매우불만족 7 =매우 만족) 워크샵 전 공유된 자료와 일정. 워크숍 발표 내용과 전달력 수준. 작업그룹 토론의 준비와 명확성. 전체그룹 토론의 준비와 명확성. 워크숍이 어떻게 마무리되었는지.	 5.87 6.40 6.20 6.13 6.40
Q8: 다음 항목들에 대한 평가 "내 의견으로는 워크샵 동안..." (1 =매우 불만족 7=매우 만족) 운영자는 모든 참가자가 동등한 기회를 가질 수 있도록 노력했다. 무엇을 말하고 싶을 때 항상 내 의견을 표현할 수 있었다. 참가자들은 서로와 함께 작업하는 데 편안했다. 참가자들 간의 갈등은 모든 참가자들의 만족할 수 있게 해결되었다. 기술적인 어려움(마이크 등) 때문에 내 참여가 제한되지 않았다. 언어적인 어려움 때문에 내 참여가 제한되지 않았다.	 6.87 6.60 6.60 6.07 6.60 6.13
설문조사 질문 **순환:** **응답 수:** ***사람들이 댓글을 제공한 응답 수**	**가중 평균/ % / * 응답 수**
합의를 통해 결정에 도달하기	
Q9 워크숍이 끝날 때까지 다음 주제에 대해 얼마나 많은 합의가 이루어졌다고 생각하시나요?: 1 =합의 안됨 7 =완벽히 합의됨) 이해관계자들이 달성하고자 하는 목표들에 대한 정의. 종을 보전하거나 관리하는데 발생하는 어려움(도전). 종을 보전하거나 관리하기 위해 필요한 보전 활동의 우선순위. 권장되는 보전 활동의 실행 방법을 어떻게 조율하거나 관리해야 하는지.	 6.20 6.27 6.33 5.93
개인정보	
Q10-Q12	아래에
Q13: 언어: 워크샵은 제 모국어로 진행되었습니다 (백분율) 그렇다 아니다	 73.33 26.26
Q14: 언어: 다음 사항에 어느 정도 동의하십니까? (1 =매우 부동의 7 =매우 동의) 워크샵의 주로 활용된 언어로 항상 효과적으로 의사소통 할 수 있었다. 워크샵 전체 기간 동안 효과적인 의사소통을 돕기 위해 충분한 번역 및 통역 지원이 제공되었다.	 6.00 6.60
기타 의견	
Q15: 본 크샵에 대해 더 이야기하고 싶은 내용이 있나요?.	11 응답 (아래에)

Q5응답: 참석하지 않은 전문가 및 이해관계자 목록
농림축산부 산하, 해양 수산부 산하 기관 사람. 모두 고르게 참여했음.농림축산식품부 lg상록재단 지역주민 그룹.지자체, 환경전문가, 인류학자, 사회학자.환경부 관계자, 예산군 지자체장 또는 관계기관 공무원, 일본 및 중국의 황새 관련 NGO, 예산군 지역주민, 예산군 관내 개발 인허가 담당 공무원, 충남도지사, 한국전력공사 사장 등. 황새 마을 주민들. 환경부. 정부. 특히 황새의 주요 서식지인 예산.정책결정자(환경부 등). 지역사회(이해충돌자).

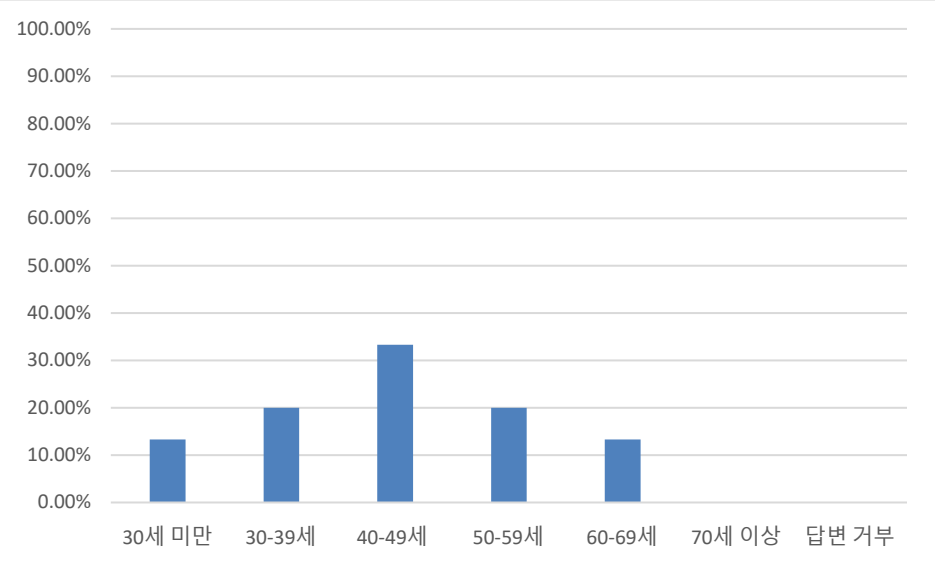
Q10: 다음 중 어떤 항목이 이 워크샵에서의 당신의 역할을 가장 잘 설명하나요? (하나만 선택하세요)



Q11: 성별: 본인의 성별을 어떻게 정의하나요? (하나 선택)



Q12: 당신의 나이는? (하나만 표시)



Q15: 본 크샵에 대해 더 이야기하고 싶은 내용이 있나요?
유용했고 만족한 워크샵이었늡니다 수고하셨습니다. 워크샵 덕분에 보전전략의 방향설정을 제대로 할 수 있었고 다양한 의견을 들을 수 있어 좋았습니다. 시간에 쫓기는 상황보다, 여유있는 진행이 아쉽다. 본 워크샾의 결과물인 '황새 보전계획'을 영문과 국문을 합본으로 만들어서 누구나 다운받아 확인할 수 있도록 공개하기를 바라고, 다른 멸종위기종들의 보전계획을 수립할 때도 이와같은 방식의 워크샾이 진행되기를 바랍니다. 충분하지는 않지만 다른 많은 사람들의 생각을 공유할 수 있는 기회가 주어졌기 때문에, 부족한 시간에도 불구하고 유익했다고 생각함. 워크샵 3 일 동안 많이 배웠지만 일정이 다소 빡빡하게 진행되었다고 생각합니다. 조금만 더 일정에 여유가 있었으면 합니다. 이번 워크숍을 위해 수고해 주신 IUCN CPSG 회원들에게 감사드립니다.감사합니다. 워크숍 방식(방식)은 한국에서는 자주 사용하지 않는 방식이라 평소보다 훨씬 더 깊은 대화를 나눌 수 있었습니다. 황새에게 큰 도움이 되었습니다. IUCN 의 노력에 감사드립니다. 정말 매우 만족스럽습니다.환경부 참석 부재.

Oriental Stork Conservation Planning Workshop Survey 2023 (Korea)

Summary of Results

Survey Questions **Circulation:** **Number of responses:** ***Number of responses where people offered comments**	**Weighted Average / % / *No. responses**
General	
Q1: I am willing to provide my information for CPSG use as described above: (percentage) Yes No	 100% 0.00%
Q2: Overall, how satisfied are you with this workshop? (1= not satisfied 7= very satisfied)	6.71
Plan to Act	
Q3: Based on my workshop experience: (1 = strongly disagree 7 = strongly agree) Priorities for management and conservation of the species are clearer to me. I believe I can contribute more effectively to managing and conserving the species. I have a bigger network of people to contact for advice or input to help with my work with the species. I believe that collaboration on conservation activities for the species will improve.	 6.47 6.65 6.29 6.60
Promote Inclusive Participation	
Q4: Were key experts and stakeholders in the conservation of the species present at the workshop? (e.g. people, government agencies, organizations, community groups). (1= non were present 7 = all were present)	6.00
Q5**:** List any stakeholders who could have made a valuable contribution but <u>were not present</u> at this workshop. (e.g. people, community groups, organizations, government agencies).	10 responses (below)
Use Sound Science	
Q6: In my view during the workshop: (1 = strongly disagree 7 = strongly agree) We used the best available information. Enough time was spent evaluating the quality of the available information. The analytical tools used were a good fit for the required tasks. Outputs from the analytical tools added value to decision-making. Scientific concepts and outputs were communicated effectively Important gaps in the knowledge we need to protect or manage this species were identified. The planning process encouraged the use of information and evidence from a range of sources.	 6.12 5.82 6.35 6.24 5.94 6.12 5.41
Ensure Good Design and Neutral Facilitation	
Q7: Describe your overall satisfaction with the following workshop elements: (1 = not satisfied 7 = very satisfied) Pre-workshop briefing materials and agenda. Quality and delivery of workshop presentations. Clarity and organization of working group discussions. Clarity and organization of entire group (plenary) discussions. How the workshop was concluded.	 5.87 6.40 6.20 6.13 6.40
Q8: Please rate the following statements: “In my view, during the workshop….” (1 = strongly disagree 7= strongly agree) The facilitator worked to ensure all participants had an equal opportunity to be heard. Whenever I had something to say, I was able to get my point across. Participants were comfortable working with each other. Any conflict between participants did not interfere in the development of the workshop.	 6.87 6.60 6.60 6.07

Technical difficulties did not limit my participation. Language difficulties did not limit my participation.	6.60 6.13
Reach Decisions Through Consensus	
Q9: In your view, by the end of the workshop, how much agreement existed on the following topics: 1 = no agreement 7 = complete agreement)	
A shared definition of what stakeholders want to achieve. The challenges involved in conserving or managing the species. Priority conservation activities needed to protect or manage the species. How implementation of the recommended conservation activities should be coordinated or managed.	6.20 6.27 6.33 5.93
Personal Details	
Q10-Q12	below
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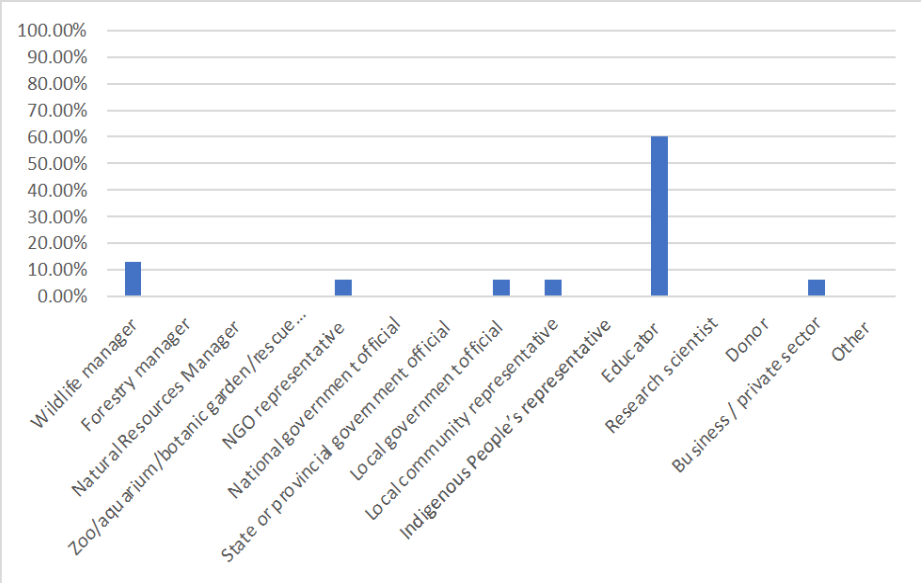
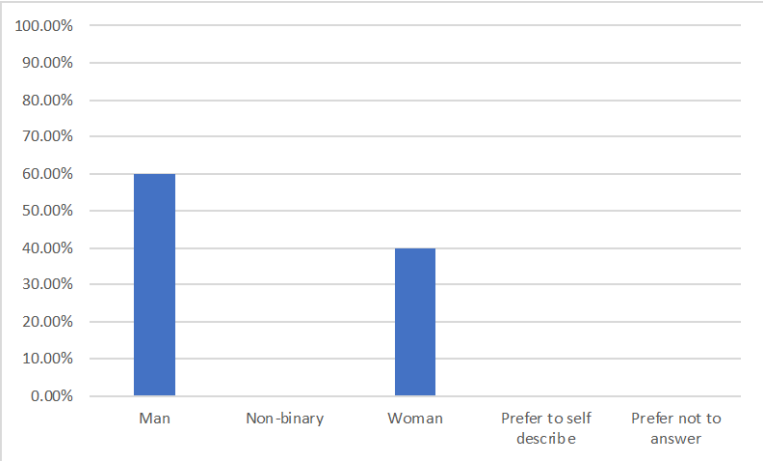
Q13: Language: the workshop was held in my native language? (percentage)	
Yes No	73.33% 26.26%
Q14: Language: to what extent do you agree with the following statements? (1 = strongly disagree 7 = strongly agree)	
I was always able to communicate effectively in the main language of the workshop. Enough translation and interpretation support were provided to help me communicate effectively throughout the workshop.	6.00 6.00
Other Comments	
Q15: Is there anything else you would like to say about the planning workshop?	11 responses (below)

Q5 Responses: List of experts and stakeholders not present
Institutions under the Ministry of Agriculture, Food and Rural Affairs and the Ministry of Oceans and Fisheries.
Everyone participated equally.
Ministry of Agriculture, Food and Rural Affairs LG Sangnok Foundation local residents group.
Local governments, environmental experts, anthropologists, sociologists.
Ministry of Environment officials, Yesan County local government heads or related agency officials, Japanese and Chinese stork-related NGOs, Yesan County local residents, officials in charge of development permits within Yesan County, South Chungcheong Province governor, Korea Electric Power Corporation president, etc.
Residents of Stork Village.
Ministry of Environment.
Community (conflict of interest).

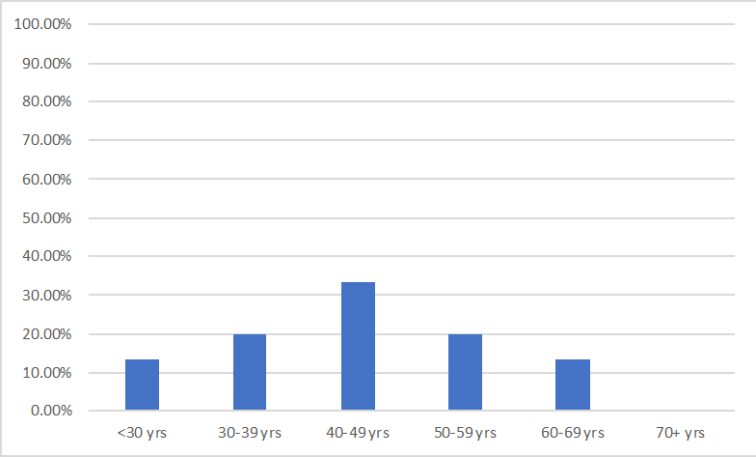
Q10: Which of the following BEST describes your role at this workshop?



Q11: Gender: how do you identify?



Q12: What is your age?



Q15: Is there anything else you would like to say about the planning workshop?
Thanks to IUCN CPSG members for all you have done for this workshop. The workshop method (Bottom-up method) is not often used in Korea, so we were able to have a much deeper conversation than usual. It was very helpful for Oriental Stork.
Thank you IUCN for your efforts. Very satisfactory indeed. Thanks to the workshop, I was able to properly set the direction of the conservation strategy and it was great to hear a variety of opinions.
Rather than being pressed for time, the leisurely progress is disappointing.
We hope that the result of this workshop, 'Stork Conservation Plan', will be published in a combination of English and Korean so that anyone can download and check it. We also hope that a similar workshop will be conducted when establishing conservation plans for other endangered species.
Although it is not enough, I think it was beneficial despite the lack of time because it gave me the opportunity to share the thoughts of many other people.
I learned a lot during the three days of the workshop, but I think the schedule was a bit tight.
I wish there was a little more room in the schedule.
thank you
Absence of Ministry of Environment attendance. Government. Especially YESAN, the main habitat of Oriental Storks