The Representation of The Ecological Crisis in Indonesian Novels: How Does The Social-Ecological System Occur?

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<th>Submitted: 14/02/2024</th>
<th>Revised: 03/03/2024</th>
<th>Accepted: 02/04/2024</th>
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Abstract. While Indonesian novels have been explored for their depiction of ecological crises, there has yet to be a detailed examination of how these narratives reflect the ensuing socio-ecological systems. This study investigates the portrayal of socio-ecological systems within Indonesian novels in the context of ecological crises. Employing qualitative methods and content analysis, this research utilizes the updated socio-ecological systems framework proposed by McGinnis and Ostrom (2014). The findings reveal various aspects of the crises represented, including forest destruction, forest fires, air pollution, animal extinction, and the degradation of natural reserves. Furthermore, the ecological crisis that has occurred actually gives rise to a socio-ecological system that represents the internal relationships among the resource system, government system, resource unit, and actors, and is influenced by external factors such as the social, economic, and political settings, and related ecosystems. Additionally, this representation of the socio-ecological system provides insights into the conditions of the ecological crisis in Indonesia, particularly in palm oil plantations and nature reserves.

Keywords: Ecological Crisis, Social-Ecological System, Indonesian Novels, Ecocriticism

https://ojs.unm.ac.id/eralingua

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INTRODUCTION

The current ecological crisis potentially threatens human life on Earth (Vasan, 2018). This crisis originated with the onset of the Industrial Revolution (Moore, 2017). An indicator of an ecological crisis is the disruption of the existence or the threat to the survival of a population or species due to environmental changes (Onebunne & Okechukwu, 2021). This situation stems from increased exploitation of nature coupled with a partial and reductionist view of modern civilization (Amirullah, 2015). The Slovenian philosopher, Žižek, asserts that this prevalent perspective has arisen because scientific activities continuously receive substantial capital inflows, bolstered by capitalism (Mudhoffir, 2011). These considerations substantiate the claim that the ecological crisis poses a real threat to human life, a situation further aggravated by its roots in satisfying human needs.

Today’s ecological crises, including global warming, climate change, as well as air, soil, and water pollution, significantly impact not only the environmental conditions but also the socio-ecological systems. Numerous studies have demonstrated how the climate crisis adversely affects local socio-ecological systems. For instance, Amico et al. (2020) reported that climate change has triggered outbreaks of Hemileia vastatrix, the fungus responsible for coffee leaf rust, in Mexico and Central America. This phenomenon varies in intensity depending on the legal and institutional resilience across different socio-ecological contexts, thereby reducing the welfare of coffee farmers and adversely affecting the socio-ecological systems. In Indonesia, Kamim (2020) observed that reclamation projects have deteriorated marine ecosystems and precipitated an ecological crisis. The socio-ecological system affected involves communities experiencing reduced incomes due to the loss of their fishing areas. Similarly, another study by Umam (2020) in Indonesia revealed that an ecological crisis has undermined the economic stability of fishermen and farmers in the coastal and inland areas of Sumenep, attributed to unpredictable climatic conditions causing significant financial losses. These studies collectively illustrate that the ecological crisis profoundly influences socio-ecological systems, particularly for communities dependent on natural resources, who have seen substantial declines in their incomes.

The increasingly severe ecological crisis has heightened awareness among Indonesian novelists, who have depicted this crisis in their works through various representations. A representation is an embodiment or construction that conveys specific meanings and achieves a concrete objective. Essentially, it introduces a phenomenon that, although external to the novels, diverges from mere superficial conventional reality (Davidsen, 2018). In this study, we explore not only the representation of the ecological crisis in novels but also the conditions of the socio-ecological systems that have been affected by this crisis.

Complex socio-ecological systems are capable of supporting a diverse array of human-used resources. This capability stems from the system's role in identifying various factors that affect the resource system and enhancing its sustainability, in conjunction with policy interventions (Ostrom, 2009). Utilizing a framework that analyzes different socio-ecological processes, including the utilization and degradation of resources and infrastructure, simplifies the identification of these
factors (McGinnis & Ostrom, 2014). Such a framework significantly contributes to the ultimate goal of fostering human resilience and facilitating adaptation to various environmental changes (Manfredo et al., 2014).

McGinnis and Ostrom (2014) provided an updated framework of socio-ecological systems illustrated in Figure 1. This framework comprises four principal variables: the resource system, resource unit, governance system, and actors. The resource system, an ecosystem with a specific coverage area, is utilized for designated purposes. The governance system includes the entities that manage these resources. These two variables establish the conditions necessary for requisite actions. The interplay between them is shaped by the social, economic, and political environments. The resource unit is a component of the resource system employed as input in various actions. Actors, the individuals involved in these actions, adhere to regulations set by the governance system and are authorized to engage with the resource units. This interaction is influenced by the surrounding ecosystem. Thus, actors play a crucial role in the management of resource units, adhering to the governance system’s rules. Effective management of these units ensures the overall well-being of the resource system.

Figure 1. Socio-Ecological Systems Framework (McGinnis & Ostrom, 2014)

Several focal points exist within the research on the representation of ecological crises in novels, particularly those depicting the crises in specific regions or countries. Sufina & Bhuvaneswari (2018) explored the theme of ecological imbalance in Indian fiction, which they attribute primarily to Westernization and urbanization. This imbalance is depicted as part of the broader ecological crisis. Another study by Stanley & Phillips (2017) examined the literary portrayal of ecology in South Africa, aiming to redefine the interactions between humans and non-humans. They argued that economic rights related to tourism—impacting both animals and humans—have
been compromised by disentangling the connections between race, colonialism, apartheid, and post-apartheid injustices.

In Indonesia, three studies have focused on the literary ecology to examine the causes of ecological crises depicted in novels. The first study identified several crises, including deforestation, the decline in eagle populations, the loss of local flora varieties, pollution in lake waters, erosion on bare hills, soil nutrient depletion, the emergence of leafhoppers, and the introduction of chemical pesticides. These crises stem from human behaviors that treat nature merely as a resource to fulfill personal interests and are driven by egocentric and economic exploitations (Rini, 2018). The second study attributes ecological crises to the clearing of lands for palm oil cultivation, which leads to severe deforestation, droughts, forest fires, wildlife extinction, and a rise in global temperatures (Busairi et al., 2021). The third study links ecological crises to deforestation for economic benefits favored by certain groups (Sawijiningrum, 2018). Collectively, these studies portray the ecological crisis as a consequence of specific economic objectives. These studies can be categorized as literary ecology criticism (ecocriticism), which focuses on the ecological crisis. Consequently, these analyses are limited to examining the conditions of the ecological crisis and do not explore the impact of these crises on socio-ecological conditions.

This research focuses on the representation of socio-ecological systems in Indonesian novels, which is expected to offer a new perspective in understanding the phenomenon of ecological literary studies. This approach is supported by Partelow (Partelow, 2018), who reviewed various studies related to socio-ecological systems and argued that the framework could be applied to numerous ecological instances. Thus, we explore the potential of the socio-ecological system framework to understand the interactions within novels between society and ecological conditions. This exploration addresses a gap in literary ecology research.

RESEARCH METHOD

This research utilized a qualitative methodology to interpret the meaning of texts (Creswell, 2012). The method employed was content analysis, which was used to draw specific conclusions about the texts. This research procedure follows Creswell (2012), beginning with identifying the problem and conducting a literature review, which highlighted that while literary ecological criticism has focused primarily on the ecological crisis itself, it has not yet examined its impact on the socio-ecological system. Subsequently, the purpose of this study is to investigate the socio-ecological systems resulting from the ecological crisis depicted in Indonesian novels.

Data source selection was based on the number of studies listed on Google Scholar concerning novels themed around ecological crises set in forests. This search yielded two novels: Luka Perempuan Asap by Nafi'ah al-Ma'rab, published in 2017, and Kekal: Untuk Semesta yang Semestinya Lestari by Jalu Kancana, published in 2019. The instruments used for data collection, analysis, and interpretation were based on the socio-ecological system framework by McGinnis and Ostrom (2014). This framework enabled us to analyze the socio-ecological systems emerging from the ecological crises portrayed in these novels. The analysis adhered to the technique proposed by Philip Mayring (2000), which involves formulating research questions, providing
theoretical definitions of analysis aspects, establishing analysis criteria, categorizing parts of the text, and interpreting them according to these criteria.

In the final steps, we conducted the writing of results and discussions separately. In the results section, we presented the ecological crises found within the novels, while the discussions focused on their socio-ecological systems. Ultimately, we will provide conclusions along with the study's limitations and recommendations for future research.

RESULT

The novels Luka Perempuan Asap and Kekal: Untuk Semesta yang Semestinya Lestari present varied representations of ecological crises. Generally, Luka Perempuan Asap depicts the ecological crisis in the context of palm oil plantations in the Riau Islands, Sumatra. Conversely, Kekal: Untuk Semesta yang Semestinya Lestari portrays the struggles of environmental activists against corporate exploitation of forests.

Both novels illustrate ecological crises through scenarios such as forest destruction, forest fires, air pollution, droughts, animal extinction, and global warming. Additionally, Kekal: Untuk Semesta yang Semestinya Lestari specifically addresses the destruction of natural preserves. We analyze these portrayals sequentially to offer a comprehensive overview of the ecological crises depicted in these novels.

1. Deforestation

The novel Kekal: Untuk Semesta yang Semestinya Lestari delineates four critical aspects of deforestation. Initially, it highlights a substantial reduction in forest areas, exemplified by a 75% decrease in the forests of Jambi in 2014. Secondly, it notes a significant decline in the natural forests within Berbak National Park, which has also reduced by 75% due to the introduction of a carbon-absorbing tree species. Thirdly, the book criticizes the lax regulatory framework governing forest use, which has allowed rampant exploitation. Lastly, it points out that in some regions, logging activities have been officially sanctioned by governmental permits.

"The problems are numerous. According to the 2014 Regional Environmental Status of Jambi, the reduction in Jambi's forests reached 75% from its previous extent. Meanwhile, the planting of carbon-absorbing tree species in Berbak National Park has further diminished the already reduced natural forest by another 75%." (Kancana, 2019, p. 105)

In reality, as depicted in the novel, deforestation is a critical issue in Indonesia. For instance, between 1990 and 2000, Jambi Province experienced the second-highest deforestation rate in the country, following Riau Province, with an area of 0.04 million hectares affected (Margono et al., 2012; Wijaya et al., 2015). Furthermore, land clearing for palm oil plantations constituted two-fifths of the national deforestation rate, significantly contributing to increases until 2016 (Austin et al., 2019).

Regarding the representation of exploitation and forest usage permits, connections with other studies have been identified, highlighting inconsistencies
between local government regulations and forest conservation efforts. Moreover, policies that overlook ecosystem preservation have exacerbated this situation (Nurfatriani et al., 2015). Consequently, the depiction of forest destruction in this novel provides crucial insights into the drivers of the ecological crisis.

The depiction of forest destruction crafted by the author provides a vivid illustration of deforestation as the underlying cause of the ecological crisis in Indonesia. This portrayal is widely acknowledged and supported by empirical data and observations in the field. Although the data utilized in the novel are not official, they effectively dramatize the issue for readers. Through this representation, readers gain a profound understanding of the struggles faced by the people of Riau as they grapple with the impacts of deforestation.

2. Forest Fires and Air Pollution

The novel Luka Perempuan Asap depicts the clandestine burning of forests for palm oil land clearing, which leads to extensive smog coverage. This smog severely disrupted community activities, rendering the air unbreathable and forcing residents to seal their homes. Consequently, people were compelled to wear masks daily, and a significant number suffered from respiratory diseases. Furthermore, the novel reveals that the arson was typically carried out by villagers hired for a meager salary of one hundred thousand rupiah, yet the companies that employed them faced no penalties.

"People began to seal the gaps in their house walls. Windows were never opened, and all vents were sealed off. Masks were being sold everywhere. ... 'The villagers who burned the land, they were the ones imprisoned. They were tempted by a hundred thousand rupiah, even though they could have worked as palm harvesters instead.'" (Al-Ma’rab, 2017, pp. 237–238).

The novel Kekal: Untuk Semesta yang Semestinya Lestari accurately portrays the illegal forest fires in Riau. These fires not only caused the local wildlife to scatter but also served an ulterior motive: to discredit environmental activists who were criticizing and opposing the company responsible for the fires.

"First, the case of the forest fire allegations in Riau, which involved the late Mr. Murat, my teacher, also apparently included Ridho from Pekanbaru. ... The primary targets of Company C were Ridho and the late Mr. Murat." (Kancana, 2019, pp. 182–183)

The forest fires depicted in the novel were conducted for land clearing purposes. Burning is a method that is easy, economical, and quick for clearing land but is considered a serious offense. This prohibition is explicitly articulated in Article 69 paragraph (1) letter h of the Law of the Republic of Indonesia No. 32 of 2009 on Environmental Protection and Management, which states: "everyone is prohibited from clearing land by burning (Undang-Undang Republik Indonesia Nomor 32 Tahun 2009 Tentang Perlindungan Dan Pengelolaan Lingkungan Hidup, 2009)."
Forest fires are intimately linked with the issue of air pollution, particularly when the burning occurs under arid conditions or near significant peatlands. Under these circumstances, fires tend to spread rapidly, and the formation of smog is inevitable. This smog severely pollutes the air, complicating respiratory activities and increasing the risk of mortality.

The novel’s depiction of this smog phenomenon is grounded in actual events that transpired in Riau. The 2014 haze event in Riau, attributed to forest fires, was marked by a record-high 1,319 hotspots. Additionally, the smog deteriorated air quality to hazardous levels, with an ISPU value exceeding 500 (Mulyana, 2019). Furthermore, one study indicated the difficulty in prosecuting arsonists due to the lack of evidence (Latif & Munir, 2017).

As manifestations of the ecological crisis, the two novels portray forest fires and air pollution distinctively. *Luka Perempuan Asap* offers a detailed account of the air pollution challenges that hinder daily activities. Conversely, *Kekal: Untuk Semesta yang Semestinya Lestari* succinctly narrates the impact of fires on forest fauna.

### 3. Drought

Drought in the ecological areas depicted in the novel is attributed to the high water demands of palm oil trees. *Luka Perempuan Asap* demonstrates that palm oil cultivation is water-intensive, with each tree requiring twelve liters of water to produce its fruit. Consequently, surrounding vegetation often appears wilted, as the palm oil trees deplete the area’s water resources. Additionally, the narrative reveals that the local government has resisted clearing land for palm oil plantations due to concerns over potential water reserve destruction.

"Palm oil consumes a lot of water; over twelve liters per day are used by a single palm oil tree to produce its fruit. Can you imagine the drought that will occur? You will see all the plants around the palm trees die, it could even reach your own backyard. All the plants dry up because the water is completely absorbed." (Al-Ma’rab, 2017, p. 177).

This portrayal of palm trees as high water consumers is not entirely precise. While it is true that palm oil planting can reduce the area’s water discharge by 30%-40% (Taufiq et al., 2013), this reduction is relatively modest compared to other crops like pine, coconut, and acacia, which use more water (Pasaribu et al., 2012). Therefore, the overall water discharge around the plantation is unlikely to decrease drastically.

In the novel *Luka Perempuan Asap*, the depiction of drought induced by palm oil cultivation is portrayed realistically. This narrative element is influenced by the vested interests of local characters: the local government and Mrs. Wilda. The government purportedly uses the drought as a pretext to solicit bribes from palm oil producers, whereas Mrs. Wilda promotes this scenario to secure research funding from international firms.

Conversely, *Kekal: Untuk Semesta yang Semestinya Lestari* raises concerns over the potential reclassification of the Ciharus Nature Reserve into a mining area, a change that would likely diminish water availability and heighten the risk of severe flooding in the Garut region of West Java. This scenario, while theoretical, prompts
readers to contemplate the real-world implications of such ecological changes, thereby deepening their understanding of the issues.

"Even if Ciharus is affected and loses its status as a nature reserve due to the land being freed for mining, I will be alright. At the very least, the water quality managed by Bandung’s Water Supply Company (PDAM) will deteriorate. The city of Garut will also suffer from severe flooding. Even worse, in the coming years, whose exact time is unknown, the quantity will decrease, leading to the PDAM pipes becoming parched and troubled by water shortages." (Kancana, 2019, p. 134)

In both novels, drought is portrayed as a condition of ecological crisis used for dramatic effect and reflection rather than being depicted directly. However, the narratives present concerns about the potential for drought within the broader context of ecological crises. Through this portrayal, the authors aim to encourage readers to approach nature exploration conscientiously and to avoid transforming these explorations into exploitations.

4. Animal Extinction

The novel Kekal: Untuk Semesta yang Semestinya Lestari portrays instances of violence against animals, depicting birds and squirrels fleeing from fires and an elephant being tortured on land cleared for commercial development. Additionally, the novel explores the conflict between tigers and humans in the Hatapang Village area, which arises from deforestation activities conducted by a timber management company. This deforestation has not only shrunk the tiger’s habitat but also diminished its prey base, thereby escalating conflicts with humans.

"The flames quickly spread through the towering trees. Birds flew frantically from the dense foliage, and squirrels scurried from one tree to another. This was the first time I witnessed forest destruction accompanied by human laughter. Even worse, in another video, I saw an elephant being deliberately stabbed by the same group of people. The look in the elephant’s eyes seemed to plead for mercy to the wild." (Kancana, 2019, pp. 79–80)

The extinction of animals due to habitat contraction is a critical issue, with specific species becoming endangered. For instance, in Tesso Nilo National Park, Riau Province, the conversion of land into plantations and settlements has led to the declining populations of Sumatran tigers and Sumatran elephants. In fact, instances of tigers and elephants appearing in residential areas are common (Edorita & Zulwisman, 2021). Additionally, in Lampung Province, the elephant population has decreased by 69% due to deforestation (Maulina et al., 2016). Furthermore, a study has documented that gibbons in the Sumatran Rainforest have altered their eating patterns and behaviors, which has deteriorated their quality of life, due to habitat destruction by fire (O’Brien et al., 2003).

Therefore, the representation in the novel of the potential for animal extinction accords with the reality on the ground. The decreasing number of animal
habitats designated for plantations or settlements illustrates the increasingly critical ecological condition. The crisis is further exacerbated by conflicts between animals and humans. Thus, this representation reflects an imbalance of survival between humans and animals.

5. The Destruction of Natural Reserves

The depiction of the destruction of natural preserves is vividly portrayed in the novel *Kekal: Untuk Semesta yang Semestinya Lestari*. This portrayal is exemplified by the company's efforts to secure a government decree that would authorize commercial activities within the nature reserve. One notable commercial endeavor mentioned is carbon trading. Additionally, the novel highlights that the company planned to clear land within the Bird Island Nature Reserve for these activities.

"Obviously, they desired the SK25 because carrying out commercial activities within a nature reserve clearly violates the law. I am aware of this. Thus, through their cunning methods, they manipulated the law and the academic community to gain access to exploit the nature reserve." (Kancana, 2019, p. 61)

The decree mentioned in the novel as SK25 is, in reality, the Decree of the Minister of Environment and Forestry of the Republic of Indonesia number SK.25/Menlhk/Setjen/PLA.2/1/2018, concerning the Change of Functions of Part of a Nature Reserve into a Nature Tourism Park. The government's intent behind issuing SK25 is to enhance conservation efforts, support water supply for villages, and facilitate geothermal energy utilization. However, activists oppose this downgrade in protection status, citing potential ecological disasters as their main concern (Tuasikal, 2019).

Consequently, the novel *Kekal: Untuk Semesta yang Semestinya Lestari* portrays conservation efforts from the activists’ perspective, who are frequently terrorized and unjustly incarcerated. Such biased representations are typical in green literature, which often emphasizes the necessity of partisanship to safeguard ecological interests amidst worsening environmental crises (Dewi, 2016).

The novel *Kekal: Untuk Semesta yang Semestinya Lestari* champions this cause, depicting the activists' struggle to restore the Kamojang Nature Reserve's original status. The portrayals in the novel are grounded in factual records from digital documents, including news and regulatory texts. However, elements like terror, slander, and the threat of imprisonment should be critically evaluated to ensure they accurately reflect the intended message of the representations.

DISCUSSION

The ecological crisis influences the socio-ecological system, aiding the ecosystem in adapting and better sustaining or enhancing environmental conditions in a consistent and quantifiable manner. The novels *Luka Perempuan Asap* and *Kekal: Untuk Semesta yang Semestinya Lestari* illustrate how the socio-ecological system contributes to maintaining and improving the ecosystem's condition following an ecological crisis. This concept has been integrated into the McGinnis & Ostrom social-ecological system framework, depicted in Figure 2.
In *Luka Perempuan Asap*, the ecological crises portrayed include drought, forest fires, and air pollution, all set against the backdrop of palm oil plantations. Among these, drought is presented as the initial catalyst that disrupts a previously stable socio-ecological system which had functioned effectively for many years. Conversely, in *Kekal: Untuk Semesta yang Semestinya Lestari*, the primary ecological crisis explored is the exploitation of nature reserves for mining. Understanding these dynamics requires examining the efforts to reinstate conservation status and preserve the nature reserves.

The resource system (RS) depicted in the novel *Luka Perempuan Asap* encompasses the palm oil plantation sector in Riau Province, Indonesia. As palm oil plantations expand, extensive new land clearing activities are underway. These developments require proper licensing procedures, preventing landowners from acting arbitrarily. Following the ecological crisis, the region experienced a three-month drought that exacerbated the situation, significantly reducing the productivity of palm oil. This issue was compounded by a drop in selling prices, leading to palm fruits rotting in warehouses.

"There's land being cleared." | "Yes, there's smoke everywhere." | "Is there a permit for this sort of thing?" | "Perhaps there already is." | "But the soil here is partly peat, which will be very difficult to extinguish." (*Al-Ma’rāb, 2017, p. 104*)
In the novel *Kekal: Untuk Semesta yang Semestinya Lestari*, the resource system is represented by a forest designated as a nature reserve, which serves to protect various plant and animal species. This forest is at risk of degradation from potential mining activities that could severely damage its ecological integrity.

"There is a new land clearing project for geothermal mining authorized by SK25 there. We are in a race against time. If Ciharus quickly becomes an international issue and is thoroughly scrutinized by the IUCN, they won’t be able to touch it." (*Kancana, 2019, p. 119*)

Based on these circumstances, capitalism is identified as the root problem, where every individual seeks to act solely in their own interest, which reinforces anti-human natural tendencies and leads to an ecological crisis (*Muthmainnah et al., 2020; Zhang, 2013*). The existence of an ecological crisis disrupts the balance of the resource system. Palm oil plantations can no longer sustain livelihoods nor are they seen as having potential. Additionally, nature reserves are also at risk of degradation due to mining activities.

**The government system (GS)** in the ecological crisis represented in the novel *Luka Perempuan Asap* is the government’s strict land clearing permit regulation. The government is unable to grant these permits as it must first evaluate the environmental impacts on the land, including assessing potential damage or pollution risks. It argues that allowing land clearing for palm oil plantations would significantly affect drought conditions and increase the likelihood of fires. Palm trees, which have high water requirements, are likely to deplete moisture from the surrounding area. Additionally, peatlands, known for their susceptibility to fire, could become new hotspots and are extremely prone to forest fires. These conditions are expected to exacerbate air pollution and smog.

It is estimated that the palm oil you plan to plant could damage the water reserves in the area. Therefore, we cannot grant permission for this land clearing." (*Al-Ma’rab, 2017, p. 95*). The heat has persisted for more than three months without a break of rain. The palm oil fronds are reluctant to sprout due to the lack of water. In a single harvest, where the fields usually produce thousands of kilograms of palm oil, now they yield only hundreds. Coupled with the very low prices, many people are nearly driven to madness (*Al-Ma’rab, 2017, p. 147*).

In the novel *Kekal: Untuk Semesta yang Semestinya Lestari*, the government system primarily addresses the conflicts involving non-governmental organizations (NGOs) that oppose the conversion of the Ciharus Forest into a mining site. This conflict began when the government issued SK25, a permit allowing commercial activities within the nature conservation area. To counter these activities, the activists developed a strategy to gather evidence of ecological destruction in the Ciharus Forest and the illegal actions perpetrated by the company.
"If that's the case, we must complete our research. This will serve as a counter-research to theirs! Then, we'll disseminate it to the outdoor enthusiasts here. Similarly, it should be spread across the media outlets in West Java. We'll simplify the presentation so that the public can easily understand the findings. And we will demand that SK25 be revoked immediately!"

The government system represented in the novel provides evidence that government decisions are crucial in transforming the government system itself. Government policies need to promote sustainable development to achieve a balance between conservation and ecosystem utilization, even though this may cause disruptions to the forestry industry's operations (Suwondo et al., 2018). This is also evident in these novels. In the novel Luka Perempuan Asap, the government's decision supported efforts to minimize the ecological crisis. In Kekal, government policies potentially lead to a new ecological crisis.

Based on the resource system and government system discussed above, evaluative activities are aspects that are regulated to become interactions (I) in focal action situations. Evaluative activities are carried out so that the resource system and government system can run according to their objectives. This approach was once implemented by the Chinese government, which established ecological management policies to monitor and regulate the ecological practices of industries. These policies clarified the legal status of environmental regulatory agencies, including the establishment of stringent administrative accountability measures (Yang, 2015). In this context, permits for land clearing and mining in nature reserves are issues that continue to be evaluated to ensure that the ecological crisis does not have a major impact. Evaluative activities, which are the outcomes (O) of changes in the resource system and government system, are carried out to minimise the threats of ecological disasters such as drought, fire, air pollution, and the reduction of biodiversity.

The changes in the resource system and government system in situations of ecological crisis are influenced by economic, social, and political factors (S). In the novels, several aspects of these factors involve technology and economic development. The technological nature of these factors can be observed in the decline in palm oil productivity due to drought. This is due to the minimal use of technology in regulating water discharge. The community in the novel lacks information about managing water needs for palm oil plantations. Meanwhile, the economic development aspect shown in the novel is the company's pretext that the encroachment of the nature reserve is for economic purposes. Therefore, economic, social, and political settings affect changes in the resource system and government system in ecological crises in terms of technology and economic development.

The resource unit (RU) shown in the novel Luka Perempuan Asap is palm oil as the community's main commodity. Palm oil is described as a commodity that has high value and can make plantation owners and employees affluent. Hidayah et al. (2016) argue that this situation is particularly vulnerable as the community relies solely on one source of income; thus, a decline in palm oil prices can lead to significant income losses. This novel also represents that aspect, showing that the ecological crisis has
caused both palm oil productivity and prices to fall, thereby plunging the community into economic hardship.

"Palm oil prices have completely collapsed, causing widespread complaints. ... In a single harvest, fields that typically produce thousands of kilograms of palm oil now yield only hundreds. Coupled with the very low prices, many people are nearly driven to madness." (Al-Ma’rab, 2017, p. 147)

In the novel Kekal: Untuk Semesta yang Semestinya Lestari, the resource unit depicted is the diversity of animals and plants within the Ciharus nature reserves. This resource unit is at risk of damage due to a land clearing permit for mining. Research on the impact of mining activities on forest degradation has provided clear evidence (see Agussalim et al., 2023; Elcaputera & Frastien, 2020; Pangemanan et al., 2022). This novel also represents these conditions.

"O flora and fauna, forgive those owners who blindly seek money by exploiting the mountains, forests, and seas. Perhaps they fear their families will not have enough clothing, food, and shelter. They have merely forgotten. They have overlooked the ecological factors and buried them beneath economic considerations." (Kancana, 2019, p. 245).

Based on these issues, the resource units depicted in the ecological crisis within the novel include both the number of units and their economic value. Specifically, the number of units refers to the decreased outputs in palm oil production, forest land, and biological diversity. The economic value is represented by the falling prices of palm oil.

The key actors (A) in Luka Perempuan Asap are the government and Kang Marno. The government has implemented stricter land clearing regulations to protect the environment and mitigate the ecological crisis. Although Mun is the protagonist of the novel, he does not play a central role in the socio-ecological system. Conversely, in Kekal: Untuk Semesta yang Semestinya Lestari, the primary actor is Alit Sastera, an activist committed to preserving the Ciharu Forest. Alit Sastera and his colleagues endeavor to prove that land clearing in the nature reserve is a grave error that could precipitate an ecological disaster.

These crises have catalyzed actors to transform the socio-ecological system. Actors strive to modify and navigate the socio-ecological system impacted by the ecological crisis. As stated, the decline in palm oil production and its prices necessitate evaluative activities aimed at identifying solutions to enhance production and economic returns while minimizing environmental repercussions. In these scenarios, actors, including the government and environmental activists like Alit Sastera, are critical in evaluating and responding to changes within the socio-ecological system.

This dynamic between resource units and actors is inseparable from the effects on the related ecosystem (ECO). In Luka Perempuan Asap, the dry season exacerbates the drought conditions, leading to hotspots that potentially ignite forest
fires. This drought not only reduces palm oil yield but also compels the government to enforce stricter regulations on palm oil land clearing. In Kekal: Untuk Semesta yang Semestinya Lestari, the status of the Ciharu Forest as a nature reserve directly influences the survival of its flora and fauna and intersects with the lives of the characters. Maintaining nature reserves is crucial as they play a significant role in regulating climate conditions and supporting biodiversity.

CONCLUSION
The novels Luka Perempuan Asap and Kekal have depicted the ecological crisis occurring in forest areas, including forest degradation, fires, air pollution, drought, animal extinction, and encroachment on nature reserves. However, the ecological crisis reveals its impact on the socio-ecological system at palm oil plantations and the Ciharus Forest (RS). It is evident that both the government and environmental activists play a crucial role (A) in managing governance (GS) to evaluate actions (I) that minimize the threat of ecological disasters (O) such as reduced palm oil productivity due to drought and potential damage to wildlife and plant diversity due to mining (RU). The socio-ecological system observed is influenced by technology and economic development (S) and related ecosystems such as the dry season and the status of nature reserves (ECO). Through these novels, the represented ecological crisis does not occur in isolation but is connected to a broader socio-ecological system.

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