

First dispersal event of a reintroduced Asiatic black bear (*Ursus thibetanus*) in Korea

Amaël Borzée, Yoonjung Yi, Desiree Andersen, Kyungmin Kim, Kwang-Seon Moon, Jeong-Jin Kim, Tae-Wook Kim & Yikweon Jang*

ABSTRACT. Once reaching maturity, individuals of most mammal species typically disperse towards suitable habitats, adequate to their ecological requirements. If the habitat has reached saturation for carrying capacity, these individuals may disperse further to find adequate habitat. The Asiatic black bear (*Ursus thibetanus*) has been reintroduced on the Korean Peninsula since the early 2000s, and is now considered successfully reintroduced. The population size in the Jiri Mountain National Park, where the species has been reintroduced, has reached about 56 individuals, and for the first time a young male has dispersed a significant distance outside of the national park. The individual was caught and released within its home range before dispersing again. Our research highlights the dispersal pathway followed by the individual, the landscapes crossed, and the public reaction to this dispersal event.

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KEY WORDS: Asiatic black bear, *Ursus thibetanus*, reintroduced species, dispersal event, Republic of Korea.

Amaël Borzée, Yoonjung Yi, Desiree Andersen, Kyungmin Kim & Yikweon Jang [jjangy@ewha.ac.kr], Division of Eco-Science, Ewha Womans University, Seoul 03760, Republic of Korea; Kwang-Seon Moon, Jeong-Jin Kim, Tae-Wook Kim, Species Restoration Technology Institute, Korea National Park Service, 53-1 Hwangjeon, Masan, Gurye, South Jeolla Province, 26466, Republic of Korea.

Первый случай расселения гималайского медведя (*Ursus thibetanus*), реинтродуцированного в Корее

А. Борзи, Я. Ии, Д. Андерсен, К. Ким, К.-С. Мун, Д.-Д. Ким, Т.-В. Ким, И. Занг*

РЕЗЮМЕ. Особи большинства видов млекопитающих, после достижения половой зрелости, обычно расселяются по подходящим местам обитания, соответствующим их экологическим требованиям. Если биотоп уже занят, индивидуумы могут расходиться дальше, в поисках подходящих местообитаний. Гималайский медведь (*Ursus thibetanus*) реинтродуцирован на Корейском полуострове с начала 2000-х годов, и в настоящее время считается успешно восстановленным. Численность популяции в Национальном парке горы Йири, где этот вид был реинтродуцирован, составляет 56 особей. Впервые молодой самец *U. thibetanus* был отмечен на значительном расстоянии за пределами национального парка. Медведь был отловлен и выпущен в пределах своего прежнего местообитания, но потом снова покинул парк. В статье обсуждается маршрут перемещения медведя и пройденные биотопы, а также общественная реакция на это событие.

КЛЮЧЕВЫЕ СЛОВА: гималайский медведь, *Ursus thibetanus*, реинтродуцированный вид, расселение, Республика Корея.

Introduction

Asiatic black bears (*Ursus thibetanus*) are currently extant in the Republic of Korea, but only due to reintroduction efforts. The species went functionally extinct in the 1990s following hunting, gradual obliteration of resources culminating in the Korean War (1950–1953), and the subsequent lack of adequate habitat (Kim *et al.*, 2011). Following the extinction of the species in the Republic of Korea, several individual *U. thibetanus*

originating from nearby countries were introduced in the Jiri Mountain National Park (Choi *et al.*, 2010; Kim *et al.*, 2011). Reintroductions started in 2004, and the latest reintroduction event occurred in 2015 (Lee & Jeong, 2009; personal communication with Head of the Jiri Mountain National Park). The population on Jiri Mountain is estimated to be sustainable in a demographic sense; however, complementation is required to retain a genetically-viable population (Park, 2001). To the best of our knowledge, this is the first population reintroduction of *U. thibetanus*, although population rehabilitation projects have already been carried out for that species (Ashraf, 2008).

* Corresponding author.

The distribution of *U. thibetanus* in Jiri Mountain is affected by several factors including vegetation cover, specifically of *Quercus mongolica* and *Pinus densiflora* (Park, 2001); plant productivity, i.e. chestnuts are more nutritious than oaks, which are better than pine trees (Bennett *et al.*, 1943), except in wet areas (Arno, 1985), and trails/roads (Kang & Paek, 2005). Once all resources are taken through the defense of home ranges, new individuals, i.e. young or introduced, must disperse in order to establish their own home range. Dispersal may however happen earlier as pre-saturation dispersal has been documented (Swenson *et al.*, 1998). Dispersal is sex biased in bears, i.e. male bears have a higher dispersal probability than females (*U. arctos*: Mano, 1994; Zedrosser *et al.*, 2007; *U. thibetanus*: Japan Wildlife Research Center, 1997; *U. americanus*: White *et al.*, 2000). For *U. americanus*, greater dispersal distance

is strongly linked to high habitat suitability and low harvest density. In this species, males disperse about 60 km at about two years of age (Moore *et al.*, 2014). Interestingly, this species has been described as displaying similar behavioural traits as *U. thibetanus* (Hwang & Garshelis, 2007).

Material and methods

The *U. thibetanus* reintroduction project started in 2004 and a total of 28 bears were translocated from Russia, North Korea, and China. As of the end of the breeding season 2017, there were a total of 56 individuals in the Park, including 29 locally born individuals. The Jiri Mountain National Park is located in the southern part of the Republic of Korea between 35.212°N and 35.445°N and between 127.453°E and

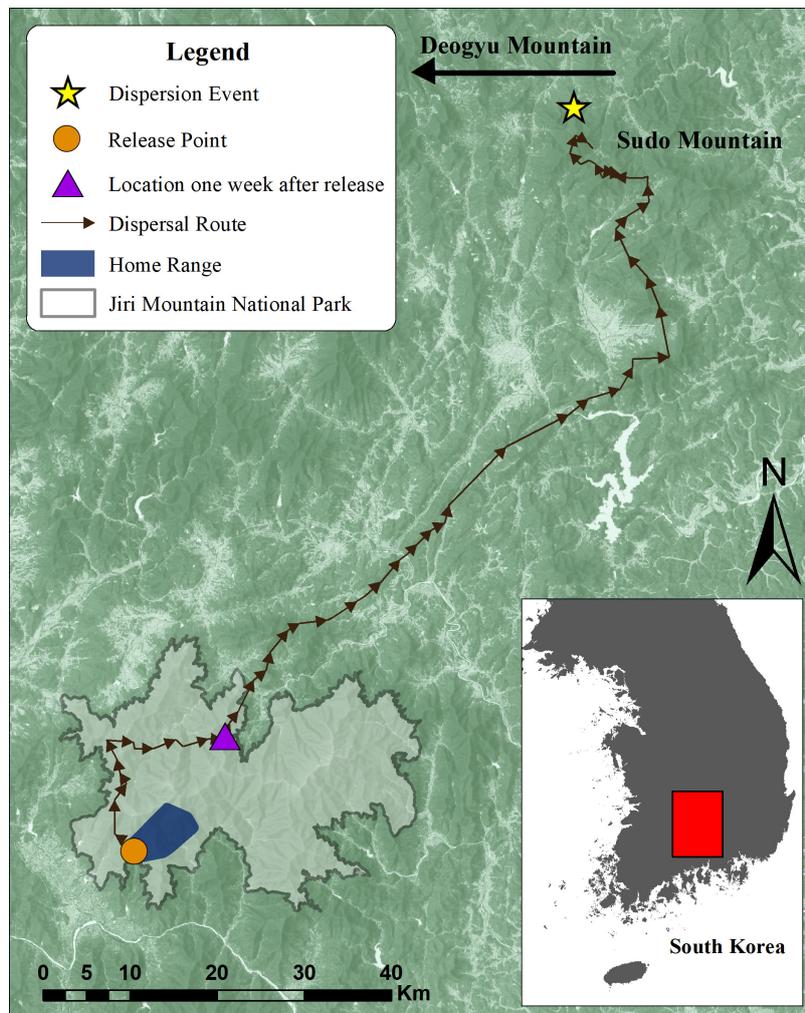


Fig. 1. Map of home range (estimated through minimal convex polygon drawing) and dispersal route for the focal individual, between 6 and 25 July 2017. The bear was found near Sudo Mountain and re-released into the southwestern part of the Jiri Mountain National Park. One week after its release back into the park, it was located in the northern central area of the park, close to the original predicted dispersion site. Service Layer Credits: Esri, USGS, NGA, NASA, CGIAR, N. Robinson, NCEAS, NLS, OS, NMA, eodastystyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community and GeoServicesMap Esri Korea. Map generated in ArcMap 10.5 (Esri, Redlands, USA).

127.825°E. The park covers 479 km², lying along the borders of North Jeolla, South Jeolla, and South Gyeongsang provinces.

A subset of the total bear population is tracked on a daily basis with either GPS tracking or telemetry by rangers from the Species Restoration Technology Institute (SRTI), a branch of the Korea National Park Service. Newly released individuals are tagged with telemetry and GPS tags, although the loss rate is relatively high (personal communication with Head of the Jiri Mountain National Park). Two second-generation seven-month old males, were separated from their mother and released into the park on 27 October 2015, tagged with radio transmitter M3600 (ATS, Isanti, USA) and subsequently detected using dial tone receptors IC-R10 (ICOM; Osaka, Japan) coupled to Yagi antennae. Prior to this, these individuals were held in captivity with their mother and were separated and released to reduce the risk of habituation if held in captivity for too long. Both individuals survived release into the national park but lost their tracking devices within months, and thus tracking records are missing in recent months. Here, the focus is on two dispersal events by one of these two males, which lost its tracking device in September 2016. Until dispersal, the focal individual had established its home range in the south-western area of the Jiri Mountain National Park, estimated through a minimal convex polygon analysis (Fig. 1), close to the point where it had been released, and close to but not in contact with the fenced open-area where it had been raised with its mother and sibling.

Results

Dispersal events

On the morning of 14 June 2017, a second-generation young male bear, identified as KM-53, was found in Sudo Mountain, 110 km away from the closest edge of its latest known home range (Fig. 1). It was found feeding on popular chocolate biscuits left unattended by construction workers. This is the first recorded dispersal event by an individual descending from the *U. thibetanus* individuals introduced in the Jiri Mountain National Park.

Once found after the first dispersal event, the individual was caught by SRTI rangers, identified through genetic analysis, and re-released within its last known home range on 6 July 2017. The bear was then refitted with a radio tag and kept under constant monitoring. Following its release, it circled the Jiri Mountain National Park clockwise and dispersed a second time. The exact pathway for the second dispersal event is known (Fig. 1) and the SRTI assumes that it was the same one as the one used for the first dispersal event. The focal individual crossed through the “Asiatic Black Bear Eco-corridor.” Until recently, the matrix between Jiri Mountain and Deokyu Mountain was disconnected by a motorway. The matrix was renovated two years ago, and the motorway now frequently runs under tunnels and wildlife underpasses. There is one specific section between the two mountains where the only remaining barrier is a rarely-used two-lane road, bordered by trees on one side and low vegetation on the other (Fig. 2). The young male *U. thibetanus* crossed between the two



Fig. 2. Likely crossing point between Deokyu and Jiri Mountains. The two-lane road at this locality is the narrowest and least frequently used boundary of the Jiri Mountain National Park (35.5269° N; 127.6284° E). This photo illustrates the type of habitat with a weak resistance to the dispersion of *U. thibetanus*.

forests in this area before dispersing further north (Fig. 1). This corridor is the most likely access point to Sudo Mountain, an east-west low altitude mountain range, with the highest peak being 1 317 m high.

The individual is expected to have dispersed due to reaching maturity and the inclination to explore this new habitat. The bear settled in the same area after both dispersal events (Fig. 1). Following the second dispersal event, the individual was caught again on 27 July 2017, and related administrative bodies are currently discussing the potential future steps to be taken. Other bears have been found outside of the Jiri Mountain National Park in the past, but none was linked to dispersal events, and all were relatively close: 15 km to the north in Hamyang and 7 km to the south in Gurye.

Public perception

The reintroduction program started in 2004, and despite facing pronounced difficulties and negative coverage, it has avoided negative headlines in the press in the last several years. The Asiatic black bear made the headlines of the press in the Republic of Korea following the first dispersal event, which resulted in both positive and negative perspectives. It is notable that out of the seven news outlets surveyed, five had neutral to positive takes on the event. These included The Chosun Ilbo (2017), SBS News (2017), KBS News (2017), The Kyunghyang Shinmun (2017) and The Seoul Shinmun (2017). These highlighted the positive outcome of the reintroduction project, which has led to a dispersal event, and called for Deokyu Mountain National Park and Sudo Mountain to be designated as bear habitat, while noting the need for further ecological analyses. Two news outlets were negative, with The Dong-a Ilbo (2017) suggesting that the presence of such a predator warranted specified warnings, and Nocut News (2017) urging for the reconsideration of the project in general.

Discussion

Dispersal events of a second-generation individual within this reintroduced population are clear indications that the locally born bears follow natural trends. The dispersal of a two-year-old male matches with the species behaviour for dispersal age (Hwang & Garselis, 2007) and seasonal activity (Ishibashi & Saitoh, 2004). Additionally, male *U. thibetanus* have larger home ranges and disperse further than females (Japan Wildlife Research Center, 1997; Shimane Prefecture, 2001), and dispersal is often greater for bears that have been held in captivity (Ordiz *et al.*, 2007). Park (2001) estimated that for *U. thibetanus* in Jiri Mountain the 80% carrying capacity was around 0.66 ± 0.84 individuals / km², corresponding to a low estimate of 75 individuals. The population size as of spring 2017 was still below this number, but dispersal was to be expected once the population reached this threshold. At this point, the movement of dispersing individuals was expected to

be guided by anthropogenically influenced landscape elements (Doko *et al.*, 2011), wherein animals follow least resistance paths by avoiding roads (Mattson & Henry, 1986), farms (Mysterud, 1983) and other human activities (Elgmork, 1978, 1983; Mattson *et al.*, 1987). Accordingly, the dispersion of KM-53 did follow a path of least resistance.

The potential for the dispersal events to be related to foraging is low, as the last known home range of this individual was in the south of the Jiri Mountain National Park, and the bear was recaptured north of the national park. It is possible that the displacement was food resource related, but this is difficult to determine because differences in food resource availability in and outside of the national park are unknown. Other potential resources of interest for dispersing individuals are territory and mating opportunities. As the individual already dispersed twice and covered a large distance following its second release within the park, it is expected that it may try to disperse from the Jiri National Park if released again. It is thus of great support that the public opinion about the dispersal events is not negative overall. We recommend the creation of additional national parks within the connected habitat matrix for the settlement of dispersing individuals and their translocation to non-connected habitat in the north of the country when the habitat in Jiri Mountain and the connected habitat matrix reaches saturation.

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