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Adaptive Governance Model: Development of Green Villages Based on the Policy of Siak Green Regency

Model Tata Kelola Pemerintahan Adaptif: Pengembangan Kampung Hijau Berbasis Kebijakan Kabupaten Hijau Siak

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Abstract

Green Villages are a strategic approach to promoting sustainable development, especially in tropical peat areas. This initiative is part of the Green Regency Siak policy in response to the importance of community-based environmental governance in achieving the Sustainable Development Goals (SDGs). However, in-depth studies related to the adaptive governance model in this policy are still limited, both from a theoretical and empirical perspective. This study uses a descriptive qualitative approach with case studies in several villages in Siak Regency that have implemented Green Villages. Data were collected through in-depth interviews, document studies, and participatory observations, and then analyzed thematically using the theoretical framework of adaptive governance. The results of this study found that the adaptive governance model in Siak Regency consists of four main dimensions, namely, multi-actor participation, institutional flexibility, integration of local knowledge, and response to environmental dynamics. Its implementation includes village regulations, restoration programs, and ecological fiscal incentives. This study concludes that the success of Green Villages is largely determined by local adaptive capacity and cross-sectoral support. A collaborative and social learning-based governance framework is needed in dealing with the complexity of sustainable peat ecosystem management.

Keywords

Village; Green Village; Green Governance; Adaptive Governance; Green Siak Policy.

Abstrak

Kampung Hijau merupakan pendekatan strategis dalam mendorong pembangunan berkelanjutan, khususnya di wilayah gambut tropis. Inisiatif ini menjadi bagian dari kebijakan Siak Kabupaten Hijau sebagai respons terhadap pentingnya tata kelola lingkungan berbasis komunitas dalam mencapai Tujuan Pembangunan Berkelanjutan (SDGs). Namun, kajian mendalam terkait model tata kelola adaptif dalam kebijakan ini masih terbatas, baik dari sisi teoretis maupun empiris. Penelitian ini menggunakan pendekatan kualitatif deskriptif dengan studi kasus di beberapa kampung di Kabupaten Siak yang telah mengimplementasikan Kampung Hijau. Data dikumpulkan melalui wawancara mendalam, studi dokumen, dan observasi partisipatif, lalu dianalisis secara tematik menggunakan kerangka teori adaptive governance. Hasil penelitian ini menemukan bahwa model tata kelola adaptif di Kabupaten Siak terdiri atas empat dimensi utama yaitu, partisipasi multi-aktor, fleksibilitas kelembagaan, integrasi pengetahuan lokal, dan respons terhadap dinamika lingkungan. Implementasinya mencakup regulasi kampung, program restorasi, serta insentif fiskal ekologis. Penelitian ini menyimpulkan bahwa keberhasilan Kampung Hijau sangat ditentukan oleh kapasitas adaptif lokal dan dukungan lintas sektor. Diperlukan kerangka tata kelola kolaboratif dan berbasis pembelajaran sosial dalam menghadapi kompleksitas pengelolaan ekosistem gambut secara berkelanjutan.

Kata Kunci

Desa; Desa Hijau; Tata Kelola Hijau; Tata Kelola Adaptif; Kebijakan Siak Hijau.

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1. Introduction

In recent years, the search for sustainable development models at the local level has become increasingly urgent, especially in areas with vulnerable ecological characteristics such as tropical peatlands. Local governments in Indonesia are required to not only encourage economic growth but also ensure environmental sustainability and social justice. This challenge is what drives the birth of a policy approach that integrates the principles of green development (green policy) and adaptive governance, as a framework that can respond to socio-ecological complexity in a collaborative and participatory manner. In Indonesia, the SDGs have been internalized through various policies, including the Village Fund Program which is a strategic fiscal instrument to support local development that is responsive to socio-ecological challenges (Ramdani & Kharisma, 2025).

Green policy emphasizes the integration of economic growth and environmental protection through sustainability-based policy instruments. In this context, the adaptive governance approach is present as a governance model that is dynamic, flexible, and based on social learning. Plummer and Armitage (2010) developed four main pillars of adaptive governance: adaptive capacity, environmental governance, experiential learning, and the linkages of local and global policies. This framework is very relevant in designing ecosystem-based village development policies that are not linear and constantly changing due to social, economic, and climate dynamics.

Natural resource management is crucial in supporting sustainable economic growth. If managed unwisely, the exploitation of natural resources can cause environmental degradation that leads to long-term losses, both in terms of economy, ecology, and society. On the contrary, good natural resource management can strengthen community resilience and encourage local economic innovation. In this context, the adaptive governance approach is increasingly relevant, namely a governance framework that can respond to the dynamics of environmental change flexibly and collaboratively (Subhan et al., 2022).

Various studies have shown that the success of environmental management is highly dependent on the existence of adaptive, participatory, and community-based governance. For example, studies show that the active involvement of citizens in the management of mangrove ecosystems significantly increases ecological resilience. Other studies affirm the importance of cross-actor collaboration, local institutional integration (Rahmawati et al., 2024; Sisca Indriyani et al., 2024; Warouw et al., 2023), as well as institutional support within the Climate Village Program (Sisca Indriyani et al., 2024). Furthermore, it highlights the important value of local wisdom in creating socio-ecological resilience during rapid climate change (Siedenburg, n.d.2022).

Green Villages are a form of community-based policy innovation that combines ecological, social, and economic aspects in a single local governance unit. Different from the conventional village development approach, the development of Green Villages focuses on the conservation of local ecosystems, strengthening village institutions, environmental education, and active participation of residents in development planning and implementation. Through the integration of programs such as organic agriculture, community-based waste management, and peat conservation, Kampung Hijau becomes a socio-ecological laboratory on a micro-scale that answers global challenges.

Siak Regency, Riau Province, is one of the pioneer areas in the implementation of this model through the Green Regency Siak policy. With more than 57% of its area in the form of peatlands and carbon potential of up to 1.5 billion tons, Siak is strategically positioned in national climate change mitigation. The Siak Regency Government adopted the principle of green local governance through Regional Regulation Number 4 of 2022 and Regional Regulation Number 88 of 2024, which

encourage synergy between ecological fiscal incentives, participatory planning, and strengthening village institutions. Green Villages are the main instrument of this policy to bridge the direction of sustainable development from top-down with social dynamics from the bottom up. The following is a map of the distribution of peatlands in Siak Regency, Riau Province.

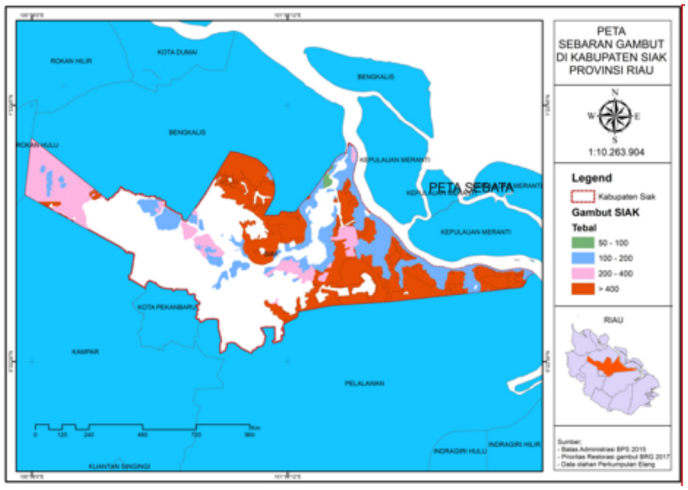

Figure 1. Map of Peat Distribution in Siak Regency, Riau Province

Source: Presentation by Head of Bappeda Siak Regency "Collaborative Finance Practice Supports Siak Green Regency", 2024

The Siak Regency Government has established the Siak Green Regency policy which aims to integrate the principles of sustainable development into local governance. This policy is legally strengthened through Regional Regulation Number 4 of 2022 and supported by implementing regulations such as Regent Regulation Number 88 of 2024 (an amendment from Regent Regulation No. 114 of 2022), which regulates the management of special village assistance in support of the vision of Green Siak (Lailia, 2014). At the heart of the implementation of this policy is the Green Village program, which is a forum for community-based environmental innovation and participatory education to build resilient and productive village communities.

Through this policy, Siak carries the principle of green local governance which not only harmonizes economic and ecological interests, but also strengthens the social dimension through participation, distribution justice, local wisdom, and fiscal accountability. Green Villages are a vehicle where local innovations such as organic agriculture, community-based waste management, and peatland conservation are integrated in village development planning.

This research presents a theoretical and practical novelty in the study of environmental governance, by placing tropical peat areas as the main context and Green Villages as adaptive institutional innovations. The approach used not only captures local practices, but also evaluates the effectiveness of the adaptive governance framework in supporting the achievement of the SDGs at the village level. Through conceptual elaboration, field data, and policy analysis, this research contributes to developing sustainable village governance models that are responsive to today's climate and social challenges.

2. Methods

This study uses a qualitative approach with a descriptive study design to understand in depth the practice of implementing adaptive governance within the policy framework of Green Villages in Siak Regency. Qualitative research was chosen because it was able to explore meanings, dynamics, and social complexities that cannot be explained through statistical procedures. The location of the research was

determined (Niam et al., 2024) purposively by considering the active involvement of the village in the Siak Hijau program, the availability of documentation, and accessibility for observation activities. The villages selected are representations of diverse policy implementation practices in terms of institutional capacity, participatory approaches, and local ecological conditions.

The research informants were also selected purposively with the snowball sampling technique to capture stakeholders who have knowledge and direct involvement in the implementation of the Green Village. The information consists of village officials, community leaders, local economic actors, as well as representatives of related Village Apparatus Organizations (OPD), such as the Regional Development Planning Agency (Bappeda), the Environment Service, and the Community Empowerment Service (PMK). Data collection included semi-structured in-depth interviews, participatory observations, and document studies. Semi-structured interviews are used because (Moser & Korstjens, 2018) they are "guided by a flexible interview protocol" to explore the actor's narrative openly. Observations are made on routine activities in the village, such as waste management, organic farming, or development deliberations. The documents analyzed include regulations such as Regional Regulation No. 4 of 2022, Regent Regulation No. 88 of 2024, reports on Siak Hijau activities, and other related publications. To ensure the validity of the data, this study uses source and method triangulation techniques. Triangulation is carried out by comparing data from interviews, observations, and policy documents to obtain a complete and reliable picture. Triangulation in qualitative research plays an important role in increasing credibility and avoiding single-interpretation bias (Carter et al., 2014; DeJonckheere & Vaughn, 2019).

3. Results and Discussion

Adaptive governance is a governance approach that allows the governance system to adapt to environmental dynamics through learning and policy flexibility. This approach is relevant in the context of community-based natural resource management in Siak Regency, which continues to face ecological challenges such as peatland degradation and forest and land fires (Plummer & Armitage, 2010). In addition to being a means of responding to change, adaptive governance also serves to strengthen institutional capacity, improve the competence of government actors, and encourage the development of systematic regulations and planning. Thus, adaptive governance forms a governance framework that can facilitate the achievement of policy objectives, especially in the collaborative and sustainable management of natural resources (Armitage et al., 2009).

A comprehensive adaptive governance framework for village-based local policy practices. The analysis was carried out based on the four dimensions of adaptive governance theory according to Plummer and Armitage (2010), namely: adaptive capacity potential, environmental governance, experience for practice, and important relationships between global environmental changes.

3.1. Adaptive Capacity Potential

Geographical potential such as the size of the peat ecosystem and the flow of the Siak River show the importance of ecological structures that can support adaptation. However, adaptive capacity does not only depend on natural resources, but on how local actors, institutions, communities, and Micro, Small, and Medium Enterprises (MSMEs) can harness this potential innovatively and sustainably (Angeler et al., 2019).

Siak Regency has a rich geographical and ecological wealth that strongly supports the Green Village initiative. With an area of 8,556.09 km², more than 50%

of this area consists of peat ecosystems that store carbon reserves of up to 1.52 billion tons, making it a strategic area in climate change mitigation. In addition, the potential of Social Forestry in Siak Regency reaches 40,831.18 hectares, which is an opportunity for community-based forest management. This area is also crossed by the Siak Watershed covering an area of 10,423 km², which supports the ecological function and socio-economic activities of the residents.

In addition, the potential of nature and ecotourism is the advantage of Siak Regency in encouraging sustainable development at the village level. One of its assets is the 28,000-hectare Emerald National Park in Dayun Village, which is a primary swamp forest area and a natural lake with the presence of rare fauna such as tigers, red bears, and arowana fish. Then Bungaraya District has six leading sectors in the form of agriculture, ornamental plants, food, fisheries, livestock, and forestry which can be developed as an integrated agro-tourism area.

On the other hand, there are several practices of Micro, Small and Medium Enterprises (MSMEs) that are based on natural resources and local potential in Siak Regency, as summarized in the table below:

Table 1. MSMEs Based on Village-Owned Enterprises (Bumdes/BUMKam) Based on Natural Resources and Local Potential in Siak Regency

	Product Type	Information
1	Pineapple syrup "Mrs. Pina"	Temusai Village, Pusako District
2	Peat snakehead fish albumin branded Albugo	PT Alam Siak Lestari (ASL) from Siak Regency
3	Flour & Snack Kemojo Cake	Bunga Raya District
4	Fruit agroforestry & horticulture in social forestry land	Dayun Village
5	Integrated cattle farming & agroforestry palm plus horticulture	Dosan Village

Source: Processed by Authors, 2025

For the optimization of the Green Village program, of course, further support is needed in terms of strengthening village institutions, improving zoning management strategies and market access, and consistency of funding in various sectors. Green Villages demonstrate adaptive capacity through organic farming training activities, participation-based waste management, and green economy initiatives. Local innovation and social learning processes are important indicators of adaptive capacity that strengthen village resilience (Armitage et al., 2009).

As Bettini et al. (2015) affirm, adaptive capacity in socio-ecological systems is not only determined by the availability of resources, but also by the ability to learn from experience, make evidence-based decisions, and act collectively in the face of challenges such as climate change and environmental crises. As a form of structural support, the Siak Regency Government has implemented the Ecology-based Regency Budget Transfer (TAKE) scheme as a fiscal incentive for villages that show good performance in environmental protection. In 2025, TAKE will be distributed to 92 villages with a total budget of IDR 1,709,069,715, a significant increase from 68 villages in the previous year. These funds are used to support reforestation programs, forest and land fire prevention, and training on ecological indicators and environmental management. As Bettini et al. (2015) explain, adaptive capacity is also manifested in local innovation practices, such as:

a. Temusai Village, which has declared itself as a Green Village since 2019, with a focus on oyster mushroom farming on peatlands and strengthening environmental institutions.
b. BUMKam Dosan and Pusaka Hamlet received TAKE funding support of IDR 179 million for environmental and sanitation facilities in 2024.

c. The incubation program of the Elderly Group Strategy – Visit to the Elderly Family of Siak (SKELAS-KUBISA) encourages the emergence of innovative local products such as pineapple syrup and processed snakehead fish.

Social learning that is part of adaptive capacity is also seen in the way the community responds to the training and technical assistance facilitated through TAKE and collaboration with civil society organizations such as Fitra Riau. This shows the importance of learning-by-doing in strengthening community resilience to environmental pressures.

3.2. Environmental Governance

Environmental governance within the framework of adaptive governance reflects a system that can adapt to socio-ecological dynamics through an inclusive institutional structure, a participatory decision-making process, and a collaborative distribution of responsibilities (Plummer & Armitage, 2010). The strength of adaptive governance lies in the interconnectedness between formal and informal institutions that can move flexibly and respond to environmental uncertainties through a knowledge- and evidence-based process.

From the perspective of green governance, the success of environmental management is largely determined by institutional capacity that can ensure fair distribution of resources, political responsiveness, and active community involvement in the deliberative process. In Siak Regency, this framework is realized through several policies that integrate the ecological dimension into the local fiscal and institutional system. For example, Perbup No. 22 of 2018 became the legal foundation for the implementation of the Green Regency Siak program, which was then strengthened by the Ecology-Based District Budget Transfer (TAKE) scheme, a form of ecological fiscal incentive in the allocation of Village Funds (ADK) (Juhola, 2014).

To facilitate the assessment of environmental performance at the village level, the Green Village Index (IKH) was developed as a two-dimensional and ten-indicator based measurement tool. The IKH is not only an evaluative instrument, but also the basis for providing TAKE incentives, thereby encouraging integration between fiscal governance and ecological governance.

Environmental governance in Siak shows concrete collaborative practices. Regency governments, villages, and civil society organizations such as FITRA Riau jointly carry out socialization, technical assistance, and evaluation of TAKE indicators. Initiatives such as agroforestry in Kampung Temusai with the Riau Core Association and the partnership to overcome forest and land fires demonstrate co-governance practices that are cross-sectoral and cross-scale.

The Green Siak policy at the village level is designed to support sustainable development in line with the regional development goals of Siak Regency. This policy is realized through the Green Village Index, which consists of two main dimensions, namely, Environmental Protection and Economic Improvement.

The Environmental Protection Dimension includes five indicators, namely regulatory policy, budget allocation, institutional strengthening, innovation and activities, and the Ecological Village Index (IDM Ecological). Meanwhile, the Economic Improvement Dimension also includes five similar indicators, namely regulatory policies, budget allocation, institutional strengthening, innovation and economic activities, and the Economic Village Index (IDM Economic). These two dimensions contribute to the performance of green villages (Green Village Performance) which will support the achievement of regional development goals and are listed in the Siak Regency Regional Medium-Term Development Plan (RPJMD) document.

The Siak Hijau policy has three main objectives, namely natural resource management based on the principles of sustainability and sustainability, improving the community's economy and regional income, and structuring natural resources with a conservation, hierarchical, and intensification approach. To realize this goal, a spatial pattern is applied that is divided into four main zones, namely the Conservation Zone, Agriculture and Forestry Zone, Industrial Zone, and Residential Zone. The implementation of this policy involves various parties through the Multistakeholder Forum, consisting of the government, the private sector, the community, civil society organizations/Non-Governmental Organizations (NGOs), and academia, to ensure synergy and effectiveness in achieving the vision of sustainable development in Siak Regency. Through the integration of policies, multi-stakeholder participation, and index-based measurement, Siak Hijau aims to realize environmentally friendly and sustainable village development.

The successful implementation of green policies in Siak Regency is inseparable from the synergy across actors and sectors, which reflects a polycentric and participatory approach to governance. Some forms of strategic collaboration that support environmental governance include:

a. Socialization, technical assistance, and evaluation of TAKE indicators were carried out collaboratively by the Regency Government, Village Government, and Fitra Riau.
b. Implementation of Regent Regulation No. 22 of 2018 through the preparation of village regulations and agroforestry innovations in Temusai Village with the Riau Terrace Association.
c. Partnerships in forest and land fire management and strengthening local awareness, including the construction of the Siak Hijau media portal since 2021 as a public communication channel.

The fiscal dimension is also an important element in strengthening the adaptive capacity of villages. The TAKE scheme that utilizes the Reforestation Fund Revenue Sharing Fund (DBH DR) is directed to support villages that show good ecological performance. This is in line with the ecological fiscal transfer (EFT) approach which places fiscal incentives as recognition of village environmental services (Burchill, 2005).

The Green Village program in this context is not only a tool for environmental intervention, but also a vehicle for real adaptive governance practices. Actors such as local governments, NGOs, the private sector, academics, and village communities are involved in deliberative forums, inter-OPD deliberations, and cross-sector discussions that strengthen planning cohesion (Febrina et al., 2025).

The regulatory framework that supports this governance includes Regional Regulation No. 12 of 2016 concerning the Siak Regional Medium-Term Development Plan (RPJMD) and Regent Regulation No. 22 of 2018 which is a roadmap towards a Green Siak. Regional Regulation No. 4 of 2022 expands this approach by jurisdiction by establishing the Green Siak Coordination Team (TKSH) as an integrative mechanism across actors and institutions (Wicaksono & Agung, 2019).

The implementation of the Siak Hijau policy is regulated through Siak Regency Regional Regulation Number 4 of 2022 concerning the Siak Green Policy, which was later strengthened by the Decree of the Siak Regent. Based on this regulation, TKSH was formed as the main task force responsible for planning, implementing, coordinating, synchronizing programs, supervision, as well as monitoring and evaluating the Siak Hijau policy. TKSH is supported by the Executive Secretariat, which functions to provide technical support such as administrative management,

data collection, information dissemination, program monitoring and evaluation, and building partnerships with stakeholders.

The implementation support structure is divided into three main divisions, namely the Administration Division, the Funding Division, and the Partnership Division, which collaborate closely with various parties. Multistakeholder collaboration involves three main groups. First, 12 Regional Apparatus Organizations (OPD) at the local level, such as Bappeda, the Environment Agency, the Regional Disaster Management Agency (BPBD), the Tourism, Agriculture, Food Security, Industry, Cooperatives and MSMEs, Fisheries and Marine, Public Works and Public Housing (PUPR), and Community and Village Empowerment (PMD). Second, the Sedagho Siak Forum, a civil society coalition consisting of 26 Non-Governmental Organizations (NGOs) such as Fitra Riau, the Indonesian Forum for the Environment (WALHI), the Riau Peat Community Network (JMGR), the Coalition of Independent Institutions for Transparency and Accountability (Kaliptra), the Oil Palm Farmers Union (SPKS), Greenpeace, and others. Third, the private sector, represented by five large companies active in the Siak Hijau initiative, namely Riau Andalan Pulp and Paper (RAPP), Arara Abadi, Sinar Mas, Musim Mas, and Wilmar.

This collaboration reflects an inclusive approach in the implementation of Green Siak, which prioritizes cooperation between the government, civil society, and the private sector to achieve sustainable development goals in Siak Regency.

In line with this, public participation and local institutions are an important foundation of adaptive governance. The Green Village Program actively encourages the involvement of customary institutions, youth organizations, Village Consultative Bodies (BPD), and Village-Owned Enterprises (BUMKam) in planning, supervision, and evaluation of environmental activities. In this case, local legitimacy is built through social accountability and fiscal transparency, in line with the spirit of bottom-up governance. Thus, environmental governance in Siak is directed comprehensively at the district scale, not only sectoral. The success of environmental governance in Siak is supported by a pattern of partnerships between the government, NGOs, and community advocacy, in line with an inclusive collaborative advocacy model (Maulida et al., 2021).

This cross-sector collaboration is also seen in the practice of co-investment between the Healthy and Green Siak Care Group (KPSSH) and private companies, for example in the provision of incentives for forest and land fire prevention and sustainable palm oil certification. This approach proves that adaptive governance can synergize financial, social, and institutional resources simultaneously. Collaborative success is also shown in the practice of (Van Assche et al., 2022) co-investment, where KPSSH and large companies support village programs, such as providing incentives for forest and land fire prevention and smallholder oil palm certification. It shows how adaptive governance can combine institutional and financial resources from different sectors.

Finally, TAKE is not only a fiscal instrument, but also a catalyst for the transformation of village planning capacity ecologically. The TAKE budget supports training, village forums, and the preparation of green development plans that are in line with the principles of green fiscal accountability and the Village Sustainable Development Goals (SDGs) (Febrina et al., 2025).

3.3. Experience For Practice

One of the key pillars of adaptive governance is experiential learning, which provides space for stakeholders to respond to socio-ecological dynamics through reflection, innovation, and policy adjustment in a sustainable manner. (Plummer & Armitage,

2010) This process forms a collective learning cycle that strengthens community resilience and governance effectiveness at the local level.

In Siak Regency, the Siak Green Regency policy and the Green Village program are concrete manifestations of community-based adaptive learning. The initiative serves not only as a policy instrument, but also as a socio-ecological laboratory where innovation practices are tested, participatory approaches are developed, and cross-sectoral knowledge transfer takes place actively:

a. Field-Based Innovation and Adaptive Practice Replication

   Field experiences result in a variety of contextual innovations that grow from the ground up. For example, Dosan Village has been pioneering organic farming on Peatland since 2019. According to WALHI Riau (2022), this method has succeeded in reducing fuel use by up to 70% and increasing crop yields by 30%. This achievement is not only a local success but has been replicated by at least 15 other villages. This shows that adaptive practices that have been proven successful have a high diffusion effect at the inter-village level.

   This learning model is strengthened by the establishment of the Village Waste Bank, the development of green economy-based BUMKam business units, to regular training with academics and NGOs. These practices reflect that the key lessons of the Siak model lie in its ability to combine local action with cross-actor and sectoral knowledge, making it a potential replication model for other regions, particularly those with similar ecological characteristics (Febrina et al., 2025)

b. Village Forum as a Collective Learning Medium

   Adaptive learning is not only individual, but also collective. The village forum is a deliberative space that brings together residents, BPDs, NGOs, academics, and village officials. Data from the Riau Forest Rescue Work Network (Jikalahari) (2023) shows at least 24 active forums with regular meetings. Evaluations show that 85% of forum participants feel more inspired to adopt conservation practices. This suggests that horizontal learning through these forums contributes directly to the internalization of adaptive governance values.

c. Adaptation of the TAKE Incentive Scheme

   The TAKE incentive scheme was developed with a reflective approach. Initially based on quantitative indicators, it is now combined with a qualitative approach to accommodate local innovation. This transformation reflects an important lesson, the flexibility of fiscal policy design based on local experiences can increase village participation and motivation, as well as accelerate the strengthening of adaptive governance.

d. Practice-Based Evaluation and Capacity Building of Village Officials

   Self-evaluation and digital reporting based on the TAKE application encourage villages to conduct annual reflections on achievements and challenges. 122 village operators have been trained, and this practice creates a data-driven learning cycle. This model teaches that monitoring combined with increasing the capacity of village apparatus will strengthen institutional resilience and local accountability. The evaluation of the program to improve the professionalism of village officials shows that direct learning from village work practices increases the adaptive capabilities of village governments (Anto et al., 2024).

   The Siak Hijau TAKE program was implemented from 2021 to 2023, with the aim of encouraging village performance in environmentally sound development. This program is divided into two main schemes, namely the ADK Scheme (District Fund Allocation) and the BKK (Special Financial Assistance) Incentive Scheme in 2023.

   The ADK scheme is implemented through a division formula consisting of three main components. First, the Basic Allocation of 60% is allocated equally to

each village to meet the basic needs of the fixed income village apparatus (SILTAP), with a nominal amount of Rp 745,819,668 per village. Second, the Proportional Allocation of 27% is calculated based on several indicators with a certain weight, namely the size of population (40%), the area (25%), the poverty level (15%), and the level of geographical difficulty (20%). Third, Village Performance of 3%, which is based on the Green Village Index or village ecological performance. The ADK allocation based on the implementation year (2021–2023) can be seen in the table below.

Table 2. ADK Allocation Based on Implementation Year (2021–2023)

Year	Percentage ADK	Total Allocation	Number of Recipient Villages	Highest Incentives	Lowest Incentives
2021	5%	7.582.500.000	67	IDR 229 million	IDR 65 million
2022	3%	3.408.000.000	48	IDR 165 million	IDR 48 million
2023	3%	3.717.808.689	51	IDR 118 million	IDR 49 million

Source: Bappeda Siak Regency, 2024

In addition to ADK, in 2023 a BKK allocation of IDR 2 billion will also be provided, which will be given to 20 villages with the highest Green Village Index values. Villages receiving this incentive are required to prepare activity plans in accordance with regent regulations and focus on environmental issues.

Villages that have a low green performance index or do not follow the self-assessment process automatically lose the opportunity to receive incentives, thus encouraging other villages to actively participate in efforts to preserve the environment and improve sustainable village governance.

The flow of the implementation of incentives in the Siak Green TAKE Program begins with an evaluation of the performance of the village government by the Siak Regency Government which is carried out through self-assessment. The results of the evaluation are then compiled and published in the form of the Green Village Index (IKH), which is a benchmark for the success of villages in implementing green development principles.

Furthermore, the IKH value is used as a basis in determining the number of incentives to be given. In the ADK scheme, the TAKE ADD incentive is only given to villages that obtain an IKH score above average. Meanwhile, in the BKK scheme, 20 villages with the highest IKH scores were selected to receive additional incentives. This approach aims to encourage healthy competition between villages in achieving more environmentally friendly and sustainable development.

As part of efforts to encourage sustainable and environmentally sound village development, the Siak Regency Government has implemented incentive and disincentive schemes through the TAKE Program since 2020. This program measures village performance through participation and submission of IKH-based evaluation data. The following figure presents a recapitulation of the results of the implementation of incentives and disincentives over the past four years, which reflects the dynamics of village participation and the effectiveness of the implementation of the evaluation system.

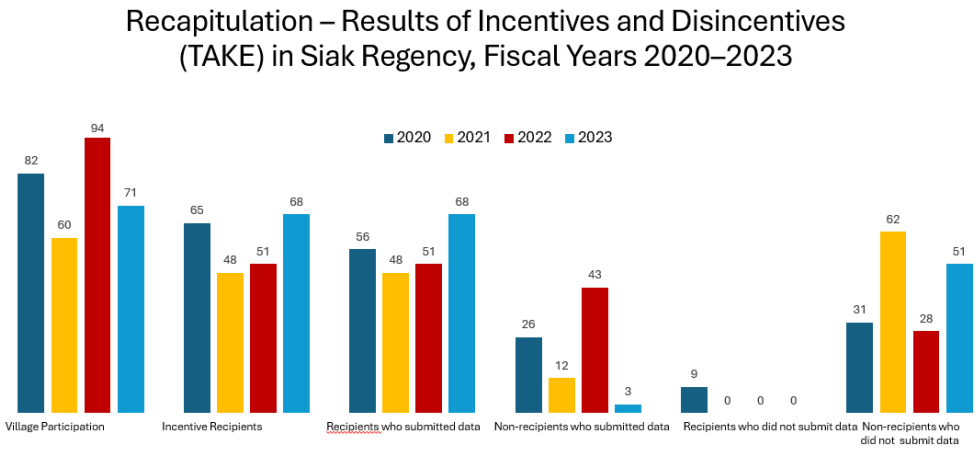

Figure 2. Recapitulation – Results of Incentives and Disincentives (TAKE) of Siak Regency FY 2020-2023

Source: Processed by Authors, 2024

Based on figure 2, in the period 2020 to 2023, the implementation of incentives and disincentives in the TAKE Green Siak Program shows significant developments, especially in village participation and evaluation mechanisms. The assessment was initially carried out manually in 2020–2021, then switched to a digital system through the Siak Hijau TAKE application in 2022–2023, which was proven to increase village participation. The number of participating villages increased from 82 villages in 2020 to 94 in 2022, although it had decreased in 2021 (60 villages) and 2023 (71 villages). Incentive recipients also fluctuated, with the highest number in 2020 (65 villages) and the lowest in 2021–2022 (48 villages). Villages receiving incentives that sent data remained stable (56–68 villages), while non-recipient villages that continued to send data increased dramatically in 2022 (43 villages). Interestingly, none of the incentive recipients submitted data, indicating a high level of compliance. In contrast, non-recipient villages that did not send data reached their peak in 2021 (62 villages) and decreased in 2022 (28 villages). This indicates that the digital system can increase efficiency and encourage active participation of villagers in ecology-based performance evaluation.

e. Field Practice as a Source of Legitimacy and Horizontal Learning

Dayun Village developed peat-based ecotourism which later became an inspiration for other villages. Land conservation practices, the use of green open spaces, and community-based waste treatment show that policy legitimacy is not only formed from above, but also through concrete evidence from below (bottom-up legitimacy). This is in line with the principles of learning-by-doing and learning-from-others that place local experience as the primary source of knowledge and policy direction (Plummer & Armitage, 2010).

The Green Village Model in Siak Regency provides a key lesson that adaptive is not just adapting but also creating a sustainable and institutionally integrated learning space. This approach successfully combines field innovations, reflective incentive systems, horizontal learning, and capacity building, thus forming a resilient policy ecosystem.

The experience of Siak Regency proves that adaptive governance is not only a theoretical discourse but can be implemented in real terms. This model has great potential to be replicated in other areas, especially areas with vulnerable

ecosystems, such as peatlands or coastal areas, which require flexibility, participation, and cross-actor learning as the foundation of policy.

3.4. Important Links Between Global Environmental Change

Rapid global environmental changes are further widening the gap between the need for adaptive responses and institutional capacity at the local level. This discrepancy in the speed of adaptation shows the existence of institutional inequalities that can hinder the effectiveness of environmental policies. Therefore, institutional reform, policy innovation, and local capacity building are the main requirements for bridging these gaps (Cosens et al., 2021).

The Green Village program in Siak Regency is a concrete example of adaptive governance practices that bridge the local scale with the global environmental agenda. This policy not only protects peat ecosystems, but also contributes to the achievement of the SDGs, climate commitments in the Forestry and Other Land Use (FOLU) Net Sink 2030, and collaborative networks such as the Sustainable Regency Network (JKL).

a. The Significance of the Siak Peat Ecosystem in a Global Context

Siak Regency is in the peat landscape of Riau, one of the largest carbon stores in Indonesia. Data from Forest Watch Indonesia (2020) states that forest conversion and fires over the past three decades have contributed significantly to carbon emissions. Therefore, peat restoration is a priority strategy for global climate change mitigation (Paauw et al., 2022).

For comparison, based on a report from the 2022 People's Forest System Support Consortium (KPSHK), Pulang Pisau Regency in Central Kalimantan also has a community-based peat restoration program, but with a policy scope that is still limited to technical interventions. Meanwhile, Siak integrates the ecosystem approach with fiscal, institutional, and village participation governance simultaneously. This shows that Siak is more progressive in making peat ecosystems a foothold for multi-scale policies.

b. Local-National-Global Policy Integration

The Siak Hijau policy is designed in an integrative manner, linking Regional Regulation No. 4 of 2020 with national regulations such as Law No. 32/2009, FOLU Net Sink 2030, and the Riau Hijau Program. Siak's position is in line with areas such as Kutai Kartanegara, which also integrates regional climate action with national policies. However, Siak distinguishes itself by adopting ecological incentives based on village performance, which has not been done much by other districts.

Siak's adaptive policies are even beginning to penetrate the global agenda through the potential for integration with jurisdiction-based carbon markets, which have not been explicitly done in many other regions.

c. Reducing Emissions from Deforestation and Forest Degradation Plus (REDD+) Initiative, Jurisdictional Approach, and Global Collaboration

Siak Regency is one of the national pilot areas in the REDD+ program through the GREEN for Riau scheme, in collaboration with the United Nations Environment Programme (UNEP), the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD), and international partners. Through a jurisdictional approach, Siak positions itself as a pioneer at the subnational level in connecting landscape governance, emission reduction, and access to global incentive schemes.

By comparison, Kapuas Hulu Regency in West Kalimantan has also developed a jurisdictional approach in the context of protected forests and

biodiversity conservation. However, the approach in Kapuas Hulu is more dominant in forest conservation, while Siak combines conservation with village development and fiscal agendas, making it more complex and relevant to adaptive governance (Rendra Oxtora, 2024).

d. Regional Climate Dynamics and Local Adaptation Demands

The El Nino phenomenon increases the risk of forest and land fires (Karhutla) in the Sumatra region, including Siak Regency. Data shows that the highest number of hotspots occurred in 2015, and decreased significantly until the 2025 projection, along with local interventions.

Siak has developed canal blocks, early warning systems, and community-based restoration systemically. This makes Siak a regional model with an adaptation strategy that is not only reactive but also proactive and preventive. Community participation in the development and supervision of environmental infrastructure has been proven to reduce the risk of fire, while strengthening the adaptive capacity of villages. This strategy not only supports emission mitigation but also strengthens resilience to local climate disasters.

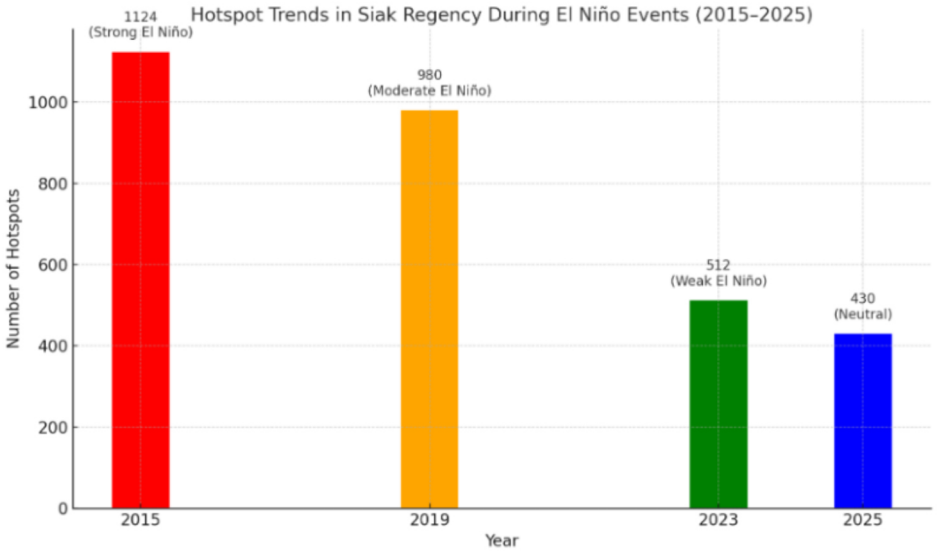

Figure 3. Hotspot Trends in Siak Regency During the El Nino Period (2015–2025)

Source: Ministry of Environment and Forestry (KLHK) – SIPONGI, NOAA, BMKG (Projection 2024–2025)

The figure above shows the relationship between El Nino intensity and the number of forest/land fire hotspots detected in Siak Regency, Riau Province during the period 2015 to 2025.

- 2015 – Strong El Nino (1,124 hotspots), the worst fire season occurred this year. A strong El Nino extends the dry season to an extreme, lowering peat moisture and increasing the risk of major fires.
- 2019 – Moderate El Nino (980 hotspots), although weaker than 2015, El Nino is still causing widespread fires. Emergency response and the beginning of peat restoration programs have begun to be active in several villages.
- 2023 – Weak El Nino (512 hotspots), the number of hotspots decreased as peat restoration interventions, the construction of canal blocks, and more prepared community-based early warning systems were implemented.
- 2025 (Projection) – Neutral Conditions (430 hotspots), this year is not expected to experience a significant El Nino. However, there are still hot spots due to local weather patterns and land-use pressures. The decrease in the number of hotspots reflects the positive results of village adaptive governance, the Green Siak policy, and integration with national agendas such as FOLU Net Sink 2030.

e. Community-Based Adaptive Governance and Multiscale Evaluation

The decline in the trend of hotspots in Siak from 1,124 in 2015 to a projected 430 in 2025 reflects the effectiveness of structured and layered policies, ranging from village planning (APBDes Hijau), ecological fiscal incentives (TAKE), to strengthening local institutions. This achievement is reflected through activities such as:

- Peat ecosystem restoration
- Ecological fiscal incentive scheme (TAKE)
- Integration of green indicators in the Village Revenue Budget (APBDes)
- Strengthening the institutional and social capacity of the village

Thus, Siak demonstrates a more holistic and multi-scale adaptive governance practice, as emphasized by Dorsch & Flachsland (2017), and, namely the importance of interconnectedness between local and global systems in dealing with the complexity of climate change.

4. Conclusion

This study makes an important contribution to the development of adaptive governance frameworks at the local level. Theoretically, the Green Village model in Siak Regency offers conceptual reinforcement of the four main dimensions in adaptive governance (Plummer & Armitage, 2010), namely:

1. Adaptive Capacity Potential

It is manifested in the form of strengthening the capacity of communities and village institutions through the Ecology-based District Budget Transfer (TAKE) scheme, which encourages innovation, involvement of MSMEs, and ecotourism based on local resources. Cross-actor collaboration strengthens responsiveness to environmental risks.

2. Environmental Governance

This dimension emphasizes the integration of actors across sectors through deliberative and participatory processes. Regulatory support such as Regional Regulation No. 4 of 2022 and Perbup No. 22 of 2018 are the legal foundations in operationalizing jurisdiction-based sustainable landscape governance.

3. Experiential Learning

The Green Village is a field-based policy and innovation test room, where conservation practices, organic agriculture, and waste management are sources of knowledge that are replicated across villages. This process is strengthened by data-driven evaluations, community engagement, and adaptation of incentive performance indicators.

4. Relationship with Global Environmental Change

This model successfully connects local efforts with global agendas such as the SDGs, REDD+, and FOLU Net Sink 2030. Through partnerships with international institutions and participation in the Sustainable Regency Network (JKL), Siak Hijau demonstrates how local policies can contribute to climate goals and sustainable development on a global scale.

In practical terms, this study shows that Siak Regency can implement adaptive governance in tropical peatlands through inclusive policies, fiscal incentives (TAKEs), and cross-scale collaboration. The Green Village model is proof that the community-based approach can be applied systemically and replicated in other areas that have similar ecosystem conditions. Siak's experience underscores the importance of institutional flexibility, fiscal sustainability, and social learning in supporting local green policy transformation.

However, this study is still limited to the administrative area of Siak Regency and has not explored the dynamics between other regions or provinces that have different socio-ecological contexts. In addition, the limitations of longitudinal data and the suboptimal involvement of the private sector in in-depth interviews are challenges in the complete picture of multi-stakeholder governance.

Further research is expected to examine the effectiveness of adaptive governance on a broader scale, including comparative exploration between districts or provinces. In addition, a transdisciplinary approach is needed to strengthen integration between green fiscal policies, digital technologies, and ecosystem-based adaptation strategies in supporting sustainable village development. This approach is also important to test the resilience of green policies to political dynamics and extreme climate change.

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