

Resource use conflicts in the Caliraya-Lumot Watershed Forest Reserve, Philippines

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ABSTRACT. The study assessed policies concerning the Caliraya-Lumot Watershed Forest Reserve (CLWFR), examining the diverse uses of the watershed — land and water — and their resulting resource use conflicts. It aimed to develop policy and operational recommendations for improved area management. Primary and secondary data were used to consolidate the policies, while a survey instrument was employed to gather information from the respondents. The CLWFR is a crucial watershed in Luzon, supplying power to the grid. Despite the management efforts, resource use conflicts persist in CLWFR. The significant resource use conflicts specifically related to land and water include illegal settlements, land tenure rights, hydropower generation, recreation and tourism, and aquaculture production, among others. These conflicts encompass disagreements regarding access, control, and uses and arise from the coexistence of various uses that either contradict the existing policies or conflict with one another. These issues, if not addressed, can lead to further degradation of the CLWFR, impacting the delivery of the ecosystem services for which this particular watershed is intended. Recommendations were drawn up to address these social and institutional aspects of implementation.

Keywords: land use, power generation settlement, reservoir management, ridge-to-reef

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INTRODUCTION

Forests, water, pastures, and land are resources with diverse uses and management goals. Understanding these diverse requirements and interests is crucial for successful resource management. However, inadequate management can lead to conflicts arising from rivalry over material possessions, financial advantages, land, or power. Such conflicts often arise when parties feel their needs are not addressed and

believe their values, needs, or interests are at risk (Engel & Korf, 2005). Natural resource conflicts can involve local, regional, national, or international entities. They can range from disputes over land use among local communities over woodland ownership or fishing equipment among fishermen. On one level, access to or control over vital resources can be a significant challenge in many cases.

Competition for natural resources is intensifying due to several factors, including demographic changes (*e.g.*, population growth, migration, and urbanization), market pressures (*e.g.*, increased commercialization, intensification, and privatization of local economies, economic reforms, integration of national and global economies), and environmental changes that necessitate changes in subsistence practices (*e.g.*, floods, recurring droughts, altered river flows, changes in wildlife migration, among others).

These pressures often drive people to overexploit renewable natural resources beyond sustainable levels, such as forests, water bodies, grazing areas, marine resources, animals, and agricultural land. Conflicts may arise due to stakeholders' differing perspectives on the role of forests, competing demands from overlapping policy areas, mechanisms for policy implementation, and distrust between stakeholders, thus exacerbating conflicts (Bonsu *et al.*, 2019).

In the Philippines, forestlands are owned by the state but are frequently occupied by people while the government acts as an absentee landowner. Conflicts and disagreements often arise from sudden rights ownership and management changes when previously inhabited forestlands are proclaimed protected areas or reserves to enhance their protection. Failure to resolve these issues can result in greater resource degradation and poor management.

The Caliraya-Lumot Watershed Forest Reserve (CLWFR) exemplifies the findings of existing research on resource use conflicts. However, it is worth noting that this case is unique since it involves two man-made lakes within the reserve that were previously classified as agricultural lands. Despite its protected status since 1965 and significant value for hydroelectric power generation, ecology, and tourism, resource conflicts persist in CLWFR. Therefore, examining various aspects of the conflict and exploring potential resolutions is important.

This paper aims to identify the most common resource use conflicts in CLWFR, considering their socioeconomic, political, and environmental contributing factors. It also analyses the environmental and local stakeholders' effects of these disputes, reviews existing resource use policies and regulations, and proposes sustainable

resource management strategies to promote equitable resource utilization and reduce conflicts. By shedding light on the resource use conflicts in CLWFR, this research intends to contribute to the sustainable management of the reserve. These findings can offer recommendations for sustainable resource management practices that mitigate conflicts and foster equitable resource utilization by addressing the underlying causes of conflicts.

METHODOLOGY

Research design

The case analysis method was used to investigate the complex phenomenon within its natural setting. Key informant interviews (KII) were conducted with stakeholders, including the National Power Corporation (NPC) and the local government of Lumban, Kalayaan, and Cavinti in Laguna. This method involved collecting detailed and diverse data, allowing for the identification of common themes and patterns. The case study approach also facilitated the investigation of context-specific factors contributing to resource use conflicts in the CLWFR. The findings of this study can offer tailored insights and recommendations to inform sustainable resource management policies and strategies in similar contexts.

Study site

The Caliraya-Lumot Watershed Forest Reserve (CLWFR) (**Figure 1**) spans 11,028.04 ha, including the lakes. It is situated within the municipalities of Cavinti, Kalayaan, Lumban, and Paete in Laguna, and Real in Quezon. The reserve's approximate area is 9,604.12 ha, with Caliraya Lake covering 964.04 ha and Lumot Lake covering 459.88 ha. The Caliraya Watershed extends over approximately 12,508.64 ha, including the lakes, with 6,126.32 ha inside the reserve and 6,382.32 ha outside. The Lumot Watershed encompasses 3,810.64 ha, including the lake, with 3,477.8 ha situated within the reserve and 332.84 ha outside. The geographic coordinates of the reserve range between longitude 121° 29 '59.16 and 121° 36' 58.75" and the latitude of 14° 22 '4.16 and 14° 12' 58.54". The terrain is predominantly flat to moderately sloping, with slopes varying from less than 3% to 18% across approximately 80% of the area. These man-made lakes are primarily for hydroelectric power generation (NPC, 2018).

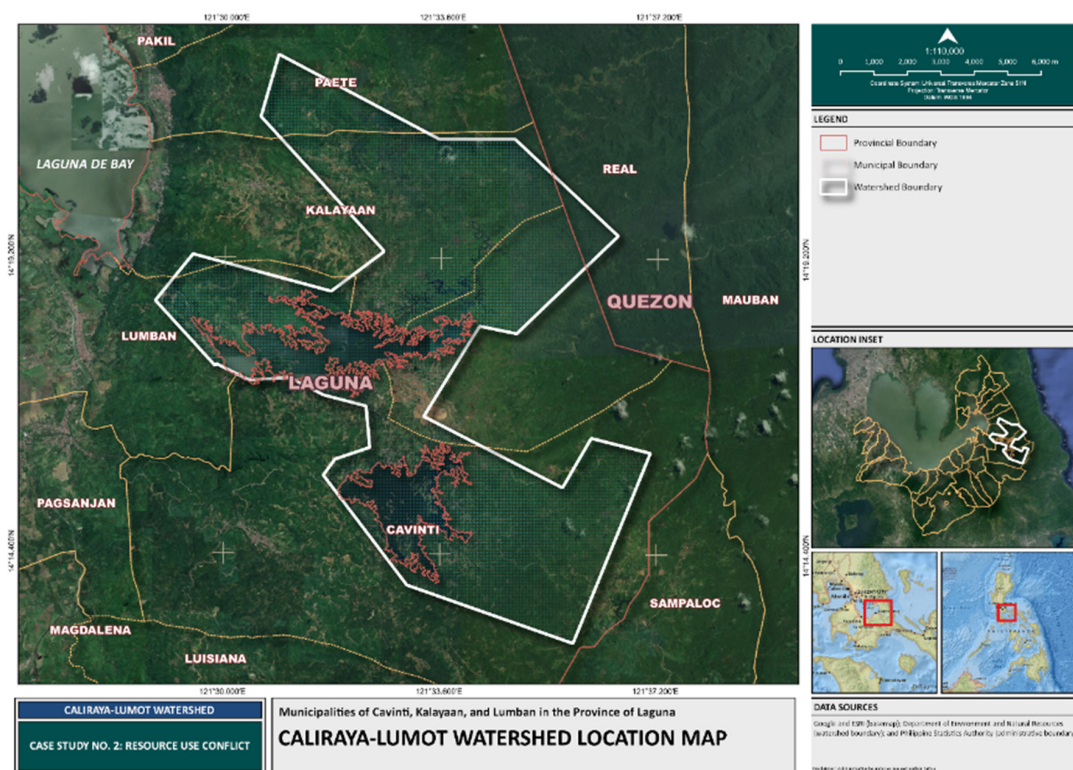


Figure 1. Location map of the Caliraya-Lumot Watershed Reserve, Philippines.

Data collection

Reviewing documents and reports was conducted to gather information on CLWFR, related studies, and policies. The KII with major stakeholders, including the NPC and local governments of Cavinti, Kalayaan, and Lumban, were done to verify and reinforce information gathered from the documents reviewed. While parts of CLWFR also fall within the municipal boundaries of Paete in Laguna and Real in Quezon, this study focused solely on the municipalities adjacent to Cavinti and Lumot lakes.

This study utilized a semi-structured interviews to allow flexibility in questioning and to explore interesting or relevant points raised by the key informants. The interview questions were tailored to the specific stakeholders and designed to address the main research questions and objectives. Measures were taken to ensure data validity and quality, including cross-referencing data from various stakeholders and sources to ensure consistency and accuracy.

Data analysis

Thematic analysis analyzed the data collected from key informant interviews. This method

entails identification, interpretation, and analysis of patterns of themes in qualitative data in relation to participants' experiences and practices, views and perspectives, and behavior (Braun & Clarke, 2012). The research team transcribed and reviewed all interview recordings to understand the data comprehensively. Initial codes were created to identify patterns and themes, then reviewed and refined as necessary. The codes were organized into broader themes based on similarities and differences in meanings and further reviewed and refined them to ensure they accurately represented the data. Finally, the team defined the final themes and sub-themes, supported by quotes or examples from the data. These two phases, initial coding and identification of themes, are critical to establish reliability of the analysis (Clarke & Braun, 2013).

Thematic analysis was used to satisfy the following themes: resource use conflicts (explores conflicts related to the use of resources, such as land and water conflicts); factors contributing to resource use conflicts (investigates the underlying factors contributing to resource use conflicts, including competing stakeholder interests, limited access to information and resources,

insufficient policies and regulations, NPC's police power, and enforcement capabilities); effects of resource use conflicts (examines the impacts of resource use conflicts on the environment, the local communities, the Local Government Units or LGUs, and the NPC); and conflict resolution and sustainable resource management (investigates the strategies and approaches employed in the CLWFR to resolve resource use conflicts and promote sustainable resource management).

RESULTS AND DISCUSSION

Policies and regulations related to resource use and management of CLWFR

Proclamation No. 573, issued on 26 June 1969, established the Caliraya-Lumot Watershed (CLW) as a permanent forest reserve, with a specific parcel of land (Parcel No. 9) as a permanent forest reserve subject to private rights. In 1972, Executive Order (EO) No. 383 was issued designating a specific area in Caliraya Watershed to develop the Japanese Memorial Shrine and Garden as a symbol of amity and friendship between the Philippine and Japanese governments. This led to the area's rapid growth as a tourist spot and transformation into a tourist attraction. Additionally, Proclamation No. 1579 s. 1976, excluded 1,352 ha parcel of land in the CLWFR and classified it as alienable and disposable (A&D) land. Under EO 224, issued on 16 July 1987, the NPC was granted complete jurisdiction, control, and rehabilitation over CLWFR and its surrounding watershed areas.

In addition to these major policies, several other regulations are relevant to the management of the CLWFR. Commonwealth Act No. 141 (s. 1936, Sect. 88) declares that the reserved tracts of land reserved under Sect. 83 are non-alienable and shall not be subject to occupation, entry, sale, lease, or other disposition. Republic Act No. 1273 (s. 1955, Sect. 1) prohibits the construction of structures or edifice within 40 m of river or stream banks, and the land must be designated and protected as permanent timberland. Presidential Decree (PD) No. 705 (s. 1975, Sect. 16) stipulates that 20-m strips of land from the edge of the normal high waterline of rivers and streams with at least 5 m channel-facing lakes are required for forest purposes. PD No. 1067 (s. 1976, Article 51) designates buffer zones for rivers and streams, urban areas, agricultural areas, and forests. Furthermore, DENR Administrative Order

(DAO) No. 07 (s. 2021, Sect. 6.3) provides the measurement of legal easements from the lake's greatest water depth based on normal high-water marks, excluding areas under the jurisdiction of the Laguna Lake Development Authority (LLDA) and other government agencies.

The issuance of these various policies allocating specific areas for different purposes has resulted in conflicting uses, including agriculture, tourism, recreation (such as resorts and rest houses), and settlement, among others. These conflicting uses challenge the primary objective of preserving the watershed.

Resource use conflicts

Thematic analysis of key informant interviews with NPC and LGU officials identified significant resource use conflicts in the CLWFR, specifically regarding land and water. Land-use conflicts encompass land grabbing, widespread sale of land rights resulting in land use and land cover changes, and water-use conflicts leading to water quality and quantity degradation. Additional conflicts include resource extraction, recreation development, and solid waste management (Figure 2).

Land use conflict. The Caliraya Watershed was originally designated as an upper reservoir to meet the needs of Caliraya and support the Kalayaan Hydroelectric Plants for power generation. Despite its classification as a forest reserve and protected area, conflicting land uses prevail in the watershed, causing degradation and threatening its sustainability. Conflicting uses include agricultural activities, ecotourism, establishment of recreation facilities (resorts, sports, and rest houses), and informal settlements. Traditional practices such as intensive agriculture, illegal logging, charcoal making, timber and non-timber product harvesting, and unauthorized land sales further contribute to the degradation of the watershed (Jose & Cardenas, 2010).

The issue of land rights is a major concern. Some individuals have claimed land rights through tax declarations, and illegal construction within buffer zones is prevalent. The KII revealed an increasing influx of migrants into the forest reserve, which opens opportunities for unregulated activities like illegal logging, timber extraction, poaching, *kaingin* (slash and burn farming), and charcoal making. Furthermore, ecotourism as one of the

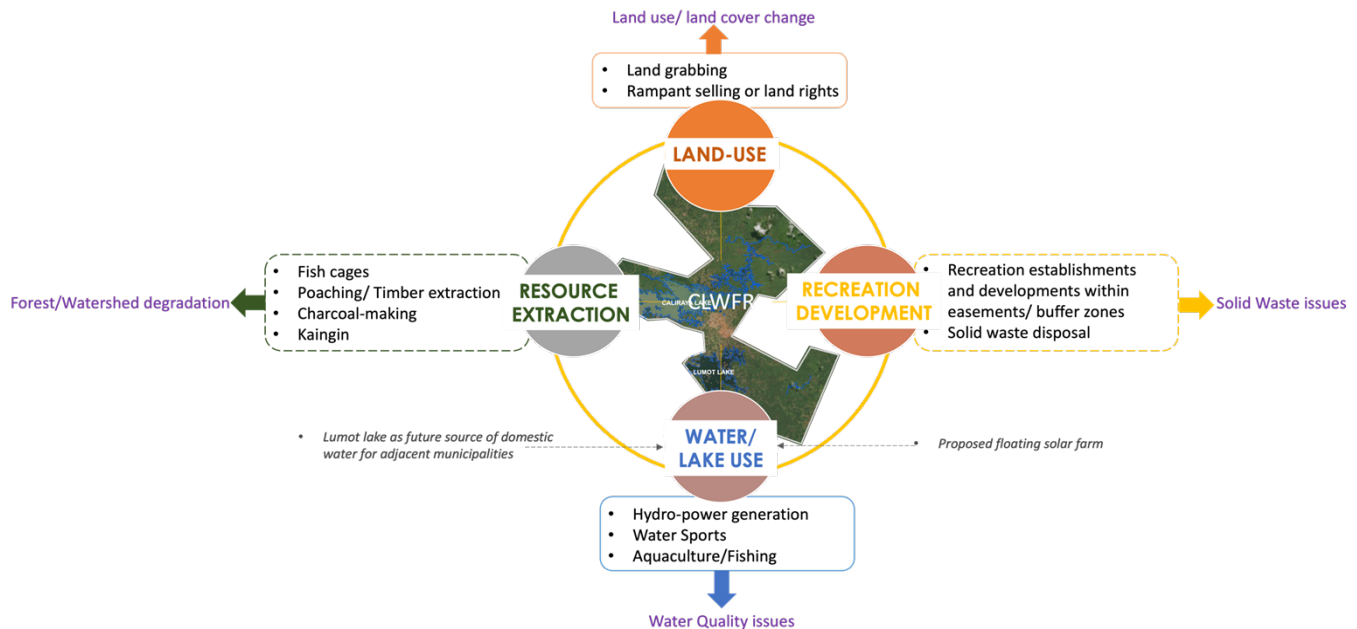


Figure 2. Thematic diagram of the major resource use conflicts.

resource uses also increases the vulnerability of the forest reserve to poaching. With sole jurisdiction over the watershed areas, the NPC faces limitations such as budget constraints, resulting in reduced patrolling and weak overall support from the field to top management, exacerbating land use issues.

The issue of land rights has become a dilemma for the local government within the CLWFR due to PD 573 and EO 224. Some residents claim that their land rights or titles were granted before 1969, potentially falling outside the scope of the law. However, verifying such claims is beyond the responsibility of the local government.

Between the year 1988 and 2020, there has been a substantial decrease in land areas allocated for open forests, with a reduction of approximately 35% in 2003 (925.7 ha) from a land area of 1,434.2 in 1988 and a continuous decline of 77% in 2010 (321.9 ha) (**Table 1**). Although there was a noticeable increase in land area in 2015 (746.4 ha) compared to 2010, it only accounts for 52% of the number of 1988 figures and eventually dropped to 594 ha in 2020 (**Figures 3 and 4**). The decline in open forest was attributed to increased brushland areas and the emergence of the built-up regions. Brush/shrub land and built-up areas were expanded from 2010–2020.

The presence of non-conforming land cover, including agricultural land and built-up areas within forest lands and reservoirs, gives rise to numerous issues, concerns, and conflicts. Non-conforming land cover under forest lands was recorded in Kalayaan, Cavinti, Lumban, and Paete, with agricultural lands totaling 418.8 ha, predominantly in Kalayaan (252.5 ha). Lumban had the highest recorded area of built-up land within forest lands at 48.5 ha. Within the reservoir boundaries, 3.41 ha of built-up areas were recorded.

Legal easements based on land classification and land cover were established for Caliraya and Lumot lake reservoirs. Of particular concern within each easement is the presence of built-up areas, accounting for 1.67 ha or 3.06% of the total, mainly in the municipalities of Cavinti and Lumban. Additionally, under the alienable and disposable easement from a 20-m buffer of the reservoir, brush/shrub land covers 44.48 ha (81.55% of the easements), while open forest covers 2.03 ha (3.72%), mainly in Lewin, Lumban. Regarding forest lands, the 40-m easement resulted in the existence of agricultural and settlement areas. Annual crops cover 3.62 ha (3.62%) within the easement, and perennial crops cover 48 ha (5.42%). Built-up areas within the easement accounted for 7.00 ha (1.61%), with Cavinti (3.46 ha), Lumban (2.07 ha), and Kalayaan

Table 1. Land cover change of Caliraya-Lumot Watershed Reserve, 1988 to 2020.

Land cover	1988	2003	2010	2015	2020
Annual crop	5,527.0	-	551.4	603.6	557.6
Brush/Shrubs	-	1,304.5	5,997.6	5,438.3	5,181.5
Built-up	-	-	306.9	263.1	328.9
Closed forest	99.7	-	-	-	-
Grassland	-	-	-	6.8	178.5
Inland water	1,646.8	1,843.7	1,773.8	1,782.2	1,704.2
Open forest	1,434.2	925.7	321.9	746.4	594.0
Open/Barren	-	-	0.4	5.8	-
Perennial crop	2,028.1	6,661.9	1,783.9	1,889.5	2,191.1
Area (in ha)	10,735.8	10,735.8	10,735.8	10,735.8	10,735.8

Source: NAMRIA Land Cover, 1988-2020

(0.03 ha) having the highest areas. Cavinti and Kalayaan also had similar regions of 4.4 ha for annual crops. Cavinti accounted for the most extensive areas of perennial crops (20.28 ha).

Water use conflict. The CLW was originally designated as a watershed reservation to utilize lake water for power generation (Jose & Cardenas, 2010). The Kalayaan Pumped Storage Power Plant (KPSPP) draws lake water to Caliraya Lake for storage during off-peak demand. It generates 300 MW of hydroelectric electricity during peak demand periods by releasing stored water and supplying the Luzon power Grid (Lasco & Espaldon, 2005). However, due to the scenic beauty of the lakes and the various environmental services offered by the watershed, the use of lake water has expanded beyond power generation. While LGU respondents do not currently consider other benefits conflicting with power generation, they may affect its intended purpose in the future.

The proliferation of recreation and tourism facilities within the watershed poses another conflict, not only for water use but also due to tourism activities contributing to water pollution. LLDA requires all establishments within the Laguna de Bay basin to secure LLDA clearance and discharge permits, as mandated by Republic Act (RA) 4850 and RA 9275. However, non-compliance with these regulations still exists, as some establishments need waste treatment facilities, resulting in the discharge of untreated wastewater into the lakes. Although LGUs permit establishing tourism and recreation facilities, certain conditions, such as the non-permanence

of structures, need to be observed, which may be uncertain given the current situation in the area.

In Lumot Lake, the use of lake water for fishing or aquaculture production, particularly fish cages, is a major economic activity. In the past, the Department of Agriculture, through the Bureau of Fisheries and Aquatic Resources (DA-BFAR), conducted seeding in the area to support aquaculture production. Aquaculture production itself does not have a significant effect on the operation of the dam and hydropower. However, it may impact the diversity of species in Laguna Lake when fish species are released during water releases.

Another water use that could conflict with power generation is the proposed establishment of a floating solar farm, the NKS Solar One Floating Project, in Lumot and Caliraya lakes. This development may affect fish production areas and the maritime lane. There is also a growing demand for additional domestic water supply from nearby municipalities, with Lumot Lake being considered as a potential source. Furthermore, lake water is used for transporting logs from Quezon Province to nearby areas.

Power generation, the primary use of lake water, also conflicts with other uses, particularly maintenance activities. Tunnel bleaching is one of the maintenance activities that affects people living downstream. The presence of bleach in the water during the bleaching process, along with the reaction of chlorine with other minerals and elements, can generate toxins such as dioxins,

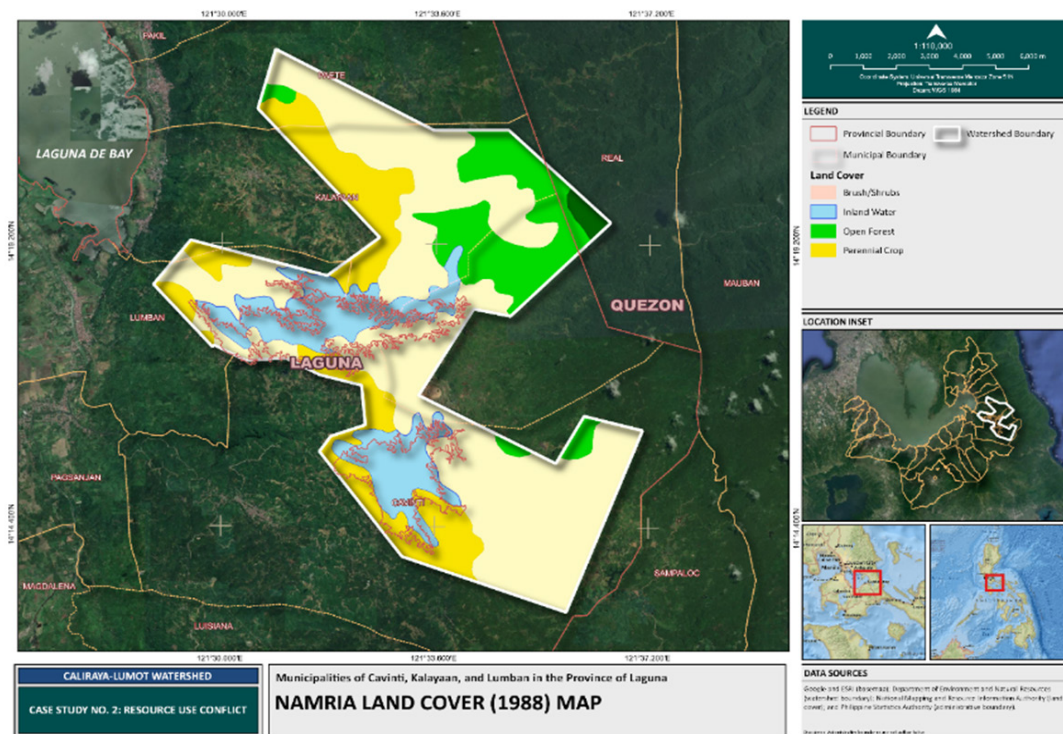


Figure 3. Caliraya-Lumot Watershed Land Cover Map, 1988 (NAMRIA, 1988).

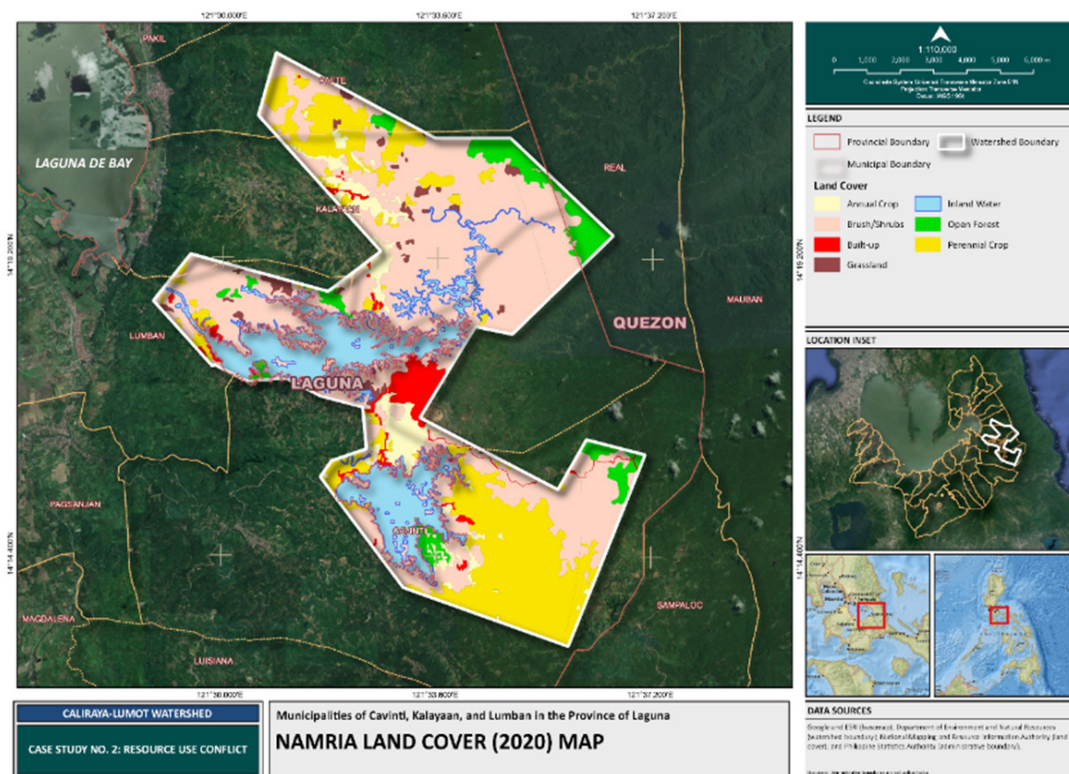


Figure 4. Caliraya-Lumot Watershed Land Cover Map, 2020 (NAMRIA, 2020).

furans, and polychlorinated dibenzo-p-dioxins (PCDDs). These persistent organic pollutants can persist in water for years (Beirne, 2020).

Factors contributing to resource use conflicts

Conflicting stakeholder interests

National Power Corporation and Hydropower Generation. NPC was initially established as a non-stock, public corporation under Commonwealth Act No. 120 in 1936. However, with the Electric Power Industry Reform Act (EPIRA) of 2001 (RA 9136), NPC's operations and duties were decentralized, and its generation and transmission assets were required to be privatized. NPC now focuses on supplying energy to off-grid communities through its Small Power Utilities Group (NPC-SPUG) and ensuring dam safety and flood control measures.

Before privatizing power generation, NPC was responsible for all power generation. However, with the introduction of EO 215 s. 1987 and the EPIRA law, the generation assets of NPC, including the CBK Power Plant Complex and the Kalayaan Pumped Storage Power Plant (KPSPP), were privatized. CBK Power owns and operates the KPSPP, which supplies peak electricity to the Luzon Grid. The KPSPP operates within the Caliraya flood operation rule and adheres to government regulations for its power plant operations.

Local Government Units. Under the Local Government Code (RA No. 7160 s. 1991), the LGUs have a responsibility and right to contribute to the national government to regulate and preserve ecological balance within their territorial domains. However, there are currently very few such partnerships in the forest. LGUs are expected to share the responsibility of managing and maintaining an ecological balance within their territorial jurisdictions with the national government. Despite having administrative jurisdiction over the lakes, the LGUs do not have complete jurisdiction over the Caliraya and Lumot lakes but acknowledge NPC's authority over CLWFR.

However, land use planning and zoning for the CLWFR areas are within LGUs' mandate. The LGU grants business permits zoning approvals and levies minimum business fees. With the current collaboration and partnership between the

LGUs and NPC, there are chances for cooperation to enhance water resource management. The formation of the Caliraya-Lumot Watershed Ecological Community (CLWEC), composed of the DENR, the NPC, and other stakeholders in CLWFR, was also proposed for better coordination and resolution of issues (DENR CALABARZON, 2021). NPC CLWAT created CLWEC as an offshoot of the call to integrate the efforts of all stakeholders in the sustainable management of the watershed (NPC CLWAT, 2020).

Other organizations. The HARIBON Foundation, in collaboration with Coca-Cola Foundation, NPC, BirdLife International, Caliraya Ecosave, Inc., and the Macquarie Group Foundation, established the '*Buhay Punlaan*' project in CLWFR. This 3-ha outdoor classroom serves as a learning laboratory to address the shortage of native tree species in the country.

The Philippines' Department of Energy (DOE) prioritizes renewable energy development according to RA 9513 (The Renewable Energy Act of 2008). Renewable energy sources (RES) refer to both accessible and limitless. The potential of solar energy is part of cost-effective renewable energy (Lee *et al.*, 2020). The DOE has issued a service contract to NKS Solar One, Inc. for developing a solar floating power project in the Caliraya-Lumot reservoir, covering the Cavinti and Lumban reservoirs. Currently, the project is in its pre-development stage, involving permitting processes, social acceptance studies, public consultations, and technical assessments (DOE, 2022).

Access to resources and police power

The NPC faces significant challenges in patrolling and enforcing regulations within the CLWFR due to budget and workforce. As of 2023, the NPC's Caliraya-Lumot Watershed Area Team (CLWAT) operates with only four regular personnel, a reduction from previous levels due to budget constraints. The workforce reduction has impacted watershed patrol, community relations, and reforestation projects. NPC's CLWAT conducts watershed protection and law enforcement activities but needs more human resources to enforce regulations.

NPC's punitive measures. The NPC is actively involved in addressing cases of illegal logging and illegal occupancy within CLWFR. These cases are dealt with through their CLWAT and

legal office, and attending court proceedings has become a challenge due to the NPC now enforcing regulations and reclaiming the rights of the locals. NPC exercises quasi-judicial power similar to the Department of Environment and Natural Resources (DENR), further highlighting the difficulties posed by the limited human resources.

The enforcement actions often involve influential individuals and known figures who have acquired land rights through previous owners. Some of which were converted to resorts and other facilities. Despite these lands being non-alienable and non-disposable, tax declarations have been used to obtain rights, complicating NPC's management responsibilities in the forest reserve. With the government's acquisition of these lands and NPC's designation as the managing authority, there are ongoing legal challenges, including court cases addressing illegal logging and occupancy.

Land rights were obtained through tax declarations since the area is deemed non-alienable and non-disposable. However, the government gained ownership of these lands, and NPC is now responsible for managing them as part of the initiative to designate the area as a forest reserve. Nonetheless, there are ongoing court cases related to illegal logging and occupancy that NPC's CLWAT and legal office are addressing.

Inadequate policies and regulations

Conflicts arise from diverse roles, mandates, and policy guidance of various stakeholders, including NPC, LGUs, other government agencies, local communities, and the private sector. Inadequate policies and regulations contribute to conflicts over land and water rights and use. These conflicts often originate from differences in interpretation and implementation of laws and policies, resulting to inconsistent and disjointed outcomes in resource management.

Table 2 and **Figure 5** provide an overview of the political, environmental, social, technological, legal, and economic (PESTLE) factors that contribute to the conflicts related to land and water rights and use in CLWFR.

Effects of resource use conflicts

The CLWFR, serving as a crucial reservoir for power generation in Luzon, is significantly impacted by land use change and anthropogenic activities, making socioeconomic factors the

primary drivers of environmental changes and deterioration. These disturbances have a lasting and far-reaching impact on critical ecological processes and services (Estacio *et al.*, 2021). Conflicting land uses, such as agricultural activities, ecotourism, establishment of recreation facilities (resorts, sports, and rest houses), and informal settlements, have led to the current state of degradation and over-exploitation within the watershed. The CLWFR is now damaged and contaminated due to these conflicting uses. The communities residing in the watershed are highly vulnerable to social, economic, and biophysical stressors resulting from environmental changes, including land use conversion caused by the informal settlers. The lack of sustainable alternative sources of income and the increasing population within the watershed further strain the environment (Jose & Cardenas, 2010).

One critical issue within the CLWFR is the illegal sale of land rights, often without valid ownership proof. This leads to disputes over land titles and instances of land grabbing. Moreover, the lack of clear titles, as addressed in EO No. 1035, Sect. 2–16, hinders property owners from leveraging their land for financial purposes. There is also a concerning risk of counterfeit land titles being issued and properties being sold without the legitimate owner's consent.

The unauthorized construction within the legal easement is considered a serious offense punishable under PD No. 1067. During the reconnaissance survey, the research team observed encroachments on the easement zones of Lumot and Caliya lakes. Land use conflicts and illegal land sales within CLWFR have resulted in numerous unresolved legal battles, leaving illegally occupied lands unmanaged by NPC.

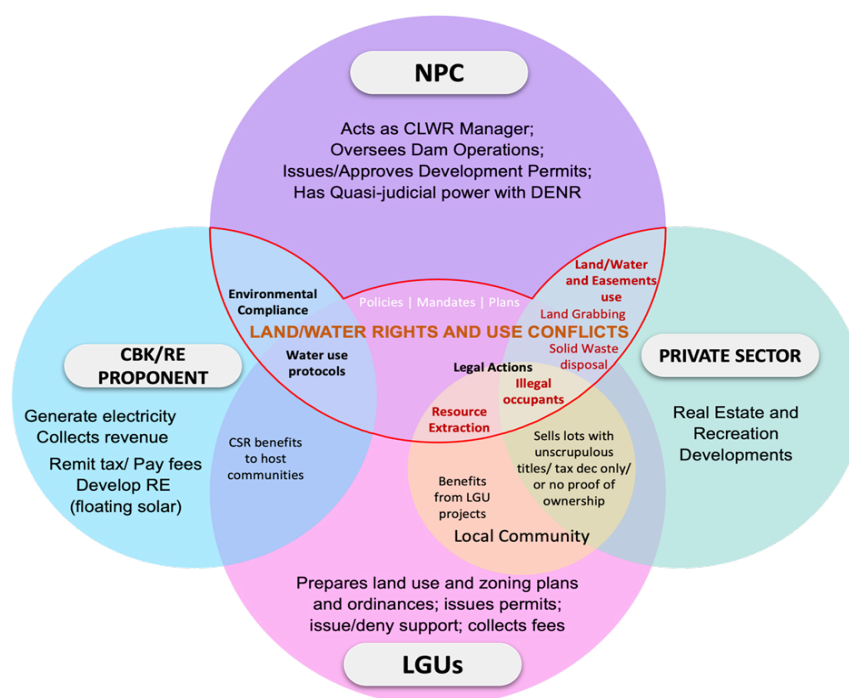
Water resources used by households and for recreation contribute to water pollution in the area. This pollution is compounded by water extraction from the polluted Laguna de Bay for power generation. Polluted water restricts plant growth and poses potential health risks to domestic users due to bacterial, viral, and parasitic diseases. The contamination of soil and groundwater occurs when toxic water freely circulates in nature (poisons the soil and pollutes the groundwater), endangering the lives of organisms in the region. Additionally, sewage water discharge into the sea negatively affects marine life (Kilic, 2021). While data on associated

Table 2. Factors resulting in CLWFR resource-use conflicts: PESTLE.

Factor	NPC	LGU	Local community	Energy sector (CBK, renewable energy proponent)	Private sector (Resort businesses, private individuals)
Political	• Mandated by law to implement watershed management function • RA 9136 (EPIRA Law) • EO 224 • EO 25 • EO 215 • PP 573	• Mandated by law: • RA 7160 • RA 9003 • Devolved functions • Localize policy implementation	• LGC – Barangay Level interaction	• CSR and other benefits • Secure permits and licenses issued by LLDA, LGU, and other government agencies. • Implement, monitor, and report	• Influence in political decisions • With financial resources • Wealthy and known influential people in Philippine society
Environmental	• Management of easement- 3 m (Urban), 20 m (A&D), and 40 m (FL) • Watershed Management through reforestation, protection, law enforcement, community relations • Dam management • Water quality, solid waste monitoring	• Solid waste management, including water hyacinth • Regulation of water and land use • CLUP, FLUP • Issuance of resolution of support/non-support • Mgt. of easement- 3 m (Urban), 20 m (A&D), and 40m (FL) • BPSO support on law enforcement	• Solid waste disposal • Feeds for aquaculture (Lumot) • Population pressure on land and water resources • Tree balling and selling to landscaping companies • Carabao grass planting and selling	• Focus on power plant operation • Compliance with flood control protocol and lake water pumping • RE service contract issued by DOE for floating solar pursuant to RA 9513 (RE Law)	• Construction of structures in easements and water bodies, reclamation; • Soil/land preparation for golf courses, real estate, and resorts causes soil erosion/siltation
Social	• CSR initiatives • Tree planting (temporary labor sources) • Retirement/ resignation and ending of prosecution cases • IEC, Training on livelihood	• Occupancy management • Population mapping, built-up areas planning/ expansion • Sources of livelihood	• Increase in population • Occupancy in prohibited areas	• CSR • IEC • ER 1–94 benefits	• Businesses and occupancy in prohibited areas • Ecotourism
Technological	• Dam management • Telemetry and safety of hydrometeorological equipment	• Transfer of knowledge through community training • Provide technical and in-kind support on agricultural technology and other innovations in energy, waste, etc.	• Multi-use applications in land and water management • Charcoal bracketing to minimize/avoid traditional charcoal-making • Aquaculture and agriculture	• Floating solar • KPSPP operation	• Resort owner's plan for boardwalk, resort infrastructures, boating, speed boat, parachute, water recreation technologies • Need for government monitoring, law enforcement
Legal	• EO 224, EO 258, Proc. 573, RA 9136 (EPIRA Law) • ER 1–94 • UC-EC • Filing of cases in court • Slow processes of legal cases due to internal administrative limitations and coordination within NPC HO and field unit	• Zoning plan (<i>e.g.</i>, A & D to built-up/ Urban classification) could lead to shorter area coverage of the easements • Issuance of clearance, resolution of support	• Derive resources from the watershed, including illegal gathering • Prone to prosecution in the court of forestry cases • Land disputes and prone to land grabbing by influential people	• Pay taxes • Compliance to regulations	• With resources to face charges in court

Table 2. Factors resulting in CLWFR resource-use conflicts: PESTLE. (Cont.)

Factor	NPC	LGU	Local community	Energy sector (CBK, renewable energy proponent)	Private sector (Resort businesses, private individuals)
Economic	•Seedling and fingerlings dispersal •Capacity building and livelihood •Regulation on the use of land and water	•Business Permit •Aquaculture permit •Tax declaration receipt	•Selling of land rights •Revenue from resorts and recreation services, farming, charcoal-making, timber poaching, and transport •Fish cage operation, labor and feeds, and input supply chain	•Resorts operation •Easements for recreation, dam safety	•Land grabbing •Unscrupulous titling •Donations and participation in the CSR, jobs generation •Fees, charges, and taxes

**Figure 5.** PESTLE Venn diagram.

health risks from the polluted Caliraya and Lumot lakes is unavailable, it remains a possible effect of conflicting resource use.

The CLWFR is also a renowned tourist destination. Although it contributes to the local economy, conflicts arising from water and land use within the reservation threaten its sustainability. Studies indicate that ecotourism can lead to changes in biodiversity, water quality, and other impacts that affect the climate and biosphere. Even well-

intentioned ecotourists risk disturbing wildlife habitats, disrupting feeding and breeding cycles, and spreading diseases. Some environmentalists argue that the tourism sector encourages unsustainable practices and environmental stress. However, ecotourism can also bring significant economic benefits to local communities. Environmental and ecotourism are growing three times faster globally than tourism (Lama *et al.*, 2019).

CLWFR's conflict resolution and sustainable resource management

Factors contributing to resource-use conflicts are unique to the administrative and jurisdictional peculiarities of CLWFR. Generally, approaches to managing and resolving natural resource conflict include (1) customary systems, (2) national legal systems, and (3) collaborative management through joint decision-making among stakeholders (Matiru & Castro, 2000; Engel & Korf, 2005). Customary conflict resolution entails resolving conflicts through the intervention of elders (Wondmagegn *et al.*, 2019), which is not applicable in CLWFR. On the other hand, legal systems govern natural resource management through laws, policies, regulations, and the administration of justice. Arbitration and adjudication are the principal methods of dispute resolution (Matiru & Castro, 2000). In the case of CLWFR, the NPC primarily employs national legal systems through adjudication for conflict resolution in resource management.

The NPC's approach to managing illegal activities in the CLWFR, primarily through legal action against offenders, is often seen as reactive and unsustainable (Figure 6). Filing cases against illegal settlers, timber poachers, and other violators, while necessary, can be time-consuming, costly, and often ineffective due to the changing dynamics of NPC officials and the protracted nature of legal proceedings. This situation is exacerbated when dealing with influential land

claimants and business owners, posing significant challenges to the NPC's legal team.

Furthermore, delayed budget appropriation from the Energy Regulatory Commission (ERC) through PSALM and NPC for the Bantay Watershed Task Force hinders programs that could curtail illegal activities within the reservation.

These circumstances highlight NPC's limited capacity to engage in sustainable natural resource management. The organization faces financial constraints regarding staff, equipment, and expertise to anticipate and handle conflicts within CLWFR. Effective conflict management mechanisms are lacking, with punitive measures being the primary approach. Although ecological measures for mitigating land and water use conflicts have been implemented, particularly in the context of hydropower generation, ecotourism, and aquaculture, the effectiveness of these measures depends on the governing agency's ability to enforce them adequately.

On a positive note, NPC continues to collaborate with the DENR in forest protection activities and conducts information and education campaigns to inform local stakeholders about CLWFR's policies and regulations. To achieve sustainable and proactive conflict resolution, NPC requires a sustainable financing mechanism, such as payments for ecosystem services, to support its natural resources management goals. NPC

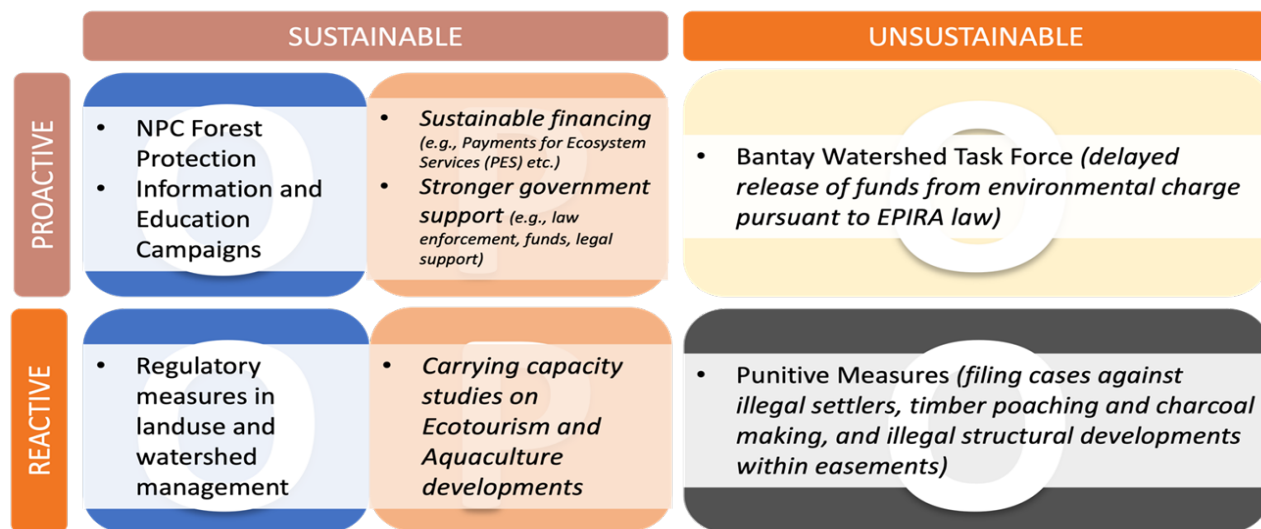


Figure 6. Conflict resolution strategies in CLWFR: Observed (O) and Proposed (P).

could also adopt regulatory measures in land use and watershed management in coordination with other regulatory agencies. Additionally, conducting carrying capacity assessments for both ecotourism and aquaculture is essential to prevent further development and subsequent conflicts. In short term, more immediate action could involve stronger support from the government in terms of law enforcement and the establishment of joint and collaborative conflict management systems.

CONCLUSIONS AND RECOMMENDATIONS

The CLWFR faces numerous conflicts and disagreements among its stakeholders despite being under the management and jurisdiction of the NPC as mandated by several policies and proclamations. Conflicts arise due to competing claims and uses of land and water resources by various parties, including private sectors, resulting in ongoing disputes and challenges to sustainable resource management. Specific conflicts include land grabbing, land conversion, continuous tourist establishment developments, and water use conflicts arising from competing uses of the Caliraya and Lumot lakes for hydropower generation, recreation activities, and fishing. Other conflicts, such as poaching, timber extraction, and charcoal making, also contribute to the challenges faced in the CLWFR.

To address these conflicts, it is recommended to establish or strengthen a watershed management council as a governing body, with the NPC and DENR as lead agencies. This council would facilitate guidance and coordination among stakeholders, ensuring effective management and sustainable use of the resources within CLWFR. While a watershed management council exists for the Pagsanjan-Lumban Sub-watershed, it is crucial to have a separate council specifically dedicated to CLWFR and consider it a distinct water quality management area. Additionally, establishing a common portal for updates, plans, and programs at NPC would promote transparency and facilitate monitoring of watershed activities. It is also important to have a harmonized plan for the management of CLWFR among concerned LGUs and NPC. Moreover, stronger monitoring and control protocols must be observed to prevent further development.

Moreover, the establishment of shared responsibility among stakeholders is vital, necessitating the clear definition of roles, obligations, and areas of concern within CLWFR. By doing so, conflicts can be mitigated, and sustainable resource use can be ensured. Through collaborative efforts and effective governance, stakeholders can work together to manage CLWFR's resources to benefit all parties involved. Lastly, revisiting the EO 224 is suggested to explore possible reforms to strengthen NPC's capabilities in managing the CLWFR.

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