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Wildlife restoration in Nepal: tracking the conservation translocations in the country

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Abstract

Negative consequences of human impacts on biodiversity are undisputable and inadequate efforts in managing biodiversity have been realized across the globe. The present biodiversity crisis, including burgeoning effects of climate change, therefore, has warranted restoration actions in place. Conservation translocation, one of the effective measures of restoration, involves the individuals of species deliberate movement from one habitat to another, particularly animal species. Nepal has been practicing the conservation translocations for more than four decades. However, details of conservation translocation events and outcomes are not well documented. This article aims to explore the status and issues of conservation translocation in Nepal. . For the purpose, we reviewed seven protected area management plans and nine species conservation action plans available in public domain along with related peer reviewed journal articles. We documented the conservation translocation of Blackbuck, Gharials, Swamp deer, Greater One Horned Rhino, Elongated tortoise, Narrow Headed Soft Shell Turtle, Wild Water Buffalo and Vulture. Adoption of feeble adaptive management framework and ad hoc approach of wildlife translocation has left many rooms for improvement in the translocation strategies of Nepal. This is largely exemplified by the improvement required in Vulture Breeding Center, Swamp deer and Wild water buffalo translocations to Chitwan National Park, and Blackbuck translocation to Bardia National Park. For many species, data and information are limited to evaluate the wildlife restoration outcomes independently.

Keywords: *Reinforcement, Swamp deer, Turtle, Wild water buffalo*

Introduction

Biodiversity engenders critical life support system as it provides ecosystem services - the key to the wellbeing of humans (Wang et al., 2021). Currently facing tremendous extinction threats due to anthropogenic pressures, particularly overexploitation and agricultural activities, impacts of climate change on biodiversity are anticipated to affect many species in the future (Maxwell et al., 2016). As the human population is increasing at an exponential rate, more than eight billion by 2022 and accelerated per capita resource consumption, we can expect increased pressure on natural resources leading to further degradation of the ecosystems and human well-being (Gross, 2023).

Biodiversity in Nepal is facing multitude of challenges. Land use land cover change, urbanization and associated effects in those areas are affecting species and ecosystems that have detrimental consequences for ecosystem services and wellbeing (Aryal et al., 2020; Chaudhary et al., 2016). Infrastructure development is causing habitat degradation even in the ecosystems within the protected areas and the trend is expected to increase in the near future (Sharma et al., 2018). Observed and anticipated impacts from climatic changes in the Himalayas have shown the necessity of researches to ensure climate sensitive conservation planning and implementation (Bhattacharjee et al., 2017). There is a dire need for the evidence based intervention for the conservation of threatened biodiversity in Nepal (Paudel & Heinen, 2015).

In the past, conservation biology was proposed as essential element to revert the loss of biodiversity and associated degradation of ecosystem services

(Young, 2000). However, as of now, unsustainable exploitation and consumption of resources are increasing and impact of climate change is increasing rapidly. For sustainable solutions to the pressing problems in biodiversity conservation, ecological restoration is the key and this has been realized from global commitments made to address environmental and social problems. For example, New York Declaration on Forests (NYDF) adopted in 2014 and refreshed on 2021 aims to restore at least 350 million hectors of forest (https://forestdeclaration.org/about/new-york-declaration-on-forests/) (Forest Declaration, 2021) while United Nations Decades on Ecosystem Restoration 2021-2030 aims "to prevent, halt and reverse the degradation of ecosystems at every continents and every oceans as a means to end poverty, halt climate change and prevent mass extinction" (UNEP & FAO, 2022).

Properly executed restoration activities are important to restore individual species, ecosystem function and ecosystem services (Harrington et al., 2013). Ecological restoration involves the restoration of the ecosystem or components of those and includes integration of several fields. Not only traditional approaches, this has emphasized multi-stakeholder collaboration using newer mechanisms and arrangements from local to global scales (Martin, 2017; Uprety et al., 2012). Ecosystem restoration involves restoration of the species, habitat, population, or landscape or the restoration of the services, including the conservation translocation.

Conservation translocations are the planned movement of the animals from one habitat to another for the purpose of reaching the conservation outcomes (IUCN/SSC, 2013). Various forms of conservation translocations are being practiced throughout the world. They are grouped either as population reintroduction and conservation introduction based on habitat use history of the site. If the release is made on habitat already used by the species at any time in the past or present, it is known as population reintroduction while if they are released to totally new environment they are known as conservation introduction (IUCN/SSC, 2013)., Population reintroduction are grouped into two classes viz. reintroduction and reinforcement and both are commonly practiced (Corlett, 2016). In reintroduction program, animals are released to their native range while in reinforcement program; individuals are released into existing population (IUCN/SSC, 2013). Animal reintroductions are carried out with the objectives of ensuring the survival and reproduction of the species and establishment of the viable population of the species at the end (Shier, 2015). There is possibility of translocation science being the face of the conservation biology as the innovation in the field could be vital to halt the biodiversity loss across the globe (Evans et al., 2023).

Translocation of wildlife is a complex problem with financial, political, ecological and socio-economic opportunities and constraints and the successful execution requires a systematic and structured approach to project planning and implementation (Schwartz & Martin, 2013). Global practices of conservation translocations have provided lessons on some criteria and indicators to consider before, during and after conservation translocations (Soorae, 2021). A clear recipe is possible neither for what species to include nor about where to do interventions. These decisions should be guided by existing and future scenarios of dynamic socio-environmental domains. However, the sciences, both the natural science and social sciences receive due considerations in the decision making. Furthermore, reintroduction process involves a series of the decision making steps and in each phase, there are possibilities for the alternative decisions to be taken which will be vital for the ultimate fate of the whole projects (Panfylova et al., 2019). Our ability to make a rational choice is compromised by human error in judgment, and structural decision-making can act as a tool to address the same (Panfylova et al., 2019). Despite the growth of the conservation translocation as a tool of conservation, analysis of comprehensive of pattern of translocation is not possible due to inadequate regularly updated and accessible database (Novak et al., 2021), which also holds true for Nepal.

Thus, in this review, efforts have been made to analyze the translocation movements in Nepal with the aim of i) analyzing context of conservation translocation planning documents and ii) understanding the execution of the conservation translocation and outcomes after a time span.

Materials and Methods

Study area

Nepal (28.3949° N, 84.1240° E) with an area of 147,516 km2 has wide altitudinal variation ranging from 60 m to 8848 m within the north south stretch of nearly 193 km resulting in five major physiographic regions (Tarai, Siwalik, Hill, Middle Mountain and High Mountain, Figure 1). Each of these physiographic regions has diverse climatic condition. Furthermore, Himalaya is formed by the collision of Indian Plate and Eurasian Plate and Nepal is a part of the Himalaya. Nepal is also located at the junction of two biogeographic realms Palaeartic in the North and Indo-Malayan in the South (GoN/MoFSC, 2014). These factors result in 118 ecosystem types in Nepal, 75 vegetation types, and 35 forest types in Nepal (DNPWC & BCN, 2018). Furthermore, within less than 1% of total land area of world, Nepal has around 2.7% flowering plant species, 4.5% of mammal species, 9% of bird species, 2.6% of butterfly and moth species of the world (DNPWC & BCN, 2018). Nepal is a home to 212 species of mammals (Amin et al., 2018), 57 species of amphibians and 143 species of reptiles (Rai et al., 2022). Nepal has established a wide range of protected areas that includes 12 national parks, six conservation areas, one hunting reserve and a wildlife reserve, and there are buffer zones in the periphery of 12 national parks.

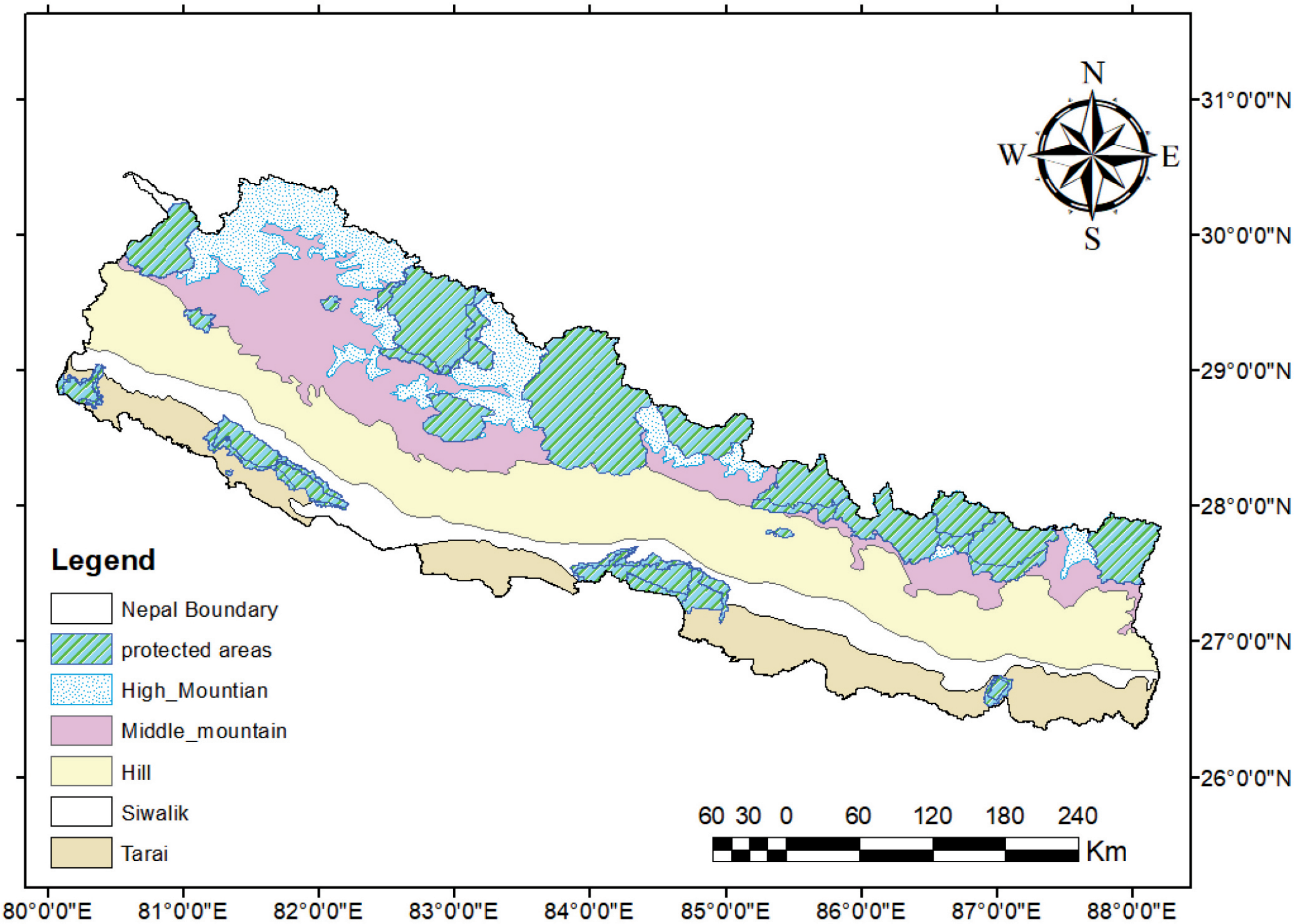


Figure 1: Map of Nepal showing the physiographic region and protected areas.

Methods

This study is primarily based on the review of species conservation action plans, management plans of the protected areas and government reports that are available on the website of Department of National Parks and Wildlife Reserve (DNPWC) and websites of the protected areas. Government of Nepal periodically updates the management plans of protected areas and species conservation action plans with revisions. Thus, whenever there were more than two reports or documents on the online archives, only the recent ones were reviewed to explore the provisions related to conservation translocation. Data on the conservation translocation that has been carried out till date were compiled from published government reports and data visualization was done using ggplot2 (Wickham, 2016) in R (R Core Team, 2021) implemented in RStudio (RStudio Team, 2022) . Since we have not used specific testing methods and techniques to reach a conclusion, the results should be taken as simple interpretation of the basic status rather than cause - effects as well as do's and don'ts.

Results and Discussion

Conservation translocations in Nepal have largely been response of conservation authorities towards degraded habitats and declining populations, chiefly of large vertebrates, in lowlands. Reintroductions have been long suggested to address the issues of faunal collapse that have occurred in the Tarai regions including the protected areas (Heinen & Yonzon, 1994) and some efforts have been made (Acharya *et al*., 2017; Thapa et al., 2013). In this article, we attempt to compile information on state of wildlife translocations in Nepal by exploring existing protected area management plans, species conservation action plans and selected cases.

Conservation translocation in conservation plans

Conservation translocation in Nepal has been identified as an important management tool by both the protected area management plans and species conservation action plans. Management plans of seven protected areas mention about the translocation (Table 1). Greater One Horned Rhinoceros (rhino hereafter), Swamp deer, Gaur, Wild Water Buffalo and Blackbuck are the primary mammals that are prioritized for translocation in protected areas of Tarai, while Swamp francolin is the only bird listed by the protected area management plans in Tarai Region for translocation. Blue sheep translocation is stated by management plans of Lamtang NP and Sagarmatha NP. All seven PA Management Plans have focused on inter park translocation except Chitwan National Park prioritizing intra park translocation so as to conserve and reduce mortality of Rhino.

Table 1: Provision of Conservation Translocation in Protected Area Management Plans

SN	Management Plan	Translocation related focus	Translocation related provisions	Source
1	Management Plan of Bardia National Park and its Buffer Zone (FY 2079/80-2083/84 BS)	Study	Conduct feasibility study in the source site and release site for translocation of Rhino	(BNP, 2022)
		Translocation	Translocate additional 50 individuals of Rhino to BNP from Chitwan National Park, 50 individuals of Swamp Deer to establish viable population and 50 individuals of Gaur from Chitwan-Parsa Complex to sustain alternative viable population in western Nepal.	
2	Lamtang National Park and its Buffer	Study	Conduct the feasibility study to translocate Blue sheep to LNP as a way to supplement the prey base of Snow	(LNP, 2020)

	Zone Management Plan (FY 2077/78 – 2081/82 BS)		Leopard	
3	Snow Leopard and Ecosystem Management Plan (2017-2026)	Study	Conduct Feasibility Study to assess reintroduction potentiality of prey base of Snow Leopard	(MoFSC, 2017)
4	Banke National Park and its Buffer Zone Management Plan (FY 2075/76-2079/80 BS)	Translocation	Translocate Blackbuck to BaNP	(BaNP, 2018)
5	Koshi Tappu Wildlife Reserve and Its Buffer zone management plan (FY 2074/75-2078/79 BS)	Study	Conduct feasibility studies for translocation of rhino and swamp deer, tiger and large carnivores including leopard. Conduct feasibility study in other PAs to translocate Swamp francolin (*Francolin gularis*) and Wild Water Buffalo. Study the failure of Gharial Release in the Past.	(KTWR, 2018)
		Translocation	Proposes a strategy to translocate and introduce new breed of Wild Water Buffalo from Assam India	
6	Management Plan of Krishnasar Conservation Area (BS 2074/75-2078/79)	Study	Status study of the translocated population and identifying sites suitable for further translocations as research priority.	(KrCA, 2017)
		Translocation	Translocate Blackbuck to other protected areas with similar habitat.	
7	Sagarmatha National Park and its Buffer Zone Management Plan 2016-2020	Study	Conduct feasibility study to translocate blue sheep to supplement prey species of Snow Leopard.	(GoN/MoFSC/DNPWC/SNP, 2016)
		Translocation	Translocation of blue sheep to SNP as a mitigation measure for human-wildlife conflict.	
8	Chitwan National Park and its Buffer Zone Management Plan 2013-2017	Study	Conduct feasibility study to translocate rhino to other parts of CNP. Explore the possibility of reintroducing Wild water buffalo to CNP. Initiate the feasibility study to translocate Gaur to BNP from CNP.	(GoN/MoFSC/DNPWC/CNP, 2013)
		Translocation	Remains open to translocate rhino from the high density areas to other PAs Proposes to reintroduce a sizeable population of swamp deer in Sukhibhar area of CNP	

Most of the provisions in the species conservation action plans are analogous to the plan mentioned in the protected area management plans (Table 1 and Table 2). However, some of provisions are novel in species conservation action plans *viz.* Dolphin translocation management plan is in place not included in PA management plans.

Translocation of the species is a complex issue which demands the prediction and execution of conservation translocations based on state of the art science and refinements of translocation techniques (Evans et al., 2023). The casual factors of the rarity are species specific, meaning we need to customize the reintroduction success criteria to incorporate the differences (Haskins, 2015). However, the provisions mentioned in most of the species conservation action plans of Nepal are too generic confined to listing the activities- study or translocation actions.

For instances, though the genetic study on Cheer pheasant is almost nonexistent in case of Nepal, the species conservation action plan has recommended the translocation of some individuals between the populations to address genetic depression (DNPWC & DFSC, 2018). Similarly, translocation of blue sheep to Lamtang National Park and Sagarmatha National Park has been prioritized by the PA management plans (Table 1), however the Snow Leopard Conservation Action Plan for Nepal (2017 – 2021) remains silent on same (DNPWC, 2017a) and the blue sheep translocation is purposed for enriching prey availability of Snow Leopard. Conservation translocation does not necessarily results in enhancement of the species populations, they can add challenges such as reduced genetic fitness, transmission of diseases and so on (Berger Tal et al., 2020; Peters et al., 2020) which are not adequately addressed by the action plans.

Table 2: Issues of Conservation Translocation in Species Conservation Action Plans

SN	Species Action Plan	Translocation related focus	Translocation related provisions	Source
1	Dolphin Conservation Action Plan 2021-2025	Translocation	Identifies the essentiality of either immigration from India or translocation for maintaining the viable population of Gangatic Dolphin even for the largest population of Koshi	(DNPWC & DoFSC, 2021)
2	Gaur Conservation Action Plan for Nepal 2020-2024	Study	Proposes to conduct habitat suitability and translocation possibility of Gaur in BaNP, BNP, KTWR, and Trijuga forest of Udayapur district	(DNPWC, 2020a)
		Translocation	Proposes to translocate Gaur to KTWR and Triyuga Forest to create meta population in eastern Nepal	
3	Wild Water Buffalo (*Bubalus arnee*) Conservation Action Plan for Nepal(2020-2024)	Study	Proposes to undertake assessment and lesson learning of translocation of Wild Water Buffalo to CNP	(DNPWC, 2020b)
		Translocation	Proposes to translocate additional 25 Wild Water Buffalo to CNP to increase the herd size Identifies the potentiality of translocation of Wild Water Buffalo to BNP on basis of success of translocation to CNP	
4	Pheasant Conservation Action Plan for Nepal (2019-2023)	Study	Recognizes the problem of Genetic Depression in case of Cheer Pheasants of Nepal and proposes to conduct genetic study	(DNPWC & DFSC, 2018)

		Translocation	Identifies the translocations of some individuals from one population to other to address issues of genetic depression	
5	Gharial Conservation Action Plan for Nepal (2018-2022)	Upgrading	Identifies the needs to systemization ex-situ conservation with development of Gharial husbandry and management guideline, release protocol and sharing best practices. Identifies the necessities to develop capacity of human resources	(DNPWC, 2018)
6	The Greater One-horned Rhinoceros Conservation Action Plan for Nepal (2017-2021)	Study	Aims to assess the habitat suitability for Rhino at KTWR	(DNPWC, 2017b)
		Translocation	Proposes to translocate at least 10 rhino to SuNP and 15 rhino to BNP to support meta-population network	
			Proposes intra park translocation of Rhino from high density region of park to low density region as a means of increasing population	
7	Site Specific Conservation Action Plan for Blackbuck in Shuklaphanta Wildlife Reserve, Nepal 2016-2020	Study	Remains open to collaborate between Shuklaphanta Wildlife Reserve and research and academic institutions to conduct research and monitoring related to blackbuck translocation Conduct feasibility study to establish another population in other Pas	(DNPWC, 2016a)
8	Tiger Conservation Action Plan for Nepal (2016-2020)	Translocation	Identifies swamp deer and wild water buffalo as ecosystems and identifies their reintroduction to the CNP as a means to maintain the grassland and wetland in the Park	(DNPWC, 2016b)
9	Vulture Conservation Action Plan for Nepal (2015—2019)	Reintroduction	Aims to use captive breeding and reintroduction as complementary measures to in-situ conservation interventions to prevent the extinction of species of vulture in Nepal	(DNPWC, 2015)
		Planning	Identifies the need of translocation plan and building and infrastructure for the future release of captive breed vulture	

Conservation translocation practice in Nepal

Conservation translocation in Nepal is predominated by the population reintroduction and both forms of population reintroduction i.e. reintroduction and reinforcement are in practice. Gharial breeding (in CNP and BNP) and releases in Narayani, Rapti and Babai; turtles released in areas of CNP, Swamp deer translocation to BNP and Vulture breeding and release program represent the examples of conservation reinforcement. In the meantime, Swamp deer translocation to CNP, Rhino translocation to ShNP and BNP, Gharial release to Koshi and Kaligandaki Rivers, Blackbuck translocation to Hirapur Phanta of Shuklaphanta and Bagaura Phanta of BNP, and wild water buffalo translocation to CNP represents the example of reintroduction.

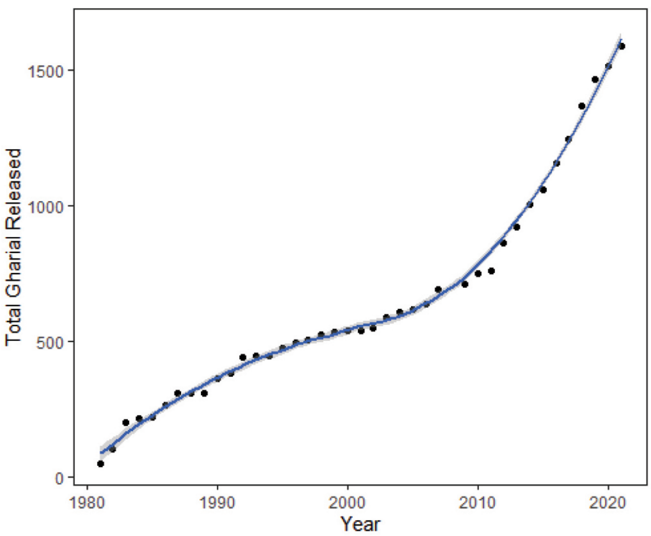
Gharial breeding and release

Gharial population throughout the range in 1940s was estimated to be 5000 – 10000 individuals that were reported to decline to less than 200 individuals in 1970s (Whitaker, 2007). The decline is attributed to a diverse array of anthropogenic interferences such as exploitation, changes in riverine habitat quality and infrastructure being a few among many (Lang et al., 2019). To halt the species declines, Government of Nepal initiated a Gharial Conservation Program (Gharial Conservation Breeding Center – GCBC) in Chitwan National Park (Maskey et al., 2006). GCBC protects the nesting habitat of Gharial, collects the eggs from nests, hatches those eggs and carries out in-situ releases (Maskey et al., 2006). Up to 2022, altogether, 1692 Gharials that have been hatched and reared at the Gharial Breeding center have been released in different river systems of Nepal (Figure 2a). Most of the releases (82.21%) have been done at Rapti and Narayani Rivers of Central Nepal (Figure 2b.) and 57.44% of the release have been done at Rapti River alone. Furthermore, a male Gharial was captured from the Babai River and was released to the Rapti River in 2017 (CNP, 2018).

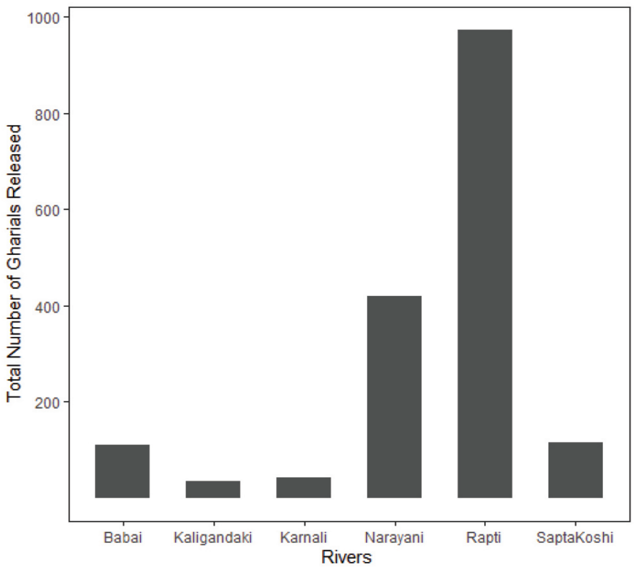
The population of the Gharial has been increasing gradually in the rivers of Nepal with the reported population of 198 individuals in 2016 (GoN/MoFE/DNPWC, 2022). Though, abundance is a poor measure of the reintroduction success (Shier, 2015), recovery of the population of species which was once presumed to follow the path of extinction (Whitaker, 2007) should be taken as positive sign. However, in one year of release 50% of the released population is reported to disappear, indicating the low success of reintroduction (Ballouard et al., 2010). Furthermore, the population of the Gharials is heavily female skewed in case of Chitwan Population compared to that of Bardia (Bashyal et al., 2021). As the sex in the Gharials, particularly during the population monitoring are determined by visual observation of ghara, amateurs usually cannot differentiate between the sub-adult male and female, which could be one of the reasons for reported bias in male female ratio (Bashyal et al., 2021). Still, the male biased population in CNP was reported to add challenge in conservation of Gharials with reported decline of reproductive success. To address the issue, a male Gharial was captured at Babai, and was released to Rapti River (CNP, 2018).

Blackbuck conservation

There is over 45 year long history of Blackbuck translocation in Nepal. A total of 52 individuals were translocated from Khairapur and Central



a)



b)

Figure 2: Gharials released in different rivers of Nepal a) Cumulative number of Gharials released b) river wise number of gharials released (Source: (CNP, 2022))

Zoo in three different incidents (Table 3) (Bist et al., 2021; DNPWC, 2016a). Blackbuck usually prefers the habitat with the short grasses however, Bhaugara Phanta were dominated by tall grassland, thus unsuitable habitat and predation resulted in extirpation of the species (DNPWC, 2016a). Habitat quality is the most important factors in translocation and without high quality habitat the success of translocation are low regardless of the number of the animals released and preparatory works carried out (Griffith et al., 1989).

Starting from 2012, efforts are being made to establish the second population of Blackbuck in Hirapur Phanta of Shuklaphanta National Park and 28 individuals were translocated (Table 3) and are now kept at enclosure. The site specific plan aims to expand the area of the enclosure to 40 ha from 17 ha current (the then) areas (DNPWC, 2016a) and later release the species to open space when the herd size reaches 100 and this abundance based decision could be counter-productive. Population size is a poor indicator of the extinction risk, particularly in case of the reintroduction program (Shier, 2015). Furthermore, the individuals kept in closed conditions such as zoos are supposed to have evolved under the relaxed selection pressure and are more adapted to the ex-situ habitat conditions (Lacy, 2013). That adaptation could be a maladaptation to the conditions of natural environment. As the source population of blackbuck for Hirapur Phanta is either the zoos or another closed population from Khairapur, those individuals could potentially have poor defense mechanism against natural predators and other factors due to contemporary evolution. Pre-release training of the captive breeding animals are suggested to ensure they can adapt to the new environment (Yang et al., 2018). Concerned authority should plan the training of the blackbuck in the aspects such as defense against predators, before completely releasing them in natural habitats.

Greater One Horned Rhinoceros (Rhino) translocation

Rhino translocation was initiated in Nepal in 1986 by translocating 13 individuals from CNP to Karnali Flood Plains of BNP and continued till 2017. During the period, a total of 100 Rhino have been translocated to BNP and ShNP (Figure 3a). The reintroduced rhino population declined during the Maiost insurgency period (1996-2006) particularly due to poaching. A total of 36 rhinoceros were killed between 1999/00 and 2004/05 (DNPWC, 2006; M. Khadka & Thapaliya, 2007). In 2007 census, only 31 Rhino were recorded from BNP, nearly one third of 83 individuals translocated to the park between 1986 and 2003 (DNPWC, 2009). The population is recovering gradually (Figure 3b), and surpassed half the number, 38 in BNP and 17 in ShNP (GoN/MoFE/DNPWC, 2022), translocated from CNP.

Habitat management and protection measures are essential to maintain the rhino population in CNP. To protect this species, there is dire need to establish the metapopulation network through translocation of rhinos in other protected areas of Nepal (Sinha et al., 2011; Subedi et al., 2017). Population viability analysis (PVA) also supports this idea, which indicates that rhino populations of BNP are prone to local extirpation if they are exposed

Table 3: Chronological records of Blackbuck translocation in Nepal

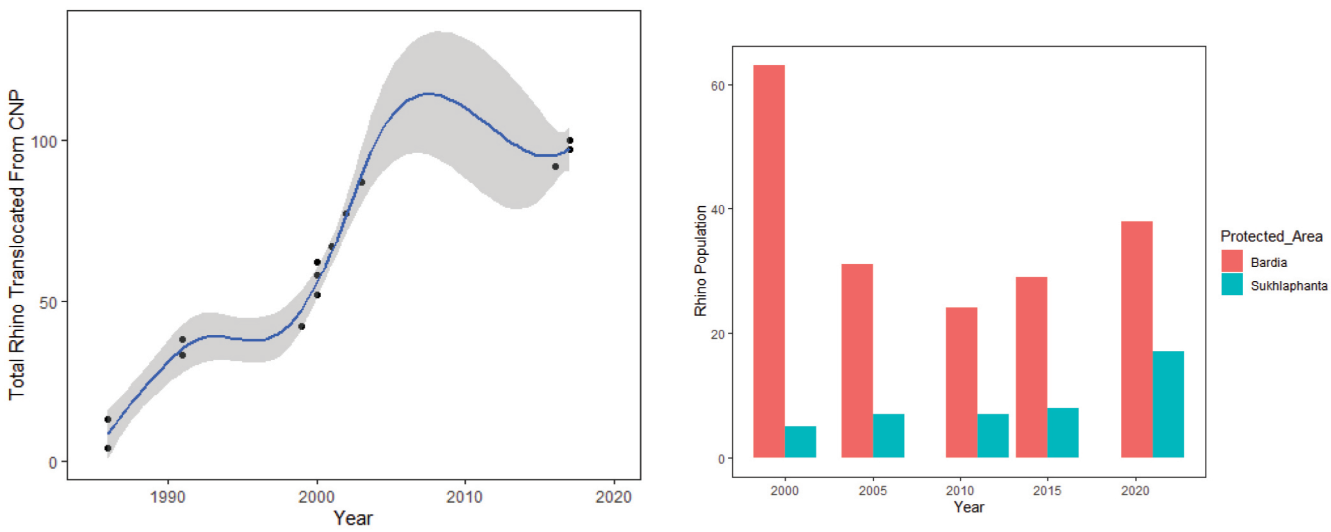
Year	From	To	Animals Translocated
1977	Khairapur	Baghaura Phanta, BNP	8
1987	Khairapur	Baghaura Phanta, BNP	17
1987	Central Zoo, Jawalakhel	Baghaura Phanta, BNP	27
	Sub total		**52**
2012	Mini Zoo, Nepalgunj	Hirapur, ShNP (then SWR)	22
2012	Central Zoo, Jawalakhel	Hirapur, ShNP (then SWR)	6
2015	Khairapur	Hirapur, ShNP	14
	Sub total		**42**
	Total		**94**

Source: (DNPWC, 2016a; GoN/MoFSC/DNPWC, 2017) to poaching pressure while translocation of 3 individuals regularly for 30 years can establish self-sufficient population (Kafley et al., 2015) justifying translocation needs. Chitwan populations were found to be stable and have potential to become source population in both PVA and population and habitat suitability analysis (PVHA) though the degree of contribution differed between the two studies. PAV indicated that CNP can supplement 10 to 15 individuals every three year (Kafley et al., 2015) if properly managed, Chitwan can supplement eight males and five females annually to establish other population (Subedi et al., 2017).

Wild Water buffalo

As majority of the area in KTWR is prone to the peak floods and buffer zone of the reserve is devoid of natural forests, Wild Water Buffalos are forced to seek refuge in the cropland during floods (Heinen & Paudel, 2015). Furthermore, resuming the risk of an unforeseeable future catastrophe, recommendations were made to establish the second population of the Wild Water Buffalo outside KTWR, and CNP was suggested as a suitable habitat based on the evidence of being the past home of the species, a better protected national park, and the firm availability of the suitable habitats (Heinen & Kandel, 2006). Furthermore, 8.92 Square Kilometer of Babai Flood Plains of BNP was identified as suitable site for the species, based on geospatial and vegetation based habitat suitability (Thapa et al., 2020). Biological feasibility, social feasibility, regulatory compliance and resources availability are crucial for successful animal translocation (IUCN/SSC, 2013). However, most researches done to guide conservation rely heavily on geospatial tools and partial analysis of vegetation which are insufficient to cover full range of biological feasibility.

Fifteen wild water buffalos, 12 from KTWR and three from the Central Zoo and were translocated to the 30 ha enclosure in Padampur area of CNP in 2017, of which four females died in the same fiscal year that includes all three from Central Zoo (CNP, 2018; GoN/MoFSC/DNPWC, 2018). In the span of 5 years, the translocated population gave birth to six calves and showed hope for establishment of reintroduced population. Later on, all of the Arna translocated died and the population is zero at present (GoN/MoFE/DNPWC, 2022) and the causes are believed to be management issues. Poor planning, lack of resources and ignorance to the avoidable issues have been the cause of the reintroduction failure in the past (Haskins, 2015) and recent Arna translocation outcomes conform to this.



a) b)

Figure 3: a) Cumulative number of Rhino translocate to Bardia NP and Shuklaphanta NP b) Population of Rhinoceros in BNP and ShNP at different year (Source: (GoN/MoFE/DNPWC, 2019))

Swamp Deer

Five individuals of Swamp deer (2 male and 3 female) were translocated to BNP in 2016 while seven (7) individuals (5 female and 2 male) were translocated to CNP in 2017 (Table 4). In CNP, Swamp deer were kept in the enclosure made at Padampur. However, all the individuals died (Heinen et al., 2019) within one year of translocation. Bardia National Park Management Plan has planned to translocate at least 50 individuals from Shuklaphanta NP to establish the viable population (BNP, 2022). Decision choices in reintroduction programs is usually difficult to make owing the uncertainty about the population dynamics and ecology of the individuals in novel habitat conditions and this can be addressed by active adaptive management whereby the process is iterated and a balance is maintained between learning and management (Runge, 2013).

Turtle/Tortoise

In CNP and BNP, Turtle Conservation Center has been established within the premises of the Gharial Conservation Center in 1999 (CNP, 2016). Five species of turtles are maintained at the conservation center that includes Elongated tortoise (Indotestudo elongata), Tricarinate Hill Turtle (Melanochelys tricarinata), Flapshell Turtle (Lessimys punctata), Peacock Soft Shell Turtle (Nilssonia hurum) and Black Pond Turtle (Melanochelys trijuga) (CNP, 2018). However, TCC is more utilized as for exhibition center rather than conservation center. Two ad hoc cases of the turtle reintroduction have been carried out from Turtle Conservation Center. Five individuals of elongated tortoise were released on May 22, 2014 by making soft enclosure (B. Khadka, 2014) and information on success of that release is not known. In 2020, the team deployed for locating the nest of the Gharials found three nest of Narrow headed Soft-shell turtle (Chitra indica) with the clutch size of 120, 197 and 197 from which 83, 134 and 158 eggs were successfully hatched after the average of 54 days and later released to Rapti River (Khadka et al., 2022).

Vulture breeding and release

Vulture Breeding Center was established at Kasara of CNP by keeping the 14 chicks from the Hemja Village Development committee in the first year and 30 and 20 vulture chicks collected in second and third year respectively from different parts of Palpa, Rupendehi, Dang and Kapilvastu districts (Paudel, 2014). Even in natural condition, the

Table 4: Translocation of Swamp deer from Shuklaphanta to BNP and CNP

SN	Date	From	To	Details	Source
1	May 30, 2016 to June 5, 2016	ShNP	BNP	5 (2 male, 3 female)	(GoN/MoFSC/DNPWC, 2017)
2	April 26, 2017 to May 4, 2017	ShNP	CNP	7 (5 female, 2 male)	(GoN/MoFSC/DNPWC, 2018)

Table 5: Details of the Vulture Egg laid, chicks hatched, survived and released to wild

Year	Eggs Laid	Chicks hatched	Chicks Survived	Vulture Released to wild	Remarks
2008					Establishment of Vulture Breeding Center
2012	4	0	0		
2014	11	1	1		First Egg hatched
2015	8	0			
2016	15	9	8		One chicks died after hatching
2017	21	6	6	6	
2018	20	2	2	12	
2019	19	0		13	
2020	14	0		8	
2021	12	0		10	
2022				10	
Total	**109**	**17**	**16**	**49**	

Source: (CNP, 2013, 2019, 2020, 2022; GoN/MoFE/DNPWC, 2018; GoN/MoFSC/DNPWC, 2013)

White Rupmed Vultures (WRV) was reported to have breeding success in excess of 50% (Baral & Gautam, 2007). Thus, we can say that Breeding center failed miserably as the breeding success was reported to be lower than in the natural environment.

Conclusion

Anthropogenic influence and associated drivers have changed the dynamics of ecosystems compromising the ability to provide the ecosystem services. Thus, in addition to restoration of habitat, restoration of species is equally necessary and conservation translocation support as a means to restore the species in indigenous or naïve habitat. Nepal has introduced conservation translocation as management tools in both protected area management plans and species conservation action plans. Some of these documents though prepared under the leadership of Department of National Park and Wildlife Conservation, lack coherence even for the same species. This indicates the possibility of the ad hoc decisions while formulating the plans. Furthermore, most of those provisions are simple statements and promises without due consideration to the ecology and conservation biology of the species. Conservation translocation have been carried out for some reptiles, birds and mammals in an attempt to either augment the existing population or reestablish the additional sub-population as an insurance against the stochastic extinction. Conservation translocations are vital for the successful conservation of species in protected areas or other native habitats that are mostly surrounded by the anthropogenic landscapes. Conservation translocation, in this context, should be carried out with strong foundation integrating species, population and ecosystem dimensions. Restoration sites potentially differ from native conditions of source populations, therefore translocation should be practiced on the basis of adaptive management framework and continuous interventions follow up to achieve the success.

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