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Management Review On The Effectiveness Of Protected Area Management In Tinuy-An Falls Protected Landscape (Tfpl) Caraga Region, Philippines

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Abstract:
This study will facilitate the Management Review of the Effectiveness of the Protected Area Management in TFPL utilizing the Management Effectiveness Tracking Tool (METT) prescribed in the DENR-BMB Technical Bulletin No. 2018-05. Fifteen (15) members of the TFPL Protected Area Management Board (PAMB), or 71%, voluntarily completed the survey and signed consent forms in compliance with the Philippine Data Privacy Act of 2012 (RA 10173) during the PAMB Meeting on March 13, 2024. The management review of TFPL indicates an average score of 1.90 for perceived threats and stressors, reflecting a moderate impact on the protected area in the Caraga Region. The management effectiveness of TFPL is rated at 75%, according to the consolidated scores from the 15 respondents. Management interventions include context, planning, process, inputs, output, and outcome. The context element establishes the legal foundation, with stakeholders being informed about TFPL boundaries being crucial. The planning element integrates regulations and objectives into TFPL's manuals, with budget allocation and support leveraging for the integrated protected area fund establishment. The process element ensures stakeholders' involvement, particularly indigenous peoples, in sustaining economic benefits, overseeing the protected area's carrying capacity, and safeguarding ecosystems while preserving culture. These efforts are crucial for achieving the sustainable management goals of TFPL and ensuring biodiversity conservation and cultural value preservation.
Keywords: *Protected Area, Effectiveness, Management, Evaluation, Assessment.*

INTRODUCTION:

The Tinuy-an Falls Protected Landscape (TFPL) in the Caraga Region of the Philippines represents a vital conservation area, not only due to its rich biodiversity but also because of its significant ecological and cultural importance. As one of the country's natural treasures, TFPL harbors a variety of endemic species and crucial ecosystems that play a key role in maintaining regional ecological balance. However, despite its legal protection, TFPL faces mounting threats from both human activities and environmental factors. These include illegal logging, hunting, unsustainable agricultural practices, and resource extraction, all of which undermine its integrity and threaten its capacity to support biodiversity. The increasing pressure on the area's natural resources is compounded by rapid population growth, competing land uses, and insufficient enforcement of regulations.

Protected areas such as TFPL are fundamental to global conservation strategies, serving as critical refuges for endangered species and ecosystems. However, merely designating an area as protected is not sufficient for ensuring its long-term conservation. Effective management, guided by comprehensive and adaptive strategies, is crucial to mitigating the pressures that threaten these areas. This is particularly true for TFPL, where the interplay between conservation goals and the socio-economic needs of local communities creates complex challenges. Many residents rely on resource extraction, including agriculture, fishing, and small-scale mining, to meet their daily needs, which often leads to unsustainable practices that degrade the environment.

The Philippine government, through the National Integrated Protected Areas System (NIPAS) and the Expanded NIPAS (ENIPAS) Act, has established a legal framework aimed at conserving the country's

biodiversity hotspots, including TFPL. However, despite the existence of these legal protections, TFPL has not undergone a comprehensive management effectiveness evaluation since its inclusion in the E-NIPAS system in 2018. This lack of assessment leaves a critical knowledge gap about how effectively the protected area is being managed and whether current strategies are achieving their intended outcomes. Given the evolving nature of environmental challenges and the increasing vulnerability of ecosystems to climate change, there is an urgent need to evaluate and refine management approaches to ensure the area's long-term resilience.

This study aims to fill this gap by conducting an in-depth management effectiveness review of TFPL. The primary objective is to assess the current management strategies, identify strengths and weaknesses, and propose actionable recommendations to enhance the protected area's conservation effectiveness. Specifically, the study will evaluate the degree to which management practices are safeguarding TFPL's biodiversity, addressing socio-economic challenges, and ensuring the active involvement of local communities in conservation efforts. Through this, the research will provide valuable insights into how TFPL's management can be strengthened to better cope with ongoing and emerging threats.

The significance of this study lies not only in its potential to improve the conservation outcomes for TFPL but also in its broader implications for protected area management in the Philippines. By contributing to the global conservation discourse and aligning with Sustainable Development Goal 15: Life on Land, which focuses on protecting, restoring, and promoting the sustainable use of terrestrial ecosystems, this study will help ensure that TFPL continues to serve as a critical model of biodiversity protection, ecological sustainability, and community-based conservation. Furthermore, it will support the long-term sustainability of the protected area, providing both ecological and socio- economic benefits for future generations.

Ultimately, this study aims to empower local communities, strengthen environmental stewardship, and enhance the effectiveness of conservation policies, ensuring that TFPL remains a thriving, resilient ecosystem capable of supporting both biodiversity and the livelihoods of surrounding communities.

METHODOLOGY:

The conceptual framework of this study, as illustrated in Figure 1, involves the evaluation of TFPL in alignment with its goals and mandates as a designated protected area, incorporating assessments of its socio-cultural, biological, and physical management aspects, utilizing a Management Effectiveness Tracking Tool (METT). Using METT as the method for the management review, this study will scrutinize the pressures and threats confronting TFPL, as well as evaluate the effectiveness of its management across various parameters including context, planning, inputs, process, output, and outcome.

The periodic management review using METT will become the basis for PAMB's action planning, integrating policy recommendations to achieve excellence in TFPL management as a designated protected area.

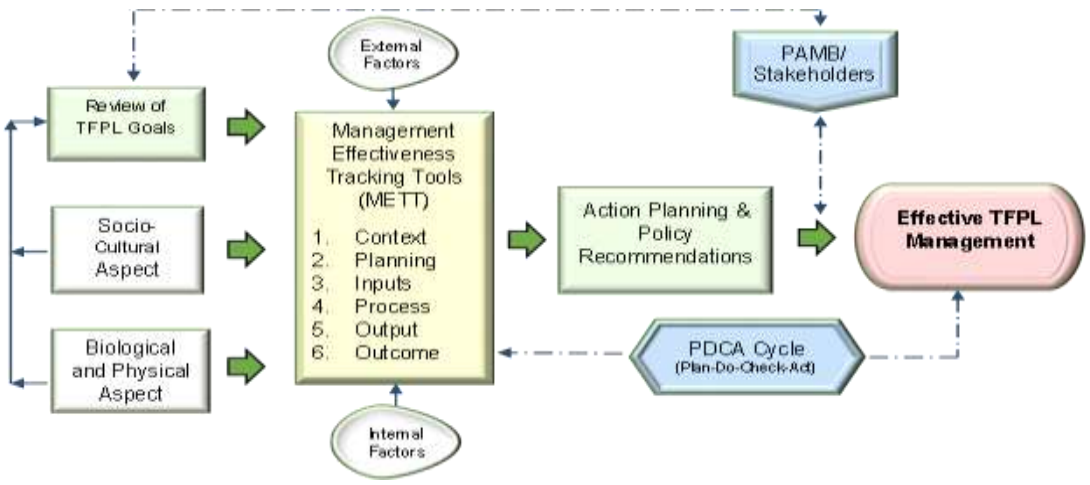

Figure 1:Conceptual Framework in the Management Review on the Effectiveness of the Protected Area Management

in Tinuy-an Falls Protected Landscape in Caraga Region, Philippines

The locale and subject of the study focused on the Tinuy-an Falls Protected Landscape (TFPL) is located in the Caraga Region of Mindanao, Philippines, covering 4,321.75 hectares across the provinces of Agusan del Sur and Surigao del Sur. Designated as a protected area under Republic Act No. 1038, TFPL is critical for conserving biodiversity, protecting ecosystems, and supporting the livelihoods of local communities. Geographically, TFPL is positioned at 8.1436° N latitude and 125.7984° E longitude, straddling key ecological zones, including the South Diwata Range and the Eastern Mindanao Biodiversity Corridor. These areas are vital for maintaining biodiversity in the region, as TFPL contains one of the last remaining lowland dipterocarp forests in Mindanao.

In addition to its ecological significance, TFPL is an important cultural and economic resource. It provides vital water resources for local communities and agriculture while serving as a cultural landscape for the Indigenous Manobo and Mamanwa peoples. These communities depend on the landscape for sustainable farming, forest products, and traditional practices. TFPL also contributes to the local economy through ecotourism, with the famous Tinuy-an Falls attracting visitors and creating opportunities for local businesses and employment.

The study focused on evaluating the management effectiveness of TFPL as a protected area. Specifically, it assessed the adequacy of the Protected Area Management Plan (PAMP), examined the governance role of the Protected Area Management Board (PAMB), and evaluated the participation of local and indigenous communities in conservation efforts. Additionally, the study utilized the Management Effectiveness Tracking Tool (METT) to monitor conservation outcomes and management success. Although TFPL was designated as a protected area in 2018, it had not yet undergone a comprehensive Management Effectiveness Assessment (MEA), making this study an opportunity to identify challenges and propose recommendations for its long-term sustainability.

Respondents' selection aimed for a full enumeration of all twenty-two (22) members of the Protected Area Management Board (PAMB), chaired by the DENR Regional Director. During the PAMB meeting, the members completed the METT forms administered by the researcher. Under the Philippine Data Privacy Act of 2012 (RA 10173), the respondents voluntarily provided their consent by signing the appropriate consent documents.

The researcher utilized the Management Effectiveness Tracking Tool (METT). Key Informant Interviews (KIIs) were the primary method used to facilitate the METT. Respondents were provided with a detailed briefing covering the protected area, its objectives, METT procedures, and related processes. The purpose of the briefing was to inform respondents about the objectives of the management effectiveness assessment and to support the completion of the forms. The researcher conducted the METT with technical assistance from the Protected Area Superintendent (PASu) and their staff.

The METT Data Sheet is divided into two sections. Data Sheet 1 contains basic site information, while Data Sheet 2 lists potential threats to the protected area. In Data Sheet 2, threats are categorized into various types, including residential and commercial development, agricultural and aquaculture activities, biological resource utilization, climate change, extreme weather conditions, and socio-cultural threats. Respondents were asked to identify these threats, assess their impacts on the protected area, and assign them a score and rank. Threats considered highly significant received a score of 3, while those of moderate and low significance were rated 2 and 1, respectively. Threats perceived as absent or inapplicable were scored 0, and any items with insufficient information were left blank.

An additional assessment form, comprising 30 questions, was used to evaluate the six elements of management effectiveness: context, planning, inputs, processes, outputs, and outcomes. This form was distributed to respondents, who were instructed to score it individually, with completion also occurring in a plenary session. Participants were encouraged to seek clarification for any unclear questions and engage in discussion.

Secondary data collection was conducted primarily through local government units, including City and Municipal Environment and Natural Resources Offices (C/MENROs) and City and Municipal Planning and Development Offices (C/MPDOs). Significant contributions were also obtained from the Department of Environment and Natural Resources (DENR), particularly through its Community Environment and Natural Resources Offices (CENROs) and Regional Office. The research findings were

further validated and enhanced through focus group discussions (FGDs) and plenary presentations during the Protected Area Management Board (PAMB) meeting.

DESCRIPTION OF THE TINUY-AN FALLS PROTECTED LANDSCAPE:

Description of Tinuy-an Falls Protected Landscape as a Protected Area

The Tinuy-an Falls Protected Landscape spans 4,321.75 hectares across three municipalities: Barangay Manat, Trento, Agusan del Sur (2,534.93 hectares); Barangays Imelda, Bunawan Brook, and San Andres, Bunawan, Agusan del Sur (1,345.27 hectares); and Barangays Burboanan and Mone, Bislig City, Surigao del Sur (441.39 hectares). This protected area is bordered by Bunawan, Agusan del Sur to the west-northwest; Trento, Agusan del Sur to the southwest; Pamaypayan, Surigao del Sur to the southeast; and Bislig City to the north-northeast and east. The total area of the designated landscape is 69.96 square kilometers, located within the Pangasananan territory of the Manobo people in Bislig City, Surigao del Sur, Caraga Region XIII, Mindanao, Philippines.

Tinuy-an Falls Protected Landscape Protected Area Management

The management of the Tinuy-an Falls Protected Landscape (TFPL) is primarily overseen by the Protected Area Management Board (PAMB), established under Section 11 of the ENIPAS Act of 2018. The PAMB is tasked with ensuring that TFPL's management aligns with core principles such as sustainability, accountability, transparency, participation, and political impartiality. Its key responsibilities include overseeing the protected area's management, approving policies, plans, and proposals, recommending changes to the Department of Environment and Natural Resources (DENR), and assessing the effectiveness of management strategies.

The day-to-day operations of TFPL are handled by the TFPL Protected Area Management Office (PAMO), which consists of 14 staff members, one of whom holds a permanent position while the remaining members are employed on a casual or contract basis. The office is funded through government allocations under the Maintenance and Other Operating Expenses (MOOE) budget of the DENR, ensuring the necessary resources for effective management.

As an Area of Outstanding Natural Beauty (AONB) under the ENIPAS Act of 2018, TFPL is managed with a focus on preserving its biodiversity, unique landforms, and cultural heritage. The core management objectives include conserving biodiversity and ecosystems, supporting sustainable resource management by tenured occupants, fostering active participation from stakeholders, strengthening management structures, and ensuring the sustainability of management systems over time.

Since TFPL was designated a protected area five years ago, this study aims to assess and improve its management effectiveness. The management review is a critical step in identifying areas for improvement, addressing emerging challenges, and guiding the PAMB in its ongoing efforts to conserve and protect TFPL's natural and cultural assets

Tinuy-an Falls Protected Landscape as a Key Biodiversity Area

TFPL encompasses the South Diwata Key Biodiversity Area (KBA), which spans 154,828.81 square kilometers and plays a vital role in the Eastern Mindanao Key Biodiversity Corridor. According to the 2021 Biodiversity Monitoring System (BMS) by DENR, 118 plant species were recorded within TFPL, including 16 priority species listed in the updated National List of Threatened Philippine Plants (DAO 2017-11). Among these, two species are classified as endangered (EN), eleven as vulnerable (VU), and three as other threatened species (OTS). The biodiversity index further highlights the area's richness, with a Shannon diversity index (H) of 3.4, a dominance (D) of 0.17, and an evenness of 0.80, indicating a diverse and well-balanced ecosystem where no single species dominates.

Along with the recorded flora species, the 2021 BMS also documented 58 fauna species, which include birds, mammals, amphibians, reptiles, freshwater fishes, and crustaceans. Of these, 35 species are classified as threatened. Furthermore, two priority species were identified, as outlined in DAO 2019-09, the Updated National List of Threatened Philippine Fauna and their Categories.

Threats and Pressures of the TFPL as Protected Area

The following discussion consolidates the results of the respondents' perceptions regarding threats and stressors influencing TFPL.

Residential and Commercial Development within a Protected Area. This category obtained an average

score of 3.60, indicating a high adjectival rating. The specific ratings per category are as follows: housing and settlement received a score of 6.00; commercial and industrial areas obtained a score of 2.00; and tourism and recreation infrastructures garnered a score of 2.80. The growing pressures from residential, commercial, and tourism development within the Tinuy-an Falls Protected Landscape (TFPL) highlight the urgent need for stringent regulations and strategic planning to ensure that human activities are balanced with the area's conservation goals. As human presence increases, the risks to TFPL's biodiversity and overall ecological integrity also intensify (Smith et al., 2021). To mitigate these threats, it is essential to implement effective zoning, land-use management, and sustainable development strategies (Jones & Roberts, 2019). Successful conservation requires a collaborative approach, with active participation from stakeholders, including local authorities and community members, to ensure that any development within the protected area aligns with its environmental and cultural preservation objectives (Anderson, 2020). If these issues are not addressed, TFPL may face long-term ecological degradation, undermining its role as a protected landscape and diminishing its natural and cultural value (Brown & Green, 2018).

Agricultural and Aquaculture within a Protected Area. This item achieved an average score of 2.30, indicating a high adjectival rating. Categories are the following: annual and perennial crops received a score of 3.40; Utilization of portions of the protected area for upland vegetable and other agricultural/plantation crop farms (including pollutive inputs such as insecticides and pesticides) also scored 3.40; illegal drug cultivation received a score of 1.00; Wood and pulp plantations scored 3.60; Livestock farming and grazing scored 1.40; freshwater aquaculture scored 1.00. These activities contribute to soil erosion, water pollution, and habitat loss, all of which threaten the biodiversity and overall ecological health of the protected landscape (Tilman et al., 2017). The expansion of monoculture plantations and the intensification of agricultural practices further disrupt natural ecosystems, diminishing their capacity to provide essential services such as water filtration and soil stabilization (Hein et al., 2017). Similarly, livestock farming and grazing lead to overgrazing, soil compaction, and the depletion of vegetation, exacerbating the degradation of the landscape (Naylor et al., 2020). If these issues are not addressed, they could result in irreversible environmental harm, jeopardizing the long-term sustainability of the landscape and its ability to deliver critical ecosystem services. To mitigate these risks, the implementation of stricter regulations, sustainable agricultural and aquaculture practices, and robust enforcement mechanisms is necessary. Furthermore, active community involvement and sound land-use planning are crucial to ensure that human development aligns with conservation goals, safeguarding the ecological and cultural significance of TFPL for future generations.

Energy production and mining within or outside a protected area. The average rating for this category is 0.70, signifying a low adjectival rating. The specific ratings are allocated as follows: oil and gas drilling received a score of 0; mining/quarrying scored 1.60; energy generation, including from hydropower dams obtained a score of 0.20; and Treasure Hunting scored 1.0. Although the low adjectival rating suggests that energy production and mining have a lesser impact compared to other threats, this is mainly due to their absence within the TFPL. However, this does not mean these activities lack significant environmental risks. On the contrary, they are highly regulated due to the potential damage they can cause. For instance, oil and gas drilling can lead to habitat destruction and groundwater contamination (Bebbington, 2012). Similarly, mining and quarrying contribute to deforestation, soil erosion, and water pollution, all of which harm biodiversity and disrupt essential ecosystem services (Heemskerk, 2009). While hydropower projects are often considered a renewable energy source, they can disrupt aquatic ecosystems and displace local communities (Poff et al., 2007). Additionally, treasure hunting poses threats to soil integrity and cultural heritage sites (Clements et al., 2013). These risks highlight the necessity for stringent regulation to avoid irreversible environmental harm. Without appropriate oversight, the ecological stability of the TFPL could be severely compromised. Therefore, to safeguard both its biodiversity and cultural value, it is crucial to enforce stricter regulations, conduct thorough environmental impact assessments, and impose limits on resource extraction.

Transportation and service corridors within a protected area. The average score for this category is 1.30, indicating a low adjectival rating. Specific items within this category include roads and railroads, which scored 1.00; road-kill, which scored 2.60; utility and service lines (such as electricity cables, and telephone lines), which scored 0.60; and shipping lanes/canals and flight paths, which also scored 0.60. The

transportation and service corridors in the Tinuy-an Falls Protected Landscape (TFPL) indicate a relatively minimal immediate impact. However, roads, railways, utility lines, and shipping routes pose significant ecological risks. Roads and railways fragment habitats, disrupt wildlife movement, and increase illegal activities while contributing to soil erosion and habitat degradation (Forman et al., 2003; Laurance et al., 2009). Road-kill is a major concern, leading to high wildlife mortality rates and hindering migration, which impacts biodiversity and population resilience (Trombulak & Frissell, 2000). Utility lines and shipping routes further disrupt ecosystems, causing direct harm to wildlife and altering natural habitats (Barrios & Rodríguez, 2004). If unregulated, these corridors could cause long-term ecological damage, including habitat fragmentation and increased mortality. Mitigation measures, such as wildlife corridors, overpasses, and careful land- use planning, are necessary to protect the landscape's biodiversity and ecological integrity (Van der Ree et al., 2015). Strict regulations and targeted management strategies are essential to minimize the impact of these activities and preserve the TFPL for future generations.

Biological resource use and harm within a protected area. This category received an average score of 2.52, signifying a high adjectival rating. It evaluated based on the following activities: hunting, killing, and collecting terrestrial animals (including incidents resulting from human/wildlife conflict), which scored 3.20; gathering terrestrial plants or plant products (non-timber), which scored 2.80; logging and wood harvesting, which scored 2.52; fishing, killing, and harvesting aquatic resources, which scored 2.20; and trawling, blast, and poison fishing, which scored 1.80. Hunting and human-wildlife conflict lead to direct harm to wildlife populations and disrupt ecosystem dynamics, which can lead to species decline and reduced biodiversity (Ripple et al., 2014). The collection of non-timber products, while less immediately destructive, can still degrade habitats and diminish resources necessary for wildlife and local livelihoods (Vandermeer & Perfecto, 2007). Logging and wood harvesting can result in deforestation, soil erosion, and the loss of essential ecosystem services like water regulation and carbon sequestration (Chazdon, 2008). Harmful fishing practices such as trawling, blast fishing, and poison fishing severely damage aquatic ecosystems, deplete fish stocks, and threaten critical habitats such as coral reefs (Morgan & Chuenpagdee, 2003).

If left unchecked, these activities could lead to the irreversible loss of biodiversity and ecological functions within TFPL, endangering its role as a protected area. Stronger enforcement of regulations, promotion of sustainable resource use, and active community engagement in conservation are necessary to safeguard TFPL's ecological integrity. Education on the long-term environmental consequences of these activities is essential for fostering responsible resource management and ensuring the area's protection for future generations.

Human intrusions and disturbance within a protected area. The average rating for this category is 2.20, indicating a high adjectival rating. It includes specific items as follows: recreational activities and tourism scored 4.00; war, civil unrest, and military exercises scored 1.80; research, education, and other work-related activities in protected areas scored 2.40; activities of protected area managers (e.g., construction or vehicle use, artificial watering points, and dams) scored 1.80; and deliberate vandalism, destructive activities, or threats to protected area staff and visitors scored
1.00. Human activities within the Tinuy-an Falls Protected Landscape (TFPL) present significant threats to its ecological integrity. The most pressing concern is the impact of recreational activities and tourism, which, if not properly managed, can lead to overuse, habitat degradation, and disturbance to wildlife (Buckley, 2004). While tourism provides economic benefits, uncontrolled growth can damage ecosystems, cause pollution, and disrupt local communities (Hughes & Gossling, 2008). Other human disturbances, including military exercises, research activities, and the operations of protected area managers, also pose risks. Military activities and civil unrest can result in habitat destruction and displacement of wildlife (Janssen et al., 2009). Infrastructure developments, such as road construction and dams, can fragment ecosystems and facilitate the spread of invasive species (Schultz, 2005). Deliberate acts of vandalism further exacerbate these issues by damaging critical habitats and cultural sites and threatening the safety of both staff and visitors (Vasquez, 2008). To mitigate these risks, it is crucial to enforce stricter regulations on tourism, improve management practices, and engage local communities in the preservation efforts to ensure the sustainability of TFPL's biodiversity and cultural heritage.

Natural system modifications. With an average score of 1.53, this category indicates a medium adjectival

rating. Scores by specific category are as follows: fire/ arson scored 1.20; dams, hydrological modification, and water management/use scored 0.8; increased fragmentation within a protected area scored 1.60; isolation from another natural habitat scored 2.40; other 'edge effects' on park values scored 1.00; and loss of keystone species scored 2.20. Natural system modifications in the Tinuy-an Falls Protected Landscape (TFPL) present considerable ecological threats. Fires and arson can severely damage habitats and disrupt local species, while hydrological changes, such as damming, can affect water resources and aquatic ecosystems (Poff et al., 2007). Habitat fragmentation and isolation impede wildlife movement, leading to a decline in biodiversity and greater vulnerability to climate change (Fahrig, 2003). Additionally, edge effects and the loss of keystone species destabilize ecosystems, facilitating the spread of invasive species and interfering with critical ecological functions (Estes et al., 2011). If these issues remain unaddressed, they could result in lasting ecological damage, diminishing TFPL's ability to support diverse species. Effective management, including habitat restoration and sustainable land and water management, is essential to mitigate these risks and maintain the protected area's ecological balance.

Invasive and other problematic species and genes. An average score of 0.45 implies a low adjectival rating for this category. The details of this category are as follows: invasive non-native/alien plants (weeds) received a score of 1.00; invasive non-native/alien animals and pathogens (non-native or native but causing new/increased problems) scored 0.20; and introduced genetic material (e.g., genetically modified organisms) scored 0.40. Invasive species and genetic material pose significant risks to the Tinuy-an Falls Protected Landscape (TFPL). Although the current threat is low, the introduction of non-native plants, animals, pathogens, and genetically modified organisms (GMOs) can disrupt ecosystems and biodiversity. Invasive plants can outcompete native species, leading to habitat degradation (Simberloff, 2011), while invasive animals and pathogens can alter food webs and introduce diseases, causing population declines (Mack et al., 2000). GMOs, if introduced, may reduce genetic diversity and undermine the adaptability of native species (Ellstrand, 2003). Even at low levels, the cumulative impacts of invasive species can destabilize ecological processes and reduce TFPL's ability to support native wildlife. Preventative measures, including monitoring and early detection systems, are crucial to mitigate these risks and protect the landscape's biodiversity.

Pollution entering or generated within the protected area. The average score for this category is 1.03, implying a medium adjectival rating. Contributions to the moderate rating encompass various factors such as household sewage and urban wastewater achieved a score of 1.80; sewage and wastewater from protected area facilities (e.g., toilets, hotels, etc.) obtained a score of 1.20; industrial, mining, and military effluents and discharges (e.g., poor water quality discharge from dams, unnatural temperatures, de-oxygenation, other pollution) scored 0.80; agricultural and forestry effluents (e.g., excess fertilizers or pesticides) received a score of 1.60; garbage and solid waste scored 1.40; airborne pollutants had a score of 0; and excess energy (e.g., heat pollution, lights, etc.) earned a score of 0.40. Pollution within the Tinuy-an Falls Protected Landscape (TFPL) presents significant ecological threats, with various sources contributing to environmental degradation. The moderate average score reflects the diverse types of pollution affecting the area. Sewage and wastewater from households and facilities within the protected area, such as hotels and toilets, lead to water contamination. This results in nutrient overload, eutrophication, and the degradation of aquatic habitats (Carpenter et al., 1998). Industrial, mining, and military effluents introduce harmful chemicals, including heavy metals and altered water temperatures, which disrupt aquatic ecosystems and threaten biodiversity (Harrison et al., 2006). Agricultural runoff, which includes excess fertilizers, pesticides, and other chemicals, further pollutes water and soil, damaging plant health and aquatic life (Foley et al., 2005). Additionally, the accumulation of garbage and solid waste, particularly plastics, poses a significant threat to wildlife, causing entanglement or ingestion, and leading to long-term environmental damage (Jambeck et al., 2015). While the overall pollution score is moderate, the combined impact of these pollutants can have lasting effects on the area's biodiversity and water quality. Airborne pollutants, though less prominent, still contribute to broader environmental issues such as acid rain, which can damage soils, plants, and aquatic systems. Together, these pollution sources undermine TFPL's ecological integrity, reducing its ability to support diverse species and provide essential ecosystem services. Addressing these risks requires the implementation of effective waste management systems, pollution monitoring programs, and strict regulatory measures. It is essential to promote sustainable agricultural practices and responsible waste

disposal both within and around the protected area. By enforcing these strategies, the long-term preservation of TFPL's biodiversity and ecological health can be achieved.

Geological events. This category attained an average score of 2.40, indicating a high adjectival rating. It is ascribed to the following factors: volcanoes scored 0.20; earthquakes/tsunamis scored 3.40; landslides achieved a score of 2.80; and erosion and siltation/deposition (e.g., shoreline or riverbed changes) scored 3.20. Geological events such as volcanic eruptions, earthquakes, tsunamis, landslides, and erosion have significant impacts on both human populations and ecosystems. Volcanic eruptions can destroy infrastructure, displace communities, and cause long- lasting environmental damage, with recovery often taking years (Camus et al., 2000). Earthquakes and tsunamis, the most destructive events, lead to widespread devastation, including loss of life, damage to infrastructure, and prolonged economic disruptions (Hough, 2017). Landslides, often triggered by rainfall or earthquakes, can bury communities, block rivers, and disrupt transportation, resulting in fatalities and economic loss (Iverson, 2000). Erosion and siltation, although gradual, cause long-term damage to coastal areas and river systems, threatening agriculture, scarcity of water supplies, and increasing vulnerability to flooding (Boothroyd & Thompson, 1985). In summary, geological events pose both immediate and long-term threats, with earthquakes and tsunamis being the most destructive. Volcanic eruptions, landslides, and erosion also create ongoing challenges. Effective preparedness and recovery strategies are essential to minimize their impacts.

Climate change and severe weather. It achieved an average score of 1.70, signifying a medium adjectival rating for this category. It is influenced by the following factors: habitat shifting and alteration scored 1.60; droughts scored 0.80; temperature extremes scored 1.80; and storms and flooding scored 2.60. Climate change and severe weather events have profound effects on both ecosystems and human societies. Shifting habitats disrupt ecosystems as species adapt to changing climates, potentially leading to biodiversity loss and impacting agriculture (Walther et al., 2002). Droughts deplete water resources, intensifying food insecurity and economic challenges (Cook et al., 2014). Extreme temperatures, including heatwaves, pose health risks and stress energy and water systems, while cold extremes damage agriculture and infrastructure (Kovats & Hajat, 2008). Storms and flooding, exacerbated by rising sea levels and more frequent extreme weather, cause widespread destruction, displacement, and significant economic losses (Bauer et al., 2013). These impacts underscore the urgent need for effective climate adaptation and mitigation strategies.

Specific cultural and social threats. This category, with an average score of 3.04, indicates a high adjectival rating. The contributing factors include: loss of cultural links, traditional knowledge, and/or management practices scored 2.40; natural deterioration of significant cultural site values achieved a score of 2.60; destruction of cultural heritage buildings, gardens, sites, etc., which obtained a score of 2.00; effect of influential groups on indigenous people values and freedom to decide scored 3.40; and loss of support to communities and projects due to changes in political leadership with potential impact on the change of leadership scored 3.80. The impacts on cultural heritage and communities are significant, jeopardizing identities and traditions. The loss of cultural links and traditional knowledge
weakens social cohesion and disrupts heritage transmission (Berkes, 2008). The natural deterioration of cultural sites and the destruction of heritage buildings permanently erase valuable historical assets, impacting local identity (Smith, 2006). External influences on Indigenous Peoples undermine their autonomy, leading to cultural displacement (Nash, 2004). Political leadership changes can destabilize community projects, altering priorities and hindering long-term cultural preservation (Chapin, 2004). These challenges highlight the need to protect cultural heritage and community autonomy.

RESULTS AND DISCUSSIONS:

Management Effectiveness of TFPL using METT Context

In the context element, all respondents unanimously gave TFPL the highest rating of three (3), resulting in a total score of forty-five (45). This reflects a consensus that TFPL has been formally recognized under Republic Act 11038, also known as the Expanded National Integrated Protected Area System (E-NIPAS) Act of 2018. Signed by President Rodrigo Roa Duterte on June 22, 2018, this law designates TFPL as a legally protected landscape. This official gazetting reinforces the area's legal status, offering protection against activities that could threaten its biodiversity and natural resources. Such legal recognition is crucial for establishing a framework for conservation, management, and sustainable development, which are

essential for preserving the ecological integrity of the region amidst increasing environmental pressures (Republic Act No. 11038, 2018).

Planning

The planning element for TFPL was evaluated based on various factors, including regulations, objectives, design, management plans, and adjacent land and water use. The total score of 188 reflects a generally positive assessment. Fifty-seven percent of respondents rated the planning process highly (score of 3), indicating strong satisfaction, while 41% rated it satisfactory (score of 2), suggesting that improvements could still be made. Only 1% expressed dissatisfaction (score of 1). These results indicate that, while the planning framework is largely effective, there is room for enhancement, particularly in increasing community involvement and improving coordination among stakeholders (Berkes, 2008).

Effective planning with clear regulations and objectives is essential for the success and sustainability of protected areas (Chapin, 2004). Respondents highlighted the implementation of clear regulations that control inappropriate land use and activities within the protected area, providing a solid foundation for management (Chapin, 2004). Regulations targeting key threats, such as extraction, pollution, and habitat destruction, based on the area's carrying capacity, are crucial to preserving the area's ecological integrity (Kovats & Hajat, 2008).

TFPL has also set specific and measurable objectives within the Protected Area Management Plan (PAMP) or Integrated Protected Area Plan (IPAP), addressing critical components like species populations, ecosystem services, and socio-economic outcomes (Berkes, 2008). At least 70% of resources and workforce have been allocated to support these priorities, demonstrating a strong commitment to achieving conservation goals.

The design of the protected area is aligned with conservation objectives, ensuring its suitability for species and habitat protection while maintaining key ecological processes, such as groundwater flows and natural disturbance patterns (Berkes, 2008). The spatial plan effectively protects important life stages of species, enhances habitat connectivity, and supports ecological functions. Additionally, the management plan is being actively implemented, with 70% of planned activities, including high-priority tasks, completed as scheduled. A regular work plan ensures that activities are carried out on time, with 70% of Workforce Plan tasks being executed.

Finally, the planning of adjacent land and water use has been carefully considered to address the long-term needs of the protected area, ensuring its ongoing sustainability and conservation (Chapin, 2004; Kovats & Hajat, 2008).

Input

The assessment of the input element for TFPL reveals that while there are generally positive ratings, improvements are still needed. Fifty-seven percent of respondents rated it with a score of 2, indicating moderate satisfaction, while 32% rated it 3, reflecting higher satisfaction, and 6% gave a score of 1, suggesting areas of concern. While the protected area has sufficient trained staff and deputized enforcers, enforcement capabilities could be strengthened with better monitoring systems and reporting mechanisms (Berkes, 2008). Though the available information on critical habitats and species is adequate for planning, staffing levels remain below optimal, affecting the management of key activities. Staff training is considered insufficient for the demands of conservation, and enhancing this would improve management efficiency (Kovats & Hajat, 2008). Despite meeting the minimum staffing requirements outlined in the Protected Area Management Plan (PAMP), additional personnel and training would better address conservation challenges (Chapin, 2004).

Financially, TFPL has a reasonable core budget, but reliance on external funding for innovative programs limits long-term sustainability. Strengthening internal funding mechanisms, such as the integrated protected area fund, would provide more stability (Smith, 2006). Communication among stakeholders is effective, with enforcers able to reach key areas within eight hours, ensuring operational efficiency (Berkes, 2008). Overall, while the current management structure at TFPL is adequate, improving staff capacity, financial resources, and communication systems would enhance the area's conservation efforts and long-term sustainability (Chapin, 2004; Berkes, 2008; Kovats & Hajat, 2008; Smith, 2006).

Process

The process element of TFPL management received varied ratings, with 48% of respondents giving it a

high rating (score of 3), 46% a moderate rating (score of 2), and 6% expressing dissatisfaction (score of 1). Several factors influenced these ratings. While the protected area's boundaries are recognized by both management and local communities, with proper demarcation and signage, further efforts are needed to ensure full enforcement and visibility (Chapin, 2004). Protection systems are partially effective, with 70% of violations apprehended through systematic monitoring, yet more robust enforcement mechanisms are needed to reduce violations (Kovats & Hajat, 2008). Although significant research is being conducted, these activities do not fully align with the specific management needs of the protected area, suggesting the need for more focused studies to inform management decisions (Berkes, 2008).

Key management aspects, such as conserving critical habitats and species, are being addressed, but some crucial issues remain, highlighting the need for more targeted actions (Chapin, 2004). The Workforce Plan (WFP) is partially implemented, with 50-70% of resource management activities being fulfilled, but budget management could be enhanced to improve resource allocation (Smith, 2006). Equipment and facilities are generally maintained, but gaps in resources limit the efficiency of management. Furthermore, although there is an education and awareness program, it does not fully meet the needs of the local community, suggesting the need for program improvements (Kovats & Hajat, 2008). Collaboration with neighboring officials and corporate land and water users is limited, with agreements established with only 20% of local government units (LGUs) and one corporate partner, indicating room for further engagement (Berkes, 2008). Indigenous communities are involved in certain decision-making processes and are represented in the Protected Area Management Board (PAMB), but their participation could be more comprehensive. Local communities also play a role in management decisions and field activities, but their involvement could be further expanded (Chapin, 2004). While the monitoring and evaluation system is established and has consistently tracked governance, biophysical, and socio-economic parameters, the integration of this data into management decisions remains a challenge (Kovats & Hajat, 2008). Finally, although there is some collaboration with tourism operators, this relationship remains underdeveloped, and increased cooperation would enhance both sustainable tourism and conservation efforts (Smith, 2006).

Output/Outcome

The output and outcome elements received mixed ratings, with 51% of respondents rating them a 2, indicating satisfactory performance, while 43% gave a score of 3, reflecting a higher level of satisfaction, and 6% rated it a 1, suggesting dissatisfaction. Key factors influencing these ratings include the economic benefits that flow to local communities, though these benefits could be increased to better support sustainable livelihoods (Berkes, 2008). Visitor facilities and services are generally adequate, meeting the needs of 80% of peak visitors with essential infrastructure like access trails, toilets, and shelters, although improvements are necessary to accommodate future growth and enhance the visitor experience (Chapin, 2004). While some biodiversity, ecological, and cultural values are showing signs of degradation, the most critical values remain largely intact. This suggests that while the current management is effective in maintaining core values, there is an ongoing need for enhanced conservation measures to prevent further degradation and ensure long-term sustainability (Kovats & Hajat, 2008). Furthermore, several factors, all rated at 100% implementation, are critical to the effective management of the protected area. The management framework guarantees stakeholder participation in the planning process, regular updates to the management plan, and the integration of monitoring, research, and evaluation findings. Additionally, the availability of Operations and Enforcement Manuals significantly enhances the efficiency of management activities (Berkes, 2008). Management planning also encompasses the surrounding catchment area, focusing on maintaining essential environmental conditions such as water flow, quality, and timing, while addressing air pollution to protect the area's habitats (Kovats & Hajat, 2008). This comprehensive approach ensures the broader environmental context is integrated into conservation efforts.

Key initiatives include establishing wildlife corridors that link the protected area to vital habitats, allowing for species migration, particularly for fish and wildlife. These corridors support biodiversity by facilitating species movement. Moreover, management strategies address ecosystem-specific needs, including securing freshwater resources and implementing fire management practices to conserve habitats (Chapin, 2004). Effective communication and trust between local and indigenous communities, stakeholders, and

protected area managers are essential for conservation success. Programs designed to improve community welfare while conserving protected area resources are actively supported by local and indigenous communities (Smith, 2006). Additionally, at least 20% of the integrated protected area fund is allocated to support sustainable financing activities, ensuring long- term management funding. Finally, ongoing research and monitoring are crucial for assessing the state of biodiversity, ecological processes, and cultural values. These efforts inform management decisions and guide targeted programs to address threats, ensuring that conservation strategies are continuously integrated into park management practices (Kovats & Hajat, 2008).

CONCLUSIONS:

In conclusion, the Tinuy-an Falls Protected Landscape (TFPL) faces significant challenges to its long-term sustainability, driven by both environmental and socio-economic pressures. The growing local population is placing increasing demand on natural resources, resulting in competition for land and water and contributing to habitat destruction, pollution, and deforestation. Key threats include residential and commercial development, illegal activities like logging, poaching, and overfishing, as well as unsustainable agricultural and aquaculture practices, all of which degrade the environment and deplete water resources. Although the management effectiveness of TFPL is rated at 75% based on the consolidated scores from the 15 respondents, several critical areas require improvement. Weaknesses were identified in planning, resource allocation, stakeholder coordination, community involvement, and monitoring systems. Furthermore, the absence of alternative livelihoods for local communities exacerbates these challenges. Many residents rely on resource extraction activities, such as agriculture and aquaculture, for their livelihoods. However, without sustainable alternatives in sectors like ecotourism, these practices continue to negatively impact the environment. To ensure the long-term viability of TFPL, addressing these issues is vital. Improving resource management, enhancing community participation, and developing alternative livelihood options are key steps in protecting the landscape. Strengthening governance and management structures, along with promoting sustainable economic opportunities, will help preserve TFPL's ecological integrity and support its socio-economic stability moving forward.

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