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EDITED BY

Maiko Sakamoto,
The University of Tokyo, Japan

REVIEWED BY

Melissa Haeffner,
Portland State University, United States
Rossella Alba,
Humboldt University of Berlin, Germany

*CORRESPONDENCE

Mikiko Sugiura
✉ sugiura_mikiko@sophia.ac.jp

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How gentle power enables community-based conservation: hydrosocial practices and institutional support in Tokyo's satoyama

Mikiko Sugiura*

Graduate School of Global Studies/Center for Global Education and Discovery, Sophia University, Tokyo, Japan

Power dynamics significantly influence environmental governance outcomes, yet mechanisms between coercive top-down control and purely voluntary participation remain undertheorized. This study proposes “gentle power” as an analytical concept and examines its functions through a case study looking into 40 years of satoyama conservation in Tokyo's Zushi-Onoji area, employing document analysis and participant observation. Satoyama landscapes exemplify the hydrosocial cycle, where water physically connects forest-wetland-paddy mosaics while being shaped by generations of human management. Local water management and environmental maintenance (e.g., adjustments of paddy field water levels and temperatures) have sustained biodiversity by supporting the reproductive cycles of amphibians and insects, while mitigating methane emissions. Analysis reveals that gentle power enables institutional bricolage through three integrated functions: knowledge integration (legitimizing traditional ecological knowledge through demonstrated effectiveness), institutional transformation (achieving bottom-up policy change through strategic engagement with existing frameworks), and adaptive sustainability (maintaining conservation through flexible role adjustment amid demographic change). These findings suggest that gentle power offers an alternative pathway for community-based conservation, one grounded in mutual trust, demonstrated expertise, and collaborative learning.

KEYWORDS

adaptive governance, community-based conservation, environmental governance, gentle power, hydrosocial cycle, satoyama, social-ecological systems, Traditional Ecological Knowledge

1 Introduction

1.1 Social-ecological systems approach and the development of community-based conservation

Regarding effective environmental conservation—understood as achieving both ecological outcomes (e.g., biodiversity, ecosystem function, water cycle) and social sustainability (e.g., livelihoods, equity, long-term community participation) (Berkes, 2004; Armitage et al., 2020)—new conservation approaches have emerged that go beyond treating social systems and

ecosystems as separate entities. These approaches are based on the concept of including humans within ecosystems through understanding coupled social-ecological systems (SES) (Berkes, 2004). From this systems perspective, conservation success is recognized as arising not from isolated technical or regulatory interventions, but from multi-scale interactions with ecosystems that have multiple, nested subsystems.

As one such systems approach, Community-Based Conservation (CBC) frameworks have been widely adopted. Western et al. (1994) note that while defining CBC uniformly is difficult and counterproductive, its central philosophy emphasizes the coexistence of humans and nature, communities regaining control over their resource management, and improving economic benefits through conservation activities. CBC has evolved from traditional exclusionary conservation (pure nature protection) and buffer zone protection around protected areas and national parks to encompass broader-scale conservation activities, including natural resource use in rural areas. While CBC developed within the context of developing countries, it has also evolved—regardless of whether in developed or developing nations—in a direction that emphasizes community participation and integrates Traditional Ecological Knowledge (TEK) into conservation practices, which thereby aims to reconcile ecological objectives with social needs. The latter has been explored in various locations as one of the resource management approaches through collaboration between local communities and institutional frameworks (Takeuchi, 2010).

However, many CBC initiatives face challenges in achieving sustainable outcomes. Contributing factors include: insufficient understanding of community heterogeneity (Agrawal and Gibson, 1999); difficulties in building trust and sharing goals across various levels of collaboration necessary for adaptive co-management of complex systems (Armitage et al., 2009); insufficient attention to power dynamics among diverse stakeholders—including how power operates through both visible and invisible mechanisms (Cleaver and Whaley, 2018)—and ethical considerations, as well as discontinuities between scientific knowledge and policy (Armitage et al., 2008); and insufficient focus on implementing the rational decision-making processes actually needed due to excessive demands for guaranteed results (Agrawal and Gibson, 1999).

These challenges become particularly complex when conservation goals require integrating scientific knowledge with local ecological practices within social-ecological systems. Traditional governance approaches often rely on “development by design”—mechanisms and institutions imposed by external authorities and consequently tend to neglect context specificity and people’s improvisational practices and agency (Cleaver, 2012). The challenge is not simply involving local communities in conservation activities, but rather developing governance methods that function effectively within the complex dynamics of integrated social-ecological systems.

To address these challenges, two interrelated shifts are required. First, improvisation—what Cleaver (2012) calls “institutional bricolage”—is required to understand governance, which is not as the linear implementation of pre-designed institutions. Second, governance must be seen as shaped by power dynamics through both visible and invisible mechanisms (Cleaver and Whaley, 2018). These shifts are interrelated in that understanding how institutions adapt requires examining power relations that enable or constrain adaptation. Reconsidering power structures is therefore essential for governance in complex social-ecological systems.

1.2 The potential of environmental governance through “gentle power”

Reconsidering power structures in environmental governance provides some useful perspectives on these challenges. Top-down regulatory approaches are ill-suited to nonlinear and unpredictable natural processes, often generating system failures such as superficial compliance and loss of intrinsic motivation rather than genuine commitment to conservation goals (Berkes, 2004). Conversely, even purely voluntary community-based approaches require careful attention to internal power structures and the influence of stakeholder negotiations on decision-making (Agrawal and Gibson, 1999).

In this context, new attempts at understanding power relations in environmental governance that differ from traditional institutional approaches have attracted attention. “Polycentric governance”—dynamics of autonomy and coordination at different scales rather than a single center—has long provided an advanced perspective (Ostrom, 2005; Ostrom et al., 1961). Additionally, “institutional bricolage,” which argues that institutions develop and are modified improvisationally (Cleaver, 2012), the shift from top-down to adaptive co-management (ACM) (Armitage et al., 2009), and the emphasis on transformability to enhance resilience in the transition to adaptive governance (Folke et al., 2005) offer new perspectives. Recent critical institutional analyses further emphasize that understanding adaptive governance requires attention not only to institutional processes but also to power mechanisms—both visible and invisible—and to how meaning is constructed through social interactions (Cleaver and Whaley, 2018). Furthermore, “co-management” based on the principle of subsidiarity, which emphasizes decision-making at the local level, provides important insights (Plummer and FitzGibbon, 2004). It is important to note that this “co-management” is not a fixed state but rather indicates a process of power-sharing through extensive deliberation, negotiation and joint learning within problem-solving networks (Carlsson and Berkes, 2005).

Much of this discourse suggests that more nuanced and complex power relations exist between coercive command-and-control and completely voluntary participation. This study proposes the analytical concept of “gentle power” as a tentative framework for capturing the mechanisms of influence operating in this intermediate space. It is provisionally defined as the exercise of power—or power itself—that achieves environmental governance through collaboration and relationship-building while respecting stakeholder autonomy. Unlike Weber’s classical concept of power as “the ability to influence others despite resistance” (Knoke, 1990) or the distinction in international relations theory between hard power through coercion and soft power through incentives and policy legitimacy (Nye, 2004), gentle power focuses on influence based on mutual trust and collaboration rather than generating resistance or providing incentives.

1.3 Research objectives and contributions

The objective of this study is to exploratively examine how “gentle power” can function in environmental governance through a case study of satoyama conservation activities in Tokyo. This study examines the following working hypothesis by analyzing community-based conservation activities in the Zushi-Onoji Historical Environmental Conservation Area based on documentary sources and participant observation data.

Working Hypothesis: “Gentle power,” a power mechanism which involves neither external coercion nor completely voluntary participation, functions by integrating institutional support with local autonomy. It thereby contributes to effective environmental conservation.

This study is positioned as an exploratory case study. Through case analysis, it aims to inductively derive the manifestation mechanisms of “gentle power” and the conditions for its effectiveness, which thereby provide a theoretical framework for more detailed empirical research. This research offers a new perspective for power analysis in CBC studies while deriving practical implications for adaptive governance in social-ecological systems.

2 Conceptual framework

2.1 Development of power theory in environmental governance

2.1.1 Classical concepts of power

The concept of power is a multifaceted and complex theme, and its complexity, consisting of multiple elements, makes uniform definition and measurement difficult (Lukes, 2004). In classical understandings of power in the social sciences, power is viewed as human interaction, and assuming that actors broadly include not only individuals and groups but also positions and roles, it has been conceived as the ability of one actor (A) to make another actor (a) do something that “a” would not otherwise have done (Dahl, 1957). Beyond actors, it includes constituent elements such as bases of power (resources), means, and scope to provide a framework for systematically analyzing the exercise of influence in relationships between actors. On the other hand, in social-ecological systems (SES), in addition to the challenges of traditional power theory, integration of diverse theoretical perspectives and approaches to power dynamics became necessary to address complex governance challenges premised on interdependencies.

2.1.2 Development of environmental governance theory and its advantages

Regarding the context of water resource governance, for example, discussions of Adaptive Water Governance (AWG)—which emphasizes collaboration and learning—attempt to incorporate the enhancement of adaptive capacity into governance theory through the contextual complexity of social-ecological systems (SES) and polycentric structures involving diverse institutional actors and citizen participation (Pahl-Wostl and Knieper, 2014; Carlisle and Gruby, 2017). Building on these discussions, refinement of power concepts through the distinction between conduct shaping and context shaping based on the directness and indirectness of impacts on humans (Boonstra, 2016), as well as power exercise in polycentric governance and limitations of polycentric governance theory (Morrison et al., 2019), have also been pointed out.

Additionally, McIlwain et al. (2023) critically reviewed a series of power structure analyses in the AWG context, noting that no common definition of “power” can be found across many studies, and that sociological and social theoretical frameworks (such as Giddens, Foucault, and Lukes) that could integrate discourses and knowledge often overlooked in analysis into AWG are insufficiently utilized.

They also raise issues, including insufficient attention to power asymmetries, inadequate response to contextual complexity, and overlooking of pressures within social systems. Shackleton et al. (2023) note that while environmental conservation implicitly engages with power in various ways to achieve conservation outcomes, analytical perspectives on this have been limited, and identify four approaches to power in environmental conservation: actor-centered power, institutional power, structural power, and discursive power. They also propose six analytical guidelines: decision-making, values, ways of understanding conflict, perspectives on winners and losers, participatory schemes, and interventions. Svarstad et al. (2018) identify actor-oriented, neo-Marxist, and Foucauldian approaches as perspectives on power in political ecology, emphasizing the need to combine different power theories to capture the diverse manifestations of power in environmental conflicts and governance. The relational typology presented by Bennett and Satterfield (2018) also emphasizes the need to integrate political ecology and institutionalism in approaching environmental governance, which offers insights into how power shapes institutions and, conversely, how institutions shape power.

In parallel with this diversification of power analysis and integration of theories, institutional approaches concerning the effectiveness of environmental governance have also developed. While Young (2002) does not use the term power, he argues that institutional effectiveness depends on whether institutions “fit” their environment and society, and on the appropriateness of “interplay” with other institutions and “scale.” The view that institutional design and interplay based on norms, values, trust, and knowledge sharing are essential for effective environmental governance implies limitations of coercion-based approaches. As Ostrom (1990) pointed out, coercion-based approaches can achieve rapid behavioral change, but they often generate resistance and may consequently undermine the social relationships necessary for long-term conservation success.

These developments indicate that power in environmental governance operates not through simple coercion or domination but through institutional design and interactions based on norms, values, trust, and knowledge sharing, opening pathways toward more nuanced and context-dependent understandings of power.

2.1.3 Challenges and prospects in power analysis

Despite theoretical advances, important challenges remain in power analysis in environmental governance. Akamani (2023) identifies institutional requirements (awareness, motivation, capacity, opportunity) for transitioning to ecosystem-based adaptation, noting that the concept of adaptive governance itself may become structured and limit the effectiveness of institutions meeting these requirements. On the other hand, in power structure analysis from polycentric systems approaches, warnings have been issued about the “institutional complexity trap” (where transaction costs increase over time and coordination becomes more difficult), which will lead to actor fatigue, policy stagnation, and reduced system capacity to address diverse governance challenges (Morrison et al., 2023).

These challenges, in addition to long-standing issues including insufficient attention to power asymmetries, inadequate response to contextual complexity, and overlooking of pressures within social systems, suggest that theoretical diversity risks fragmenting research agendas and that efforts to integratively apply these insights are necessary.

2.2 Conceptualizing gentle power

2.2.1 Provisional definition and basic characteristics

As discussed in the previous section, power theory in environmental governance has evolved significantly from classical concepts of coercion and domination to complex processes involving diverse actors. Attempts at theoretical refinement and integration have emerged, including: multilayered understandings of power as actor-centered, institutional, structural, and discursive (Shackleton et al., 2023); integration of different theoretical perspectives such as neo-Marxist and Foucauldian approaches (Svarstad et al., 2018); relational typologies to capture the mutual constitution of power and institutions (Bennett and Satterfield, 2018); and institutional approaches emphasizing institutional fit, interplay, and scale (Young, 2002). These demonstrate that power in environmental governance operates not through simple command-and-control but through dynamic processes of collaboration, learning, adaptation, and knowledge integration.

However, conceptual frameworks for capturing the more nuanced exercise of power that exists between coercive command-and-control and completely voluntary participation remain insufficiently developed. This study proposes the tentative concept of “gentle power” to analyze the mechanisms and its functions operating in this intermediate space. In the context of adaptive governance, “middle-range” conceptual frameworks have been proposed to address tensions between empirical contexts and abstract approaches (Sharma-Wallace et al., 2018; Pahl-Wostl, 2009), and similar significance is expected for this exploratory conceptualization.

Gentle power is provisionally defined as the exercise of power that influences environmental governance through collaboration and relationship-building while respecting stakeholder autonomy. In contrast to Weber’s classical concept of power as “the ability to influence others despite resistance” (Dahl, 1957), this concept focuses on influence that promotes collaboration rather than generates resistance. It also differs from Nye’s (2004) concept of soft power in international relations theory (influence through incentives and policy legitimacy as opposed to hard power through coercion). Whereas soft power primarily refers to influence through incentives and attraction, gentle power is understood as influence based not on incentives but on mutual trust, shared norms, and knowledge integration (Table 1). Unlike hard power, which relies on coercion and formal authority to secure compliance, gentle power functions through the demonstration of expertise and sustained collaborative relationships. While it can be understood as a specific form of relational power (Bennett and

Satterfield, 2018), gentle power emphasizes the specific mechanisms through which influence is generated in the environmental governance context—trust-building, knowledge integration, and collaborative learning. Most importantly, gentle power provides an analytical framework for understanding how power relations enable the institutional bricolage processes described by Cleaver (2012), thereby explaining the improvisational institution-building. Gentle power demonstrates how influence based on trust and expertise, rather than coercion or incentives, promotes collaborative adaptation by shifting away from the idea of pre-designed institutions and analyzing power dynamics through visible and invisible mechanisms.

Recent research has enriched the discussion over power in environmental governance. Cleaver and Whaley (2018) argue from a critical institutionalist perspective that three interrelated dimensions of adaptive governance should be considered: process (how arrangements are formed and enacted), power (how they benefit some and fail to serve others), and meaning (how they gain legitimacy and persistence). They further emphasize that power operates not only through formal authority and explicit decision-making (visible power) but also through norms, culture, and everyday interactions (invisible power). The political ecology perspective further emphasizes that water governance inherently involves power relations embedded in a “socio-hydrological configuration” in which water and society mutually constitute each other (Zwarteveen and Boelens, 2014). While such analyses often address structural inequalities and adversarial contexts, gentle power focuses on the potential for collaborative practices and knowledge integration to reconfigure power relations at the local level within existing institutional frameworks. It provides an analytical lens for understanding relational dynamics that enable institutional bricolage (Cleaver, 2012) without relying on coercion or purely voluntary coordination. Gentle power works as an invisible power mechanism, operating through trust and expertise rather than formal command.

2.2.2 Functions and conditions for manifestation in social-ecological systems

In the context of social-ecological systems (SES), gentle power is understood to function across multiple dimensions. First, it facilitates the integration of Traditional Ecological Knowledge (TEK) with scientific knowledge. Through sustained relationships between knowledge holders and learners, locally-specific knowledge systems are incorporated into conservation practices. Second, it enables collaborative decision-making processes that accommodate diverse perspectives. This is achieved not through top-down directives or complete bottom-up approaches, but in a form where local autonomy is

TABLE 1 Gentle power compared to related concepts.

Concept	Primary mechanism	Basis of influence	Relationship to gentle power (GP)
Hard power (Weber, Dahl, 1957)	Coercion, domination	Material resources, formal authority	GP explicitly rejects coercion and command-and-control
Soft power (Nye, 2004)	Attraction, incentives	Policy legitimacy, economic rewards	GP based on trust and demonstrated expertise, not incentives
Relational power (Bennett and Satterfield, 2018)	Mutual constitution of power and institutions	Quality of interactions, network positioning	GP is a specific form of relational power emphasizing collaborative learning and trust
Institutional bricolage (Cleaver, 2012)	Improvisation, hybridization	Existing institutional resources	GP enables bricolage processes by facilitating collaboration without coercion

respected within institutional frameworks. Third, legitimacy of practices is constructed through demonstrated effectiveness that provides concrete evidence of conservation outcomes. These functions are consistent with the effectiveness of institutional “fit” and “interplay” pointed out by Young (2002). They also align with observations that power and privilege embedded in institutions, organizations, and human practices can result in inequitable social-ecological practices (SEP) (May, 2022).

To understand these functions of gentle power, Cleaver's (2012) theory of institutional bricolage provides a useful perspective. Cleaver argues that institutions do not function as designed, but rather are formed and evolve through improvisational “bricolage” of existing customs, norms, rules, and social relations on the ground. As this study focuses on environmental governance, three key elements of bricolage, particularly relevant to it, have been involved: utilization of existing institutional resources, creative institutional transformation, and adaptive adjustment to changing circumstances. In this process, hybrid institutions emerge that combine traditional and modern, formal and informal elements, and institutional legitimacy and authority are socially conferred through such bricolage processes. However, Cleaver's framework does not necessarily explicitly address what kinds of power relations operate in these processes of improvisational institution-building. Therefore, it is not possible to accurately predict how newly introduced institutions will be revised, adapted, socially embedded, or abandoned through institutional bricolage processes (Cleaver, 2002). Gentle power can be positioned as a power mechanism that operates when bricolage occurs improvisationally, manifesting through multiple integrated functions. It contrasts with two extreme approaches: coercive institutional design, which eliminates on-the-ground flexibility and completely voluntary processes, which make coordination costs and legitimacy-building difficult. Gentle power functions as an influence that enables local improvisation within a framework of institutional support while utilizing existing knowledge systems, social relationships, and norms.

Specifically, the following conditions are considered necessary for gentle power to manifest. First is the existence of locally embedded knowledge and practices. Traditional Ecological Knowledge (TEK) and practices rooted in local contexts serve as resources that present alternatives to externally designed institutions. This overlaps with Cleaver's utilization of “existing institutional resources.” Furthermore, when the effectiveness of such local knowledge is substantiated by scientific data such as biodiversity and vegetation recovery, the persuasiveness of these alternatives is strengthened. Second is the integration of institutional framework support with autonomy. Institutional actors such as local governments play a role not in constraining local improvisational initiatives but in providing their foundation and conferring legitimacy. Third is flexibility in adaptive role adjustment. In response to changing circumstances, roles among actors are adjusted in a bricolage-like manner while maintaining conservation goals, rather than remaining fixed. This reframes the adaptability of adaptive governance emphasized by Folke et al. (2005) from the perspective of the quality of power relations. The satoyama conservation activities in Zushi-Onoji examined in this study provide an empirical case demonstrating how gentle power operates in such bricolage processes (Table 1).

2.3 Analytical perspectives

Based on the above conceptualization, this study examines the case from the following three perspectives grounded in Cleaver's

(2012) theory of institutional bricolage: (1) the existence of locally embedded knowledge and practices, (2) integration of institutional framework support with autonomy, and (3) flexibility in adaptive role adjustment. The methodology for specifically applying these perspectives is detailed in the next section.

3 Methodology

3.1 Research approach

This study is positioned as an exploratory case study. According to Yin (2018), case study research is a research approach that seeks to grasp the essence of complex social phenomena, and exploratory approaches in particular play an important role in the trial-and-error process and formation of research design. “Gentle power” in this study is a tentative concept in environmental governance research, and a theory-building exploratory study is appropriate for clarifying its functional mechanisms and conditions for effectiveness.

The reasons for selecting the Zushi-Onoji area in Machida City, Tokyo as the research site are as follows. First, this area has typicality as a satoyama located in suburban areas, embodying the contemporary challenge where urbanization pressure and conservation necessity coexist. Second, institutional transitions from the designation as a conservation area in 1978 to the present are documented to some extent, which enables tracking of governance developments by multiple actors: administration, local communities, and citizens. Third, it is a rare case where the transformation of power relations can be observed through transitions across multiple dimensions: institutions, local government involvement, and local actors' intentions and activities.

The research method adopted an approach combining document-based analysis and participant observation. By grasping institutional transitions and policy contexts through document-based analysis and understanding on-the-ground practices and relational dynamics through participant observation, this study aimed for a multilayered understanding of “gentle power.”

3.2 Data sources and analytical framework

Data for this study were collected from the following multiple sources.

3.2.1 Documentary sources

Primary sources included the management method survey report (1996) by the Tokyo Metropolitan Government Environmental Conservation Bureau's in collaboration with the farmers' association, Machida City's (2022), *Survey on Awareness of Satoyama Environment Conservation and Utilization (2023a)*, and Machida City (2024). These materials provide detailed information on institutional transitions from conservation area designation to the shift to commissioned management, negotiation processes between local residents and administration, the role of Traditional Ecological Knowledge (TEK), and local residents' awareness. It should be noted that our use of TEK follows the broader conservation science definition (Berkes, 2004) of place-based, multigenerational knowledge systems, rather than referring

exclusively to Indigenous peoples' knowledge. Secondary sources included academic literature on satoyama conservation in Japan (Kitagawa, 2003; Kobori and Primack, 2003a,b; Takeuchi, 2010; Takeuchi et al., 2003; Tagoku, 2010, etc.), literature on satoyama ecology and rice paddy management (Washitani, 2001; Natsuhara, 2013), international literature on community-based conservation (Berkes, 2004; Western et al., 1994), and newspaper reports, positioning this case within a theoretical context.

3.2.2 Participant observation data

Data were collected through participation in conservation activities in the Zushi-Onoji area from June 2022 to December 2025. The researcher regularly participated in conservation activities as a member of the citizen supporter organization, Yatomori Club (approximately 27 registered members as of November 2025), observing practices such as farming, water management, and biodiversity surveys. The regular activities were coordinated to support the Machida Rekikan Kanri Kumiai (approximately 10 members). Information (e.g., decision-making processes, knowledge transmission, and inter-organizational relationships) was obtained through interactions with the farmer leader (88 years old as of November 2025) and farmers in their 50s to 80s, Tokyo Metropolitan Government officials, and volunteer members.

Through regular participation in fieldwork as a collaborative team member, the author gained insights into unspoken knowledge practices and social dynamics and developed a nuanced understanding through this sustained participation about how local ecological knowledge is practiced and negotiated in daily interactions, and how power relations operate informally through expertise demonstration, decision-making, and adaptive role adjustments, which aligns with ethnographic traditions in environmental governance research (Cleaver, 2012).

3.2.3 Ethical considerations

This research was conducted in accordance with ethical principles for research involving human participants. All participant observation activities were undertaken with the knowledge and consent of the involved parties. Confidentiality was maintained for all participants, and personal identifying information was protected. As this study involved non-invasive observation of ongoing conservation activities and voluntary interactions with participants in public or semi-public settings, formal ethics committee approval was not required under institutional guidelines. Nevertheless, all data collection adhered to research ethics principles respecting participant autonomy, privacy, and dignity.

3.2.4 Analytical framework

To specifically apply the institutional bricolage perspective presented in Section 2.3, the following analytical methods were employed.

First, as "tracking existing institutional resources," the study extracted from documentary sources and participant observation data how local traditional knowledge, practices, and norms have been utilized. Specifically, it chronologically tracked how water management techniques, seasonal cycles of farming work, and indigenous knowledge of ecosystem management were incorporated into (or excluded from) institutional conservation plans.

Second, as "process analysis of institutional support," the study analyzed policy documents from the Tokyo Metropolitan Government and Machida City, minutes of the farmers' association, and activity records of citizen organizations to clarify how institutional actors have supported and legitimized local autonomy. Particular attention was paid to transitions in formal rules, organizations, and procedures (Ostrom, 2005) and the negotiation processes behind them.

Third, as "observation of adaptive role adjustment," through participant observation, the study recorded how roles among actors changed according to circumstances. Organizational responses to external changes such as aging and typhoon damage were tracked in detail to elucidate the mechanisms of bricolage-like institutional adjustment.

Through these analyses, this study clarifies the interactions between ecological elements (biodiversity, water management) and social elements (knowledge, organizations, institutions) in the social-ecological systems (SES) framework (Ostrom, 2009), and elucidates how gentle power functions in bricolage processes.

3.3 Research limitations and validity

This study has several limitations. First, given its nature as an exploratory case study, it is based on a single regional case, and generalizability is constrained. The study aims to propose the "gentle power" concept and theorize its functional mechanisms, and comparative research will be necessary in the future to assess its applicability to other regions.

Second, regarding data collection, more systematic qualitative data collection (e.g., structured interviews, actor-network analysis) remains a future task. At present, the study focuses primarily on document-based analysis and participant observation with limited quantitative data and long-term monitoring data.

Nevertheless, these limitations do not significantly undermine the validity of this research. In exploratory research, a structured yet flexible approach for detailed description and conceptualization is important in the early stages of theory-building (Eisenhardt, 1989), and the combination of documentary sources and participant observation is appropriate for understanding both institutional transitions and on-the-ground practices. Moreover, the Zushi-Onoji area is distinguished by several features. First, the institutional change in the area has been documented for over 40 years since the 1970s. Through examining long-term governance transformation, the shift of power relations has been observed across institutions, government involvement, and knowledge authority. It contrasts with other indigenous conservation cases focusing on structured injustice in that this showcases urban ecology in a modernizing metropolitan context. It deals with semi-natural environments maintained through human-caused disturbance, incorporating TEK transmission and adaptive governance. Notably, it demonstrates how human agricultural activity can positively contribute to both biodiversity conservation and climate change mitigation.

4 Case study

4.1 Characteristics and contemporary significance of satoyama

The term "satoyama" is a Japanese word combining "sato" (villages) and "yama" (mountains), referring to traditional rural landscapes as a complex mosaic comprising rice paddies, secondary

forests, grasslands, wetlands, etc. (Takei, 2003; Takeuchi et al., 2003). This land-use system was formed through centuries of human-nature interactions and, as Knight (2010) calls it “encultured nature,” embodies social-ecological systems where nature and culture intersect. In satoyama, interdependent resource management has been practiced through regular undergrowth clearing, use of firewood and charcoal, utilization of forest resources such as mushrooms, and maintenance of water source conservation functions. Seasonal water-level control in the paddy fields demonstrates the hydrosocial nature of satoyama, where hydrological processes are inseparable from social practices (Linton and Budds, 2014), bringing biodiversity and ecosystem services in addition to food production (Washitani, 2001; Natsuhara, 2013). This combination of goods and services extends beyond the economic benefits of local communities to provide cultural and spiritual services, playing an important role in shaping Japanese identity (Sasaki, 2018; Kalland and Asquith, 1997).

The transition in satoyama management also represents a transition in environmental stewardship premised on the dynamic relationship between human activities and ecosystem functions. In the latter half of the 20th century, due to the fuel revolution, urbanization, and the mismatch between the postwar timber market centered on imported materials and domestic forestry policies, demand for the forest regeneration system and resource use that required regular harvesting drastically declined. As a result, satoyama were abandoned, satoyama landscapes changed from mosaic to monotonous, and the spread of pine wilt disease and other problems occurred (Takeuchi, 2010; Kamada, 2018). These trends are evident in the South Tama region, where dramatic declines in rice paddies, forests, and wetlands occurred between 1950 and 2020 (Figure 1). However, entering the 21st century, with the re-evaluation of ecosystem services and growing international interest, satoyama—where locally-specific knowledge systems are inherited as important foundations for biodiversity conservation and environmental education—has once again attracted attention (Ito and Sugiura, 2021). The “Satoyama Initiative,” adopted

at the 10th Conference of the Parties to the Convention on Biological Diversity (COP10) in 2010, positions satoyama as Socio-Ecological Production Landscapes and Seascapes (SEPLS), providing an international framework aimed at reconciling biodiversity conservation with sustainable resource use (UNU-IAS et al., 2014). The fact that changes in wetland conditions resulting from water level management in paddy fields contribute to biodiversity demonstrates that human-induced environments ultimately substantiate the interactive relationship between humans and the environment (Natsuhara, 2013). In addition to ecological value as carbon sinks and biodiversity conservation (UNU-IAS et al., 2014; Iwata et al., 2014), the relationship between TK development and satoyama (Cetinkaya et al., 2011) and the perspective of resilience—natural disaster risk reduction utilizing water resource networks (an example of Eco-DRR)—have been pointed out in recent years (Fukamachi, 2023). Thus, in contemporary satoyama research, inheritance of Traditional Ecological Knowledge (TEK), community participation, and approaches to adaptive governance have become major issues, and the Zushi-Onoji area examined in this study is a rare case that has documented practical responses to these challenges over the long term.

4.2 Institutional transitions in Zushi-Onoji

4.2.1 Overview of the study area

The Zushi-Onoji area, the research site for this study, is located in the Tama Hills in northern Machida City, approximately 35 kilometers southwest of central Tokyo (Figure 2). In the dendritic valley topography called “yato,” hillside forests fulfill water source conservation functions while wetlands and rice paddies at the valley bottom support rice cultivation utilizing abundant spring water, forming an interdependent social-ecological system. Water management in the Zushi-Onoji area relies on traditional irrigation techniques coordinated by the farmers’ association. Irrigation

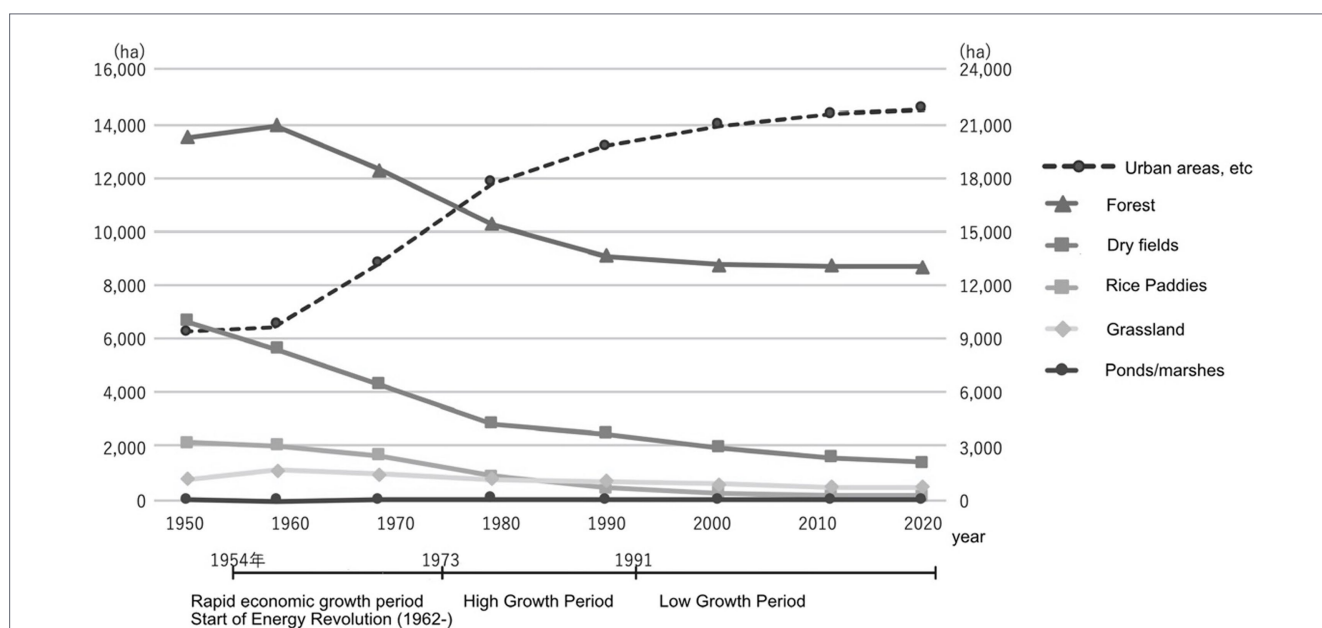


FIGURE 1

Land use changes in South Tama region (1950–2020). Land use transitions showing decline of agricultural and natural habitats during Japan’s rapid urbanization and economic growth (1950–2020). Zushi-Onoji conservation area is located within this region. Source: Adapted from Tokyo Metropolitan Government (2023), Tokyo Red Data Book 2023.

water supply, through small-scale diversion channels from hillside spring water, such as forest streams, represents a characteristic of the Yato valley topography. The system employs simple open channels partly with wooden weirs and earthen levees to manage water flow to valley-bottom rice paddies and wetlands by gravity flow. The farmers' association coordinates seasonal water allocation, including water temperature regulation, management of supplementary water from ponds, and maintenance of the surrounding environment that enables these practices, following traditional agricultural calendars (Figure 3). These practices maintain year-round wetland conditions supporting amphibian breeding while contributing to methane emission reduction. This landscape exemplifies the hydrosocial cycle (Linton and Budds, 2014), where water flow physically connects the forest-wetland-paddy mosaic via generations of human management decisions—water cycle and social practices are mutually constitutive rather than merely interacting. In the urbanizing Tokyo metropolitan area, such semi-natural environments are rare and highly important for biodiversity conservation as habitats for diverse organisms, including amphibians, aquatic insects, waterfowl, and wetland plants (Ministry of Environment, n.d.). In 1978, the Tokyo Metropolitan Government designated this area as a “Historical Environmental Conservation Area” under the “Ordinance on Nature Conservation and Restoration in Tokyo” (Kitagawa, 2003). Since then, institutional transitions in governance by multiple actors—local communities, administration, and citizens—have been documented, from the establishment of the farmers' association in 1992, the introduction of commissioned management in 1996, and the launch of various citizen activity groups before and after that period, including the creation of the citizen supporter group that is the subject of this study in 2022 (Tokyo Metropolitan Government, Bureau of Environment, 1996).

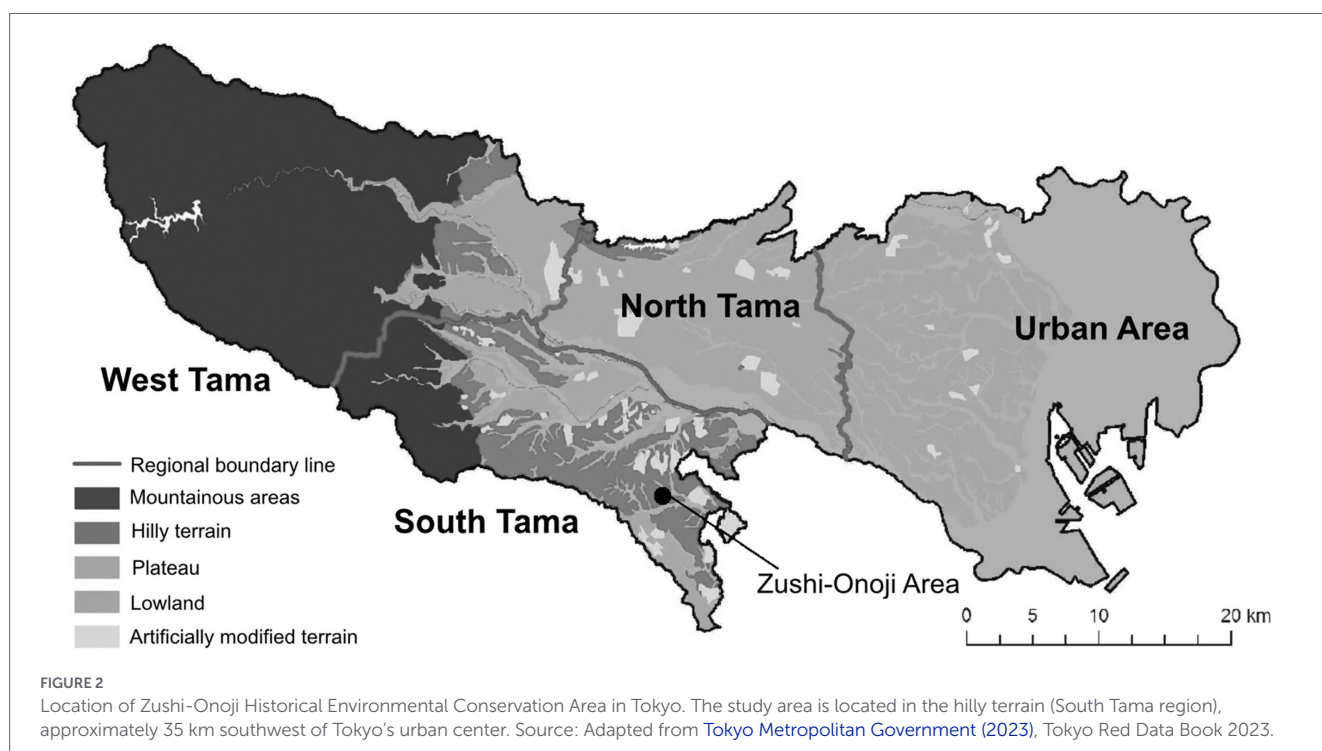
Conservation governance in this area has developed through three stages. In each stage, elements of institutional bricolage—local

knowledge, institutional support, and adaptive adjustment—have interacted with one another, realizing institutional transformation through gentle power.

4.2.2 Stage 1: initial conflict and advocacy (1978–1991)

The designation of the conservation area in 1978 was a regulatory measure to address rapid urbanization, but it imposed strict restrictions on land use, resource use, and economic activities, creating serious conflict with local farmers (Kitagawa, 2003). Farmland within the conservation area was placed in an economically disadvantaged situation: while development was restricted because it was located in urbanization control areas, the tax preferential measures available to farmland in urbanization promotion areas were not applicable.

In response to this situation, local farmers actively engaged in advocacy activities. In a petition dated December 1977 to Governor Minobe Ryokichi, farmers explicitly stated their opposition to the conservation designation: “We absolutely oppose this designation as residents... Do not sacrifice urban farmers who are actively engaged in agricultural practice to development... We earnestly request development that allows us to work” (petition dated December 20, 1977, Tagoku personal archive). Through these negotiations with the Tokyo Metropolitan Bureau of Environmental Protection, they successfully obtained the application of the “Act on Promotion of Public Land Acquisition” (1972), securing a tax deduction of 15 million yen for land within the conservation area and a commitment from the Tokyo Metropolitan Government to consider land prices in urban development areas when purchasing land (Tagoku, 2010; Sasaki, 2018). This represented one of the earliest examples nationwide where this legal framework was applied for natural environment conservation purposes, which demonstrates that community assertions could reconstruct policy implementation.



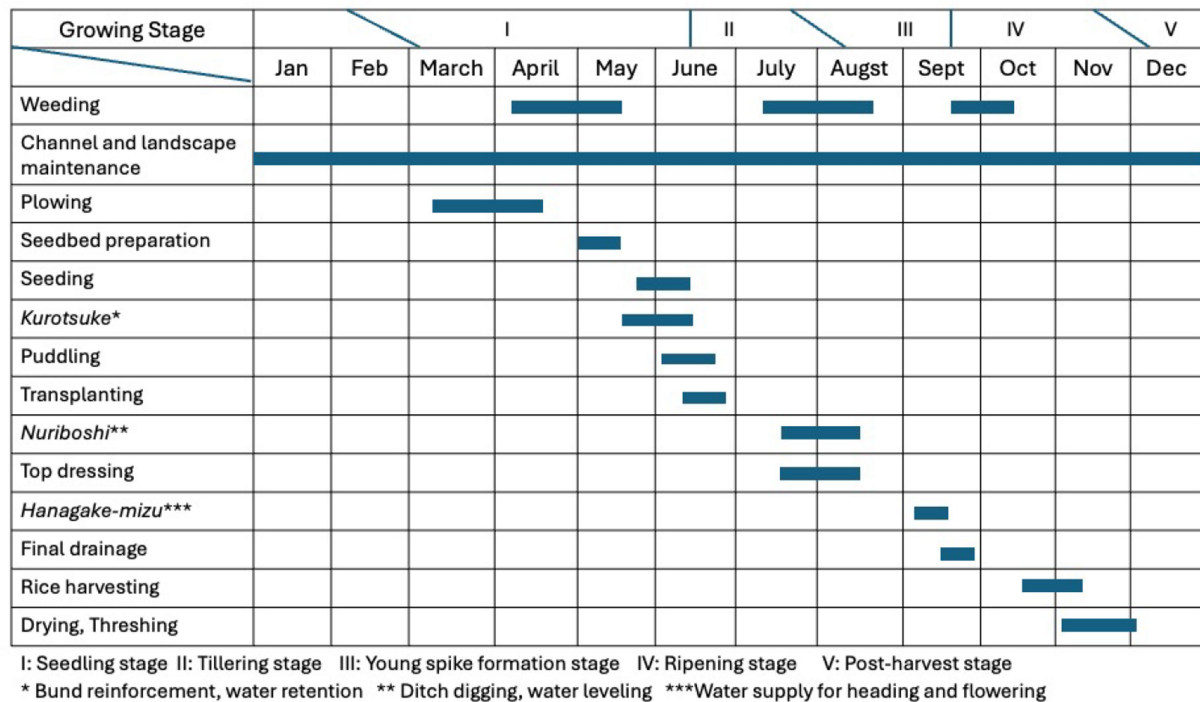


FIGURE 3

Seasonal water management calendar in Zushi-Onoji satoyama. Source: Tokyo Metropolitan Government, Bureau of Environment (1996). Annual management practices coordinated with rice growing stages (I–V). Traditional water management techniques sustain both agricultural productivity and biodiversity.

At this stage, what is important is not that local farmers advocated for the necessity of conservation, but rather that they sought an institutional framework that would enable maintenance of their livelihood base and fair tax measures. Their negotiations were based on their land management experience and awareness as local residents, serving as a precursor to the conservation activities that would subsequently unfold. From an institutional bricolage perspective, this can be understood as strategic negotiation utilizing the legitimacy of public institutions and local customary rights consciousness as “existing institutional resources” (Cleaver, 2012). Resistance to land use regulations, as an approach to legitimize local interests by utilizing existing legal frameworks, can be positioned as an early manifestation of gentle power.

4.2.3 Stage 2: institutional transformation through local knowledge (1992–2022)

The second stage is the process by which local knowledge was incorporated into the core of institutional design. After the 1978 designation, the Tokyo Metropolitan Government implemented vegetation management by contracted companies, but local farmers recognized that these management methods were inadequate from the perspective of ecosystem conservation. The following observation was commonly observed: “distant contractors could not implement traditional yato management methods and only performed simple tasks such as mowing overgrown grass” (Tagoku, 2010). Yato ecosystems require delicate management according to seasonal and ecological cycles, such as water level management in rice paddies, periodic cutting of mixed forests, and mowing of grasslands. The uniform management by contractors could not respond to such complex ecological processes.

In response, local farmers submitted a proposal to the Tokyo Metropolitan Government in September 1992, arguing that “urgent measures by local people (farmers) with rich experience and strong attachment to the area are essential for detailed environmental conservation” (proposal dated September 30, 1992, Tagoku personal archive). Based on this proposal, the “Machida Rekikan Kanri Kumiai” (farmers’ association) was voluntarily established in 1992. The establishment charter explicitly stated their purpose: “landowners and stakeholders will participate in environmental conservation projects, providing labor according to their respective capital and abilities based on the spirit of mutual aid, engaging in environmental conservation and vegetation management within the area” (Tagoku, 2010). In 1996, the Tokyo Metropolitan Government introduced a commissioned management system, which formally contracted the association for vegetation management (Tokyo Metropolitan Government, Bureau of Environment, 1996). This institutional transformation was an important turning point where Traditional Ecological Knowledge (TEK) was formally incorporated into the administrative institutional framework. The commissioned management contract specified three management principles determined by the farmers’ association: (1) ensuring biological diversity, (2) maintaining a favorable yato environment, and (3) prioritizing water environment and upstream flood control. Critically, while the Tokyo Metropolitan Government provided financial support through a commissioned contract, specific management methods were left to the association’s discretion as “experts.” The association practiced conservation activities utilizing water management techniques, agricultural calendars, and local knowledge about flora and fauna that farmers had accumulated across generations.

From an institutional bricolage perspective, “integration of institutional framework support with autonomy” was realized at this stage. By being positioned as commissioned experts, formal authority was added to the association members’ knowledge and practices. As Sasaki (2018) notes, this model demonstrated that “satoyama landscapes are best managed following traditional procedures by local farmers,” a recognition that legitimized their expertise. This expertise-based authority was facilitated by the association leader being a full-time farmer with agricultural knowledge and providing learning opportunities for others.

What deserves attention in this process is that the effectiveness of local knowledge was substantiated by ecological outcomes. As a result of conservation activities by the farmers’ association, biodiversity in rice paddies and wetlands was maintained, with the continued presence of species listed in Tokyo’s Red Data Book (Tokyo Metropolitan Government, 2023). The area, contributing to Tokyo’s Biodiversity Regional Strategy Action Plan 2025 (Tokyo Metropolitan Government, 2025) as one of the primary satoyama conservation sites, reflects its ecological significance. Such concrete outcomes demonstrated that local knowledge is eligible as an ecologically valid ecosystem management method, not merely traditional custom, serving as grounds for strengthening collaborative relationships with the administration. Gentle power here exerts influence not through coercion or commands, but through demonstrated expertise and outcomes.

It is notable that incorporating TEK into scientific research has been sustained through mutual verification between the farmers’ association and researchers. Since the 1990s, the association has continuously hosted ecosystem researchers, providing access to the conservation area and traditional knowledge, enabling long-term field studies. Several doctoral students who conducted dissertation research in this area over 20 years ago continue their research with their own graduate students, and some have returned for the research and class, sustaining a research network community among researchers and the association. These collaborative efforts contribute to the Tokyo Metropolitan Government’s periodic Red Data Book publications, where biodiversity data are scientifically documented and verified. The research network itself publishes an informal annual report and shares the achievements with the association and the administrative staff, creating a feedback loop where scientific findings and traditional knowledge guide research questions. This relationship demonstrates that knowledge integration operates as an ongoing dialogue, where traditional ecological practices and scientific monitoring mutually reinforce each other’s legitimacy.

4.2.4 Stage 3: adaptive response to demographic change (2022-present)

The third stage is the process of adaptive institutional adjustment in response to the new challenges. Entering the 2020s, the aging of core members of the farmers’ association became pronounced. At the time of this study’s participant observation (November 2025), the farmer leader had reached 88 years of age, association membership remained at approximately 10 people, and three members had judged it difficult to participate in conservation activities involving heavy labor due to health issues accompanying aging. Therefore, securing new participants became essential for continuing conservation activities.

While the local government published the 10-year satoyama conservation plan under the master plan and the future vision for 2040

(Machida City, 2022), a citizen volunteer organization, “Yatomori Club,” was established in 2022 to support the association, with the endorsement of the farmers’ association. In addition to this organization, while the public opinion about satoyama conservation varied (Machida City, 2023a; Machida City, 2024), and several other support clubs receiving support from Machida City have already been launched in other satoyama areas within Machida City, each sustainably active (Machida City, 2023b). The difference with this organization is that it aims to cover the area managed by the farmers’ association, assist the association’s activities itself, and cooperate with the farmers’ association. As of November 2025, approximately 27 people are registered, regularly participating in conservation activities at a pace of 4–8 times per month during busy farming periods and 2–3 times otherwise. Among them, Tokyo Metropolitan Government employees or their associates account for half. The number of participants per session is around 10 on “festive” days, such as rice planting, rice harvesting, and harvest festivals, and about 4–6 people participate otherwise. The frequency of activities is determined by the judgment and communication of the club’s vice-representative (a Tokyo Metropolitan Government employee) who lives nearby. This activity framework integrates diverse participants, including urban residents, while maintaining the conventional framework of “management by farmers.”

From the institutional bricolage perspective of “flexibility in adaptive role adjustment,” at this stage the actors of conservation activities are being reorganized according to circumstances. Members of the farmers’ association shifted their role from “practitioners” who performed work themselves to “instructors” who transmit knowledge to volunteers and guide their work. Meanwhile, members of Yatomori Club are positioned not merely as labor providers but as “learners” who directly learn TEK from the farmer leader and understand the significance of conservation.

What was observed through participant observation was the manner in which the farmer leader transmitted knowledge to new participants not imperatively but through demonstration of work and dialogue. For example, in adjusting rice paddy water levels, he explains why that water level is necessary at that time in relation to the life histories of organisms and growth stages of plants. In explaining soil quality, he also refers to uplift from the sea and the discovery of pottery. Such knowledge transmission processes promote participants’ voluntary engagement and understanding, generating intrinsic motivation for conservation activities.

In restoration work after storm damage, club members confirmed the aftermath of the farmers’ association’s fallen tree processing and irrigation channel repairs. Additionally, club members’ participation in the seedling preparation process for rice planting—an important task in rice cultivation—and rice paddy maintenance before planting came to be naturally accepted. This tendency became pronounced in the spring of 2025. In this process, the roles of each actor, which are normally clearly demarcated, were flexibly adjusted, and improvisational cooperative relationships were formed according to circumstances. Such bricolage-like adjustments demonstrate adaptability to unforeseen circumstances that fixed institutional design cannot handle.

At this stage, gentle power functions as “influence that enables institutional flexibility.” The farmer leader integrates diverse actors based on trust acquired through his own expertise and many years of practice, without relying on administrative authority or economic incentives. Participants engage in activities not out of obligation but

based on empathy with the significance of conservation and respect for the leader. This relationship was constructed not through coercion but through mutual understanding and collaborative experience.

4.3 Conservation outcomes

Sustained conservation efforts in the Zushi-Onoji Conservation Area have maintained habitats for endangered species listed in the Tokyo Red Data Book (Tokyo Metropolitan Government, 2023). Populations of the following three amphibian species (all designated as Critically Endangered IA) have been confirmed in this area: Tokyo Daruma Frog (*Pelophylax porosus porosus*), Japanese fire-bellied newt (*Cynops pyrrhogaster*), and Tokyo salamander (*Hynobius tokyoensis*). All 15 native amphibian species inhabiting Tokyo are now Red List species, making the conservation of satoyama wetlands an especially urgent priority.

These conservation outcomes are sustained through the practices of traditional water management in the way of adapting to yato valley topography. Since spring water from hillsides and within paddies is naturally cold, careful temperature adjustment is required for rice cultivation to protect rice from thermal stress, farmers construct shallow channels (*kuro* or *tebi-guro*) around paddy perimeters to warm cold spring water before introducing it to the main cultivation area. Water is also cascaded from upper to lower paddies to increase temperature through sun exposure. In terms of scarcity issues, two ponds provide supplementary water during dry periods. The heterogeneous moisture conditions within yato valleys—ranging from dry paddies (*kawakippa*) to wet paddies (*dobu-tta*)—require frequent monitoring of water levels and bund conditions, particularly during the growing season from spring through autumn. The point is that water management practices require regular vegetation removal and sediment clearing to maintain flow efficiency. This intensive, site-responsive management reflects generations of accumulated knowledge about the valley's microtopography and hydrological characteristics.

Furthermore, traditional water management practices also contribute to climate change mitigation. Irrigation techniques, including intermittent irrigation after mid-season drainage, aiming to reduce methane emissions from rice cultivation (Yagi et al., 1997), have been confirmed to be effective in reducing CH₄ emissions by intermittently aerating the soil, disrupting methane-producing microbial activity (Qian et al., 2023). Comprehensive meta-analysis indicates that these techniques can reduce methane emissions by 31–62% compared to continuously flooded paddy fields while maintaining rice yields (Minamikawa, 2025), which positions traditional satoyama water management as a form of climate-smart agriculture. While site-specific quantification of emission reductions in the Zushi-Onoji area is currently underway through collaborative monitoring with local farmers and institutions, these general findings from established research position traditional satoyama water management as climate-smart agriculture.

4.4 Three integrated functions of gentle power

From the above case analysis, it has become clear that gentle power operates as a power mechanism in the Zushi-Onoji area, manifesting through three integrated functions.

First, as a knowledge integration function, local Traditional Ecological Knowledge (TEK) was incorporated into administrative

institutions as a management method with scientific validity. This was realized through recognition of local knowledge not merely as custom but as expertise. Here, power was exercised through demonstrated expertise and, in that sense, was not derived from formal authority. The knowledge of the farmer leaders gained influence over local governments and stakeholders through visible conservation outcomes. This trust was based not on institutional status, but on the effectiveness of their practices.

Second, as an institutional transformation function, local actors strategically utilized existing legal frameworks to achieve bottom-up institutional transformations such as acquisition of tax preferential measures and proposals for commissioned management systems. This was accomplished not through coercive resistance but through negotiation utilizing legitimacy. They leveraged the legitimacy of conservation efforts to negotiate with government agencies, demonstrating how gentle power functions through collaborative restructuring rather than confrontation.

Third, as an adaptive sustainability function, continuity of conservation activities was maintained by flexibly adjusting roles among actors in response to unforeseen challenges such as aging and environmental changes. It can be noted that the transition of the farmer leader's role from "practitioner" to "instructor" and the integration of citizen volunteers as "learners" demonstrate a bricolage-like adaptation beyond fixed institutional designs. Here, influence operated through relational flexibility: as roles evolved organically, gentle power maintained coherence through mutual adaptation rather than hierarchical control."

These functions are mutually interrelated, indicating that gentle power should be understood not as a single mechanism but as an influence in which multiple elements—local knowledge, institutional support, and adaptive adjustment—operate in multilayered ways.

5 Discussion

5.1 Functional analysis of gentle power in institutional bricolage

The Zushi-Onoji case reveals that gentle power functions as a power mechanism that enables Cleaver's (2012) institutional bricolage processes. Specifically, bricolage processes were supported through the following three integrated functions.

First, the knowledge integration function demonstrates a process of utilizing Traditional Ecological Knowledge (TEK) embedded in the local community—"existing institutional resources"—as material for bricolage. Local knowledge, such as water level management by the farmers' association, seasonal agricultural calendars, and biodiversity oriented techniques, led to effective conservation outcomes, which were presented in Tokyo's Red Data Book as sustained presence of rare species lists and the public recognition in regional conservation strategies (Tokyo Metropolitan Government, 2023). This demonstrates the formation process of Cleaver's concept of "authoritative resources" (socially recognized and legitimate resources). What is important is that this legitimacy was acquired not from formal authority but from demonstrated effectiveness through practices.

Second, the institutional transformation function demonstrates a process of realizing what Cleaver discusses as "institutional

multiplicity” (creatively combining multiple existing institutional elements to generate new institutions). Local farmers strategically utilized the existing legal framework of the “Act on Promotion of Public Land Acquisition” (1972) to acquire tax preferential measures. Through the proposal to introduce the commissioned management system (1996), management authority over the conservation area was transferred from contractors to the local association. This represents a fundamental reorganization of conservation governance. What is important in this process is that local farmers creatively reinterpreted existing legal systems and utilized them in the new context of conservation. Farmers’ influence was based on demonstrated expertise and the ability to position local interests as public goods through biodiversity conservation.

Third, the adaptive sustainability function demonstrates the ability to flexibly reorganize roles and relationships among actors in response to changing circumstances. Facing the demographic change of aging, the farmer leader’s transformation from “practitioner” to “instructor” and the integration of Yatomori Club volunteers as “learners” occurred. Flexible collaboration in rice planting preparation and harvesting are examples of this. The foundation of this adaptive capacity is social capital—trust and reciprocity cultivated over many years. The adaptive governance of Folke et al. (2005) emphasizes precisely such flexible reorganization capacity, demonstrating that this flexibility depends on social capital nurtured by gentle power.

The essence of gentle power is a power mechanism that enables institutional bricolage through these three functions: utilization of existing resources, institutional creativity, and adaptive adjustment. In other words, gentle power is an influence that supports the process by which local actors improvisationally combine existing institutional resources, flexibly adjust according to circumstances, and create new institutions. Whereas Nye’s (2004) soft power emphasizes attraction, gentle power functions through cultivating collaborative relationships in daily practices. It represents the “relational” dimension of power in Bennett and Satterfield (2018)—influence arising not from resource asymmetries but from the quality of interactions.

5.2 Theoretical implications and practical insights

The gentle power framework responds to important theoretical challenges in Community-Based Conservation (CBC) research. Agrawal and Gibson (1999) criticized CBC research’s tendency to idealize local communities and ignore internal power disparities and governance challenges, saying that effective conservation requires more than mere “community participation.” The findings of this study provide one response to this criticism. The Zushi-Onoji case demonstrates that conservation with ecological and social outcomes requires an intermediate governance form in which institutional support enables local autonomy, neither relying on top-down coercion nor on pure bottom-up voluntarism.

In addition, the three concepts presented by Young (2002)—institutional “fit,” “interplay,” and “scale”—receive empirical support in the Zushi-Onoji case. The fit between conservation rules and local ecological knowledge, productive interplay between the Tokyo Metropolitan Government and the local association, and appropriate scaling of decision-making authority supported governance success.

For adaptive governance research, this study provides a concrete example of how theoretical principles are practiced. The principles of flexibility, learning, and collaboration emphasized by Folke et al.

(2005) were implemented through a gentle power mechanism in Zushi-Onoji. Integration of scientific monitoring with traditional knowledge through collaboration among the association, the administrative and research communities, flexible responses to damages by weather, and gradual integration of new participants all represent practical forms of adaptive governance. Particularly important is the counterevidence to the “paradox of learning” pointed out by Armitage et al. (2008). They indicated that learning processes in adaptive co-management can sometimes undermine institutional stability. However, when power relations prioritize knowledge sharing rather than knowledge monopolization, it was observed in the Zushi-Onoji case that learning strengthens rather than destabilizes governance. As the farmer leader acquired authority through demonstrated expertise, he had an incentive to disseminate knowledge widely. This structure enabled the reconciliation of learning and stability.

Practically, three policy implications are derived from the gentle power framework. First is institutionally recognizing and formalizing local ecological knowledge as complementary expertise. In Zushi-Onoji, the Tokyo Metropolitan Government granted a commissioned contract to the farmers’ association and provided compensation in a form that recognized farmers’ contributions to the area and expertise in TEK. This means positioning local knowledge not merely as part of “resident participation” but as expert knowledge on par with scientific expertise. In conservation system design, it is important to position holders of local knowledge not as implementers of policy but as co-designers of policy.

Second is creating legal and financial mechanisms that integrate conservation regulations with livelihood support. The farmers’ success in acquiring tax preferential measures corroborates the fact that conservation policies are unsustainable if they merely restrict land use. When regulations impose costs on local residents, commensurate compensation and support mechanisms are essential. Institutional design that enables the reconciliation of conservation and livelihoods supports long-term conservation success.

Third is investing in structured mechanisms for knowledge transmission. Mentorship arrangements through sustained systems or groups, such as the Yatomori Club, serve to connect experienced practitioners with new participants. This investment means that passing the relationships of trust and reciprocity to the next generation, which form the foundation of gentle power.

As to the transferability of this framework to other contexts, careful consideration is needed about the following three conditions under which gentle power functions effectively. (1) The existence of a local ecological knowledge, (2) institutional actors being open to bottom-up innovation, and (3) conservation goals not fundamentally conflicting or negotiable with community livelihood needs.

These conditions do not exist universally. Particularly in situations where serious resource degradation is progressing and urgent intervention is required, or in contexts with strong centralized governance structures, the gentle power approach will have limitations. Moreover, gentle power could become less adaptive if trust-based relationships become closed networks to resist necessary institutional change. Continuous monitoring of power dynamics is essential to maintaining collaborative governance inclusive and responsive. However, even when ideal conditions are not completely met, it is possible to partially incorporate elements of gentle power. Policy instruments such as promoting knowledge integration through participatory monitoring, creating incentive systems that reward conservation stewardship, and designing governance structures that allow role flexibility are applicable in various contexts. Comparative research examining the operation of

gentle power in different cultural and institutional contexts will more clearly elucidate this issue of transferability.

6 Conclusion

6.1 Main findings

This study conceptualized and analyzed “gentle power” as a distinctive form of influence in environmental governance operating between coercive command-and-control and purely voluntary participation. Through analyzing four decades of satoyama conservation in Zushi-Onoji, three integrated functions in institutional bricolage were identified to operate as a gentle power mechanism: legitimization of TEK through demonstrated effectiveness (knowledge integration), bottom-up policy change through strategic engagement with existing frameworks (institutional transformation), and maintenance of conservation goals through flexible role adjustment (adaptive sustainability). These functions reveal gentle power as a relational mechanism based not on material incentives, formal authority, or normative control, but on mutual trust, demonstrated competence, and collaborative learning.

6.2 Research limitations and future challenges

As this study is positioned as an exploratory single-case study, while achieving the exploratory research objective of theorizing mechanisms that enable institutional bricolage, it has important limitations. First, whether the three functions of gentle power also operate in other social-ecological systems or are phenomena specific to Japanese culture remains unverified. Second, while data collection centered on document-based analysis and participant observation is appropriate for exploratory theory-building (Eisenhardt, 1989), other methods, such as structured interviews, network analysis, and quantitative monitoring, should also be useful. Third, without comparison with cases in which gentle power did not emerge or failed, the necessary and sufficient conditions for this power mechanism remain unclear.

6.3 Future research directions

To develop gentle power from an exploratory concept to a verifiable theory, three research directions are necessary. First, comparative case studies with various governance structures serve to distinguish context-dependent elements of gentle power from others. Second, cross-cultural studies in other SEPLS contexts would verify the applicability of the approach. Third, integration of monitoring outcomes under different power configurations with social network analysis would empirically elucidate the causal mechanisms of gentle power. Through such research extensions, clarifying when, where, and how relationship-based influence mechanisms can contribute to conservation alongside other governance approaches will enrich both scholarly and practical applications of community-based conservation.

Data availability statement

This study presents original theoretical contributions through qualitative analysis of publicly available documents and

participant observation. No quantitative datasets were generated or analyzed. The administrative documents analyzed (Tokyo Metropolitan Government and Machida City reports, 1978–2025) are publicly accessible through respective government websites as cited in the references. Participant observation notes are not publicly available due to privacy and confidentiality commitments.

Ethics statement

Ethical approval was not required for the studies involving humans because this research was conducted in accordance with ethical principles for research involving human participants. Confidentiality was maintained for all participants, and personal identifying information was protected. As this study involved non-invasive observation of ongoing conservation activities and voluntary interactions with participants in public or semi-public settings, formal ethics committee approval was not required under institutional guidelines. Nevertheless, all data collection adhered to research ethics principles respecting participant autonomy, privacy, and dignity. The studies were conducted in accordance with the local legislation and institutional requirements. Verbal informed consent was obtained from participants prior to observation activities. The participants provided their written informed consent to participate in this study.

Author contributions

MS: Conceptualization, Methodology, Writing – review & editing, Funding acquisition, Investigation, Writing – original draft, Data curation, Resources.

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Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The author(s) declared that Generative AI was used in the creation of this manuscript. Generative AI was used to spell check, language editing, conversion of references to Chicago Manual of Style, consistency check between the reference list and in-text citations, and refinement of the title, abstract, and keywords. The author reviewed and revised all AI-assisted outputs and takes full responsibility for the final content.

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