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Policy Brief Rusa Deer Management in Tambrau, West Papua, Indonesia



Policy Brief

Rusa Deer Management in Tambrau, West Papua, Indonesia

Based on the recent field study in collaboration between the University of Göttingen Germany and GIZ

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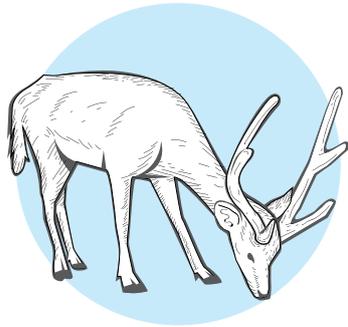
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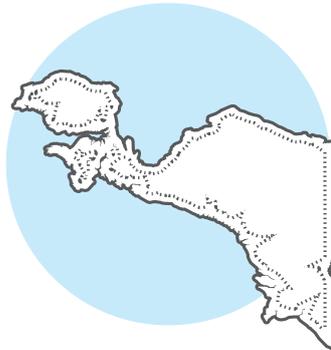
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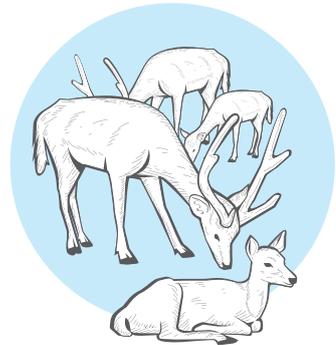
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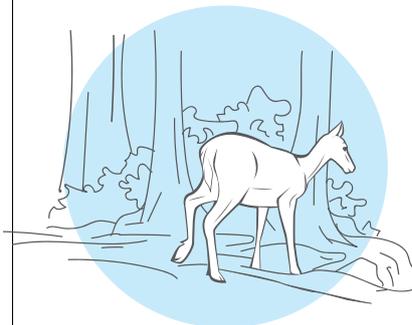
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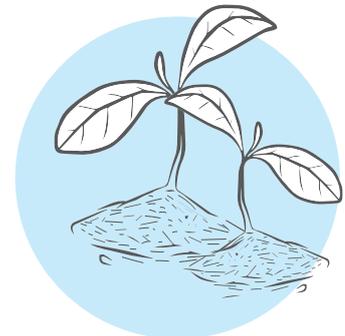
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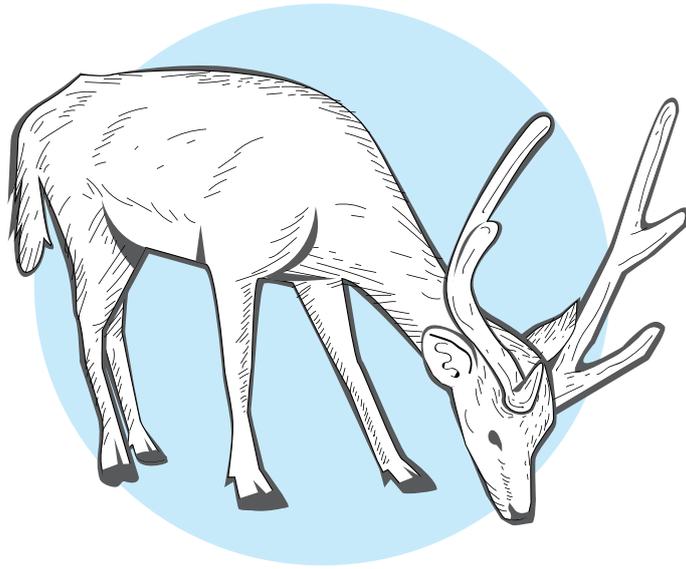


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Background



The rusa deer (*Cervus timorensis*) is native to Southeast Asia including the islands of Java, Bali and Timor. It has been introduced to various regions including New Guinea, Borneo, the Lesser Sunda Islands, Maluku, Sulawesi, Pohnpei, Mauritius, Pacific islands, Nauru, Australia, New Caledonia, and New Zealand (Long, 2003). Rusa deer was first introduced into New Guinea in the 19th century along with early human migrations, presumably for meat (Flannery, 1995, Brodie *et al.* 2018). This species has successfully dispersed across much of the lowlands of the provinces of West Papua and Papua (Tanah Papua) including the Trans-Fly region, the entire southern lowlands, Vogelkop Peninsula and the vicinity of Jayapura (Flannery, 1995). There is very limited information about the population status of rusa deer in Tanah Papua, However, current intensive study in the Tamberau region suggests that this herbivore species has a relatively high abundance in forests and grassland areas (Pangau-Adam *et al.* 2020). The introduction of mammalian species to Tanah-Papua has become the focus of conservation concern, because the region lacks most placental mammal lineages, and increased abundance of introduced species (e.g. Rusa deer, wild pigs) may considerably affect the native flora and fauna (Pangau-Adam and Brodie, 2019). Systematic assessments of the distribution range and population status of rusa deer is therefore critical to understand their ecological role in Tanah Papua and for defining management strategies.

Rusa deer and other wild animals play a significant role in the livelihoods and culture of the local people in Tanah Papua. Moreover, transmigrant communities and other ethnic groups appear to rely on wildlife hunting and utilize them for various purposes. However, the utilization of wildlife should be carried out within sustainable biological boundaries. Wildlife is part of the natural resources that can be sustainably utilized for subsistence and commercial purposes. The populations of rusa deer are potential to support economic development in the rural areas of Tamberau regency (B.Yekwam, 2019, pers.comm.), and rusa hunting would be part of conservation initiatives to protect forest and its native biodiversity. Principally hutan adat in Tanah Papua could be utilized and managed based on traditional ecological knowledge, guided by science and technology and facilitated by the regency and provincial governments (Government Special Bylaw Perdasus No. 21/2008).

A recent field work was conducted during May to October 2019 by the research team from the University of Göttingen Germany (UGOE) and Universities in Tanah Papua supported by local staff and field assistants. The aim of the study was to assess the distribution and population status of rusa deer, and to determine the extent of wildlife hunting in Tamberau Regency, West Papua, Indonesia.

Tamberau regency covers 11,592.18 km² area and consist of 29 sub-districts. Claimed as a conservation regency by the government, more than 80% of Tamberau land areas have been set aside as conservation areas and protected forest (Bappeda Tamberau, 2014). This regency in the north of West Papua Province is the largest conservation area in Tanah Papua, which collectively conserve the forested areas as well as rare turtles and many bird species that are amongst the main conservation focus (Fatem, 2015). Most areas of the forest in Tamberau are claimed as traditional or clan forest by local people, resulting in several different land-use systems, including shifting cultivation and forest garden.

Tamberau regency is amongst the regencies in Tanah Papua with small number of human population. In 2010 this was the regency with the smallest population in Indonesia (6144 people), but the number is increasing and became 32,027 (2.78 people/km²) in 2019 (BPS Tamberau, 2020).

**Tamberau regency covers
11,592.18 km²**

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Habitat of rusa deer — Margaretha Pangau-Adam

Distribution of Rusa Deer in Tamberauw

The recent field study by UGOE suggests that the distribution of rusa deer in Tamberauw region is ranging from coastal areas in the north, lowland forest, grassland in Kebar to the hill and rugged forest up to 900 m asl. Rusa deer were distributed across Tamberauw region particularly in the 15 studied districts. They mainly inhabit the lowlands, grassland and hill forest, but are rarely found at high elevation sites. The habitat of rusa deer in lowland forest holds typical canopy tree genera including *Intsia*, *Pometia*, *Ficus*, *Alstonia*, *Canarium*, *Artocarpus* and *Terminalia*, whereas mid-story trees include *Myristica*, *Syzygium*, *Garcinia*, *Diospyros*, *Maniltoa*, *Spondias*, *Gnetum* and *Pandanus*. These forest vegetation provide food and resting place for rusa deer. In the Kebar grassland area, the secondary forest is mostly dominated by matoa (*Pometia pinnata*), binuang (*Octomeles sumatrana*) and damar (*Araucaria* sp.) (Pattiselano, 2012). In this site, natural pasture or grazing areas for rusa deer is dominated by alang-alang (*Imperata cylindrica*) which was easily burned during dry season. Rusa deer has also been detected in the forests along coastal areas of Tamberauw, where the major breeding ground and habitat for the Leatherback Sea Turtle (*Dermochelys coriacea*) is situated.

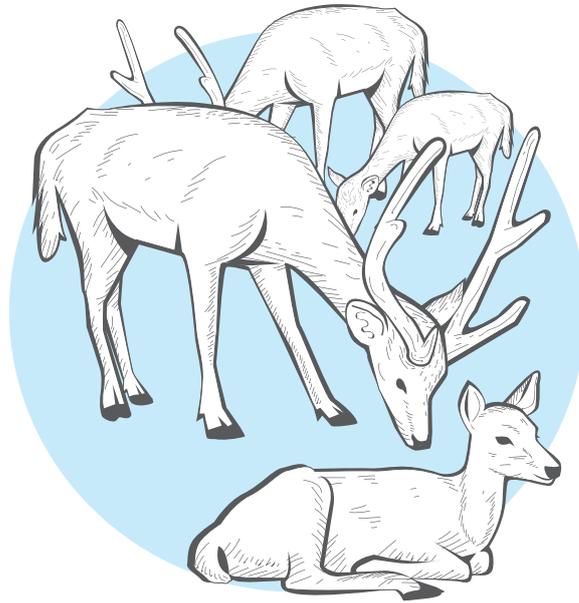




Tmbrau landscape behind Bano village (top), Kwoor river, some villages can be reached by boat (below).
— Margaretha Pangau-Adam



Population Abundance



Being an introduced species in Tanah Papua, rusa deer have adapted to different habitats with suitable conditions, including adequate foraging resources, less human population and favorable climate. Particularly, the absence of the main natural predators is likely to resulting in rapid growth of their population sizes in Tanah Papua.

FiField surveys by UGOE using the direct distance sampling method in a 48 km² area in Kwoor basin, Tambrau region indicate that the population density of rusa deer is 10.34 individual/km², 95% CI 5.36–19.98 (Table 1). In addition, the analysis of camera trap data allows the population estimation of this ungulate to be 15.3 and 23.8 individuals/ km², respectively. In comparison Pattiselano (2012) reported an estimation of rusa deer abundance in Kebar grassland to be 3 individuals/ha. A study in Australia (Moriarty 2004), specified the abundance of rusa deer in the Royal National Park with a variety of ecosystems found the estimated density to be 16.7 and 19 individuals/km² in 1999 and 2001, respectively. Along with other introduced deer species, rusa deer could potentially occupy most of the continent especially the northern Australia (Davis 2016). Due to its increasing population and predicted distribution, rusa deer has been

classified as a pest species in several states of Australia (Moriarty 2004, Davis 2016). It appeared that rusa deer in Tambrau would become overabundant unless its population is limited through traditional wildlife hunting. Further study is needed to assess the likelihood of rusa deer as a pest in the region.

The estimated population density of rusa deer in Tambrau forest is influenced by several determining factors. The detection probability of rusa deer decreased in areas adjacent to river system compared to other forested areas. Rusa deer occurred infrequently around river banks because river sides are actively used by villagers for fishing and other daily activities. Like in other parts of Tanah Papua rivers serve as travel corridors for humans and therefore provide hunting access (Brodie *et al.* 2018). In addition, the abundance of rusa deer appeared to be

higher in July and August than in other months, because of the breeding season which peaks in these months. This period also coincided with the fruiting season of forest trees such as *Terminalia* spp, *Syzygium* spp, *Cerbera* sp and *Myristica* spp, which possibly trigger the activities of rusa deer. The analysis indicated that Rusa deer prefers the habitats with a high density of forest vegetation including secondary forests that provide adequate foraging places. Moreover, this species was less detected in the areas close to human settlements. Low human population in rural areas of Tambrau results into less settlements may favor an increased population of rusa deer. The field study also suggests that high elevation significantly support its abundance, because a rough terrain hinders intensive human activities and therefore reduces hunting efforts. However as reported by villagers and hunters, rusa deer is rarely found in the forests at elevation of 800-900 m asl.



A sapling damaged by rusa deer – Margaretha Pangau-Adam

Effects of rusa deer on vegetation structure

During the field surveys, the observation of vegetation structure along all transects at rusa deer habitats was conducted and a number of damaged young trees in almost all study sites was encountered, showing the consequences of rusa deer presence on forest vegetation. Ungulates are known as ecosystem engineers because they maintain the heterogeneity of landscape, but if they are introduced in habitats wherein they are invasive, they can seriously alter species composition of plant communities (Gordon *et al.* 2004, Davis *et al.* 2016). For instance, in Papua New Guinea (Kwapena 1975), New Zealand (Allen *et al.* 1984) and Australia (Keith & Pellow 2005), the vegetation structure has been substantially altered by the browsing of introduced rusa deer and other ungulates. Also, a model of the effects of deer herbivory based on plant life-history suggests that curtailment of seed production and seedling recruitment are likely to be the major impacts of rusa deer on plant population viability (Spaggiari and de Garine-Wichatitsky, 2006). Further study and predictive modelling are needed to assess the impact of rusa deer on vegetation and forest structure in Tanah Papua, and especially in the Tambrau region. Moreover, the relationships between different forms of rusa management and the native vegetation, as well as secondary, cascading effects on the whole ecosystem, would still require intensive monitoring and research.

Table 1. Summary for the distance models performed to assess rusa deer density in Kwoor basin, West Papua (area size = 48 km²). CI stands for confidence intervals, CV is coefficient of variance.

Encounter rate group per km ⁻¹ (SE)	Expected group size (SE)	Model formula	Abundance (0.95% CI)	Density, km ⁻² (95% CI)	CV%
0.60 (0.15)	2.35 (0.12)	Half-normal cosine	497 (257–959)	10.34 (5.36–19.98)	0.33
		Hazard-rate cosine	461 (237–893)	9.60 (4.96–18.60)	0.33
		Uniform cosine	449 (166–1219)	9.36 (3.45–25.40)	0.51

Hunting Patterns and Importance of Rusa deer to the Communities



Like in other regions in Tanah Papua traditional hunting is considered as a significant livelihood activity in Tambrau regency, because it provides the majority of animal protein for families (Pangau-Adam and Noske, 2012). Interview surveys with 145 hunters/informants and 90 households using semi-structured questionnaires have indicated that a total of 18 wildlife species including several canopy birds are hunted in this region. Rusa deer and wild pigs have become the main target species of hunting activities across Tambrau with exception in the high elevation forests (> 800 m asl). The most consumed wild meat were of rusa deer and wild pig, but marsupial meat was also frequently consumed by local communities. The proportion of wild meat in the diet of villagers surveyed varied greatly between sites depending on the remoteness, habitat type and participation in cash economy (Table 2). In the remote forest villages with little outside access, wild meat and/or wild fish were the most frequent protein items identified in the diet.

Motivations of wildlife hunting in this region are mainly for subsistence, commercial purposes and traditional/religious events. In forest and riverside villages, hunting was also done to avoid rusa deer and wild pigs crossing and damaging crop fields and forest gardens. Prior to western contact, local people in Tambrau have hunted wildlife only for subsistence purposes. However the introduction of a cash market economy, combined with rapid urban and infrastructure development in Vogelkop Peninsula have brought a significant change in hunting purposes and practices in this region. About 41 % of the interviewed hunters declared that they hunted for commercial purposes, showing that there has been a market shift from local-level subsistence hunting towards intensive commercial hunting. In the very distant areas far from towns and marketplace, hunting on wildlife was still at subsistence level to fulfill the protein needs of families.

Rusa deer are mainly hunted using traditional techniques such as archery, spear and with

dogs, and also setting snares. Snares usually are targeted to capture wild pigs and rusa deer, but other non-targeted animals like cassowaries and ground marsupials can also be trapped upon encounters. It is found that hunting strategies among local communities differ depending on the organization of clan, hunters, general seasonal conditions and the immediate need for meat. Although it is prohibited, about 8.3 % of all hunters reported the use of air rifles for hunting wildlife. Hunting sites were related to clan and traditional forests (hutan adat), which include primary forest, secondary forest and mixed or forest gardens. The location of some traditional forests along river systems is far from the villages, thus hunters should own a boat or rent it to reach their hunting grounds. Renting a boat is quite expensive and impossible to compensate for if there is no harvest at hunting sites. Rusa deer hunting intensity and success varies according to differences in accessibility of the surrounding terrain, traditions, and socioeconomic status of the inhabitants.

Table 2 The frequency of wild meat as a component of the meals of villagers

 Site description	 Number of household	 Percentage meals containing wild meat (mostly of wild pig and rusa) per week	 Other protein sources
 Forest villages	 27	 65-70	 Fresh water fishes
 Coastal areas	 12	 25-30	 Marine fishes, sea turtles, turtle eggs
 Riverside villages	 14	 55-60	 Fresh water fishes, shrimps
 Town and surroundings	 20	 20-25	 Marine fishes, poultry, canned fish and meat
 Kebar valley	 17	 50-55	 Fresh water fishes, poultry, nuts

Trade on Rusa Deer

Wildlife trade in the Tamberau region focuses on the meat of introduced species, namely rusa deer meat and wild pig meat. Wildlife meat is being sold within villages or occasionally offered at the roadside of Trans Papua, but the main trade of venison occurs in trading points and markets in towns and in the cities of Sorong and Manokwari. The distance from Sausapor to Sorong is c. 115 km and takes about 4 hours by car. From Miyah and Kebar to Manokwari are about 6 and 4 hours travel by car, respectively. The price of rusa deer meat sold in the cities is much more expensive, than in villages or towns, but the benefit goes to middlemen and meat vendors. Hence, there is a big challenge for local hunters to act as key players in the trade of venison and wild pig meat. Recently, one hunter has become a wild meat handler for rusa harvest in Kwoor basin. This indicates the improvement of wild meat marketing which is now involving local people. A number of hunters would also smoke the venison as to turn it into *dendeng rusa* (i.e. smoked rusa deer meat) and then take it to the market over the following few days. Because of increasing demand of rusa deer meat

at certain occasions like Christmas and Eid feast, several hunters increased their hunting efforts during feast periods. In addition, antlers of rusa deer were collected and traded in towns and cities for home decoration. In Kebar areas rusa leather was also traded for different purposes including artistic decoration (Pattiselano, 2012).

Because of religious reasons the consumption of wild pig meat is limited to some community groups, whereas rusa deer meat can be consumed by all communities. This has led to the extend demand of rusa deer meat from markets in towns and the cities of Manokwari and Sorong. Following the increased market demand a number of hunters only concentrated on hunting on rusa deer using snare traps.

Local people are often poorly equipped with traditional methods of handling and marketing of wild meat. If this would be developed towards professional trading activities, sustainability should be thoroughly considered and implemented in order to secure the long-lasting utilization of forest products.

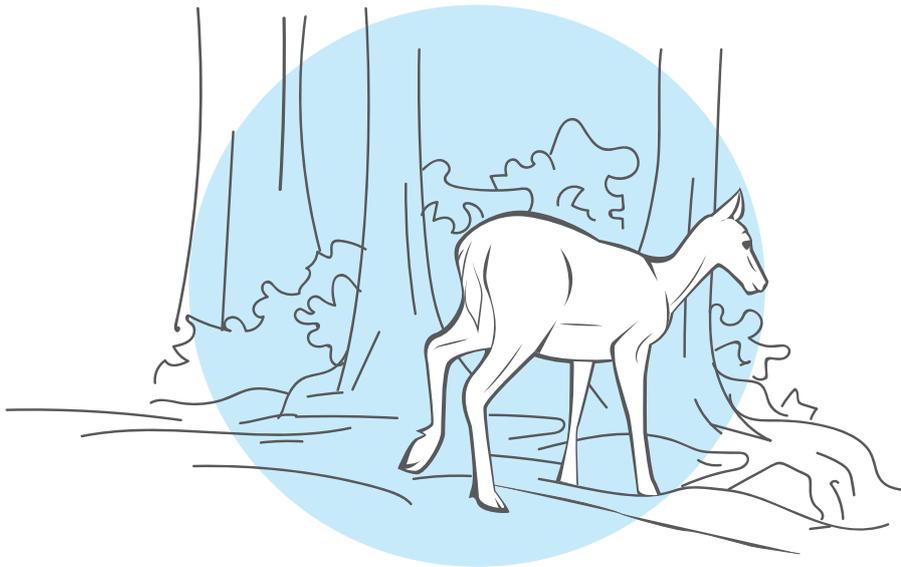


A hunter and his grand child— Margaretha Pangau-Adam

Bano village is located on the hill and considered as one of tourism spots in Tambrau regency.
— Margaretha Pangau-Adam



Wildlife Hunting and Sustainability



It is well known that unsustainable hunting will lead to population decline of species. Unsustainable harvest, exceeding recruitment, will likely cause the extirpation of target species. However, the extermination of introduced herbivores that successfully adapted and increased abundantly is not possible through predators or hunters, especially if –as in Tambrauw region–there are sufficient areas for refuge. The recent study may provide a preliminary assessment of sustainability of hunting on rusa deer using models proposed by Robinson and Redford (1991) which requires information on population density, demographic characteristics of the species, area size and hunting patterns. The analyses of hunting and capture rates, combined with estimates of population densities and rates of increase have shown that hunting levels of rusa deer in Kwoor basin, Tambrauw, is apparently sustainable under the condition of maximum production (P_{\max}) = 5.07. The potential harvest within the 48 km² study area (PH) = 97.34 individuals per year is higher than current harvest rates of ca. 69 individuals per year. However, since September 2018 parts of the study sites in Kwoor basin were established as *sasi* areas with a ban on rusa deer hunting, and this influenced the capture rates of rusa deer being lower than the potential harvest.

Because wildlife plays an important role as protein source of local people and recently also for additional income generation, many local communities are seriously concerned to manage the capture rates of animal targets. If the abundance of animals dramatically decreases and natural resources depleted, the so called *sasi* system would be applied. *Sasi* forest and wildlife may describe specific traditional rules and regulations governing access to cutting forest areas and to hunting particular wildlife. This system has been practiced in the

Sasi forest and wildlife may describe specific traditional rules and regulations governing access to cutting forest areas and to hunting particular wildlife.



A village meeting before interviews— Mahmood soofi

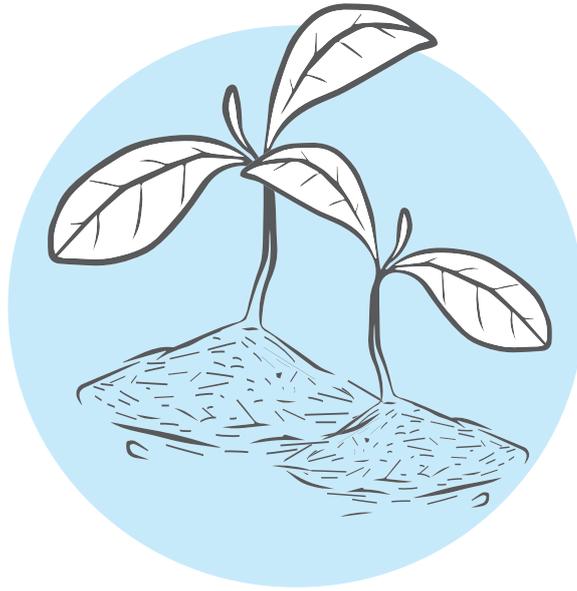
Mollucas and in many part of Tanah Papua since hundreds years. *Sasi* refers to a traditional system of natural resource management and includes banning on resource harvest on land and in sea (McLeod *et al.* 2009). *Sasi adat* is governed by traditional law and practices, and *sasi gereja* (church) is governed by the Christian church. This system can be implemented in a specific rotation way or within certain agreed periods. Some communities in Tambrau have developed and implemented *sasi adat* and *sasi gereja* to avoid overexploitation of forest, wildlife and marine resources. According to clan and community leaders *sasi* was established because the abundance of large-sized wildlife have

reduced drastically after intensive harvesting in the previous years. *Sasi* is also addressed to attract and improve ecotourism and wildlife tourism to benefit local communities.

Wildlife taboos, for instance taboo of cassowary, cuscus, cockatoos and tree kangaroos, are practiced by several clans in the study area and are a significant component that should be considered in forest management. Both the *sasi* system and taboos are forms of traditional knowledge and beliefs which can provide important mechanisms to support sustainable management of natural resources and biodiversity conservation.

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Lessons Learned



As an introduced species, rusa deer successfully colonized the Tamberau region and has become an important target of wildlife hunting. Basically, rusa deer is protected by the national law (Government Regulation PP No. 7, 1999) and considered as Vulnerable in the IUCN Red List of Threatened Species (Rahman *et al.* 2020), however its presence in Tanah Papua as an introduced species can negatively affect the composition and persistence of Papuan native flora and fauna. Thus, in order to reduce their negative impacts, it is critical to limit their population size. This could be undertaken by adopting integrated local policies on rusa hunting and trade based on traditional ecological knowledge of local communities, and the recent analyses on hunting practices and rusa population. As humans have lived and hunted in Papuan forests for many thousands of years, a special regional regulation (*Perdasus*) of wildlife hunting for Tanah Papua should be issued at regency and provincial levels. Regulation for commercial hunting could be established by the government, involving the decisions from external experts professionally trained in wildlife and habitat management. The trade scheme need to be properly monitored and managed so that hunting merely targets the introduced/invasive species (i.e. Rusa deer and wild pigs) as the trade incentives may otherwise escalate hunting pressures on native species in the region. The *sasi* system and wildlife taboos should be integrated in regional management by the regency government as local conservation initiatives to support sustainable hunting. Moreover, while hunting using snares can be detrimental to native wildlife species such as cassowaries, crowned pigeons, brush turkeys and ground marsupials, this technique should be replaced and hunters should return to traditional hunting methods. Traditional institutions together with the Tamberau regency government (Department of Environment and Forestry) could plan and set up the regulations on all types of exploitations pertaining to wildlife and forests, including the rules of preventing using shotguns to hunt.

The existing collaboration with GIZ-FORCLIME, the University of Göttingen (UGOE) and Universities in Tanah Papua (UNCEN and UNIPA) should further undertake monitoring of rusa deer population and hunting practices in Tambrau region to guide the practice of sustainable hunting and ensure that local people get benefit of rusa trade. In the meanwhile, rusa deer hunting scheme should not elevate the hunting of other native species. A form of community-based co-management could be established to properly manage and maintain sustainable wildlife hunting in the region. Furthermore, intensive research is required to clarify the ecological effects of rusa deer on the forest ecosystems.

A model of Community-based Co-management

(modified from Bodmer and Puertas, 2000)

Wildlife management should involve the combination of community-based and co-management strategies. The community-based side recognizes that communities are responsible for performing wildlife management. The co-management side involves stakeholders who have a meaningful interest in the appropriate management of Tambrau forests and this includes local communities (e.i. Dewan adat, kelompok pemuda adat, women group), government agencies, NGO extension workers and researchers. The communities will make decisions on how to manage wildlife and other forest resources. Community members vote on resource use and management issues democratically during community meetings. When communities vote, government officials, extension workers, and researchers can be present and provide advice if needed. The government programs, extension activities and research results will be incorporated in the management and resource use decisions. Wildlife extension workers should link government regulations and results from wildlife research back to the communities. Community-based co-management relies on the acquisition and communication of information. For example, local people perform management that affects animal populations. Biological

studies that focus on population assessments may generate information on the impact of hunting and effectiveness of management. The extension activities will convey results from biological studies to local people. The impact of management can only be determined through research on target species. Therefore, research and extension will link the realities of animal populations back to community-based management.

Wildlife researches and extension workers should adopt participatory approaches that involve local people. This requires building interest and trust in community-based wildlife management by researchers working with hunters when evaluating the impact of harvests. For example, one of these methods will use skulls from rusa deer that hunters have caught. By collecting skulls, hunters and their families become involved in the data collection. Women will be actively participate as they usually cook and clean the skulls, and may help their husbands or sons for labelling and storing them. This participatory approach should help researchers, extension workers and hunters to find common ground namely the 'rusa skull' to discuss wildlife hunting issues. To make this happen, a dedicated core group should apply consistent research project to advance the process. This group may consist of the wildlife researchers, extension workers including dedicated professionals who work with communities, and community representatives.

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Recommendations

The following potential research projects and programs would be recommended:



Research projects

1. Field research with focus on rusa deer - vegetation interactions aiming to characterize and quantify the impacts of rusa deer on native vegetation communities (*students from Germany have shown interest to work on this subject*).
2. Further research on the monitoring of rusa population abundance.
3. Assessment of the impacts of introduced species (rusa deer and wild pigs) on native wildlife assemblages.
4. Inventory of traditional forests, ecosystem services and forest value analysis, and potential sites for wildlife tourism and ecotourism.
5. Assessment and compilation of *sasi* systems, traditional directives and taboos related to sustainable forest management and protection.
 - b. Social forestry and community development
(*with consideration of the information from local authorities*)



Social forestry and community development (*with consideration of the information from local authorities*)

1. Rusa deer and wild pigs are abundant in the Tambrau region. Hunting on these introduced species can generate alternative income for local communities. However professional guidance is needed to pursue a sustainable wildlife hunting, therefore a form of 'Community-based Co-management' (described in previous section) should be established.
2. The extensive and monitoring studies of sustainable hunting practices (e.i. harvest rates, monitoring population trends) should be further conducted with researchers.
3. Provision of infrastructure like boat, refrigerator boxes and solar cell power would be required by local hunters and meat vendors to manage animal captured, handling and marketing of rusa deer. In collaboration with the government, the hunters and local meat vendors in need of these facilities will be identified to avoid the misuse of fund. This effort can be combined with government programs that provide supports to empower the small-scale community entrepreneur.
4. In collaboration with provincial and regency government (Department of Trade and Industry), training for local hunters and vendors in wild meat handling and marketing should be done, and training on basic financial management for households should be addressed to villagers (women and men).
5. Mapping of traditional forest territories and *sasi* sites. This could be assisted by GIZ-FORCLIME and UGOE (German University of Göttingen).
6. UGOE, UNCEN (Universitas Cenderawasih, Jayapura) and UNIPA (Universitas Negeri Papua, Manokwari) in collaboration with GIZ-FORCLIME and Tambrau Government (Department of Tourism and Creative Economy) would organize training on agroforestry system, ecotourism and wildlife tourism for local people.

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