



Integration of Local Ecological Knowledge in Bird-of-Paradise Conservation Strategy: A Case Study in the Tabi and Saireri Traditional Areas

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Abstract

This study examines the integration of local ecological knowledge into bird-of-paradise conservation strategies in the Tabi and Saireri customary areas, Papua, with a field focus in the East Sentani (Tabi) and South Yapen (Saireri) districts. Using qualitative methods with an ethnographic approach and case studies, this study aims to understand how indigenous communities manage and conserve birds-of-paradise through local wisdom practices embedded in their socio-cultural systems. Data were collected through in-depth interviews, participant observation, and focus group discussions with 32 participants consisting of traditional elders, traditional hunters, female forest managers, and village officials involved in customary-based conservation practices. Data analysis was conducted thematically to identify local values, rules, and institutional mechanisms that support conservation. The results revealed four main themes: (1) the establishment of taboo zones and sacred forests as habitat protection spaces, (2) seasonal hunting regulations and fishing gear restrictions, (3) ritual governance and customary sanctions to maintain ecological balance, and (4) community oversight mechanisms through customary institutions. The findings indicate that the integration of local knowledge is effective when recognized in formal policies through co-management schemes, strengthening the role of customary institutions, and recognizing customary sanctions in regional conservation regulations. Local knowledge-based strategies not only maintain the habitat and population of birds of paradise but also strengthen the social legitimacy of conservation policies. This study recommends the development of co-management instruments between local governments and indigenous communities as a contextual, inclusive, and sustainable policy framework for bird-of-paradise conservation in the Tabi and Saireri customary territories.

Keywords: Local ecological knowledge; Bird of paradise conservation; Tabi and Saireri traditional areas; Qualitative methods; Ethnographic approach

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INTRODUCTION

Research on the conservation of rare and endemic species is receiving increasing attention, particularly in the context of increasing anthropogenic pressure on the natural habitats inhabited by these species. Birds of paradise, as species of ecological and cultural significance, play a crucial role not only in maintaining biodiversity but also as symbols of the cultural identity of the Papuan people, particularly in the traditional territories of Tabi and Saireri (Hosen et al., 2020). The existence of this bird has strategic value, as it not only reflects the health of the tropical rainforest ecosystem as its natural habitat, but also holds profound spiritual and social significance for local communities. However, serious threats such as widespread deforestation, land conversion, and uncontrolled hunting practices have put the population at risk of significant decline (Cebrián-Piqueras et al., 2020). Therefore, integrated and sustainable conservation efforts are needed to ensure the survival of birds of paradise while

preserving their inherent cultural values. An approach that simultaneously considers both ecological and cultural dimensions is key to formulating effective and adaptive conservation strategies.

In the Indonesian context, various wildlife conservation and forest management policies have been implemented through national legal frameworks, such as the designation of conservation areas, the protection of protected species, and state-based management programs. However, the implementation of these policies in Papua is still dominated by a top-down, protected area-based approach, resulting in relatively limited space for integrating local knowledge of indigenous communities into conservation planning and decision-making (Ludwig & Macnaghten, 2020). Several forest conservation and management programs in Papua place indigenous communities as implementers or beneficiaries, but have not systematically integrated customary rule systems, traditional forest zoning, and social sanction mechanisms into formal policy designs (J. M. Robinson et al., 2021). This condition shows a gap between formal conservation practices and customary-based environmental management practices that have been carried out for generations.

Bird of paradise conservation efforts require the implementation of a holistic and multidimensional conservation approach, which not only emphasizes technical and scientific aspects, but also consciously integrates the social, cultural and economic dimensions of local communities that live alongside the species' habitat (Molnár & Babai, 2021). Approaches that utilize local ecological knowledge (LEK) are increasingly recognized in conservation studies as effective and sustainable strategies, as they align traditional wisdom with modern science. Local ecological knowledge is the result of accumulated experiences, cultural values, norms, and adaptive practices passed down from generation to generation and consistently applied by indigenous communities in managing and protecting their environment (Albuquerque et al., 2021).

Although conservation literature has long emphasized the importance of integrating local ecological knowledge, most research in Papua still focuses on descriptive documentation of local practices or on normative arguments regarding the importance of indigenous peoples' participation (Sinthumule, 2023). These studies have not yet examined in detail the operational mechanisms of integrating local knowledge into formal conservation policies, such as how customary rules are translated into area zoning, how customary sanctions interact with state regulations, or how the negotiation process between indigenous communities and conservation institutions takes place (Camino et al., 2020). Consequently, the research gap lies not only in a lack of integration, but also in a lack of comparative understanding of the variation in customary systems and their implications for the effectiveness of conservation strategies.

The Tabi and Saireri traditional areas are known for their strong customary systems and rich local wisdom in maintaining environmental balance, which reflects a harmonious relationship between the community and its natural environment (Sinthumule & Mashau, 2020). Traditional knowledge in both regions encompasses a deep understanding of the behavior, habitat, and life cycle of birds of paradise, which has been passed down from generation to generation as a crucial foundation for traditional management and conservation practices. Norms, customary rules, and rituals related to bird-of-paradise conservation serve not only as instruments of ecological protection but also as reinforcements of the cultural identity of local communities (Haq et al., 2023).

However, differences in social characteristics, customary leadership structures, hunting norms, and forest zoning systems between the Tabi and Saireri regions have not been studied comparatively in the conservation literature (Marchessaux et al., 2023). This lack of comparative studies has led to a lack of understanding of how variations in customary governance systems influence the form of integration of local knowledge into formal conservation policies (Viñals et al., 2023). Therefore, this study utilizes the differences in the Tabi and Saireri contexts as an entry point to generate new comparative insights, particularly regarding the forms of customary rules, sanction mechanisms, mapping of sacred habitats, and

the processes of interaction and negotiation with government agencies and conservation organizations.

Conceptually, this study uses the lenses of biocultural conservation and commons governance to analyze how local ecological knowledge interacts with formal conservation policies (Colloca et al., 2020). This approach allows for analysis that not only looks at the importance of indigenous peoples' participation, but also examines institutional mechanisms, distribution of authority, and forms of collaboration that enable the operational and sustainable integration of local knowledge (Tynsong et al., 2020).

This research uses qualitative methods with an ethnographic and case study approach to gain a comprehensive understanding of the mechanisms and dynamics of integrating local ecological knowledge into bird-of-paradise conservation strategies. An ethnographic approach was chosen because it provided the researcher with the opportunity to conduct participatory observations and engage directly with indigenous communities at the research site, thus enabling the collection of rich, detailed, and contextual data related to conservation practices, both traditional and adaptive. Through this approach, the researcher not only collected descriptive data but also captured the symbolic meanings, cultural values, and social behavior patterns underlying bird-of-paradise conservation practices.

Furthermore, this research is designed as a comparative case study between the Tabi and Saireri customary areas to identify similarities and differences in customary rule systems, animal use norms, and forms of collaboration with external actors. This comparative design is a novel contribution to the research because it allows for the development of a more contextual and adaptive model for integrating local knowledge.

This research focuses on the Tabi and Saireri customary territories because they have distinct social, cultural, and ecological characteristics, allowing for a more comprehensive and holistic understanding of the variations and similarities in local knowledge-based conservation strategies. These distinct contexts not only reflect the diversity of indigenous cultures and practices but also demonstrate varying environmental dynamics and ecological pressures.

The objectives of this study are formulated analytically to: (1) identify forms of local ecological knowledge related to bird-of-paradise conservation; (2) compare customary governance mechanisms in the Tabi and Saireri regions; (3) evaluate gaps in the integration of local knowledge into formal conservation policies; and (4) formulate a more inclusive and contextual model of local knowledge integration. The formulation of these objectives is intended to clarify the scope of the study and avoid overly broad generalizations.

This research involved in-depth interviews, participant observation, and focus group discussions with traditional leaders, traditional hunters, and local community members actively involved in bird-of-paradise management and conservation. This multi-method approach was chosen to obtain rich, diverse, and highly valid data, thus representing the complexity of conservation knowledge and practices within the socio-cultural context of indigenous communities.

A participatory approach that integrates local ecological knowledge into conservation policy formulation not only increases the effectiveness of natural resource conservation but also strengthens the role of indigenous communities as key actors in environmental management. This approach aligns with the sustainable conservation paradigm, which emphasizes the importance of collaboration between governments, scientists, and local communities in maintaining ecosystem balance. Furthermore, this research is expected to provide significant scientific contributions to conservation institutions and local governments in designing and implementing interventions that are more responsive and contextual to local social and ecological dynamics.

Overall, this study emphasizes the importance of viewing conservation as a multidimensional process that relies not only on modern scientific approaches but also integrates the local wisdom of indigenous communities as a crucial element. By placing a comparison of the Tabi and Saireri customary areas and an analysis of the mechanisms of local

knowledge integration as the main focus, this study seeks to provide a clearer empirical, comparative, and conceptual contribution to the development of indigenous community-based conservation strategies in Papua. This approach is expected to produce a more inclusive, adaptive, and sustainable conservation model and strengthen the position of indigenous communities as strategic partners in conservation governance.

METHOD

Research Design

This research uses a qualitative approach with a comparative case study design based on focused ethnography. This design was chosen to examine in depth the mechanisms of integrating local ecological knowledge (LEK) into bird-of-paradise conservation strategies in two distinct customary areas, Tabi and Saireri. Unlike classic long-term ethnography, this research is a focused ethnography with an intensive fieldwork duration of approximately four months, emphasizing participant observation, in-depth interviews, and analysis of contextual conservation practices. The comparative case study approach was used to identify similarities and differences in customary governance systems, norms for animal use, and forms of integration with formal conservation policies in both areas.

This research chose a qualitative approach with a case study design to gain a deep and comprehensive understanding of the integration of local ecological knowledge into bird-of-paradise conservation strategies in the Tabi and Saireri customary areas. Ethnographic methods were used as the primary foundation due to their ability to capture social and cultural dynamics through direct interaction with indigenous communities.

Study Area

The research was conducted in the Tabi and Saireri customary areas in Papua Province. The Tabi area encompasses the coastal and mountainous areas around Jayapura and its surroundings, with lowland to mountainous tropical rainforest ecosystems. The Saireri area encompasses the island and coastal areas of Cenderawasih Bay, with coastal-forest and small island ecological characteristics. Both areas were chosen because: (1) they have bird-of-paradise populations and primary forest habitats; (2) they have active customary institutional systems; and (3) there is interaction between formal government conservation programs and customary conservation practices.

The research locations were purposefully selected, taking into account the unique ecological and socio-cultural characteristics of the Tabi and Saireri customary areas, inhabited by indigenous communities who consistently maintain local traditions and knowledge. Administratively, the research locations encompass four customary villages (two in Tabi and two in Saireri). Village selection was based on the following criteria: the presence of active customary conservation practices, field accessibility, and community willingness to participate.

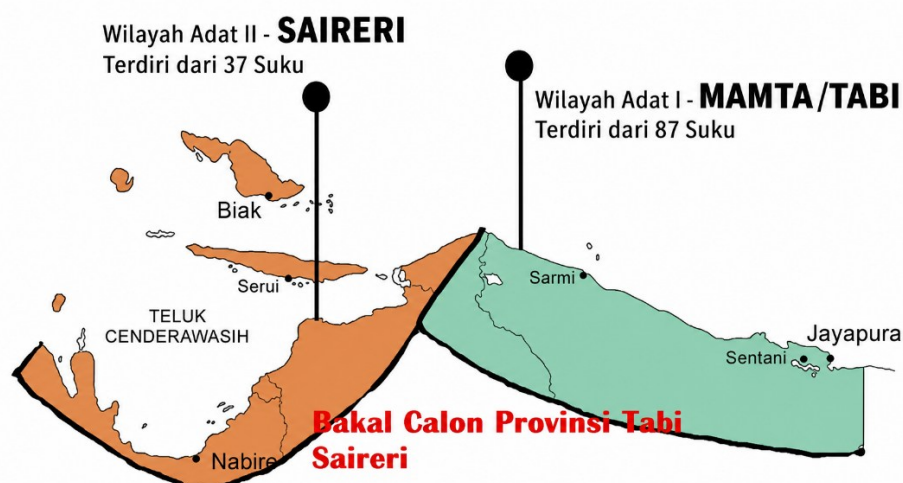


Figure 1. Map of the Tabi and Saireri Traditional Areas

Participants and Sampling Techniques

Participants were selected using purposive sampling and snowball sampling. Inclusion criteria included: (1) having knowledge or involvement in conservation practices; (2) being recognized by the community as holding local knowledge; and (3) being willing to provide consent for participation. A total of 36 participants participated, consisting of traditional elders, traditional hunters, female forest managers, indigenous youth, and representatives of local institutions. The distribution of participants is presented in Table 1.

Table 1. Characteristics of Research Participants

Participant Categories	Amount	M/F	Age Range	Role	Location
Traditional leader	8	M	45–75	Customary decision makers	Tabi & Saireri
Traditional hunters	7	M	30–65	Animal exploitation practices	Tabi & Saireri
Women forest managers	6	F	25–60	Resource management	Tabi
Indigenous youth	7	M/F	18–30	Heir of knowledge	Saireri
Village officials/local institutions	8	M/F	28–55	Policy liaison	Tabi & Saireri
Total	36				

Gender balance is maintained by involving women as forest managers and ritual knowledge providers.

Data Collection Technique

Data collection in this study used in-depth interviews, participant observation, and documentation. In-depth interviews were conducted using a semi-structured guide that covered five main domains: (1) knowledge of bird-of-paradise habitat and behavior; (2) customary hunting rules; (3) sacred forest zoning; (4) relationships with government conservation policies; and (5) changes in conservation practices.

The interview process in this study was designed in-depth to explore the community's understanding of customary regulations related to bird-of-paradise hunting, the authorities responsible for establishing hunting prohibitions, and the community's relationship and involvement with government-run conservation programs. Each interview session lasted approximately 60–120 minutes and was conducted in both Indonesian and local languages to allow the informants to convey their experiences and perspectives more naturally and contextually. All conversations were recorded in digital audio format after obtaining consent from the participants and then transcribed verbatim to maintain data integrity. To ensure accuracy of meaning, particularly for key quotations, back translation was performed so that the interpretations used in the analysis still reflected the informants' original intent.

Here are the interview guide domains and sample questions

Domain 1. Local Ecological Knowledge of Birds of Paradise

Objective: To identify forms of local knowledge related to bird ecology, habitat, and behavior.

Example questions:

- What do you know about birds of paradise in this area?
- How do people understand the habitat, mating season, and behavior of these birds?
- Are there any stories, myths, or cultural symbols associated with the bird of paradise?
- How is knowledge about these birds passed on to the younger generation?
- Are there certain natural signs that people use to know the presence of birds?

Domain 2. Customary Rules and Traditional Conservation Practices

Objective: To explore customary governance mechanisms for protecting birds and their habitats. Example questions:

- Are there any customary rules regarding hunting birds of paradise?
- Who has the authority to establish or enforce these regulations?

- c. What are the penalties for communities who violate hunting regulations or habitat destruction?
- d. How do communities protect forests that serve as bird habitats?
- e. Are there any traditional rituals related to protecting birds or forests?

Domain 3. Customary Governance Mechanisms (Comparison of Tabi and Saireri)

Objective: To compare customary institutional structures and conservation practices across regions. Example questions:

- a. How does the traditional leadership structure in this village manage natural resources?
- b. Do conservation regulations differ between villages or customary areas?
- c. How are decisions regarding forests and hunting made (deliberations, traditional leaders, etc.)?
- d. Are there any forest areas considered sacred or protected by customary law?
- e. In your opinion, what are the differences in conservation practices in the Tabi and Saireri areas?

Domain 4. Interaction with Government Conservation Policies and Programs

Objective: To evaluate the integration of local knowledge into formal policies. Example questions:

- a. Are there any government or NGO programs related to bird-of-paradise conservation in this area?
- b. How are indigenous communities involved in the program?
- c. Are government regulations aligned with or contradict customary laws?
- d. What are the obstacles to collaborating with external parties (government/NGOs)?
- e. How should government conservation programs respect customary laws?

Domain 5. Socio-Ecological Challenges and Changes

Objective: Identify modern pressures that influence conservation practices. Sample questions:

- a. Have forest conditions and bird-of-paradise populations changed in recent years?
- b. What factors are currently threatening bird conservation the most?
- c. How do economic factors, education, and development impact conservation?
- d. Do younger generations still adhere to customary laws?
- e. How do communities adapt customary laws to changing times?

Domain 6. Model of Integration of Local Knowledge and Modern Conservation

Objective: To formulate an inclusive and contextual integration model. Example questions:

- a. How should indigenous knowledge be included in official conservation policies?
- b. What role will customary institutions play in future forest management?
- c. What forms of collaboration between communities and the government are most effective?
- d. Are communities willing to participate in joint forest monitoring or patrols?
- e. What are the community's expectations for future conservation programs?

In addition to data collection through interviews, this study also employed participant observation to directly understand the social dynamics and patterns of community interaction in daily life. Observations were conducted over approximately 16 weeks, focusing on hunting activities, traditional rituals, and decision-making processes in village meetings, all of which were systematically recorded in daily field notes. To complement and strengthen the field findings, the researchers used visual documentation in the form of photographs and video recordings as supporting data. In addition, the researchers reviewed various written sources, including local policy documents, maps of customary areas, and village archives, to gain a more comprehensive understanding of the institutional and historical context underlying conservation practices in the study area.

Data Analysis

The data analysis process was carried out in stages using an open coding approach, followed by focused coding, and culminating in the formation of main themes. The unit of analysis used was the unit of meaning in each sentence or paragraph, with the involvement of two researchers as coders to maintain consistency of interpretation. The work stages included

the open coding process, codebook development, discussions until mutual agreement was reached, and the development of analytical themes. The entire data processing process was assisted by NVivo 12 software. The code tree structure included several main categories, such as knowledge of habitat, applicable customary rules, forms of social sanctions, and patterns of collaboration with the government. To ensure the validity of the findings, the resulting themes were further validated through member checking with 12 key informants.

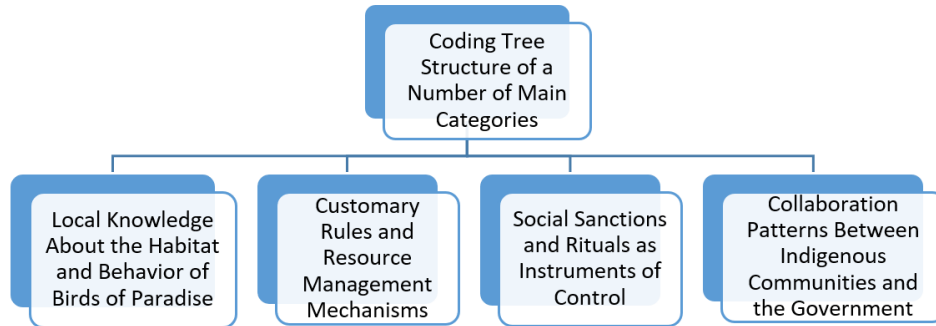


Figure 2. Coding Tree Structure

Trust and Validity

Triangulation was used as the primary strategy to ensure the robustness and validity of the data. Its application included comparing information between participants—such as traditional leaders, hunters, and women—and between data collection methods, including interviews, observations, and document reviews, as well as between research sites in the Tabi and Saireri regions. Conflicting information was not dismissed but treated as important findings that were further analyzed to enrich understanding of the research context. In terms of reflexivity, the researcher acted as an external researcher working alongside local assistants, and throughout the research process, the researcher consistently kept reflective notes as part of an effort to maintain transparency and awareness of the researcher's position and influence in the data collection and analysis process.

Research Ethics

Ethical aspects are the primary foundation for this research. The entire process was approved by the University's Social Research Ethics Committee under decision number 2025/LEK-07, as well as customary permission obtained through local village deliberations. Informant participation was based on informed consent given verbally and in writing after an explanation of the research objectives and procedures. To maintain privacy, participants' identities were disguised to ensure their confidentiality throughout the research process and reporting of results.

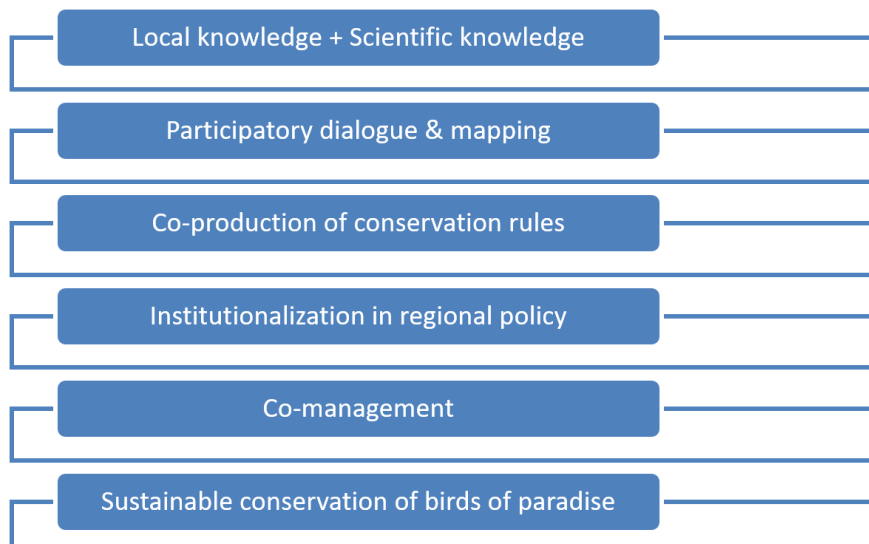


Figure 3. Conceptual Framework

RESULTS AND DISCUSSION

Identifying Forms of Local Ecological Knowledge Related to Bird of Paradise Conservation

The research results show that indigenous communities in the Tabi and Saireri regions possess local ecological knowledge that encompasses habitat classification, customary rules restricting hunting, determining the breeding period for birds of paradise, and performing rituals that also serve as a means of monitoring environmental conditions. This knowledge is passed down through oral tradition and embedded in daily social norms and practices, thus functioning as an active and ongoing conservation system within the community.

Table 2. Participant Quotes on Forms of Local Ecological Knowledge Related to Bird of Paradise Conservation

Participant Code	Location	Quote
KI-01	Tabi	"We know when the birds start dancing, it's a sign that the forest should not be disturbed."
KI-03	Saireri	"There are forests that are considered home to birds, they cannot be opened carelessly."
KI-05	Tabi	"Young people are taught that the Bird of Paradise is the guardian of the balance of the forest."
KI-07	Saireri	"During mating season, people do not enter certain areas."

Research findings demonstrate that local ecological knowledge serves as a practical framework guiding human relationships with bird habitats. This framework is not solely based on observations of natural conditions but is also influenced by cultural values and spiritual beliefs prevalent within the community. This integration of ecological and cultural dimensions creates a strong binding force for the rules and practices that effectively regulate community behavior.

Local ecological knowledge has long been seen as a key element in community-centered conservation practices, as indigenous communities typically possess a deep understanding of the dynamics of natural cycles and animal behavior in their environments. Studies have shown that this insight often stems from long-term observations spanning generations, and therefore, in local contexts, can complement and even surpass formal scientific data (Hartel et al., 2023). In the case of birds of paradise, knowledge regarding breeding times and the location of important habitats reflects a continuous process of observation internalized in social and cultural practices. The findings of this study align with the perspectives of cultural ecology and community-based conservation theory, which emphasize that the integration of traditional knowledge systems and modern scientific approaches can strengthen the effectiveness of natural resource management, particularly when such knowledge has social legitimacy and becomes part of the norms governing community behavior (Peona et al., 2021).

Studies on traditional ecological knowledge (TEK) emphasize that local knowledge does not stand alone as ecological information, but rather is integrated with a community's value systems, beliefs, and cultural practices. This is reflected in the Tabi and Saireri communities, who view the bird of paradise not simply as a wild animal but also as a cosmological representation and part of their collective identity (Saunders et al., 2021). This symbolic meaning lends strong moral legitimacy to customary rules regarding the protection of birds and their habitats, thus increasing community compliance with conservation practices. This finding aligns with the perspectives of TEK theory and community-based conservation, which emphasize that successful natural resource management is strongly influenced by the interconnectedness of ecological, social, and spiritual dimensions (Anderson et al., 2023). The integration of symbolic and normative elements serves as an effective social regulatory mechanism, while strengthening the sustainability of conservation practices at the local level.

In addition, local knowledge serves as an adaptive tool that helps communities respond to changing environmental conditions. Communities are able to adjust forest management and resource utilization patterns by considering seasonal shifts, food availability, and the ecosystem dynamics they directly observe (Studwell et al., 2021). This adaptability demonstrates that local knowledge systems are flexible and continually evolve in response to ecological changes. These findings align with literature on adaptive management and traditional ecological knowledge, which emphasizes that long-term, experiential knowledge enables indigenous communities to read natural signals and adapt management practices contextually (Tan et al., 2023). Thus, this flexibility not only maintains the sustainability of habitats and species, but also strengthens the socio-ecological resilience of communities in the face of changing environmental pressures.

Several studies have shown that local knowledge systems are often underrepresented in formal conservation policy formulation, despite their crucial role in community-level resource management practices. When local perspectives and experiences are ignored, the effectiveness of conservation programs often declines because the policies implemented are not fully aligned with the social and ecological realities on the ground (Tryjanowski et al., 2022). The findings of this study reinforce the view in the literature on community-based conservation and co-management, which emphasizes the importance of recognizing local knowledge as part of a more inclusive management framework. Integrating formal policies with traditional practices can not only enhance the social legitimacy of conservation programs but also strengthen community compliance and the sustainability of their implementation (Destro et al., 2020). Thus, incorporating local knowledge into policy design is a strategic step to create a more contextual, participatory, and effective conservation approach.

Overall, the findings of this study confirm that conservation practices rooted in local knowledge have significant capacity to maintain ecosystem sustainability, as they are supported by communities' long experience interacting with their environment. When these knowledge systems are combined with modern scientific approaches, the opportunity to formulate conservation strategies that are more relevant to the local social and ecological context becomes greater. This view aligns with various theoretical studies on integrative conservation and co-management, which emphasize the importance of synergy between modern science and traditional knowledge to increase the effectiveness and acceptability of policies at the community level (Thakur et al., 2022). By combining these two sources of knowledge, conservation strategies not only become more adaptive to environmental dynamics, but also gain stronger social support so that their implementation has the potential to be sustainable.

Comparing Customary Governance Mechanisms in the Tabi and Saireri Regions

Customary-based management in the Tabi and Saireri regions demonstrates similarities in the implementation of hunting bans and efforts to protect habitat, but differs in institutional structure and enforcement methods. In Tabi, customary leadership structures tend to be more centralized, with certain figures playing a dominant role in decision-making and imposing sanctions. In contrast, in Saireri, governance mechanisms emphasize collective decisions through community deliberation, enabling enforcement of rules to occur collectively and based on community consensus.

Table 3. Participant Quotes on Customary Governance Mechanisms in the Tabi and Saireri Regions

Participant Code	Location	Quote
KI-02	Tabi	"Decisions about forests are usually made by traditional leaders."
KI-04	Saireri	"Here decisions are taken together through village meetings."
KI-06	Tabi	"Customary sanctions can be in the form of fines and ceremonies."
KI-09	Saireri	"The sanctions are mostly in the form of warnings and mutual agreements."

Variations in customary management structures demonstrate that these systems develop contextually and adapt to local social conditions. Although both regions share similar conservation goals, their implementation differs, influenced by the leadership patterns, social relationships, and traditions of each community. These differences emphasize that customary mechanisms are not uniform but rather adapt to the social and institutional characteristics of each region.

A comparison of customary governance systems reveals a diversity of institutional forms within community-based conservation practices. Several anthropological studies emphasize that traditional leadership patterns influence how conservation regulations are implemented and adhered to. In communities with a more hierarchical structure, decision-making processes typically proceed more quickly because authority is centralized in certain customary leaders, although the space for collective participation tends to be more limited (Noor et al., 2024). The findings of this study are in line with the perspective of local institutional theory and community-based resource management, which states that the effectiveness of rule implementation is greatly influenced by social configuration and the distribution of authority in society (Blom et al., 2024). Thus, the variation between regions such as Tabi and Saireri demonstrates that customary governance models are contextual; each has strengths and limitations that shape how conservation is implemented, while also highlighting the importance of understanding local social structures when designing more inclusive and effective conservation strategies.

In contrast, collective management patterns, such as those found in the Saireri region, allow for broader community involvement in the formulation and implementation of conservation regulations. This involvement strengthens a sense of ownership and social legitimacy for collectively agreed-upon policies, resulting in higher levels of community compliance with habitat and wildlife protection regulations (Ritterson et al., 2021). This finding aligns with the literature on participatory governance and community-based natural resource management, which emphasizes that active community participation can increase the effectiveness of policy implementation through strong social support. However, inclusive deliberation mechanisms also often lead to longer decision-making processes because they require consensus from various parties (Sebastianelli et al., 2020). This condition indicates a trade-off between decision speed and level of participation, while also emphasizing that conservation governance design needs to consider the balance between administrative efficiency and social legitimacy at the community level.

Studies on governance in conservation highlight that management effectiveness is largely determined by the alignment between the institutional framework implemented and the social conditions of the local community. Various theories of governance and community-based resource management indicate that models designed without considering local dynamics tend to be difficult to accept and less effective in implementation (Figueiredo et al., 2021). The findings of this study reinforce this view, as differences in leadership patterns and decision-making mechanisms in the Tabi and Saireri areas show that the success of conservation regulations depends on their suitability to the social structure and cultural values of each community (LAHALLO et al., 2022). Thus, the literature emphasizes the importance of a contextual and adaptive approach, where conservation policies and institutions are formulated with attention to local practices, power relations, and forms of community participation in order to gain legitimacy and sustainable support.

Differences in governance patterns also influence how sanctions are enforced in indigenous communities. In some communities, sanctions, manifested through rituals and social pressure, have strong moral binding power because they are directly linked to cultural values, beliefs, and collective honor (Puffer et al., 2022). These findings suggest that social control mechanisms rooted in cultural norms can serve as effective conservation tools, even without heavy reliance on formal apparatus. This perspective aligns with the literature on social regulation and cultural-based conservation, which emphasizes that compliance with rules is

often higher when sanctions are understood as part of a community's moral fabric and identity (Cavill et al., 2024). Thus, the integration of cultural dimensions in rule enforcement not only strengthens the effectiveness of conservation at the local level, but also demonstrates that traditional value systems can be an important foundation for sustainable natural resource management.

Interregional comparisons show that no single form of customary governance can be applied uniformly across all communities. Each system develops according to the social configuration, leadership, and cultural values prevalent in each region, so efforts to link it to formal conservation policies need to take this diversity into account. This finding aligns with the literature on polycentric governance and co-management, which emphasizes the importance of a contextual approach to natural resource management, where policy effectiveness depends heavily on its alignment with local structures (Sikora et al., 2023). By understanding the institutional variations seen in Tabi and Saireri, the integration of customary rules and state policies can be designed in a more adaptive and inclusive manner, thereby increasing legitimacy, community participation, and the sustainability of conservation practices at the local level.

Evaluating the Gap in Local Knowledge Integration in Formal Policies

Research results indicate a gap between conservation practices based on customary rules and formal conservation policies implemented by the government. Local knowledge developed within communities has not been fully integrated into conservation program planning and implementation, thus underutilizing its potential contribution to effective management.

Table 4. Participant Quotes on the Gap in Integration of Local Knowledge in Formal Policies

Participant Code	Location	Quote
KI-10	Tabi	“Government programs rarely involve customary rules directly.”
KI-12	Saireri	“We are asked to protect the forest, but customary rules are not always recognized.”
KI-13	Tabi	“Sometimes policies come from outside without consultation.”
KI-15	Saireri	“We want to be involved from the start in the planning.”

The finding that local knowledge is not yet fully integrated with official policies underscores the importance of building more open and participatory collaborations between formal stakeholders and indigenous communities. If local knowledge systems are not institutionally recognized, conservation policies can potentially lose social support and the effectiveness of their implementation on the ground.

Numerous conservation studies confirm that programs that ignore the role and knowledge of local communities often face implementation barriers and low sustainability. When conservation approaches are designed top-down without involving communities as knowledge holders and managers of their living spaces, the program's social legitimacy is weakened, and compliance with regulations is difficult to maintain in the long term (Stelbrink et al., 2022). The findings of this study demonstrate a similar situation in the Tabi and Saireri regions, where customary-based conservation practices have been effective but have not been fully integrated into formal policies. From the perspective of collaborative conservation and community-based natural resource management theory, recognizing local knowledge is not only normative but also strategic for strengthening policy effectiveness by enhancing ownership, participation, and collective responsibility (Collins, 2021). Therefore, linking empirical findings with the literature suggests that equal integration between local knowledge systems and formal policy frameworks is an important prerequisite for the success of sustainable and contextual conservation programs.

In many cases, centrally formulated conservation policies tend to neglect the diversity of social, cultural, and ecological conditions at the local level, creating a distance between policy makers and the communities implementing them on the ground. This top-down approach often

triggers a lack of acceptance or even rejection from communities because the regulations applied are perceived as inconsistent with customary norms and long-standing resource management practices (Cavill et al., 2022). Research findings in the Tabi and Saireri regions show a similar trend, where customary knowledge and governance systems effectively regulate bird-of-paradise conservation, but have not yet been fully incorporated into formal policies. Within the theoretical framework of participatory governance and natural resource co-management, conservation success depends heavily on policy alignment with the local context and the involvement of communities as key actors. The literature also shows that when policies are developed through dialogue and recognition of local knowledge, program compliance and sustainability increase (W. D. Robinson et al., 2021). Therefore, linking the results of this study with theoretical studies confirms that alignment between formal policies and local practices is key to reducing community resistance while strengthening the effectiveness of conservation based on local social and cultural realities.

Several studies have emphasized that co-management schemes between governments, conservation agencies, and indigenous communities can be an effective way to bridge the gap between formal policies and local practices. Through this approach, ecological knowledge developed within communities can be integrated with modern scientific findings, resulting in conservation strategies that are more responsive to field conditions (Davis et al., 2020). Study findings in the Tabi and Saireri regions indicate that communities have established functional customary rule systems, habitat monitoring systems, and social sanction mechanisms, but these are not yet fully connected to the official policy framework. From the perspective of co-management and adaptive governance theory, cross-actor collaboration enables knowledge exchange, responsibility sharing, and more inclusive and contextual decision-making. The literature also confirms that integrating two knowledge systems—local and scientific—not only enhances policy legitimacy but also strengthens the effectiveness of resource management because decisions are based on the community's long-term ecological understanding (Blomberg et al., 2022). Thus, linking the results of this study with theoretical studies shows that the co-management model has the potential to be a strategic framework for integrating formal conservation interests with local practices that have proven to be adaptive and sustainable.

Strengthening conservation policies relies heavily on official recognition of customary institutions, which play a key role in regulating resource use and maintaining ecosystem balance at the local level. When customary institutional structures lack formal legitimacy, the rules that exist within communities tend to be marginalized in the policy system and lack bargaining power in decision-making processes. Research findings in the Tabi and Saireri regions indicate that customary norms related to the protection of birds of paradise actually possess significant social power and are widely adhered to by the community, but have not yet been fully integrated into the government's regulatory framework (Martin et al., 2025). From the perspective of institutional recognition theory and legal pluralism, the recognition of local institutions is a prerequisite for the creation of inclusive and effective resource governance, because policy legitimacy stems not only from state authority but also from community acceptance. The literature on community-based conservation also confirms that when customary institutions are formally recognized, coordination between local actors and the government becomes stronger, compliance with regulations increases, and management conflicts can be minimized (Yazdanpanah et al., 2023). Therefore, linking the results of this study with theoretical studies shows that the recognition of customary institutions is not merely symbolic, but rather a strategic step to ensure that conservation policies have a solid social foundation and are able to work in harmony with local practices that have been proven to be sustainable.

Overall, the long-term success of conservation efforts is largely determined by the ability of formal policies to accommodate and integrate long-standing local knowledge within communities. Research in the Tabi and Saireri regions indicates that customary-based

conservation practices have effective systems of rules, monitoring mechanisms, and cultural values for protecting the habitat of birds of paradise. Therefore, when these systems are not integrated into official policies, their potential effectiveness is not optimally utilized. Within the theoretical framework of knowledge integration and adaptive co-management, combining local ecological knowledge with modern scientific approaches is seen as a strategy capable of producing more contextual, participatory, and sustainable policies. The literature also emphasizes that recognizing community knowledge systems not only increases the social legitimacy of policies but also strengthens the resilience of conservation programs to social and ecological change (Skoracki et al., 2024). By linking empirical findings with these theoretical studies, it can be understood that alignment between formal policies and local practices is a crucial factor in ensuring that conservation efforts are not only technically effective, but also accepted and implemented sustainably by communities living alongside protected ecosystems.

Formulating an Inclusive Local Knowledge Integration Model

This study proposes an integration framework that positions customary institutions as strategic partners with the government in conservation management, thus transforming the role of local communities into a core part of the decision-making process. The framework emphasizes equal cooperation, formal institutional recognition, and active community involvement in the planning and implementation of conservation programs, with the goal of building more inclusive, contextual, and sustainable governance without neglecting the cultural values inherent in the community.

Table 5. Participant Quotes on the Inclusive Local Knowledge Integration Model

Participant Code	Location	Quote
KI-18	Tabi	"We are ready to cooperate with the government if customary rules are respected."
KI-20	Saireri	"Collaboration is essential for conservation to succeed."
KI-21	Tabi	"The community must be involved in decision making."
KI-22	Saireri	"The program will be successful if it fits our culture."

For integration to be inclusive, a clear and operationalized institutional framework is required, legitimate recognition of customary norms and authority, and concrete community involvement in the decision-making and implementation process. Without clear structures, legitimacy of local rules, and meaningful participation, integration efforts risk becoming merely symbolic and less effective in practice.

The idea of incorporating local knowledge into conservation practices is increasingly being discussed within the framework of co-management, which positions government and communities as sharing roles and responsibilities in safeguarding natural resources. This approach emphasizes a more balanced distribution of authority, so that decisions are not solely determined by formal authorities but also incorporate the ecological experiences and cultural values inherent within the community. Research findings in the Tabi and Saireri regions indicate that traditional institutions have effective regulatory systems and oversight mechanisms in place to protect birds of paradise, yet their role has not yet been fully recognized in formal policies. From the perspective of co-management and collaborative governance theory, this integration is seen as capable of increasing policy legitimacy, strengthening community compliance, and creating conservation strategies that are more adaptive to local dynamics. The literature also shows that when authority is managed collaboratively and local knowledge is recognized as a legitimate source of information, the success of conservation programs tends to be more sustainable, supported by a sense of collective ownership and responsibility (Stephens et al., 2021). Therefore, linking the results of this study with theoretical studies confirms that a clear division of roles between the government and indigenous communities is an important step in building an effective, inclusive, and contextual conservation system.

An inclusive, integrated framework opens up opportunities for conservation policies that are more sensitive to local social and cultural conditions, ensuring that policy formulation is inseparable from the values, norms, and practices that exist within the community. Policies formulated with local context in mind are generally more easily accepted and implemented because they align with the community's ecological perspectives and experiences. Research findings in the Tabi and Saireri regions indicate that customary rules regarding the protection of birds of paradise have strong social legitimacy, so when these principles are incorporated into formal policies, the chances of successful implementation are greater. From the perspective of contextual governance and community-based conservation theory, the alignment between the policy framework and local realities is a crucial factor in determining the level of compliance and sustainability of conservation programs. The literature also confirms that policies formulated through dialogue with the community tend to generate a stronger sense of ownership and collective responsibility (Song et al., 2024). Thus, linking the findings of this study with theoretical studies shows that integration that respects local values not only strengthens policy legitimacy, but also increases the effectiveness of conservation in the long term because it is supported by active community participation.

Various studies highlight the need for dialogue that connects local knowledge systems with scientific approaches so that both can complement each other in conservation practices. Through equal information exchange, communities' ecological experiences, derived from long-term observations, can be combined with scientific data, resulting in a more comprehensive understanding of ecosystem dynamics. Research in the Tabi and Saireri regions indicates that communities possess detailed knowledge regarding habitat, breeding seasons, and customary rules effective in protecting birds of paradise, but this knowledge has not been fully connected to formal policy frameworks. From the perspective of knowledge co-production and transdisciplinary conservation theory, cross-knowledge dialogue is seen as a crucial mechanism for building trust, reducing perception gaps, and generating more adaptive decisions. The literature also emphasizes that knowledge integration cannot occur unilaterally but requires a continuous communication process between researchers, the government, and the community (Rimlinger et al., 2021). Thus, linking the findings of this study with theoretical studies shows that open and collaborative dialogue forums are key to integrating local and scientific knowledge, so that the resulting conservation strategies are more contextual, inclusive, and effective in the long term.

Efforts to integrate local knowledge into conservation governance cannot be optimal without the support of a clear institutional structure and policy umbrella, as the absence of a legal framework often makes cooperation between indigenous communities and the government temporary and vulnerable to interruption. Research findings in the Tabi and Saireri regions indicate that customary-based conservation practices have been effectively implemented through social and ritual rules, but their connection to formal policies remains limited, resulting in inconsistent cross-stakeholder coordination. From the perspective of co-management and institutional governance theory, successful collaboration is largely determined by formal recognition of the role of customary institutions, clear division of authority, and legally regulated joint decision-making mechanisms. Community-based conservation literature also emphasizes that the existence of regulations that recognize local rights and practices can increase policy legitimacy, strengthen compliance, and maintain long-term program sustainability (Raunsay et al., 2025). By linking the findings of this study with the theoretical framework, it can be understood that the integration of local knowledge requires policy support that is not only normative, but also operational, so that collaboration between the government and indigenous communities can be stable, adaptive, and sustainable in conservation management.

The integration model formulated in this study places cross-actor collaboration, recognition of customary authority, and active community involvement as the primary foundations for sustainable conservation in the Tabi and Saireri customary territories. Field

findings indicate that the most effective conservation practices emerge when customary institutions, government, and local communities work within a framework of mutually respectful partnerships, where customary rules are formally recognized and communities are involved in decision-making and habitat monitoring. In studies of community-based conservation and co-management theory, approaches that emphasize collaboration and recognition of local institutions have been shown to increase policy legitimacy, strengthen social compliance, and encourage the sustainability of conservation programs because they align with local cultural values and practices. The literature on governance in conservation also emphasizes that community participation and recognition of local knowledge systems are essential prerequisites for creating policies that are contextual and adaptive to socio-ecological dynamics. By linking the findings of this study with this theoretical framework, it can be concluded that integration based on collaboration, recognition, and participation not only strengthens the effectiveness of bird-of-paradise conservation but also has the potential to build an inclusive, equitable, and sustainable natural resource management system in the long term.

CONCLUSION

This study concludes with several key findings directly derived from fieldwork. First, local ecological knowledge in the Tabi and Saireri customary areas serves as an operational conservation management system, primarily through hunting prohibitions, determination of breeding seasons, and socially enforced habitat zoning. Second, there are variations in customary governance mechanisms between the more centralized Tabi and the more collective Saireri, but both are effective in ensuring community compliance with conservation rules through social sanctions and rituals. Third, gaps remain between customary-based conservation practices and formal policies, particularly regarding the recognition of customary institutions in government conservation planning. Fourth, integration is most effective when customary institutions, communities, and the government collaborate on habitat monitoring and collective decision-making. These findings suggest that the success of bird-of-paradise conservation is determined not only by ecological factors, but also by the strength of social institutions and customary norms that govern human relations with their habitat. However, this study is limited by the scope of locations and the number of communities studied, so generalizations of the findings should be made with caution and require verification in other customary areas in Papua.

Based on the synthesis of these findings, several actionable policy implications are as follows. First, local governments and conservation agencies need to establish co-management mechanisms that formally recognize the role of customary institutions in determining hunting regulations, habitat zoning, and bird population monitoring. Second, a permanent coordination forum between customary authorities and conservation agencies needs to be established to ensure the integration of local knowledge into conservation planning and to align formal policies with customary norms prevailing in each region. Third, conservation programs should be accompanied by support for locally relevant alternative economic activities, such as the development of community-based ecotourism and non-exploitative craft production, to reduce economic pressures that could potentially drive hunting or forest conversion. These steps are based on empirical research data showing that the recognition of customary institutions and community participation directly increase compliance with conservation regulations.

Moving forward, strengthening the integration model requires consistent institutional support and further research that combines ecological monitoring, socio-economic analysis, and longitudinal studies of customary institutions. Comparative studies across customary territories in Papua are also needed to test the applicability of this integration model in different social contexts. Furthermore, environmental education programs based on local culture and involving the younger generation need to be developed as a strategy for transmitting ecological knowledge between generations. An approach that connects ecological data with customary practices and formal policies is expected to strengthen the contextually adaptive conservation

model, increase the social legitimacy of the policy, and maintain the sustainability of the bird-of-paradise population and forest ecosystems in the Tabi and Saireri customary territories.

RECOMMENDATION

This study recommends the development of a co-management framework that formally integrates local ecological knowledge into bird-of-paradise conservation policies. Local governments and conservation agencies should establish institutional mechanisms that recognize customary rules, sacred forest zoning, and community-based monitoring systems. Furthermore, participatory platforms involving indigenous communities, policymakers, and conservation organizations should be strengthened to ensure inclusive decision-making. Future programs should also incorporate sustainable livelihood alternatives, such as community-based ecotourism, to reduce ecological pressures on bird habitats.

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AUTHOR CONTRIBUTIONS STATEMENT

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Edward Krisson Raunsay	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓

CONFLICT OF INTEREST STATEMENT

The author declares that there is no conflict of interest regarding the publication of this paper. The research was conducted independently without any financial or personal relationships that could have influenced the results.

INFORMED CONSENT

Informed consent was obtained from all participants involved in the study. Prior to data collection, participants were provided with a clear explanation of the research objectives, procedures, and their rights, including voluntary participation and the option to withdraw at any time. Consent was obtained both verbally and in written form.

ETHICAL APPROVAL

This study was approved by the Social Research Ethics Committee of Universitas Cenderawasih under approval number 2025/LEK-07. Additionally, customary approval was obtained through local village deliberations in the Tabi and Saireri traditional areas before conducting fieldwork.

DATA AVAILABILITY

The data supporting the findings of this study are not publicly available due to ethical considerations and the protection of participants' confidentiality, particularly concerning indigenous knowledge. However, anonymized data may be made available by the author upon reasonable request.

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