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Ethics and Responsibility of Public Administration in Forest and Land Fire Prevention Governance in Mappi Regency, South Papua: A Philosophy of Administrative Science Perspective

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ABSTRACT

Forest and land fires represent a significant environmental challenge closely associated with government responsibility and public administration. Mappi Regency in South Papua Province, Indonesia, has experienced recurrent forest and land fires, with 3,879 hotspots recorded during 2012–2021. The highest occurrence was recorded in 2015, with 2,844 hotspots and an estimated burned area of approximately 134,052 hectares. This study aims to analyze forest and land fire prevention governance in Mappi Regency through the philosophy of administrative science, emphasizing ontological, epistemological, and axiological dimensions. A qualitative library research approach was employed by examining scholarly publications, relevant legislation, and official documents. The findings indicate that forest and land fires constitute both ecological and administrative challenges requiring evidence-based planning, institutional coordination, effective oversight, public accountability, and community participation. From an ontological perspective, these fires reflect interconnected environmental, social, and institutional problems. Epistemologically, prevention governance requires reliable information, systematic risk assessment, and scientifically informed decision-making. Axiologically, administrative responsibility extends beyond program implementation to encompass public welfare, environmental justice, transparency, and sustainability. The study concludes that effective prevention governance requires strengthening risk-based planning, community empowerment, early warning systems, interinstitutional collaboration, and continuous policy evaluation to ensure accountable and sustainable environmental management.

INTRODUCTION

Indonesia's forests and wetland ecosystems play a vital role in maintaining environmental balance, storing carbon, sustaining biodiversity, and supporting livelihoods. Tropical peatlands in particular hold vast carbon stocks that are released when they are drained and burned (Page & Hooijer, 2016). Forest and land fires (*kebakaran hutan dan lahan*, karhutla) damage these ecological functions and harm health, economic activity, and quality of life. The 2015 fire season produced the largest fire carbon emissions in maritime Southeast Asia since 1997 (Huijnen et al., 2016), and the resulting haze caused substantial excess mortality across the region (Koplitz et al., 2016). Because their effects cross land boundaries and affect whole populations, forest and land fires are a public problem that requires coordinated action.

Mappi Regency in South Papua Province is one area with a history of such fires. Nurhayati et al. (2025) analysed hotspots and estimated burned area in Mappi over 2012–2021 using Terra/Aqua MODIS satellite data and recorded 3,879 hotspots over the ten-year period.

The highest annual count occurred in 2015, with 2,844 hotspots, of which 1,931 were on mineral soils and 913 on peatland. The estimated burned area in 2015 was about 134,052 hectares, and the cumulative estimate for 2012–2021 was 172,752 hectares, of which about 58,412 hectares (33.8%) were peatland (Nurhayati et al., 2025). Papua's forests have become a new frontier of forest loss in Indonesia (Gaveau et al., 2021), which makes fire prevention in the region increasingly urgent.

The same study shows that hotspots begin to rise in July and peak in September–October, and that annual rainfall is significantly associated with hotspot counts ($p = 0.006$; $R^2 = 0.6311$) (Nurhayati et al., 2025). Climate therefore shapes fire dynamics, consistent with evidence that Indonesian fire activity is highly sensitive to El Niño-induced drought (Field et al., 2016). Rainfall is not the only factor, however. Fires in Indonesia are overwhelmingly ignited by people (Cattau et al., 2016), and fire use is embedded in local economies and actor networks that benefit from burning (Purnomo et al., 2017). District-level analysis further shows that remote, less developed villages with a history of agricultural burning are more likely to burn (Edwards et al., 2020). Nurhayati et al. (2025) likewise point to human activity, land cover, and peatland management as drivers of risk, and identify Mambioman Bapai and Obaa as the sub-districts with the largest estimated burned areas.

Hotspot figures must be interpreted with care. A hotspot is a satellite-detected thermal anomaly that supports early detection, but it does not by itself prove that every point is an active fire; detection depends on the algorithm, satellite overpass, and cloud cover (Giglio et al., 2016). Satellite monitoring therefore needs to be complemented by field verification and community information, so that policy is not built on overstated conclusions.

Forest and land fires cannot be understood merely as natural events or technical firefighting problems. They also concern government's capacity to plan, manage resources, coordinate agencies, supervise, communicate, and involve citizens. Fires are a classic "wicked" policy problem, marked by multiple causes, competing interests, and no single solution (Head, 2019), and lasting progress depends on preventing fires rather than suppressing them (Tacconi, 2016). Perceptions of causes and responsibilities differ across levels of governance, which complicates coordinated action (Carmenta et al., 2017). In Indonesia, Minister of Environment and Forestry Regulation No. P.32/MENLHK/SETJEN/KUM.1/3/2016 governs fire control, covering organisation, human resources, facilities, prevention and suppression, community empowerment, cooperation, reporting, supervision, evaluation, and financing. Law No. 32 of 2009 on Environmental Protection and Management, as amended, sets out government responsibilities, citizens' rights, public participation, and environmental oversight.

The philosophy of administrative science offers a lens for analysing these problems through ontology, epistemology, and axiology, and bringing different philosophical traditions to bear allows the ontological and epistemological foundations of public administration to be critically revisited (Ongaro & Ho, 2025). Ontology addresses the nature of fire as an object of public concern and administrative action. Epistemology examines how knowledge, data, and evidence are used to formulate policy, recognising that observable indicators such as hotspot counts do not by themselves reveal the social and institutional mechanisms that produce fire (Ongaro & Yang, 2025). Axiology concerns the values and moral purposes that should underpin administrative action, such as responsibility, justice, the public interest, and sustainability. Because public officials exercise authority on behalf of citizens, they are also answerable to them for how they prevent foreseeable harm (Koliba, 2025).

This study therefore analyses forest and land fires in Mappi Regency from the perspective of the philosophy of administrative science, with particular attention to the ethics and responsibility of public administration in prevention governance. It seeks to contribute conceptually by linking empirical evidence on fires in Mappi with the principles of knowledge, values, and responsibility that should guide government, and by showing how

these principles translate into concrete directions for risk-based, accountable, and participatory prevention.

METHOD

This study adopted a qualitative library research design, chosen because its aim is to examine and interpret published data and ideas on forest and land fires in Mappi Regency and connect them with the philosophy of administrative science. The review was conducted integratively so that findings from scientific, legal, and philosophical sources could be synthesised into a coherent understanding of the problem (Snyder, 2019; Torraco, 2016). All data were secondary, drawn from journal articles, legislation, and official government documents, and were treated as texts within a qualitative document analysis (Morgan, 2022). The principal source on fire dynamics in Mappi is Nurhayati et al. (2025), who used Terra/Aqua MODIS data for 2012–2021; because hotspot products detect thermal anomalies rather than confirmed fires, their figures were read as indicators of risk rather than as verified fire events (Giglio et al., 2016). The normative framework for fire control draws on Minister of Environment and Forestry Regulation No. P.32 of 2016, and the principles of environmental protection draw on Law No. 32 of 2009 and its amendments.

Data were collected by locating documents, reading sources, recording relevant information, and grouping findings by theme, and were analysed through descriptive-critical thematic analysis (Braun & Clarke, 2019). First, empirical data on hotspot counts, estimated burned area, high-risk periods, and spatial distribution were identified. Second, these findings were interpreted through the ontological, epistemological, and axiological dimensions of the philosophy of administrative science (Ongaro & Yang, 2025), recognising that administrative knowledge must attend to context and to the diversity of its sources (Wessels, 2023). Third, the implications were discussed in relation to ethics, responsibility, coordination, accountability, and participation in fire prevention governance. Because the study is library-based, it does not directly measure programme effectiveness or assess the performance of the Mappi Regency Government; such assessment requires fieldwork, for example interviews with relevant agencies and communities.

RESULT AND DISCUSSION

Fire Dynamics in Mappi Regency

The data of Nurhayati et al. (2025) show that forest and land fires are a recurrent risk in Mappi Regency. Over 2012–2021, 3,879 hotspots were recorded, 2,464 on mineral soils and 1,415 on peatland. The year 2015 had the highest count, with 2,844 hotspots and an estimated burned area of about 134,052 hectares. Over the ten years, the estimated burned area totalled 172,752 hectares, including 58,412 hectares of peatland (Nurhayati et al., 2025). The concentration of fire in 2015 mirrors the national picture: that year's strong El Niño drought produced exceptional fire activity across Indonesia (Field et al., 2016) and the region's largest fire emissions in nearly two decades (Huijnen et al., 2016). The share of peat in Mappi's burned area also matters, because peat fires smoulder below the surface, release disproportionate carbon, and are hard to extinguish once established (Page & Hooijer, 2016).

Fire is also unevenly distributed. Mambioman Bapai recorded an estimated 67,570 hectares burned over the period and Obaa about 33,099 hectares. Monthly patterns show hotspots rising from July and peaking in September–October (Nurhayati et al., 2025). This information can guide the choice of priority areas and timing for prevention. Burned-area estimates, however, are products of remote sensing analysis in that study and must not be equated with field-verified results or official annual government statistics, since satellite fire products are subject to omission and commission errors (Giglio et al., 2016).

These data point to the need for anticipatory governance. Local government and

technical agencies can use historical data to build preparedness calendars, select patrol locations, strengthen monitoring, and prepare resources before the high-risk season. Nurhayati et al. (2025) also recommend prioritising prevention in Mambioman Bapai and Obaa, including education to avoid open burning, strengthening Fire Care Community groups (*Masyarakat Peduli Api*), early warning systems, and inter-agency coordination. Evidence from elsewhere in Indonesia suggests that such prevention must target remote, less developed villages where fire is a customary land-clearing tool (Edwards et al., 2020).

Forest and Land Fires from an Ontological Perspective

Ontology concerns the nature of the object under study (Ongaro, 2019). In administrative science, forest and land fires can be understood as a public problem because they create widespread risks and impacts for communities, ecosystems, and future generations. The object of administrative study is therefore not only the fire or the burned area, but the relationship between environmental risk, government decisions, institutional capacity, and public interests.

Fires in Mappi have ecological, social, and administrative dimensions. The ecological dimension includes damage to vegetation, peatland, and ecosystem functions. The social dimension includes potential harm to health, economic activity, and community life; regional haze from the 2015 fires, for example, was linked to substantial excess mortality (Koplitz et al., 2016). The administrative dimension concerns government's authority to plan prevention, coordinate institutions, manage resources, supervise, and guarantee information and protection for citizens. Fires are also socially produced: they are shaped by economic incentives and patronage networks that reward burning (Purnomo et al., 2017) and by how land and supply chains are governed (Purnomo et al., 2018). Recognising this complexity is what makes fires a "wicked" problem for which no single agency or instrument suffices (Head, 2019).

This ontological understanding affirms that fire prevention is part of government's responsibility for public service and protection. Government cannot appear only after a fire has broken out; it must build governance capable of recognising risk and preventing harm from the outset (Tacconi, 2016). Seen this way, environmental protection becomes a goal of public administration rather than a narrowly technical, sectoral matter.

Knowledge and Scientific Data from an Epistemological Perspective

Epistemology concerns the sources, processes, and validity of knowledge. In public administration, rational policy requires data that can be tested and justified. Nurhayati et al. (2025) used Terra/Aqua MODIS imagery, rainfall data, and spatial analysis to map hotspots and estimate burned area in Mappi, and found a statistical association between annual rainfall and hotspot counts ($p = 0.006$; $R^2 = 0.6311$).

These findings can inform decisions such as when to intensify patrols, where to monitor, and what preparedness is needed. The R^2 value, however, does not mean that rainfall is the only cause of fire. The study also discusses human activity and land conditions, and wider Indonesian evidence shows that ignitions are overwhelmingly human in origin (Cattau et al., 2016) and that administrative changes such as the creation of new districts can increase fire (Edwards et al., 2020). Government should therefore combine satellite data with weather information, land cover data, community reports, and field verification.

Epistemologically, the use of data also requires transparency about sources, periods, methods, and limitations. Government should not treat a single indicator as the sole basis for decisions. Hotspot data, for example, should be understood as thermal anomalies that support early detection, not as final proof of active fire (Giglio et al., 2016). This is consistent with the view that policy should be evidence-informed rather than mechanically evidence-driven, combining scientific data with practical and local knowledge (Head, 2016). A critical attitude towards data reduces errors in setting priorities and strengthens the legitimacy of policy.

Science and technology thus do not replace administrative judgement; they strengthen

it. Government decisions must still take into account social context, local conditions, implementing capacity, and the knowledge of communities living near fire-prone areas (Wessels, 2021). Differences in how actors at different governance levels perceive the causes of fire also mean that knowledge must be negotiated across scales rather than imposed from above (Carmenta et al., 2017).

Ethics and Government Responsibility from an Axiological Perspective

Axiology concerns the values, purposes, and benefits of knowledge. In public administration, it places the public interest and moral responsibility at the foundation of government action (Ongaro & Yang, 2025). Fire management cannot be judged merely by the existence of regulations or the completion of activities, but by its real benefits for public safety and environmental sustainability.

Law No. 32 of 2009 on Environmental Protection and Management, as amended, including by Law No. 6 of 2023, provides the normative framework for environmental protection, government authority, citizens' rights and roles, and oversight. Minister of Environment and Forestry Regulation No. P.32 of 2016 regulates fire control more specifically, covering organisation, human resources, facilities, prevention, suppression, community empowerment, cooperation, reporting, supervision, evaluation, and financing.

From the perspective of administrative ethics, government is obliged to act responsibly, fairly, transparently, and accountably. Responsibility means that prevention policies must be planned and implemented consistently. Justice means that protection must reach not only accessible areas but also remote locations and vulnerable groups. Transparency means that information on risks, programmes, and resource use is communicated clearly. Accountability means that implementation can be monitored and evaluated, and that officials can be called to explain their decisions before relevant forums (Bovens, 2007; Koliba, 2025).

Community participation is another core value. Local communities hold knowledge about local conditions, land use, and environmental change. Involving them through education, early reporting, partnerships, and Fire Care Community groups can strengthen prevention, and treating citizens as co-producers of public value rather than passive recipients is central to effective governance (Osborne et al., 2016; Torfing et al., 2019). Participation must not be a formality; it requires access to information, space to voice views, and capacity support. Incentives alone are not enough: a large village-level experiment in Indonesia found that conditional payments for fire-free villages did not overcome the private gains from burning (Falcon et al., 2022), which suggests that participation must be paired with alternatives to fire-based land clearing.

The axiological dimension thus reminds us that the ultimate goal of public administration is not procedural order but the protection of the public interest. Ethical fire policy is oriented to prevention, attentive to justice, inclusive of communities, and protective of ecosystem sustainability.

Implications for Fire Prevention Governance in Mappi

First, local government and technical agencies should strengthen risk-based planning using historical hotspot data, estimated burned area, rainfall, and land characteristics. Based on the study's findings, Mambioman Bapai and Obaa can be considered priority areas for verification and prevention, although these priorities must be updated with new data and field checks (Nurhayati et al., 2025).

Second, inter-agency coordination should be clarified through defined roles, information-sharing mechanisms, and measurable response procedures. Fire control spans environment, forestry, disaster management, health, security, and village government, so fragmented sectoral work risks delays; collaborative arrangements are needed precisely because no single agency can resolve a wicked problem alone (Head, 2019; Torfing et al., 2019).

Third, human resources and facilities should be matched to Mappi's geography.

Personnel readiness, communication equipment, access to remote sites, suppression equipment, and logistics are part of administration's capacity to act before risk becomes disaster.

Fourth, community empowerment should be sustained. Education on the dangers of open burning, development of Fire Care Community groups, support for no-burn land preparation, and early reporting channels can strengthen community-based prevention. Because burning is often embedded in local economic networks, prevention must also address the incentives that make fire profitable (Purnomo et al., 2017, 2018).

Fifth, policy evaluation should measure outcomes, not merely activities. Indicators could include the speed of verifying reports, patrol coverage in priority areas, community involvement, resource readiness, follow-up of findings, and changes in fire risk. These indicators are analytical proposals that would need to be adapted to the authority and planning documents of the regional government. Table 1 summarises how the three philosophical dimensions translate into governance implications.

Table 1. Philosophical dimensions and implications for fire prevention governance in Mappi

Dimension	Guiding question	Principle	Governance implication
Ontology	What kind of problem is forest and land fire?	Fire as a complex public problem with ecological, social, and administrative dimensions	Treat prevention as part of public protection; coordinate across sectors
Epistemology	What knowledge should guide decisions?	Evidence-informed policy with transparent limits	Combine satellite data with field verification, weather data, and community reports
Axiology	Which values should guide action?	Responsibility, justice, transparency, accountability, participation, sustainability	Prioritise remote and vulnerable areas, empower communities, evaluate outcomes

Source: Authors' analysis, 2026

These implications show how the three dimensions of the philosophy of administrative science are connected. Ontology helps government understand fire as a complex public problem; epistemology demands evidence-based decisions; and axiology ensures that policy is directed towards justice, responsibility, and sustainability. Integrating the three provides a conceptual foundation for more responsible fire prevention governance.

CONCLUSION

Forest and land fires in Mappi Regency represent a complex environmental and public administration challenge that requires systematic, coordinated, and sustainable prevention strategies. During 2012–2021, approximately 3,879 hotspots were identified, with the highest concentration occurring in 2015, reaching 2,844 hotspots. The estimated burned area in 2015 was approximately 134,052 hectares, while the cumulative burned area over the ten-year period reached 172,752 hectares. These findings demonstrate the significance of strengthening preventive measures, particularly in areas and periods characterized by elevated fire risks. From an ontological perspective, forest and land fires constitute multidimensional public problems involving ecological degradation, social vulnerability, institutional responsibilities, and administrative governance. Epistemologically, effective prevention depends on reliable scientific information, systematic risk assessment, accurate interpretation of spatial data, and field verification to support evidence-based decision-making. Axiologically, fire prevention

governance must reflect ethical principles, including responsibility, justice, transparency, accountability, community participation, and environmental sustainability. Accordingly, strengthening forest and land fire prevention in Mappi Regency requires integrated risk-based planning, effective coordination among government institutions, adequate financial and technical resources, and consistent implementation of preventive policies. Community involvement should be strengthened through environmental education, local participation, and collaborative prevention initiatives that recognize local conditions and community needs. Early warning systems, continuous environmental monitoring, and transparent reporting mechanisms are essential for improving institutional preparedness and administrative responsiveness. Furthermore, prevention programs should be evaluated based on measurable outcomes, institutional accountability, and their contribution to reducing environmental and social risks. This study is limited by its reliance on library research and secondary data, which do not provide direct empirical evidence of regional government performance or policy implementation. Future research should incorporate field observations, stakeholder interviews, and institutional assessments to examine administrative practices, identify implementation barriers, and evaluate the effectiveness of collaborative fire prevention governance in Mappi Regency.

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AUTHOR CONTRIBUTIONS

DH: conceptualization, investigation, formal analysis, and writing–original draft preparation. NN: methodology, theoretical framework development, validation, and writing–review and editing. T: literature review, data curation, interpretation of findings, and writing–review and editing. All authors have read and approved the final version of the manuscript.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest related to the research, authorship, or publication of this manuscript.

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