

The Third Sika Deer Management Plan in the Shiretoko Peninsula



Kushiro Nature Conservation Office

Hokkaido Regional Forest Office

Hokkaido Government

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Chapter I. Framework of the Plan

I-1 Background of the Plan

Sika deer (*Cervus nippon yezoensis*) were once driven to extinction in certain areas of Hokkaido due to heavy snow and overhunting in the Meiji Era (1868-1912). Later, in the 1970s, a population migrated from the Akan region and spread across the Shiretoko Peninsula again. According to aerial counting surveys conducted over Shiretoko Cape, one of the species' key wintering grounds in the Peninsula, wintering sika deer population increased sharply from 53 deer in 1986 to 592 deer in 1998. Since then, the number has remained at a high level with a certain range of fluctuations. This long-term high population density is also seen in other key wintering grounds.

Despite being located in the mildly snowy region of eastern Hokkaido, the Peninsula has heavy snow because of its topography, providing a limited number of viable wintering grounds to sika deer. In addition, due to the rough terrain, most of their wintering grounds in the Peninsula are distributed discontinuously in low-altitude areas less than 300 meters above sea level (Fig. 1). The most suitable wintering habitats for sika deer in the Peninsula include locations that can offer feeding places such as grasslands and open forests where strong winds prevent snow from accumulating, and are protected by nearby coniferous forests, which serve as a shelter in the case of severe weather. The proportion of coniferous trees is higher in areas belonging to Shari Town than those in Rausu Town, resulting in a larger number of sika deer wintering in the former. Sika deer gather in these wintering grounds during the snowy season. They eat dwarf-bamboos, branches, and tree barks when the snow cover is not very extensive; however, in the deep snow season, they increasingly eat tree barks. In the snow-free season, their habitats expand into a larger area centered on the wintering ground, and a large number of individuals migrate from the Shari Town side to the Rausu Town side. Some of them inhabit high altitude zones.

The grazing pressure exerted by high-density sika deer population has had a wide range of impacts on the environment of the Shiretoko Natural World Heritage site (hereafter the "Heritage site"). These impacts include: a significant reduction in the number of specific tree species and unsuccessful regeneration, which are attributable to the bark stripping behavior by sika deer and mainly observed in their wintering grounds; a decrease in the biomass and diversity of forest floor vegetation; and a declining number of coastal native plant communities, which are characteristic to the Heritage site, and rare plants growing within such communities. If the high density of sika deer population continues for a longer period of time, it may drive rare plant species and populations to extinction, exert influence on alpine vegetation, and cause soil erosion on steep slopes.

Current high sika deer population density and changes in vegetation may be considered as an ecological process that has repeated itself in the history. However, some findings of tree-ring and other analyses suggest that significant anthropogenic changes have been made to the environment of Heritage site and wider area, and that the high population density has had the strongest impact in the last 300 years on the vegetation of Shiretoko Cape. These indicate that a qualitative change has occurred in the ecological process. The precautionary principle requires us to take a variety of feasible measures urgently, because if this situation is left unattended, irreversible adverse effects may be exerted by sika deer on the vegetation.

Sika deer populations that may affect the Heritage site's environment are distributed not only in the site but also to the neck area of the Shiretoko Peninsula, if seasonal migrations and dispersal of sub-adults are taken into consideration. Accordingly, sika deer populations in the Heritage site must be managed in a unified manner, covering areas adjacent to the site.

Meanwhile, during the period from the Epi-Jomon (2,000 to 1,500 years ago) to the Meiji/Showa era (1868-1989), there were habitats of indigenous people across the Peninsula, including the tip of Shiretoko Cape. Further, in the periods prior to the Meiji era, the Peninsula was home to wolves. These people and predators might have had a considerable impact on the dynamics of sika deer. The Plan is not intended to bring them back but to explore appropriate approaches to manage sika deer populations in the Peninsula at a biologically-optimum density by, for example, substituting their functions with human control.

During the first phase of the Plan (FY2007–FY2011), a field survey was conducted in 2008 by a team from UNESCO World Heritage Centre and IUCN. Recommendations from the team included the following four points: 1) Clear indicators should be developed to help define acceptable and unacceptable limits for the impact of grazing from sika deer on natural vegetation in the property; 2) The impacts of control measures on sika deer populations and the biodiversity and ecosystems of the property should be carefully monitored; 3) The management of sika deer within the World Heritage site should be carefully coordinated with the management of sika deer within Hokkaido in general; and 4) Any control measures of deer populations in the property should be carefully, humanely and sensitively implemented.

In 2009, in order to manage the Heritage site in an appropriate and efficient manner, the Management Plan for the Shiretoko Natural World Heritage Site was developed by the Ministry of the Environment (MoE), the Forestry Agency, the Agency for Cultural Affairs, and the Hokkaido Government,

providing basic policies concerning the promotion of institutions and projects. This Plan is positioned as an appendix to the Management Plan. In 2010, the Ecosystem Maintenance and Recovery Program Plan was established by the Ministry of Agriculture, Forestry and Fisheries (MAFF) and the MoE, in the aim of maintaining or recovering the ecosystem by mitigating the impact of grazing pressure from sika deer.

Furthermore, with support from the MAFF's General Program for Wildlife Damage Prevention, which was an initiative under the Act on Special Measures for Wildlife Damage Prevention, Rausu Town and Shari Town set out a wildlife damage prevention plan in 2008 and 2009, respectively, and implemented original measures for the management of sika deer. The Hokkaido Government introduced, on a trial basis, a rotational harvesting system for a period of three years from FY2007 to FY2009, to prevent a decline in the capture efficiency in adjacent areas.

During the second phase of the Plan (FY2012–FY2016), the aforementioned Ecosystem Maintenance and Recovery Program Plan was revised in 2015 with a short-term goal of recovering the vegetation in the early 1980s and a long-term goal of retaining or recovering the ecosystem that had been there before the start of modern-era developments through population control of sika deer and other efforts. In the same year, the Act on Wildlife Protection and Appropriate Hunting was amended as the Wildlife Protection, Control and Hunting Management Act (hereafter the “Wildlife Protection and Control Act”). This amendment demonstrates the government's intention to change the policy on specific wildlife species that are greatly increasing or widely expanding their habitat, including sika deer (*Cervus nippon*), to a wildlife control policy that leads their population to an appropriate level through capturing, etc.

I-2 Objectives of the Plan

This Plan is referred to as the Third Sika Deer Management Plan in the Shiretoko Peninsula and aims to reduce the excessive influence of the high population density of sika deer on the Heritage site's ecosystems through appropriate management of population in the site and adjacent neck area of the Shiretoko Peninsula.

I-3 Positioning of the Plan

This Plan is positioned as a regional version of the Sika Deer Management Plan in Hokkaido, a plan

developed by the Hokkaido Government to manage the Class II Specified Wildlife based on Article 7-2, paragraph 1 of the Wildlife Protection and Control Act. It is stipulated in the Management Plan for the Shiretoko Natural World Heritage Site that the management of sika deer in the Heritage site must be undertaken on the basis of this Plan. Therefore, this Plan should be implemented in coordination with other plans including the Sika Deer Management Plan in Hokkaido, the Management Plan for the Shiretoko Natural World Heritage Site, and the Ecosystem Maintenance and Recovery Program Plan, which was established based on the Natural Parks Act.

I-4 Period of the Plan

This Plan continues for a period of five years commencing on April 1, 2017 and ending on March 31, 2022. Schedule for the period is shown in Appendix 1. Upon the completion of the Plan, a review process will be conducted focusing on the results of continuous monitoring, management measures taken and goals achieved, to determine whether the Plan should be continued or modified, taking into account possible social changes. On the other hand, in case of a critical event affecting the sika deer management in the Shiretoko Peninsula, consideration will be given as to whether it is necessary to revise the Plan or take emergency measures, even if the Plan has not yet completed.

I-5 Target Areas and Zone Classification

The target areas of the Plan cover not only the entire Shiretoko Natural World Heritage site but the adjacent neck area of the Shiretoko Peninsula, so as to ensure a management approach that takes into account seasonal migration of sika deer population. The target areas are largely classified into Sika Deer Zone A, Specified Management Zone, Sika Deer Zone B, and Adjacent Zone as follows (Fig. 2).

1) Sika Deer Zone A

This Zone corresponds to the Heritage Site Zone A, covering the high-altitude area north of Mt. Onnebetsu and low-altitude area north of Rusha area-Cape Pekinnohana. However, this Zone excludes part of the Heritage Site Zone A; that is, coastal areas on Horobetsu-Iwaobetsu Plateaus and the Shiretoko Cape Zone, which is designated as the Specified Management Zone. On the other hand, it includes the Heritage Site Zone B located at the tip of the Peninsula on the Rausu side.

2) Specified Management Zone (Shiretoko Cape Zone)

The Shiretoko Cape Zone is located within the Heritage Site Zone A. However, in view of the urgent

need for management, it is designated as the Specified Management Zone. This Zone covers the land north of the northern part of the Poromoi Bay on the Shari Town side, as well as the land north of Kabuto-iwa Rock on the Rausu Town side. Within the Zone, the area north of Shishi-iwa Rock on the Shari Town side, which was once a home to richly diversified tall-herb communities, and the area north of the stream along the water line No. 1 on the Rausu Town side, will be subject to particularly intensive management due to a high concentration of sika deer population and considerable grazing pressure on rare plant communities and forests (Fig. 3).

3) Sika Deer Zone B

The Sika Deer Zone B corresponds to the Heritage Site Zone B and includes the low-altitude lands south of Rusha area-Cape Pekinnohana. The coastal areas on Horobetsu-Iwaobetsu Plateaus in the Heritage Site Zone A are also included in this Sika Deer Zone B.

4) Adjacent Zone

The Adjacent Zone consists of areas bordering with the Heritage site, from Horobetsu River to the neighborhood of Kanayama River on the Shari Town side, as well as from Rusa River to the surroundings of Uebetsu River on the Rausu Town side. Sika deer populations that graze in the Heritage site are assumed to migrate through this Zone.

I-6 Summary of the Second Phase

1) Summary by Zone

a. Sika Deer Zone A

Their encroaching on the alpine zone is still concerned, but no significant changes have been seen in the amount of rare alpine plants grazed by sika deer and the number of them wintering in the high-altitude zone. On the other hand, the Rusha area has a relatively high density of wintering sika deer compared to other areas in Shiretoko Peninsula.

b. Specified Management Zone (Shiretoko Cape)

A firearm-based population control program was in place for ten years including the three years of experimental density manipulation, which was conducted during the first half of Plan phase 1. As a result, the number of sika deer wintering in the Zone decreased to less than 20% of that before the program. To further reduce the density, a more effective hunting program has been implemented using partition fences installed in 2011. The effects of the population control program have been recognized as recovery in the culm height of *Sasa senanensis* in upland grasslands, biomass of Poaceae, canopy

height and plant cover rate of native plant communities, abundance and coverage of certain index (preferred) species and preferred forest floor vegetation species.

As a defensive measure, maintenance and repair activities were conducted on damaged vegetation protection fences installed at three locations by the MoE prior to Plan phase 1, as well as fences built by the Forestry Agency in 2004.

c. Sika Deer Zone B

The Sika Deer Zone B refers to a low-altitude area along the coastline and encompasses two wintering grounds. One on the Rausu Town side is the area from Rusa to Aidomari and the other on the Shari Town side is the area from Horobetsu to Iwaobetsu. These areas provide wintering grounds for two types of sika deer groups: groups that are resident in the area throughout a year and groups that migrate from surrounding areas and stay there only during the wintering season. In part of the Zone, these deer cause troubles to villagers' lives and fishery (kelp) operations.

In the Rusa-Aidomari area, an experimental density manipulation was carried out for three years in the first half of the Plan phase 2, following the investigation conducted to determine the capturing method in the second half of the Plan phase 1. From 2015 onwards, a capture program has been under way as part of the population control project. A large number of deer have been captured through the use of corral traps and deer-culling sharpshooting, leading to a reduced number of deer being found in the southern part of the area by aerial counting surveys. However, the capture effectiveness is limited by such factors as the long-term road closure due to heavy snow, and temporary migration of sika deer to high-altitude areas during the mid-winter season.

A continued population control measures were taken in the Horobetsu-Iwaobetsu area from FY2011 (the last year of the Plan phase 1). (These measures were undertaken as an experimental density manipulation for the three years in the first half of the Plan phase 2.) The aerial counting survey conducted in 2011 confirmed approximately 1,200 deer in the area. The number decreased by more than 80% by 2016 through population control and natural deaths in years with heavy snowfall. However, there are populations that winter in small areas at a high density, requiring development of effective capture measures. The results of wide-area aerial counting surveys conducted in 2011 and 2016 showed that the number of sika deer was on a declining trend on the Shari Town side including the Horobetsu-Iwaobetsu area, while the number remained almost unchanged on the Rausu Town side.

As a defensive measure, maintenance and repair activities were conducted on damaged vegetation protection fences installed in the Horobetsu-Iwaobetsu area by the Forestry Agency and Shari Town

government. In particular, in the “Shiretoko 100 Square-Meter Movement” areas, aged bark protection nets were rewound and deer-proof fences were extended (440 m in total), heightened and newly installed (350 m in total) by Shari Town. In the Rusa-Aidomari area, electric fences were built by Rausu Town for a distance of about eight km from Kikiribetsu to Aidomari. These fences are basically intended to keep brown bears (*Ursus arctos*) away, but at the same time contributing to the prevention of sika deer from entering roads and kelp-drying spaces on the beach.

Habitat manipulation practices were also undertaken in the Shiretoko 100 Square-Meter Movement areas in Shari Town, including the transfer of small-sized broadleaved tree seedlings from seedling fields to grounds enclosed by deer-proof fences, and medium- and large-sized seedlings from seedling grounds to areas inside and outside the deer-proof fences. Meanwhile, tree planting using indigenous topsoil was conducted in conjunction with roadside slope construction works, for a total of eight times during the Plan phase 2 (four times on the Shiretoko Crossroad, one time on the Prefectural Shiretoko Park Road, one time in the Shiretoko-goko lakes parking lot, and two times on the Prefectural Shiretoko Park-Rausu Road). Planting of *Abies sachalinensis*, a plant species less preferred by sika deer, was also conducted during one of the aforementioned construction works on the Shiretoko Crossroad in 2013.

d. Adjacent Zone

On the Shari Town side, a hunting area expanded in 2007 is still in effect, with intermittent no-hunting (break) periods being set to prevent hunting efficiency from being deteriorated by increased cautiousness of sika deer and avoid excessive influence on rare bird species. Furthermore, in the Plan phase 2 from 2013 onwards, a project designed to capture sika deer using corral traps and utilize their meat and body parts, which was originally started as a private-sector effort prior to the Plan phase 1 to minimize their influence on rare bird species and ecosystems, was carried out by the Forestry Agency at an increased number of locations. In addition, firearm-based capture activities were undertaken in the non-hunting period on an experimental basis.

On the Rausu Town side, a relatively lower density of wintering population was observed compared to other target areas. The municipal government strengthened its management and capture efforts in FY2007, leading to a higher capture pressure in subsequent years. However, the capture efficiency has been decreased in certain areas due to several reasons, including steep terrain and increased cautiousness among sika deer. The results of wide-area aerial counting surveys conducted in 2011 and 2016 showed that the number of sika deer was on a declining trend on the Shari Town side, while the number remained unchanged in most part of Rausu Town, except certain locations where the number decreased or increased.

As a defensive measure, maintenance and repair activities were conducted on damaged deer-proof fences installed in the Utoro city area by the Shari Town municipal government as well as vegetation protection fences built by the Forestry Agency. In addition, the electric fences newly established by Rausu Town in 2014 and 2015 on the north and south sides of the Rausu city center area have been contributing to the prevention of sika deer from entering the urban area.

2) Challenges

Overall, the number of sika deer in the Shiretoko Peninsula is on a declining trend as a result of various efforts including the population control project. However, in certain part of the Heritage site, a high population density has still been observed, and an increasing trend is seen at some locations in the Adjacent Zone. Considering this, and the fact that a full-scale recovery of vegetation, particularly that in forests, will require a longer period of time, it is recommended to further enhance the management and strengthen the framework. Even in areas where the number of deer was successfully reduced, it may increase again for various reasons such as migration from surrounding areas and a declining capture efficiency due to increased cautiousness among sika deer, exerting greater influence on the ecosystem. To avoid this, it is necessary to continue monitoring and take prompt measures if significant influence is observed. In cases where the population density needs to be reduced further to a target level after a significant reduction is achieved through population control, it is necessary to consider introducing a new capture approach that is different from previously effective methods and implement measures to use the approach at a relatively low cost.

At the same time, it must be ensured that the management practices are performed in an effective way and the impact on rare bird species and other ecosystems is minimized. Given the fact that the population control is most effective when the capture process is performed intensively within a short period of time, it is necessary to determine capture methods and their combination based on the number of sika deer and the expected number of capture. To manage sika deer from a long-term viewpoint, streamlining of management system and development of skilled hunters will be necessary.

I-7 Basic Management Policy

The following are the management policy common to the Heritage site:

In principle, the Heritage site should be left to natural processes. However, in cases where there is a risk that rare plant species or native plant species and plant communities characteristic of the Heritage site may be lost, management measures will be taken to avoid such risk and ensure

conservation of biodiversity.

Management practices must be performed in conformity with the following basic policy requirements:

- 1) The aim of the Plan is not to recover a static species composition at a certain point in the past but to restore dynamic ecosystems that change in accordance with ecological processes, using ecosystems prior to the beginning of modern exploitation (pre-Meiji era) as a model.
- 2) Our present-day knowledge is insufficient to determine whether the current increase in the number of sika deer is attributable to ecological processes or to human activities. However, in view of the significant impact of sika deer on ecosystems, which has occurred nationwide as a result of long-term absence of control on this species, population control and other management measures should be taken as soon as possible in accordance with the precautionary principle in the Plan areas where impacts on ecosystems are likely to occur.
- 3) The sika deer management activities are performed by Zone (Sika Deer Zone A, Specified Management Zone, Sika Deer Zone B, and Adjacent Zone) described above, taking into account the latest state of each Zone.
- 4) Each Zone is examined to determine specific management locations, considering the technical feasibility and the order of priority, which should be defined based on the number of sika deer and their impact on vegetation, etc.
- 5) An adaptive management approach should be adopted. Under this approach, management activities are performed in accordance with each Zone's management policy, and the results of the management activities are reflected in the management policy through appropriate monitoring, evaluation, and verification.
- 6) Management activities should be performed in a cautious manner by closely observing the influence on sika deer populations, biodiversity, and ecosystems. In particular, close attention should be paid to the influence on rare bird species.
- 7) In areas where there is conflict between sika deer and human activities (e.g., damage to agriculture, forestry, fishery, and local residents' lives, traffic accidents), the conflict should be resolved by implementing management programs including population control.

I-8 Management Approach

After the management area is divided into Zones based on the basic policy, a combination of the following three approaches is applied to each Zone to reduce the impact of sika deer on vegetation and other environment.

1. Defensive Approach

This approach uses: vegetation protection fences; deer proof fences; fencing around plant communities; deer access blocker that uses geographical features; bark protection nets for specific species that are widely distributed at a low density, and others.

2. Habitat Manipulation

Habitats in man-made roadside slopes and former agricultural/forestry lands are manipulated to make them less useful to sika deer and reduce environmental capacity.

3. Population Control

Sika deer are captured and their population is directly interfered with. Prior to the Plan phase 1, four areas were selected, from major wintering grounds of sika deer in the Shiretoko Peninsula, as candidates for the population control based on the results of aerial counting and other surveys. These four areas include Shiretoko Cape area, Rusa-Aidomari area, Horobetsu-Iwaobetsu area, and Makoi area. In the Plan phase 2, population control was implemented in all of the aforementioned four areas. As one of important management measures, population control will be continued in the third phase.

Chapter II. Management in Each Zone

II-1 Sika Deer Zone A

1) Current State of the Zone

a. Wintering grounds

Their major wintering grounds are located in the Rusha area, where sika deer's influence on natural regeneration has been observed, with specific tree species' barks being stripped and bottom branches being lost. In the forest floor vegetation and grasslands, significant modifications have been made to the plant community due to the proliferation of deer repellent plants. The upstream of Rusha River constitutes the lowest-altitude pass (approx. 350 m) in the Shiretoko Peninsula, where several sika deer are found, even in the winter season, around the border with the Rusa-Aidomari area on the Rausu Town side. However, there has been no report about sika deer sighted migrating to the Rusa-Aidomari area in summer after wintering in the downstream of Rusha River. The Cape Pekinnohana area on the Rausu Town side also provides a mid-scale wintering ground. In the Rusha area, both forest and grassland vegetation has been continuously under the influence of grazing pressure.

b. Non-wintering grounds

b-1. Alpine area

So far, only minor influence of sika deer grazing pressure has been seen on the alpine vegetation. However, footprints, traces, and deer trails are found in the ridge. In 2008, it was confirmed for the first time that *Viola kitamiana* on Mt. Iou was eaten by sika deer. The grazing damage on the mountain's alpine vegetation has been declining since 2011, with no traces of grazing being found in certain years. However, clear footprints and bite marks were found in Shiretoko Swamp and Lake Rausu.

b-2. Montane area–Subalpine area

Traces of sika deer are confirmed in summer season across low- and high-altitude lands. Impact of grazing pressure is considered to be relatively small so far in forest zones at 300 m or over above sea level, partly due to a small number of trees useful to sika deer.

b-3. Coastal area

Coastal native plant communities, which are the characteristic vegetation of the Peninsula, remain in a relatively good condition except for the area around wintering grounds. In this area, there are a number of communities that are hardly accessible by sika deer due to the complicated topography, as well as communities that are subject to grazing of sika deer but have seed sources located on the upper part of the nearest slope and protected from grazing. However, with regard to certain rare species with

small distribution ranges and populations, careful follow-up monitoring is necessary as they are vulnerable to grazing pressure.

c. Sika deer density estimate obtained through an aerial counting survey conducted in 2016 was 12.1 deer/km².

2) Management Policy

- (i) In this Zone, the common management policy should be adhered to in the strictest manner. Any human intervention should generally be avoided except for the defensive measures.
- (ii) Close monitoring should be continued to detect any changes in biodiversity and ecological processes. In the case where sika deer's grazing pressure poses a significant impact on vegetation, defensive measures should be used as a general rule. In the third phase, monitoring activities (e.g., vegetation surveys and aerial counting of sika deer) in Rusha area, a relatively high-density wintering ground compared to other areas in Shiretoko Peninsula, should be conducted with particular care and attention.

3) Management Objectives

Conserve dynamic ecosystems that change through ecological processes; and biodiversity including the avoidance of loss of rare plant species or native plant species and communities characteristic of the Heritage site.

4) Management Approach

- (i) Monitor the state of conservation through vegetation survey and analysis of changes in the number of sika deer wintering in the Zone; and
- (ii) Pay particularly close attention to rare native plant species and communities to ensure their conservation. Apply defensive measures as necessary.

II-2 Specified Management Zone (Shiretoko Cape Zone)

1) Current State of the Zone

a. The Shiretoko Cape Zone was found to be the highest density wintering ground among all areas subject to the Plan, with its forest vegetation and grassland vegetation on the eroded plateau being impacted by strong grazing pressure. With regard to the grassland vegetation, there was a significant loss in tall-herb communities, which were often used by brown bears, and *Sasa kurilensis* communities distributed on the Rausu Town side. However, in response to the reduction in the

number of sika deer, the average height of dwarf-bamboo in dwarf-bamboo communities has recovered to the highest level ever since the start of the population control, and biomass of Poaceae also recovered remarkably by 2012. An increasing trend has also been seen in *Artemisia montana*, *Aconitum maximum* var. *misaoanum*, *Angelica anomala*, and *Vicia cracca*. In wind-swept grasslands, there is a sign of recovery in *Empetrum nigrum* var. *japonicum*, and *Trifolium lupinaster*, which experienced significant loss in population due to grazing pressure. In addition, in 2016, some flowering individuals of *Hemerocallis yezoensis* were found for the first time.

In the forest vegetation, a large number of *Taxus cuspidata*, *Ulmus laciniata*, and *Sorbus commixta* had been killed as a result of bark stripping. However, some individuals of *Sorbus commixta* are now found to be recovering with epicormic shoots. The forest floor vegetation was also altered significantly, as dwarf-bamboo species and seedlings were lost and deer-repelling plants (e.g., *Cacalia auriculata* var. *kamtschatica* and *Dryopteris austriaca*) dominated the land. However, the decrease in the number of sika deer has moderately improved the coverage of *Maianthemum dilatatum* and increased the number of flowering individuals of *Trillium* plants and *Cimicifuga simplex*. Most of sika deer groups wintering in the Zone stay and remain in the surroundings throughout a year. However, some of them were confirmed to have migrated to the vicinity of Shiretoko Swamp during no-snow season.

b. To protect vegetation and test the sika deer repellent effect, three fenced areas (approx. 0.04 ha each) were established in grassland vegetation sites and one area (1 ha) in forest vegetation site. After the establishment, it took four to eight years to confirm the recovery of highly-preferred herbaceous plants in the fence-protected grassland vegetation, and eight to 10 years to see the recovery of seedlings and highly-preferred forest-floor plants in the fence-protected forest vegetation.

c. Available approaches include aerial counting of wintering sika deer and counting of deaths in early spring, both of which are important to understand their wintering behavior. Data on the number of wintering individuals is available since 1986, and that on the number of deaths is available since 1999. However, as the number of natural deaths has decreased drastically since the experimental density manipulation and it became difficult to distinguish natural deaths from deaths as a result of injuries caused by control hunting, the counting of deaths was discontinued in 2012.

d. Efforts were underway to eradicate bull thistle (*Cirsium vulgare*), an alien species that flourished in the Zone. As a result of the efforts and sika deer population control, its communities disappeared and distribution areas and abundance decreased.

e. The population control is still underway after three years of experimental density manipulation that started in FY2007. The number of wintering individuals has decreased to less than a quarter as compared to before the experimental density manipulation.

f. Sika deer density estimate obtained through an aerial counting survey conducted in 2016 was 17.6 deer/km².

2) Management Policy

Apply human intervention (defensive measures and population control) as necessary while following the common management policy. However, no alteration will be made to the habitat environment as the Zone provides natural wintering grounds to sika deer and no human alteration has been made to the vegetation in the Zone.

3) Management Objectives

Conserve and recover biodiversity of plant communities in wind-swept areas and montane/subalpine tall-herb communities and prevent soil erosion by reducing grazing pressure from sika deer. Recover the coverage of plant communities in wind-swept areas. The following shows numerical targets for sika deer density. Vegetation-related numerical targets will be developed based on the results of relevant monitoring, assessments, etc.

Numerical Targets

- Reduce the sika deer density to five to ten deer/km² or less, a level that may have less impact on vegetation. The density is measured through aerial counting survey conducted over the 3.2 km² area at the tip of the Peninsula during sika deer's wintering season.

4) Management Approach

Track changes in the number of sika deer wintering in the Zone while monitoring vegetation, flora, grazing pressure, etc. At the same time, implement the following measures as necessary:

- (i) Protect vegetation using defensive measures.
- (ii) Implement population control using partition fence that splits the tip area of Shiretoko Cape to support the capture activities. In the third phase, the partition fence will be used continuously to split the area, through constant repair and maintenance efforts.
- (iii) Develop and explore approaches to maintain the low density of sika deer at a relatively low cost, including flexible choice of capture method for the year according to weather conditions (e.g., depth of snow).

II-3 Sika Deer Zone B

1) Current State of the Zone

- a. The Zone provides several wintering grounds, including Horobetsu-Iwaobetsu plateau on the Shari Town side and neighborhood of Rusa-Aidomari area on the Rausu Town side. In these areas, influence on vegetation is clearly recognized. In the Horobetsu-Iwaobetsu area, thanks to the population control efforts, a slight recovery trend has been observed in several species such as *Artemisia montana* in grasslands and *Maianthemum dilatatum* in forests. On the other hand, almost no recovery has been seen in preferred plants and seedlings. Sika deer's grazing pressure is the largest obstacle to the forest regeneration projects, which are underway in abandoned farmlands as part of the Shiretoko 100 Square-Meter Movements. Cultural vegetation such as pasture plants growing in abandoned farmlands and roadside slopes serves as feed resources for sika deer during the wintering season. Most of sika deer are resident in the Zone throughout the year, except some migrating populations that stay in the Zone only in winter. In this Zone, various efforts are being undertaken as part of Shari Town's forest restoration project, including installation of protective fences in natural forests and plantations, and application of bark protection nets to sika deer-preferred tree species.
- b. The low-altitude area spreading from Rusa River to Aidomari on the Rausu Town side (Rusa-Aidomari area) also provides wintering grounds. In the mid-winter season, sika deer migrate to wind-swept areas located at higher altitudes. In this Zone, grazing pressure is concentrated in certain locations, but the influence of grazing pressure as a whole is small compared to the Shari Town side. In the Rusa area, where intensive population control is underway, some recovery is observed in the biomass of Poaceae. Traffic accidents, droppings, and other problems have been caused to local industries.
- c. To protect vegetation and test the sika deer repellent effect, two fenced areas (approx. 1 ha) were established in forest vegetation sites in the Horobetsu-Iwaobetsu area. Within the protection fence of forest vegetation, restoration of saplings and highly palatable forest floor plants was observed in about eight to 10 years from the installation of fences, and a remarkable difference was found in the vegetation coverage between inside and outside the fences.
- d. When the Plan phase 2 was developed, sika deer population density in the Horobetsu-Iwaobetsu area was assumed to be highest of all areas in the Shiretoko Peninsula, but the density decreased

later as a result of population control and other efforts.

e. In the Rusa-Aidomari area and Horobetsu-Iwaobetsu area, the MoE has been conducting population control projects since FY2015, after three years of experimental density manipulation during the FY2012–FY2014 period.

f. Sika deer density estimates obtained through an aerial counting survey conducted in 2016 were 6.1 deer/km² in the Horobetsu-Iwaobetsu area, 5.7 deer/km² in the Rusa-Aidomari area, and 26.2 deer/km² in the Unakibetsu area.

2) Management Policy

- (i) Apply human intervention (defensive measures and population control) as necessary while following the common management policy.
- (ii) When applying human intervention, sufficient attention will be paid the safety of local residents or users.
- (iii) When implementing management measures, ensure collaboration with the forest restoration project led by Shari Town.

3) Management Objectives

Conserve biodiversity by reducing grazing pressure from sika deer. Promote forest restoration in abandoned farmlands in the Horobetsu-Iwaobetsu area, where cultural vegetation, particularly that in abandoned farmlands, provides feed resources to wintering sika deer. Ensure resolution and mitigation of conflicts with local communities. The following shows numerical targets for sika deer density. Vegetation-related numerical targets will be developed based on the results of relevant monitoring, assessments, etc.

Numerical Targets

- Reduce the sika deer density estimate to be obtained through the wintering-season aerial counting survey to 5 deer/km² or less in the Horobetsu-Iwaobetsu area (altitude of 300 m or lower) and 5 deer/km² or less in the Rusa-Aidomari area (including areas at an altitude of 300 m or less and areas at an altitude of 300–600 m in the aerial counting survey zone “U13s”).

4) Management Approach

Track changes in the number of sika deer wintering in the Zone while continuing monitoring on the Shari Town side (areas subject to the 100 Square-Meter Movement, riparian forests in the downstream basin of Iwaobetsu River, etc.) and the Rausu Town side. At the same time, implement the following

measures as necessary:

- (i) Protect vegetation using defensive measures.
- (ii) Continue population control in the Horobetsu-Iwaobetsu area and the Rusa-Aidomari area.
- (iii) Explore effective capture methods to achieve the population density targets, including methods for resolving physical and social constraints.

II-4 Adjacent Zone

1) Current State of the Zone

a. In the early 1990s, transmitters were attached to sika deer overwintering in the Makoi area to track their movements. As a result, it was found that they migrated from season to season for a distance of 20 to 30 km towards the areas on the Rausu Town side, beyond Mt. Onnebetsu, which is included in the Heritage site. A similar migration pattern was observed again in the survey started in 2004. On the other hand, similar surveys conducted on sika deer overwintering in the Rusa-Aidomari area from FY2008 to FY2010 revealed that some sika deer seasonally migrated to the Peninsula's eastern neck area (south slope of Mt. Rausu, and Kotanuka and Ichani areas in Shibetsu Town), but most of them stayed in the same area.

b. From the late 1980s onwards, increasing damages caused by sika deer were reported from several locations such as farmlands in Utoro in Shari Town, which is located at the central part of the Peninsula, pastures in Rausu Town, and farmlands in Shari Town and Shibetsu Town located at the neck of the Peninsula. These municipal governments still bear heavy burden although they now have large-scale deer-proof fences and control hunting projects are under way except for certain areas.

c. From the late 1990s onwards, an increasing number of sika deer entered urban areas of Utoro, Shari Town and Rausu Town on a daily basis or stayed there throughout a year, causing conflicts with local residents such as feeding damage on garden trees. In Utoro, a deer-proof fence was installed around the urban area in 2006. As a result, and after several times of expulsion and capture, a significant decrease was observed in the number of sika deer entering the urban area. On the other hand, in the urban area of Rausu Town, an intensive capture of sika deer using blowguns was conducted in 2008, leading to a remarkable decrease in the number of sika deer appearing in the urban area.

d. In areas from Utoro to Makoi in Shari Town, and from low-altitude areas to coastal terraces in the southern part of Rausu Town, vegetation in wintering grounds and other locations is still under strong

influence of grazing pressure. In particular, in forests around the Makoi area, drastic modifications have been made to the forest floor. As a result, it was confirmed that elms were locally extinguished, and their natural regeneration was disturbed.

e. Formerly, hunting of sika deer was prohibited in the area from Kanayama River to the Wildlife Protection Area on the Shari Town side, to avoid negative impact on nesting of white-tailed eagles (*Haliaeetus albicilla*) and Blakiston's fish owls (*Ketupa blakistoni blakistoni*), as well as wintering of white-tailed eagles and Steller's sea eagles (*Haliaeetus pelagicus*). However, in 2007, a rotational harvesting system was introduced on a test basis. From 2010 onwards, the area has been open to hunters, except for certain locations to which non-hunting periods are applicable. However, hunting is prohibited in March, when most of sika deer gather in their wintering grounds, due to the possible impact of hunting on rare bird species in their breeding season. This makes it difficult to capture sika deer effectively by hunting.

f. On the Shari Town side, a private-sector project is underway to capture sika deer alive using corral traps and use their meat and body parts. However, part of the project has been discontinued because of a decrease in efficiency, which is a result of repeated capturing at same locations. From FY2013 onwards, a Forestry Agency-led sika deer capture project is in place. Started in the Utoro area, this project has now been expanded to the Oshinkoshin and Makoi areas, with the aim of capturing sika deer using corral traps at new locations. In Rausu Town, periodic population control is carried out.

g. On the Rausu Town side, the Forestry Agency captured sika deer using corral traps in the Shunkarikotan area (FY2010–FY2012). After the capture, the Agency has continuously been monitoring the sika deer population and their grazing pressure.

h. In the area from Makoi to Utoro on the Shari Town side, sika deer-proof fences were installed by the Hokkaido Regional Development Bureau to prevent sika deer from entering roads.

i. Sika deer density estimates obtained in the aerial counting survey in 2016 were 3.9 deer/km² on the Shari side and 3.2 deer/km² on the Rausu side.

2) Management Policy

- (i) Position the Zone as an important zone for the conservation of biodiversity in the Heritage site and apply human intervention (defensive measures and population control) as necessary.
- (ii) Ensure collaboration and cooperation with projects implemented by Shari Town, Rausu Town, and the private sector.

- (iii) Establish a sustainable management system through, for example, the utilization of sika deer in cooperation with the private sector and local communities and explore the future of community-based population control including the return of benefits to local communities.

3) Management Objectives

Reduce sika deer's grazing pressure to conserve biodiversity, and reduce conflict between local residents and sika deer.

4) Management Approach

Track changes in the number of sika deer wintering in the Zone and entering/exiting the Heritage site, while continuing the monitoring of vegetation and other environment. At the same time, implement the following measures as necessary:

- (i) Protect vegetation and mitigate conflict with local residents through defensive measures such as deer-proof fences.
- (ii) Support community-based population control efforts as necessary, including local community-led live capture and hunting of sika deer for utilization.

Chapter III. Monitoring and Evaluation

In the aim of promoting appropriate management of sika deer in the Heritage site based on the adaptive management approach, vegetation and sika deer population densities are defined as evaluation items, and monitoring surveys (Zone-based detailed survey and wide-area survey) are carried out for each of the evaluation items in a planned and continuous manner. Monitoring of ecosystems, biodiversity, and soil erosion will also be performed as appropriate, although evaluation methods are yet to be established. Details of monitoring items are shown in Appendix 2.

Criteria for each evaluation item will be set or reviewed in the course of implementing this Plan. These processes will be monitored, and any progress achieved in the process will be incorporated in the next phase of the Management Plan. These evaluation item criteria will be revised as necessary based on the monitoring progress during the Plan period. Survey results will be examined from a scientific viewpoint and reflected in the implementation of the Plan. At the same time, in order to receive advice from a scientific viewpoint about research and study necessary for the implementation of the Plan, these results will be reported at the Shiretoko Natural World Heritage Site Scientific Council, which is composed of academic experts, and its subsidiary body, Sika Deer/Brown Bear Working Group (Fig. 4).

Each evaluation item is defined based on the following concept:

1) Vegetation

The objective of this Plan is to reduce excessive impact of the high sika deer population density on the Heritage site's ecosystems. Accordingly, along with the sika deer population density described under 2), vegetation is an important evaluation item in the sense that it reflects impact on the ecosystems.

Table 1 shows stages of vegetation recovery in the Shiretoko Cape Zone, as well as index items. In the Specified Management Zone, vegetation has recovered to Stage 2 or 3. Considering this, for the third phase of the Plan, indicator species are designated to monitor the progress of vegetation recovery (Table 2). The monitoring will use a simplified index survey method, which was established during the Plan phase 2, and the evaluation will be performed based on the concept described below. Furthermore, a study will be conducted about vegetation management targets for the next phase of the Plan, taking into consideration recommendations received in 2008 from IUCN and the World Heritage Committee of UNESCO, and based on the results of monitoring and evaluations.

- The goal of recovery is set at the state of vegetation in early 1980s. If it is difficult to adopt the

goal for reasons such as absence of vegetation data in early 1980s, appropriate alternative goals should be set based on the recovery process that is observed in the vegetation protection fences or the process in areas where recovery is achieved earlier.

- Achievement of the goal will be evaluated using appropriate indices selected from Table 2 and apply a combination or aggregation of multiple indices to each type of vegetation based on the concept described in Table 3.
- Revisions will be made as necessary to the recovery goals and index items based on the results of monitoring and evaluations.

Table 1. Stages of vegetation recovery in Shiretoko Cape Zone and index items

					Indicator species/genus for the vegetation type (coverage or number of flowering individuals if only species name is available)				
Stage	Item	Index	Time scale	Monitoring item	Substitutional grass/herb community	Dwarf-bamboo community	Tall-herb community	Alpine heath/wind-swept grassland	Broadleaved forest
1	Increase in plant biomass	Increase in dominant species biomass	Short-term (2–4 years)	Biomass/coverage/vegetation height	• Height/volume of Poaceae	• Height of <i>Sasa senanensis</i>	• (Vegetation height) • (Preferred species total coverage)	• (Area of <i>Empetrum nigrum</i> var. <i>japonicum</i>)	• (Broadleaved tree lower branch coverage)
		Decline of non-preferred plants (quick response)		Number of flowering individuals/coverage	• <i>Cirsium vulgare</i>	• <i>Cirsium vulgare</i>	• (<i>Plantago camtschatica</i>)		
2	Recovery of preferred plants	Increase in preferred plants (quick response)	Medium-term (5–9 years)	Number of flowering individuals/coverage/height	• <i>Vicia cracca</i> • <i>Urtica platyphylla</i> • <i>Aconitum maximum</i> var. <i>misaoanum</i>	• Height of <i>Sasa senanensis</i> • <i>Vicia cracca</i> • <i>Thalictrum minus</i> var. <i>hypoleucum</i>	• Vegetation height • Preferred species total coverage • <i>Vicia cracca</i> • <i>Aruncus dioicus</i> var. <i>kamtschaticus</i> • <i>Achillea ptarmica</i> var. <i>macrocephala</i> • <i>Coelopleurum lucidum</i> var. <i>gmelinii</i> • <i>Thalictrum minus</i> var. <i>hypoleucum</i> • <i>Polygonum bistorta</i> • <i>Artemisia montana</i> • <i>Petasites japonicus</i> var. <i>giganteus</i>	• <i>Empetrum nigrum</i> var. <i>japonicum</i> • <i>Trifolium lupinaster</i> • <i>Swertia tetrapetala</i>	• Preferred species total coverage • Broadleaved tree total coverage • <i>Trillium</i> • <i>Cimicifuga simplex</i> • <i>Cirsium kamtschaticum</i>
				Seedling density/lower branch density					
					Decline of non-preferred plants (quick response)		Number of flowering individuals/coverage	• (<i>Senecio cannabifolius</i>)	
3	Recovery of rare species, etc.	Increase in preferred plants (slow response)	Long-term (10 years or more)	Number of flowering individuals/coverage			• <i>Hemerocallis yezoensis</i> • (<i>Artemisia montana</i>)	• <i>Trifolium lupinaster</i> • <i>Swertia tetrapetala</i>	• Preferred species total coverage • <i>Maianthemum dilatatum</i> • <i>Calanthe tricariata</i>
				Seedling density					• Seedling density
				Decline of non-preferred plants (slow response)		Number of flowering individuals/coverage	• <i>Senecio cannabifolius</i> ?		• <i>Ligularia hodgsonii</i>
4	Recovery of communities	Stable species composition/biomass	Long-term (10 years or more)	Diversity/total biomass/coverage		• Stable species composition/biomass			• Stable regeneration
		Recovery of past target vegetation		Basic component species total coverage		• Recovery of past target vegetation			

Table 2. Indicator species to represent the process of vegetation recovery

Time scale	Monitoring item	(Type)	Forest vegetation	Grass/herb/dwarf-bamboo vegetation
Early phase	Biomass			• Poaceae
	Height			• Dwarf-bamboos
Mid/late phase	Number of flowering individuals (Occurrence) (Flowering rate)	Preference: medium Frequency: high	<ul style="list-style-type: none"> • <i>Maianthemum dilatatum</i> • <i>Urtica platyphylla</i> • <i>Dryopteris crassirhizoma</i> 	• <i>Artemisia montana</i>
		Preference: medium Frequency: low	<ul style="list-style-type: none"> • <i>Cimicifuga simplex</i> • <i>Cirsium kamschaticum</i> • <i>Lilium cordatum</i> var. <i>glehnii</i> • <i>Lilium medeoloides</i> • <i>Aconitum maximum</i> var. <i>misaoanum</i> • <i>Epipactis papillosa</i> • <i>Cephalanthera erecta</i> • <i>Calanthe tricariata</i> 	<ul style="list-style-type: none"> • <i>Aconitum maximum</i> var. <i>misaoanum</i> • <i>Cirsium kamschaticum</i> • Umbelliferae • <i>Artemisia montana</i> var. <i>shiretokoensis</i> • <i>Artemisia japonica</i> • <i>Artemisia japonica</i> var. <i>macrocephala</i> • <i>Sanguisorba tenuifolia</i> var. <i>grandiflora</i> • <i>Aruncus dioicus</i> var. <i>kamschaticus</i> • <i>Valeriana fauriei</i> • <i>Polygonum bistorta</i> • <i>Nepeta subsessilis</i> • <i>Galium verum</i> var. <i>trachycarpum</i> • <i>Achillea ptarmica</i> var. <i>macrocephala</i>
		Preference: high Frequency: low	<ul style="list-style-type: none"> • <i>Trillium</i> • <i>Paris</i> • <i>Polygonatum odoratum</i> var. <i>maximowiczii</i> • <i>Disporum smilacinum</i> • <i>Disporum sessile</i> 	<ul style="list-style-type: none"> • <i>Thalictrum minus</i> var. <i>hypoleucum</i> • <i>Vicia cracca</i> • <i>Vicia japonica</i> • <i>Vicia unijuga</i> • <i>Anaphalis margaritacea</i> var. <i>angustior</i> • <i>Halenia corniculata</i> • <i>Adenophora pereskiaefolia</i> var. <i>heterotricha</i> • <i>Adenophora triphylla</i> var. <i>japonica</i> • <i>Geranium yezoense</i> • <i>Rumex montanus</i> • <i>Solidago virgaurea</i> • <i>Lamium album</i> var. <i>barbatum</i> • <i>Dianthus superbus</i> • <i>Hemerocallis yezoensis</i> • <i>Hemerocallis dumortieri</i> var. <i>esculenta</i> • <i>Hypericum erectum</i> • <i>Bupleurum longiradiatum</i> var. <i>breviradiatum</i>
	Lower branch density/seedling density		Tall broadleaved trees	

Table 3. Concept of evaluating vegetation index in Plan phase 3

Achievement of goals	Changes from Plan phase 2	Evaluation	Management measure (image)
Achieved	No changes/recovery trend	Appropriate	Consider ending population control
	Deteriorated	Mostly appropriate	Consider starting/strengthening population control
Not achieved	Recovery trend	Mostly appropriate	Maintain existing controls
	No changes/deteriorated	Caution needed	Strengthen population control
	Changes deviated from goals	At risk	Review plan/approach

2) Sika Deer Population Density

The population density of sika deer, which exerts a significant impact on vegetation, is evaluated according to the concept below and based on the sika deer density estimates obtained through aerial counting survey over each Zone (hereafter the “aerial survey-based density estimates”). In addition, the number of sika deer found in the aerial survey of each deer year* is defined as the population index, and used to help understand changes over years by being compared against the baseline, which is the number of sika deer found by aerial counting survey in 2002 deer year.









* Deer year: A period from June 1st to May 31st of the next year. This reflects the life cycle of sika deer as well as the fact that most of them are born in June. The number of sika deer and captured individuals are counted by each deer year.

Table 4. Concept of evaluating sika deer population density

Population Density (Aerial survey-based density estimates)	Evaluation	Management measure (image)
Less than target	Appropriate	(Continue capturing or monitor to keep low density)
More than target - less than twice target	Caution needed	(More capture efforts required)
Twice target or more	At risk	(Consider starting capture or improve capture method)




Table 5. Reference: Example of evaluation

(Evaluation of 2015 deer year against the numerical targets set under Management Objectives in Chapter II)

Zone Name (area in km ²)	Aerial survey-based density estimate (deer/km ²)	Evaluation	Changes in Plan Phase 2	Reference: Population index (against 2002 deer year-level)
Entire Shiretoko Peninsula (291.93) (North of Kanayama Riv.- Uebetsu Riv.)	5.6	-		61.6
Zone A (42.54) (excl. M00 at the tip of Shiretoko Cape)	12.1	-		97.7
Specified Management Zone (3.23) (M00 only)	17.6	Caution needed		8.2
Zone B				
Horobetsu-Iwaobetsu (29.08)	6.1	Caution needed		48.7
Rusa-Aidomari (24.68)	5.7	Caution needed		92.8
Unakibetsu (4.51)	26.2	At risk		131.1
Adjacent Zone				
Shari Town side (46.0)	3.9	-		31.8
Rausu Town side (141.89)	3.2	-		163.2

*Numerical targets (see Chapter II)

- Specified Management Zone: 5 to 10 deer/km²
- Sika Deer Zone B: 5 deer/km²

	Decreased		Unchanged		Increased
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Chapter IV. Implementation Framework of the Plan

IV-1 Consensus Building

When implementing the Plan, a clear consensus should be built with relevant government agencies and related organizations (Fig. 4). Details of this Plan, results of various surveys, and other information will be made public in a timely manner through the website and other media. In addition, information on the current state of the natural environment in the Plan area and necessary measures being undertaken under the Plan will also be disseminated in a proactive way. Effective collaboration and cooperation with relevant government agencies and interested organizations in the region will be ensured by the Shiretoko Natural World Heritage Site Regional Liaison Committee meeting as necessary to promote communication and coordination with local residents and related organizations.

IV-2 Implementation and Review of the Plan

In order to promote the Plan based on scientific knowledge and insights, meetings of the Shiretoko Natural World Heritage Site Scientific Council, which is composed of academic experts, and its subsidiary body, Sika Deer/Brown Bear Working Group, will be held on a regular basis and receive advice from a scientific viewpoint about the implementation and review of the Plan. The review of the Plan will be undertaken as necessary based on the concept of adaptive management and in accordance with the results of monitoring surveys, scientific advice, etc.

IV-3 Action Plan

An action plan will be formulated for each deer year (see p. 24) to clarify the details involved in implementing the Plan. In formulating and implementing an action plan, scientific advice should be received from the Sika Deer/Brown Bear Working Group, while building sufficient consensus with related organizations, local residents, and other entities. When selecting a management approach (defensive method, habitat manipulation, or population control) for implementing an action plan and developing a practical implementation strategy, detailed examination should be made on the technical, safety, and cost-related aspects. In addition, researches and studies necessary for the formulation and review of an action plan should be undertaken as necessary.

IV-4 Entities Responsible for Implementing the Plan

In the area subject to the Plan, the MoE, the Forestry Agency, and the Hokkaido Government should be responsible for implementing the Plan in cooperation with local municipalities such as Shari Town and Rausu Town. Central government agencies and local governments other than the aforementioned responsible entities are also expected to undertake their projects in accordance with this Plan.

1) Relevant Government Agencies and Their Roles

(i) Kushiro Nature Conservation Office, Hokkaido Regional Environment Office, Ministry of the Environment

Responsible for: conducting sika deer population control, etc., focusing on the Specified Management Zone and the Sika Deer Zone B; protecting vegetation by installing and maintaining protection fences; and conducting monitoring surveys on vegetation, sika deer population, soil erosion, etc.

(ii) Hokkaido Regional Forest Office, Forestry Agency

Responsible for: protecting forest vegetation by installing and maintaining protection fences in national forests; conducting monitoring surveys on vegetation, soil erosion, etc.; and conducting sika deer population control focusing on the Adjacent Zone.

(iii) Hokkaido Government

Responsible for: encouraging effective hunting in the Adjacent Zone by ensuring appropriate hunting area setting, etc.; developing human resources necessary for capturing sika deer and more effective capture methods; promoting the use of captured sika deer as regional resource; conducting sika deer population control; and undertaking efforts to mitigate conflicts between sika deer and human activities.

(iv) Shari Town

Responsible for: conducting population control focusing on residential areas or farmlands; protecting vegetation in the Horobetsu-Iwaobetsu area using protection fences and bark protection nets; and conducting monitoring surveys on sika deer populations, etc. through activities of Shiretoko Nature Foundation, a non-profit organization founded by the Town.

(v) Rausu Town

Responsible for: conducting population control focusing on residential areas or pastures; conducting monitoring surveys on sika deer populations, etc. through activities of Shiretoko Nature Foundation, a non-profit organization founded by the Town.

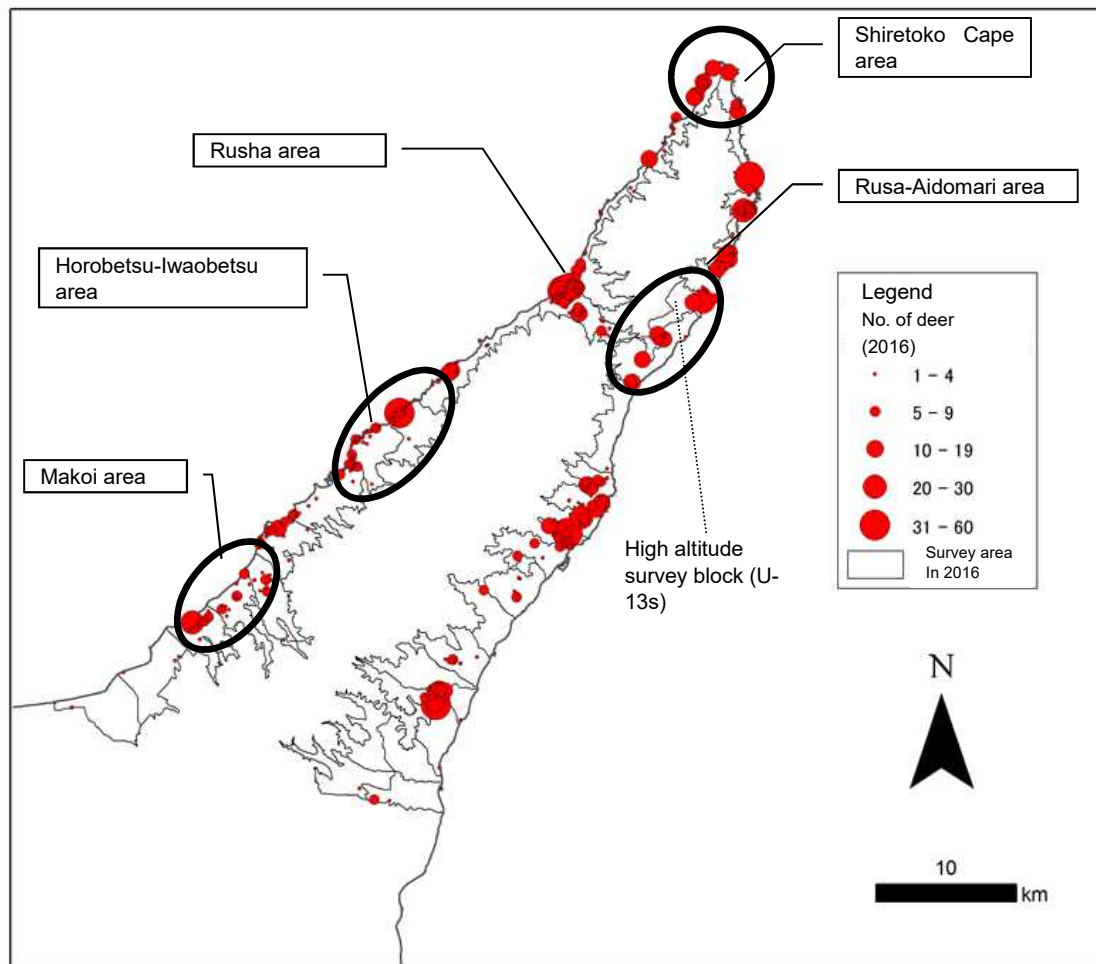


Fig. 1. Results of the wide-area aerial counting survey on sika deer (*Cervus nippon yesoensis*) in Shiretoko Peninsula in February 2016 (Locations of observed sika deer groups and their number according to their categories. The ellipse shape refers to main areas where projects were conducted by the Government to adjust the number of sika deer population).

- There were 317 groups and 1,705 individuals in 29 standard survey blocks at an altitude of lower than 300 m, while there were 2 groups and 20 individuals in a high altitude survey block (U-13s) at an altitude of 300-500 m (part of the peak of the altitude was 560 m). A total of 1,725 individuals were observed.
- The distribution of sika deer wintering sites was discontinuous.
- The disparities of the number of observed sika deer in wintering seasons significantly reduced between the eastern and western survey sites, compared to 2011. The number of observed individuals in the western sites of Shari Town was 3.4 times that in the eastern sites of Rausu Town and Shibetsu Town, while it reduced to 1.1 times.
- Compared to 2011, the density of sika deer in Shiretoko Cape area was reduced, due to some effects of adjusting the number of individuals by using partitions. The reducing tendency was confirmed in Horobetsu-Iwaobetsu area, and especially in the vicinity of Shiretoko-Goko Lakes significantly.
- In Shiretoko Cape, Rusa-Aidomari area, and Horobetsu-Iwaobetsu area, among the four candidate sites for density manipulation experiments that were selected at the time of the first plan, capturing has been conducted as a project following experiments. In Makoi area, capturing has been conducted

both at a community base and by a project of the Forestry Agency.

Zones of Sika Deer Management Plan in the Shiretoko Peninsula

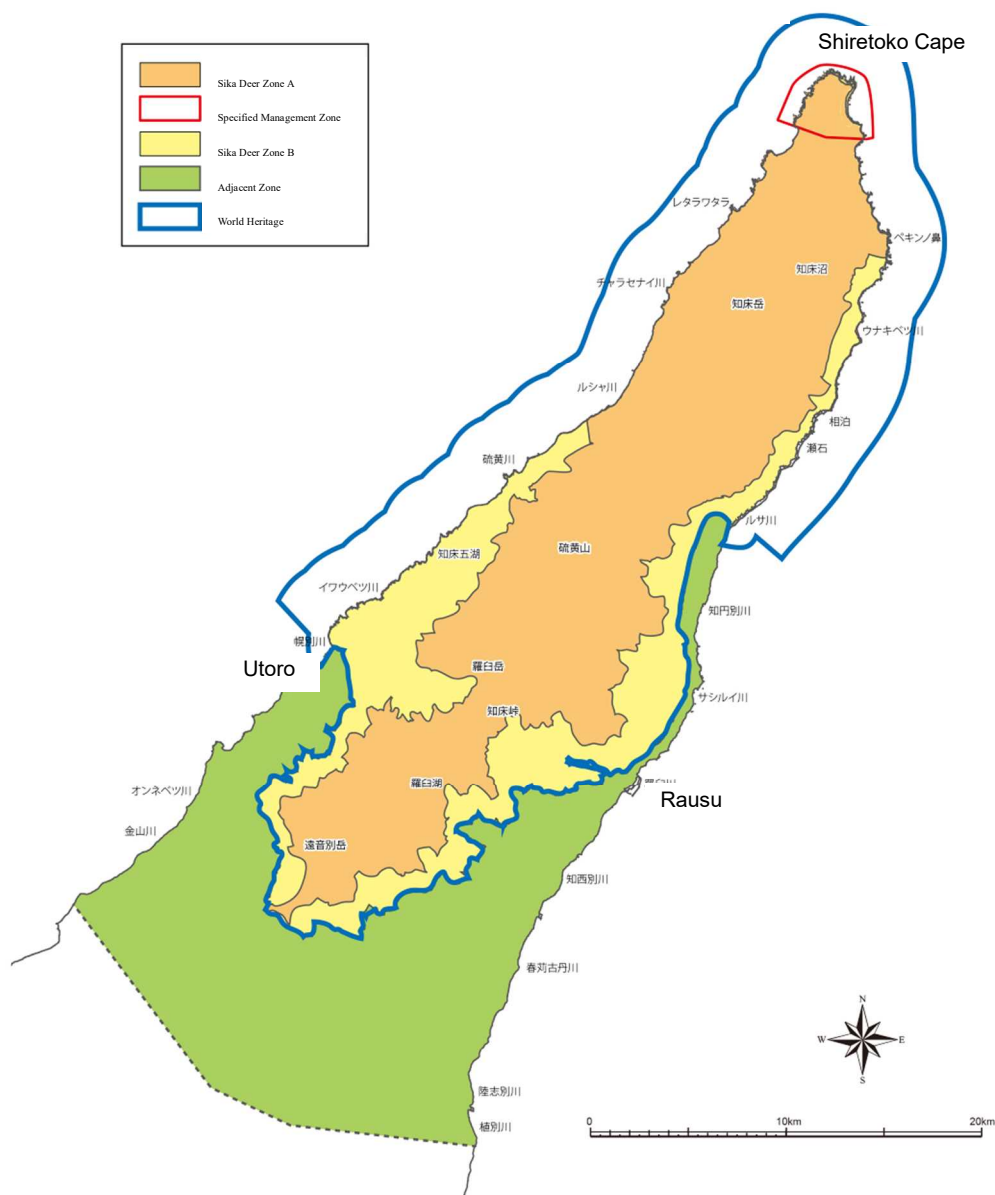


Fig. 2 Target Area of Control Plan of Sika Deer in Shiretoko Peninsula

Target area

- Sika Deer Zone A: An area among Heritage Site Zone A excluding the Specified Management Zone and the coastal side of Horobetsu-Iwaobetsu plateau
- Specified Management Zone : North of Poromoi Bay and Kabuto-iwa Rock among Shiretoko Cape area
- Sika Deer Zone B: Heritage Site Zone B and an area including the coastal side of Horobetsu-Iwaobetsu plateau
- Adjacent Zone: An area starting from around Kanayama River and Uebetsu River to the apical region of the Peninsula

*The scope of Unit 12 of Sika Deer Management Plan in Hokkaido includes Shari Town, Rausu Town, Shibetsu Town, Kiyosato Town, and Nakashibetsu Town.

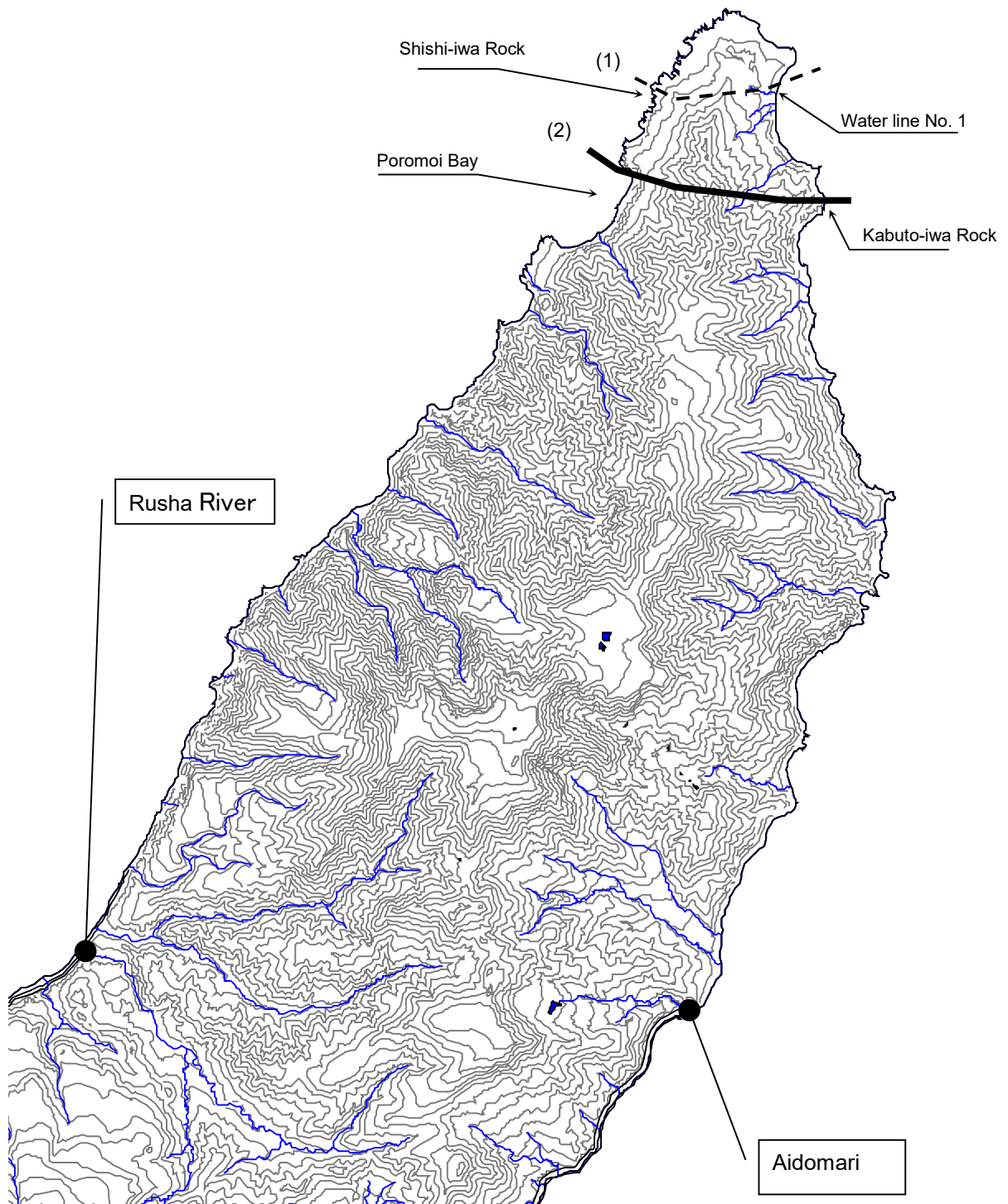


Fig. 3 Map around Shiretoko Cape

Specified Management Zone (Further than the thick solid line (2): approximately 7km²) and Wintering Sites in which intensive adjustment of the number of individuals and their monitoring are conducted (Further than the dotted line (1))

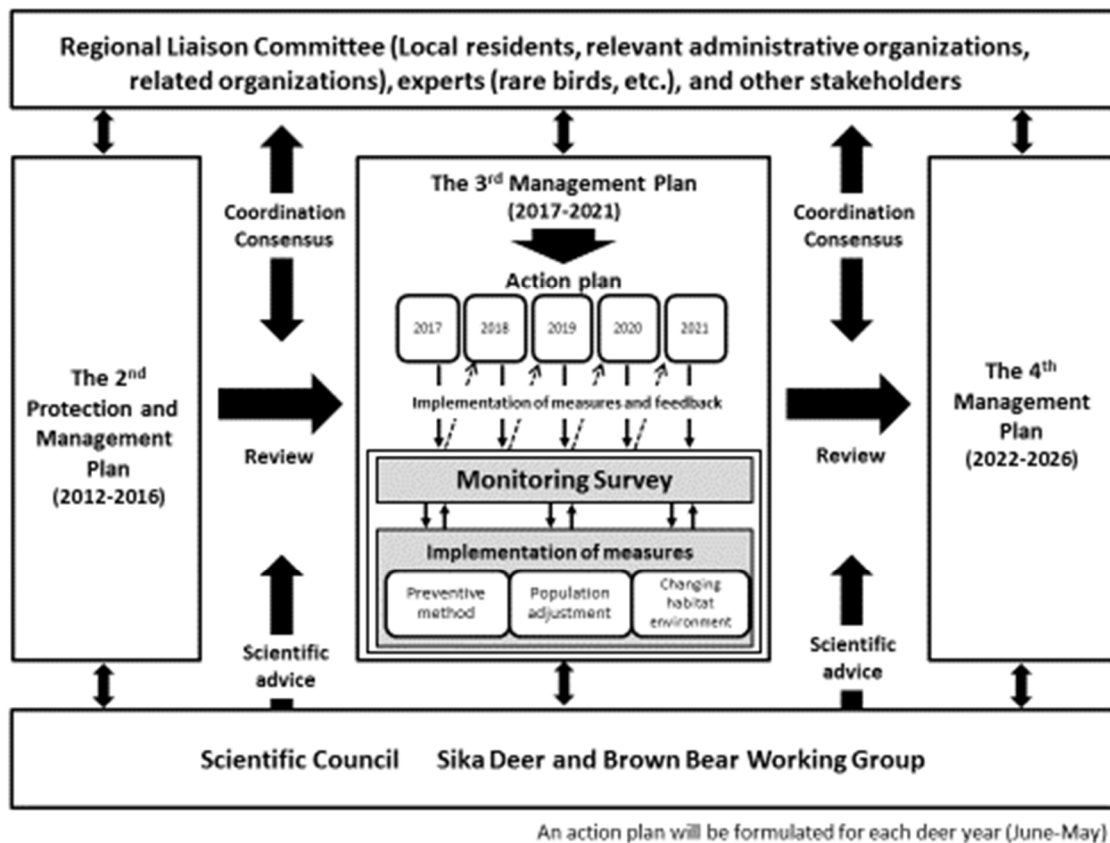


Fig. 4 Implementation process of the Third Sika Deer Management Plan in the Shiretoko Peninsula

Table 1. Schedule of the Third Sika Deer Management Plan in the Shiretoko Peninsula

		The 3rd Plan				
		JFY2017	JFY2018	JFY2019	JFY2020	JFY2021
Specified Management Zone (Shiretoko Cape)		- Adjustment of the number of individuals Adjustment of the number of individuals will be implemented by shooting utilizing partitions. - Monitoring Grasping the number of wintering individuals and vegetation surveys will be conducted.			- Assessment of results - Consideration and compilation of management policies toward the 4th Plan	
Sika Deer Zone A	Alpine zone	- Monitoring Surveys will be conducted on feeding conditions of rare alpine species, such as Viola kitamiana, etc.			- Assessment of results - Consideration and compilation of management policies toward the 4th Plan	
	Rusha	- Monitoring Grasping seasonal movements of sika deer, the number of wintering individuals and vegetation surveys will be conducted.			- Assessment of results - Consideration and compilation of management policies toward the 4th Plan	
Sika Deer Zone B	Rusa-Aidomari	- Adjustment of the number of individuals In Rusa-Aidomari area, the relation between road maintenance conditions and catchability will be noted. New methods will be considered and implemented, such as captures from ships, etc.			- Assessment of results - Consideration and compilation of management policies toward the 4th Plan	
	Horobetsu-Iwaobetsu	- Monitoring Grasping the number of wintering individuals and vegetation surveys will be conducted.				
Adjacent Zone		- Adjustment of the number of individuals Measures will be considered to establish a sustainable management system, such as utilizing community-based adjustment of sika deer. - Monitoring			- Assessment of results - Consideration and compilation of management policies toward the 4th Plan	
Review of the plan		Basic policies of the management plan will be reviewed and considered, while assessments are conducted regarding implementing conditions of the management plan.			- Consideration for the formulation of the 4th Management Plan	- Formulation of the 4th Management Plan
Response to UNESCO/IUCN		- Vegetation indicators In addition to implementing monitoring, consideration for its assessment will be promoted.			- Assessment of results - Consideration for management objectives of vegetation	

Table 2. Monitoring items of the Third Sika Deer Management Plan in the Shiretoko Peninsula

Assessment item		Actor	Monitoring item	Purpose/contents	Survey site	Plan period				
						2017	2018	2019	2020	2021
Vegetaion	Detailed survey (Adjustment area and Rusha)	MOE	Survey on restored amounts of indicator species by simple methods	In order to understand feeding pressures of sika deer and restoration status of vegetation in population adjustment areas, monitoring surveys will be conducted every two years regarding the number of roots of indicator species that bloomed, etc. by fixed survey lines on forest vegetation and grassland vegetation.	Shiretoko Cape/Horobetsu-Iwaobetsu (/Rusha)	○	○	○	○	○
		FA	Survey on vegetation impacts (forest vegetation, grassland vegetation)	In order to understand feeding pressures of sika deer and restoration status of vegetation in population adjustment areas, monitoring surveys of fixed survey blocks will be conducted. Regarding forest vegetation, surveys on forest floors, seedlings, and lower branches will be conducted every two years, and inventory surveys will be conducted once every five years. Surveys on grassland vegetation will be conducted every two years.	Shiretoko Cape/Rusa-Aidomari/Horobetsu-Iwaobetsu (/Rusha)	○	(○)	○		○
		MOE			Shiretoko Cape/Horobetsu (Furepe Falls)	Forest, Shiretoko Cape	Horobetsu	Forest, Shiretoko Cape	Horobetsu	Forest, Shiretoko Cape
		FA	Survey on restoration processes utilizing protective partitions for vegetation	Restoration conditions of vegetation will be understood by vegetation surveys on inside and outside of protective partitions that are set in the population adjustment areas, for the purpose of considering layouts and scales of protective partitions of vegetation, as well as for forecasting transitions after the adjustment of the sika deer population. Currently, protective partitions are arranged in three sites of forest survey areas (Shiretoko Cape, Horobetsu, Iwaobetsu) and three sites of grassland survey areas (all in Shiretoko Cape). In the forest survey areas of Shiretoko Cape and Horobetsu, surveys on forest floors, seedlings, and lower branches will be conducted every two years, and inventory surveys will be conducted around every five years. For Iwaobetsu, surveys will be conducted around every five years.	Shiretoko Cape/Horobetsu/Iwaobetsu	Shiretoko Cape Horobetsu/Iwaobetsu	—	Shiretoko Cape Horobetsu	—	Shiretoko Cape Horobetsu
		MOE			Shiretoko Cape					
		MOE	Short-term survey on grazed amount and restored amounts	Changes in vegetation against changes in the density of sika deer will be understood by setting feeding pressure survey plots of dwarf-bamboos at wintering sites where density manipulation experiments are conducted, for the purpose of considering allowable densities of sika deer (target number of captures in respective wintering sites). Surveys completed in Shiretoko Cape.	Shiretoko Cape					
					Rusa-Aidomari	Rusa	Rusa	Rusa	Rusa	Rusa
	Wide-area survey	FA	Survey on vegetation impacts (forest vegetation)	In order to understand feeding pressures of sika deer and restoration status of vegetation in the entire Peninsula, monitoring surveys of fixed survey areas will be conducted. In forest survey areas in Shunkarikotan and Utoro, forest floors, seedlings, and lower branches will be surveyed every two years, and similar surveys will be done in other forest survey areas around every five years. In every forest survey area, inventory surveys will be conducted around every five years.	Wintering sites in the entire area (lower than 300 m)/Altitude 300-600 m	○	○	○	○	○
		MOE	Survey on vegetation impacts (coastal vegetation)	Composition of coastal vegetation communities and rates of feeding traces will be understood, for long-term monitoring of vegetation and grasping feeding pressures by sika deer in the entire Peninsula. By setting fixed survey areas, monitoring surveys will be conducted where impacts of sika deer are observed around every five years.	Coastal vegetation in the entire area				Coast (Shari side)	Coast (Rausu side)
		MOE	Survey on vegetation impacts (alpine vegetation)	Composition of alpine vegetation communities and rates of feeding traces will be understood, for long-term monitoring of vegetation and grasping feeding pressures by sika deer in the entire Peninsula. By setting fixed survey areas, monitoring surveys will be conducted around every five years in survey areas for immediately understanding impacts (Shiretoko Mountain Range and Lake Rausu).	Alpine/subalpine vegetation in the entire area		Mountain Range	Lake Rausu		Mt. Onnebetsu
		MOE		Distribution and feeding damage of Viola kitamiana will be confirmed in fixed quadrats of Mt. Iou.	Around Mt. Iou (Viola kitamiana)	○ (monitor every year for the time being)				
	Number of individuals/ population index	MOE	Counting surveys in main wintering sites of sika deer	Fluctuation tendency and composition of the population will be understood by conducting spotlight survey and aerial counting in main wintering sites, for reviewing implementing methods for captures to decide implementing period of time, the number of captures, and so on, as well as verifying the achievement of capture projects.	Shiretoko Cape (aerial counting)	○	○	○	○	○
		Shari Town Rausu Town Shiretoko Nature Foundation			Horobetsu-Iwaobetsu/Rusa-Aidomari	○	○	○	○	○
		Shiretoko Nature Foundation/FA			Shiretoko Cape (difficult to understand the natural death status)					
			Surveys and data accumulation regarding a qualitative understanding of populations, such as weights and fertility rates of culled or naturally died individuals	Relevant information, such as age, sex, and the number of captured and naturally died individuals in major wintering sites will be grasped for verifying achievements of capture projects. In addition, weights and fertility rates of culled sika deer will be grasped. Surveys may be re-started in Shiretoko Cape if situations change, but for the time being, surveys will be suspended.	Horobetsu-Iwaobetsu, Adjacent Zone	○	○	○	○	○
		MOE	Wide-area aerial counting of wintering individuals	Distributions and scales of wintering populations will be grasped, together with the estimation of inhabiting number of sika deer across the Peninsula, by helicopter surveys, for considering layouts of vegetation protection partitions and the implementation of population adjustment, etc. Implementation of the next survey is planned in JFY2020.	Entire area	Heritage site	Heritage site	Heritage site	○	Heritage site
		MOE	Survey on the actual number of wintering individuals	For considering the number of captures, the actual number will be grasped by expelling sika deer from the entire wintering site, or some parts thereof.		○				
		MOE	Survey on seasonal movements of sika deer	Detailed information will be understood as to seasonal movements of respective wintering populations by utilizing transmitters, etc., for setting zone classification toward population management.	Entire area	Rusha	Rusha			
Soil erosion	Detailed	MOE	Survey on soil erosion conditions	The actual status and causes of soil erosion will be understood. The survey will be conducted every five years, and the next survey is planned in JFY2017.	Shiretoko Cape	○				
	Wide area	MOE FA	Wide-area survey on soil erosion conditions	Sites where wide-area soil erosion takes place and the scale thereof will be identified.	Entire area	Implement with the wide-area vegetation survey				
Impacts on ecosystem	Detailed	MOE	Survey on habitat conditions of land invertebrates (mainly insects)	Impacts of sika deer on land ecosystems will be understood mainly from the status of insects. (The next implementation is planned in around 2018.)	Shiretoko Cape/Horobetsu/Rausu			○		
		MOE	Survey on habitat conditions of landbirds	Impacts of sika deer on land ecosystems will be understood mainly from the status of birds. (The next implementation is planned in around 2018.)	Shiretoko Cape		○			