

Potential High Conservation Value of Mount Ungaran as a Step-stone for Essential Ecosystem Area Plan

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ABSTRACT

High conservation value (HCV) helps stakeholders conduct sustainable forest management by considering social and environmental aspects. It requires a high level of protection to ensure the high conservation value of an area persists in the long term. Mount Ungaran is one of the essential areas in Central Java for migratory bird areas, endangered species habitat, and water catchment areas that require fundamental action steps for sustainable conservation. Hence, this preliminary study aims to evaluate the feasibility of Mount Ungaran for HCV assessment as support for terrestrial essential ecosystem areas in Central Java. This preliminary study is an exploratory observational study. Data were collected using observation, interviews, and focus group discussions supported by data analysis from previous studies. Based on the observation, Mount Ungaran meets the criteria for HCV assessment for sustainable development of forest area conservation. However, the application of HCV needs to be considered for cross-sectoral integration and cooperation. The initial evaluation of the potential HCV inventory shows that the Mount Ungaran area has met the conservation area assessment criteria. Furthermore, Mount Ungaran plays an essential role as a habitat of endangered and protected species, provides economic incomes, social and cultural benefits. It makes the Mount Ungaran area ought to be conserved sustainably. Based on these criteria, an HCV assessment needs to be carried out as a first step in the commitment to establishing a crucial terrestrial essential ecosystem area on Mount Ungaran.

Keywords: Biodiversity, Ecosystem protection, Forest protection, HCV, Sustainable development.

1. INTRODUCTION

High conservation value (HCV) aims to help sustainably manage forests by considering social and environmental aspects in wood production [1]. HCV is carried out using a two-stage approach, the first to identify areas within or near the timber management unit area that contain social, cultural, or ecological values of extraordinary importance. The second stage is implementing a management and monitoring system to ensure the maintenance and enhancement of social, cultural, or environmental values [2,3]. Therefore, the basic principle in the HCV concept also states that an area with high conservation value attributes is allowed for development. However, HCV also requires that the

action carried out must ensure the maintenance and enhancement of conservation values in these high conservation value areas [4–6]

HCV requires a high level of protection to ensure the high conservation value of an area persists in the long term. This becomes even more urgent, significantly if the presence of HCV in an area is negatively affected by exploitation practices in forest concession areas, plantations, or forest product production sites. This requires a more significant effort to identify the presence of HCV [7], and through more intensive cross-sectoral stakeholder assessment and consultation [8–10]. Due to the importance of HCV, great care needs to be taken in determining and implementing an appropriate

management approach, complemented by monitoring activities.

Mount Ungaran is one of the areas in Central Java that has various types of ecosystems. Studies on biodiversity and habitat conservation started in 2010 show that Mount Ungaran has a high ecological function as a water source and catchment area. [11, 12]. In addition, Mount Ungaran has high biodiversity, and several species are protected by Indonesian law, IUCN, to CITES [13, 14]. These conditions make Mount Ungaran one of the Important Bird Areas, a vital bird area, and the alliance for zero extinction. However, efforts to protect the biodiversity on Mount Ungaran have obstacles such as the still rampant hunting and trade of wild plants and animals, illegal logging, and changes in land use into tourist areas. Mount Ungaran plays a vital role in people's lives because it provides natural resources that are used as a source of income to health [15, 16]

The Mount Ungaran area requires concrete action steps, one of which is the proposal for the Mount Ungaran area to become one of the terrestrial Essential Ecosystem Areas (KEE) in Central Java. This is reasonable because the Mount Ungaran ecosystem is a life support system with a unique and functional habitat. The Mount Ungaran area also acts as a corridor and habitat for wild plants and animals that are utilized. KEE can be used as an instrument of ecosystem protection outside of Nature Reserves and Nature Conservation Areas that have ecologically essential values. KEE refers to the use of protected ecosystems that support the survival of living things through

biodiversity conservation for the welfare of society and the quality of human life. Based on the above, it is necessary to conduct an HCV assessment study to support the formation of Mount Ungaran as one of the terrestrial KEEs in Central Java and as an effort to conserve biodiversity.

2. METHOD

This preliminary study is an exploratory observational study by combining field-study methods and utilizing a literature review that focuses on the stages: exploring the potential for HCV in Mount Ungaran. Data were collected using observation, interviews, and focus group discussions supported by data analysis from previous studies, which were then used to map potential HCV areas. The study was conducted in a forest area that is in direct contact with the community in Limbangan District (Figure 1).

Respondents were selected purposively with inclusion criteria 1) representing the social strata of the community, such as religious leaders, village office administrators, and elders, 2) having direct contact with the utilization of forest resources in Mount Ungaran. The respondents involved in this research were 30 people, who were local people in the villages of Limbangan and Gondang, at the foot of Mount Ungaran, Kendal Regency.

Interviews were conducted individually or in a guided focus group discussion (FGD) to minimize bias in the perception of understanding by respondents. The data collected was then analyzed through the

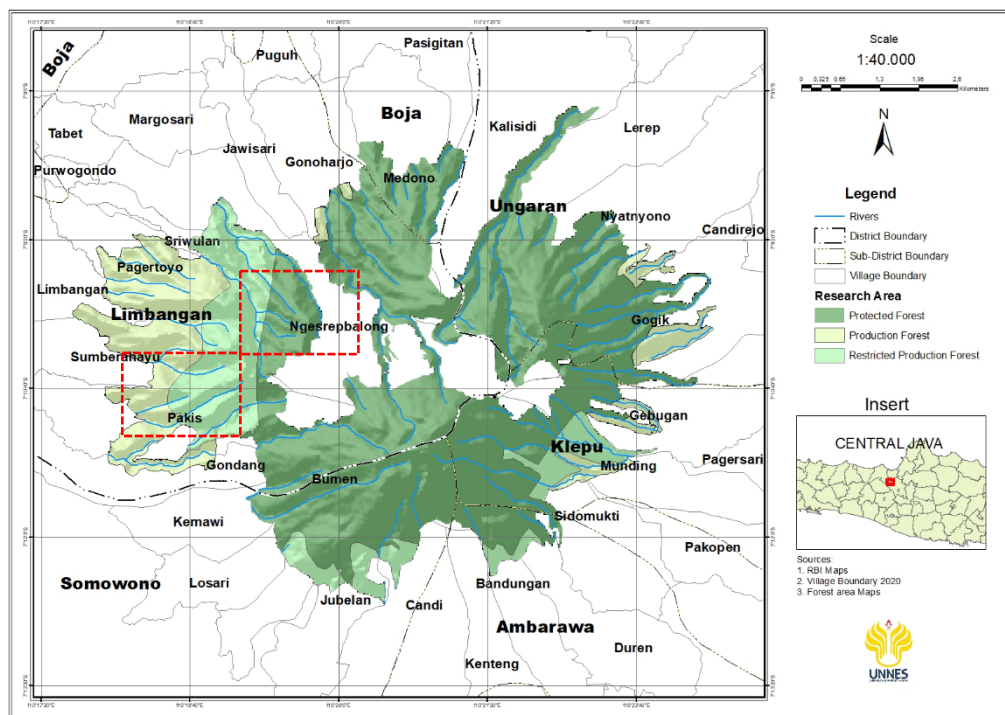


Figure 1. research locations in Mount Ungaran area indicated by red boxes.

triangulation stages of field observations, interviews, and literature studies. The data collected and gone through the triangulation stage are then grouped according to HCV clusters 1 – 6 for interpretation.

3. RESULT AND DISCUSSION

The preliminary study results of HCV in the Mount Ungaran area show that most of the Mount Ungaran area is managed by the state through the Indonesian State Forest Company (Perhutani), designated for protected production forests and limited production forests. Meanwhile, there is a conservation area, namely the Gebugan Nature Reserve, covering an area of about 1.8 hectares under the responsibility of the Natural Resources Conservation Center of Central Java. In addition, the availability of social forests also provides opportunities for communities to manage forests while meeting their economic, food, and shelter needs [17]. Meanwhile, threats to biodiversity on Mount Ungaran are identified by the still rampant hunting of wild animals and the trade of exotic plants, which can lead to a decline in the quality of the ecosystem in the area.

In proposing an area to become an essential ecosystem area, several supporting assessments are needed, one of which is the HCV approach which aims to maintain and increase the value and conservation functions in an area. The HCV assessment criteria are grouped into six categories covering biodiversity, essential landscapes for natural ecological dynamics, rare ecosystems, environmental services, basic needs, and community culture. Based on the results of the preliminary study, the Mount Ungaran area already has the necessary conditions for an HCV assessment (Table 1).

HCV provides a comprehensive assessment of the importance of the conservation of protected animal and plant species. However, it requires rapid and efficient evaluation of many species in an area [7]. The initial assessment results show that the Mount Ungaran area has a Gebugan nature reserve and a protected area. In addition, forest areas that still have high vegetation density [18,19], become the habitat of bird species such as the golden horn [20], members of Accipitridae and Falconidae [21]; mammals such as the Javan langur, as well as amphibian species such as *Nicticalus* spp. and *Philautus* spp [22]. Furthermore, observations show that the Mount Ungaran area is a crossing area for migrant raptors, as observed in Medini, Banyuwindu, and Kalisidi. Moreover, the Mount Ungaran area has been shown to contain populations of high-level predators, such as eagles (Falconidae) and possibly endemic species that continue to reproduce. This indicates that the forest area on Mount Ungaran has a high role for ecosystems in supporting wildlife.

Mount Ungaran is also a vital landscape area for natural ecological dynamics because of its function as a buffer area, animal and plant habitat, and its role as a

water supply area. However, further analysis is needed to determine the core ecosystem area (with a landscape area of 20,000 Ha -50,000 Ha) and the number of sustainable ecosystems. The results of the initial identification of HCV-3 criteria indicate no relevant supporting data to state the condition of ecosystem threats. Therefore, it is necessary to do a comprehensive ecosystem mapping and analysis. Nevertheless, the Mount Ungaran area is an important area or ecosystem as a water provider and flood control for downstream communities, as evidenced by springs, river borders, and forests on the back of the mountain. In addition, the hills in the Mount Ungaran area also have good vegetation cover and function as erosion and sedimentation controllers.

Like other mountain areas in Indonesia, open spaces on Mount Ungaran, overgrown with shrubs, can experience fires, especially during the dry season. Anthropogenic factors such as high climbing activity [23–26], the use of fire, and the littering of cigarette butts have the potential to trigger forest fires [25]. The spread of fire when fires occur in forest areas can be prevented by a talent barrier that separates the primary forest from fire-prone areas. However, the area that has the potential as a firebreak on Mount Ungaran has not been widely identified and still needs to be studied further.

In terms of the usefulness of the Mount Ungaran area, the local community has used it as a fulfillment of basic needs. Local people usually use honey, sugar palm, medicinal plants, springs, and rivers as raw water sources. Some communities in villages that are in direct contact with forests have made forest areas their primary source of livelihood. The Mount Ungaran area is also an essential area for the community's cultural identity around the mountain, which is manifested in traditional ceremonies, arts, and ethnobiological knowledge. Based on the preliminary study results, the local community made Mount Ungaran a center of local community traditions and wisdom as indicated by the presence of sacred relics, forbidden forest, Gedongsongo Temple, and a clean water source ceremony known as "*Susuk Wangan*".

Refers to the concept of HCV, where the conservation strategy aims to protect conservation areas and protected forests while providing sustainable benefits for the community [2]. Through this, it is hoped that the high demand for forests will encourage preservation efforts so that the Mount Ungaran forest area remains sustainable. However, the application of HCV needs to be considered considering the need for cross-sectoral integration and cooperation [8]. The sustainability of forest area conservation on Mount Ungaran must involve various parties considering an intersection of daily forest use. Interestingly, the intersecting forest management has been well established, and there is no conflict between elements, even though it has not been well integrated. This can be used as social capital in developing a

conservation action plan in the Mount Ungaran area by implementing multi-stakeholder partnerships between the community, government, academics, and the private sector.

Table 1. Evidence of findings and conditions that support the HCV assessment in Mount Ungaran.

Criteria	Attribute	Identification Result	
		Potent	Evidence
<i>HCV 1. Assessment of areas with significant levels of biodiversity</i>			
1.1. Areas that have or provide biodiversity support functions for protected and conservation areas	There is one or more areas in the form of protected forests, nature reserves, national parks, and or local protected areas	Exist	The existence of a protected forest in the work area of Perhutani and the Gebugan Nature Reserve
1.2. Species on the verge of extinction	Species that are listed as Critically Endangered (CR)	Exist	Types of amphibians and orchids endemic to Java
1.3. Areas that are habitat for viable populations of threatened, restricted, or protected species (likely population)	Species that are classified as endangered (EN), vulnerable (VU), protected, and endemic	Exist	Habitat for bird species of the group Accipitridae, Falconidae, Javan langur, golden hornbill
1.4. Temporary habitat, corridor, refugia	Migration crossing areas, wildlife corridors, caves, lakes	Exist	Migrant raptor crossing in Medini area, Banyuwindu, Kalisidi
<i>Assessment of landscape areas important for natural ecological dynamics</i>			
2.1. Wide landscape area	Areas that have a core area of 20,000 Ha (toolkit 2008) 50,000 Ha	There is no assessment and analysis yet	
2.2. Areas containing two or more sustainable ecosystems	Ecosystem map analysis	Not available	Need ecosystem map analysis
2.3. Areas containing populations of natural species representatives	Areas that are shown to contain populations of high levels of predators (for example, tigers or eagles) that are continuously reproducing and are likely to survive	Exist	Accipitridae, Falconidae
<i>HCV 3. Assessment of the existence of rare ecosystems</i>			
Areas that have rare or endangered ecosystems	Ecosystem map analysis	Need ecosystem map analysis	
<i>HCV 4. Environmental services assessment</i>			
4.1. Areas or ecosystems that are important as water providers and flood control for downstream communities	Springs, lakes, swamps, riverbanks, forests on mountain ridges	Exist	There are springs, river border areas, and hilly areas that are still forested
4.2. Areas important for erosion and sedimentation control	Erosion hazard rating	Exist	Hilly areas and slopes still have vegetation cover that functions as erosion and sedimentation control
4.3. firebreak	Hotspot analysis	Not yet documented	Several cases of fire occurred in the Mount Ungaran area
<i>HCV 5. Assessment of the role of forests in meeting essential community needs.</i>			
Areas that have essential functions to fulfill the basic needs of local communities	NTFPs, springs, rivers, food, boards, and medicinal plants	Exist	Honey, springs, and rivers as community raw water sources, medicinal plants
<i>HCV 6. Assessment of the role of forests in community cultural presence.</i>			
Areas that have an essential function for the traditional cultural identity of local communities	<i>Petilasan</i> , forbidden forest, temple	Exist	Forbidden forest, Gedong Songo temple

The initial assessment of the potential HCV inventory shows that the Mount Ungaran area has met the criteria for conducting a conservation area assessment, except for HCV-3. However, the non-compliance with the requirements for HCV-3 is more due to the lack of information on the map of the ecosystem area, which should have been included in the HCV assessment. Furthermore, rare and protected species and economic, social, and cultural benefits make the Mount Ungaran area essential to be conserved sustainably. Based on these criteria, an HCV assessment needs to be carried out as an initial step in the commitment to establishing a critical terrestrial ecosystem area on Mount Ungaran.

AUTHOR CONTRIBUTIONS

MR, LN: research concept.; MR, NKT: enhance research concept.; MR: research funding.; LN, DK, NKT: instrumentation and administration.; LN, DK: data collection. LN, DK, MR: analyzed the data.; LN: area mapping and illustration.; MK, NKT, LN: wrote the manuscript.; MK, LN: publication. All authors read and approved the final version of the document.

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REFERENCES

- [1] G. Mikusiński, E.H. Orlikowska, J.W. Bubnicki, B.G. Jonsson, J. Svensson, Strengthening the network of high conservation value forests in boreal landscapes, *Frontiers in Ecology and Evolution*, vol. 8, 2021, pp. 595730. DOI: [10.3389/fevo.2020.595730](https://doi.org/10.3389/fevo.2020.595730)
- [2] G. Areendran, M. Sahana, K. Raj, R. Kumar, A. Sivadas, A. Kumar, S. Deb, V.D. Gupta, A systematic review on high conservation value assessment (HCVs): Challenges and framework for future research on conservation strategy, *Science of The Total Environment*, vol. 709, 2020, pp. 135425. DOI: [10.1016/j.scitotenv.2019.135425](https://doi.org/10.1016/j.scitotenv.2019.135425)
- [3] D.M. Carranza, K. Varas-Belemmi, D. de Veer, C. Iglesias-Müller, D. Coral-Santacruz, F.A. Méndez, E. Torres-Lagos, F.A. Squeo, C.F. Gaymer, Socio-environmental conflicts: an underestimated threat to biodiversity conservation in Chile, *Environmental Science & Policy*, vol. 110, 2020, pp. 46–59. DOI: [10.1016/j.envsci.2020.04.006](https://doi.org/10.1016/j.envsci.2020.04.006)
- [4] K. Soanes, M. Sievers, Y.E. Chee, N.S.G. Williams, M. Bhardwaj, A.J. Marshall, K.M. Parris, Correcting common misconceptions to inspire conservation action in urban environments, *Conservation Biology*, vol. 33(2), 2019, p. 300–306. DOI: [10.1111/cobi.13193](https://doi.org/10.1111/cobi.13193)
- [5] E.O. Sills, C. de Sassi, P. Jagger, K. Lawlor, D.A. Miteva, S.K. Pattanayak, W.D. Sunderlin, Building the evidence base for REDD+: Study design and methods for evaluating the impacts of conservation interventions on local well-being, *Global Environmental Change*, vol. 43, 2017, p. 148–160. DOI: [10.1016/j.gloenvcha.2017.02.002](https://doi.org/10.1016/j.gloenvcha.2017.02.002)
- [6] S.T. Garnett, N.D. Burgess, J.E. Fa, A. Fernández-Llamazares, Z. Molnár, C.J. Robinson, J.E.M. Watson, K.K. Zander, B. Austin, E.S. Brondizio, *et al.*, A spatial overview of the global importance of Indigenous lands for conservation, *Nature Sustainability*, vol. 1, 2018, pp. 369–374. DOI: [10.1038/s41893-018-0100-6](https://doi.org/10.1038/s41893-018-0100-6)
- [7] N. Texier, G. Dauby, E. Bidault, P.P. Lowry II, D.U. Ikabanga, T. Stévert, An efficient method for defining plant species under High Conservation Value (HCV) criterion 1 based on the IUCN Red List criteria: a case study using species endemic to Gabon, *Journal for Nature Conservation*, vol. 62, 2021, pp. 126027. DOI: [10.1016/j.jnc.2021.126027](https://doi.org/10.1016/j.jnc.2021.126027)
- [8] C. Okereke, I. Stacewicz, Stakeholder perceptions of the environmental effectiveness of multi-stakeholder initiatives: evidence from the palm oil, soy, cotton, and timber programs, *Society & Natural Resources*, vol. 31(11), 2018, pp. 1302–1318. DOI: [10.1080/08941920.2018.1482037](https://doi.org/10.1080/08941920.2018.1482037)
- [9] M. Urano, Y. Rayadin, Are market-based forest conservation initiatives effective?, *北星論集 (経)*, vol. 59(1), 2019, pp. 59–70.
- [10] G.K. Sari, F. Nurfatriani, Ramawati, H. Komaruddin, The challenges and policy support for High-Conservation Area management in Indonesia, In *International Conference on Sustainable Management and Innovation*, 2021, pp. 1–25. DOI: [10.4108/eai.14-9-2020.2304492](https://doi.org/10.4108/eai.14-9-2020.2304492)
- [11] S.J. Sutanto, S. Ginting, Use of proposed reservoirs to reduce flood in Semarang City, In *Climate Change Impacts on Water Resources and Coastal Management in Developing Countries*, 2009, pp. 1–10.
- [12] N.K. Hisan, L.D. Jasaputra, P.A. Bernaldo, N.A.Y.P. Karlina, Arhananta, Hydrostructure of

- groundwater manifestation of Gedongsongo Geothermal Ungaran, Semarang, Central Java, Indonesia, *Journal of Earth and Marine Technology*, vol. 1(1), 2020, pp. 31–39. DOI: [10.31284/j.jemt.2020.v1i1.1150](https://doi.org/10.31284/j.jemt.2020.v1i1.1150)
- [13] M. Rahayuningsih, A.B.P. Priyono, A. Widjanarko, G. Ayu, The study of community knowledge on biodiversity in Mount Ungaran, *Journal of Physics: Conference Series*, vol. 1567(3), 2020, pp. 1-7. DOI: [10.1088/1742-6596/1567/3/032045](https://doi.org/10.1088/1742-6596/1567/3/032045)
- [14] E.R.S. Dewi, A.S. Nurgroho, M. Ulfah, Types of epiphytic orchids and host plants on Ungaran Mountain Limbangan Kendal Central Java and its potential as orchid conservation area, *International Journal of Conservation Science*, vol. 11(1), 2020, pp. 117–124.
- [15] M. Rahayuningsih, N.R. Utami, A.M. Tsabit, M. Abdullah, Developing local wisdom to integrate ethnobiology and biodiversity conservation in Mount Ungaran, Central Java Indonesia, *International Journal of Environment and Ecological Engineering*, vol. 4(9), 2017. DOI: [10.1999/1307-6892/67613](https://doi.org/10.1999/1307-6892/67613)
- [16] N.R. Utami, M. Rahayuningsih, M. Abdullah, T.A. Ahmad, Preliminary study of ethnobotany based on local wisdom in Mount Ungaran Central Java, *Journal of Physics, Conference Series*, vol. 1321(3), 2019. DOI: [10.1088/1742-6596/1321/3/032034](https://doi.org/10.1088/1742-6596/1321/3/032034)
- [17] S. Sukamti, N.T. Brata, Natural stone mining activities on the foothills of Mount Ungaran in ethnoecological perspective, *Forum Ilmu Sosial*, vol. 48(1), 2021, pp. 58–67. DOI: [10.15294/fis.v48i1.29449](https://doi.org/10.15294/fis.v48i1.29449)
- [18] M. Rahayuningsih, N.E. Kartijono, A. Retnoningsih, Short communication: the nest characteristics of wreathed hornbill (*Rhyticeros undulatus*) in Mount Ungaran, Central Java, Indonesia, *Biodiversitas*, vol. 18(3), 2017, pp. 1130–1134. DOI: [10.13057/biodiv/d180334](https://doi.org/10.13057/biodiv/d180334)
- [19] M. Rahayuningsih, N.E. Kartijono, E. Suharini, Spatial modeling of wreathed hornbill (*Acerosundulatus*) habitat in Mount Ungaran Central Java, *International Journal of Environmental Science and Development*, vol. 6(6), 2015, pp. 474–477. DOI: [10.7763/IJESD.2015.V6.640](https://doi.org/10.7763/IJESD.2015.V6.640)
- [20] M. Rahayuningsih, E.K. Nugroho, The distribution and population of wreathed hornbill (*Aceros undulatus*) in Mount Ungaran Central Java, *International Journal of Environmental Science and Development*, vol. 4(5), 2013, pp. 492–495. DOI: [10.7763/IJESD.2013.V4.401](https://doi.org/10.7763/IJESD.2013.V4.401)
- [21] A. Purnamaningrum, M.K. Bihi, A.R. Harits, Conservation status of bird species on Promasan Hiking Trail, Mount Ungaran, Central Java, *Jurnal Biologi Tropis*, vol. 21(3), 2021, pp. 624–631. DOI: [10.29303/jbt.v21i3.2841](https://doi.org/10.29303/jbt.v21i3.2841)
- [22] M. Rahayuningsih, W. Rahmawati, A. Hamidy, Analysis of the morphological characteristics of bush frog *Philautus* spp. Gistel, 1848 (Anura: Rhacophoridae) from Mount Ungaran, *Biosaintifika Journal of Biology & Biology Education*, vol. 13(2), 2021, pp. 250–257. DOI: [10.15294/biosaintifika.v13i2.31298](https://doi.org/10.15294/biosaintifika.v13i2.31298)
- [23] M.S. Ali, M. Arsyad, A. Kamaluddin, N. Busthanul, A. Dirpan, Community based disaster management: Indonesian experience, *IOP Conference Series: Earth and Environmental Science*, vol. 235(1), 2019, pp. 012012. DOI: [10.1088/1755-1315/235/1/012012](https://doi.org/10.1088/1755-1315/235/1/012012)
- [24] A. Tonggiroh, R. Syam, Environmental geochemistry of Bawakaraeng Mountain soil: implication for anthropogenic impact Gowa South Sulawesi Indonesia, *IOP Conference Series: Materials Science and Engineering*, vol. 619(1), 2019, pp. 012013. DOI: [10.1088/1757-899X/619/1/012013](https://doi.org/10.1088/1757-899X/619/1/012013)
- [25] A.J. Suprihatini, B.I. Tampubolon, D. Pramudita, M. Ekayani, Economic losses and forest fire causes at Ranu Pani Resort, Bromo Tengger Semeru National Park, *IOP Conference Series: Earth and Environmental Science*, vol. 285(1), 2019, pp. 012004. DOI: [10.1088/1755-1315/285/1/012004](https://doi.org/10.1088/1755-1315/285/1/012004)
- [26] R.B. Panjaitan, Sumartono, Sarwono, C. Saleh, The role of central government and local government and the moderating effect of good governance on forest fire policy in Indonesia, *Benchmarking: An International Journal*, vol. 26(1), 2019, pp. 147–159. DOI: [10.1108/BIJ-12-2017-0336](https://doi.org/10.1108/BIJ-12-2017-0336)