Journal of Ecosystem Sciences and Eco-Governance (JESEG)
www.jeseg.carsu.edu.ph

Vol. 3, No. 2 | December 2021
PRINT ISSN 2704 4394 | ONLINE ISSN 2782 8522

Assessment of Management Effectiveness in Mt. Magdiwata Watershed Forest Reserve, San Francisco, Agusan del Sur, Caraga, Philippines

Roberto G. Campos Jr. Julie Rose D. Apdohan and Jennifer J. Sinculan-Enyart*

Environmental Science Division, College of Forestry and Environmental Science, Caraga State University, Ampayon, Butuan City, Agusan del Norte, Philippines

*Corresponding Author
*Email: robertojr.campos24@gmail.com
Received: August 24, 2021
Revised: December 28, 2021
Accepted: December 30, 2021
Available Online: December 31, 2021

Cite this article: Campos, R.G. Jr., Apdohan, J.R.D., & Sinculan-Enyart, J.J. (2021). Assessment of Management Effectiveness in Mt. Magdiwata Watershed Forest Reserve, San Francisco, Agusan del Sur, Caraga, Philippines. *Journal of Ecosystem Science and Eco-Governance*, **3**(2):39-46.

A B S T R A C T

Mt. Magdiwata Watershed Forest Reserve (MMWFR), San Francisco, Agusan del Sur was assessed using Management Effectiveness Tracking Tool (METT). Primary data was gathered through key informant interview and secondary data were collected from the local and national government agencies primarily the Department of Environment and Natural Resources. Results show that the respondents have perceived the existing threats in MMWFR to have low impacts. However, as the rural population and development increase, pressure on the watershed resources also increases. The METT score for MMWFR management effectiveness was above average (72.60%), which means the management is in place. Input and output components had the lowest rating of 59.20% and 53.33%, respectively, which suggest limited support for effective operational or logistical needs. Regarding planning and process components, the average ratings were 77.31% and 67.95%, respectively, due to efforts in implementing a plan, monitoring biodiversity, and carrying out an education campaign. Furthermore, the context component has the highest score (96.67%) due to its Proclamation No. 282, essential in protected area management. An environmental management system is recommended to maintain optimal health conditions of the protected area to maintain watershed usefulness as a source for water supply and other forestry purposes.

Keywords: *management effectiveness tracking tool, protected area, watershed*

1 Introduction

Watersheds are vital to humans and other living organisms because they provide a wide range of ecological services. These include the supply of food, freshwater, wood, and fiber (provisioning services); the management of water quality, climate and flood (regulating services); aesthetic, spiritual, and recreation (cultural services); and essential functions such as photosynthesis, soil formation, and nutrient cycling (supporting services) that underpin other services (European Forest Institute, 2017). However, the supplies of these services are being affected due to anthropogenic activities. In the Philippines, many watersheds suffer from extreme soil erosion and declining land productivity because of increasing population, deforestation, mining activities, and land conversion (Cruz 1999).

Mt. Magdiwata Watershed Forest Reserve (MMWFR) is one of the protected watersheds in Mindanao that provides ecological services to the Municipality of San Francisco and other neighboring barangays in the Municipality of Prosperidad, Province of Agusan del Sur (Figure 1). It has an approximate area of 1,658 hectares, wherein a portion of the watershed was proclaimed as National Development Company (NDC) Reservation for agricultural plantation cultivation under the Presidential Proclamation 1939, series of 1980. It was amended by Presidential Proclamation No. 282, series of 1993 to establish Mt. Magdiwata as a "Watershed Forest Reserve" separating from the areas declared under the NDC (Community and Natural Resources Office, San Francisco, Agusan

del Sur, DENR Region 13, 1997). MMWFR aims to delimit degrading activities inside the watershed as a protected area. However, illegal mining and timber poaching may adversely affect the ecological service of providing water supply in the immediate impact areas (Serrano 2010; Serrano 2011).

Sustainable management of watersheds such as MMWFR is crucial and critical. Effective watershed management identifies degraded areas in need of restoration and regions with a high ecological value protected from degradation or conversion to other uses. According to Cruz (2014), weak governance by watershed managers is one of the underlying causes of watershed degradation. Weak watershed governance can be observed in the planning process, land use management, policies, and monitoring (Cruz 2014). Thus, the assessment of management effectiveness in watersheds is deemed necessary.

Long-term protection and conservation measures can be formulated by assessing the effectiveness of management strategies in watersheds. The findings from this study can help in the decision-making process of various stakeholders involved in the management of MMWFR, including but not limited to National Government Agencies, Local Government Units, Non-government Organizations, and People's Organizations.

This study aimed to identify the existing threats in MMWFR and assess the effectiveness of management strategies in the watershed using the Management Effectiveness Tracking Tool (METT).

2 Materials and Methods

Location and Description of Mt. Magdiwata Watershed Forest Reserve

The MMWFR is geographically located between 8°27' to 8°30' North Latitude and 125°57' to 126°03' East Longitude. It covers six barangays of the municipality of San Francisco, Province of Agusan del Sur namely: Barangays Alegria, Karaus, Ormaca, Mate, San Isidro and Bayugan 2 (Figure 1).

Mt. Magdiwata is sacred among the Manobo Tribes due to its legend and belief that the soul of Giant Magdiwata might punish anyone who destroys its natural resources. The mountain is characterized by prominent ranges with approximately 592 meters above sea level. It has 14 series of waterfalls, the endemic flora and fauna, the natural swimming holes and cold springs, and the enormous Bagrass tree (*Eucalyptus binacag*) that can be found only in the area.

Management Effectiveness Tracking Tool (METT)

The Management Effectiveness Tracking Tool (METT) is an assessment tool developed to monitor progress towards improving the management effectiveness of a protected area. First published in 2002, the METT was one of the first tools designed to reflect the IUCN/WCPA framework for protected area management effectiveness (PAME). The World Bank/WWF Alliance originally developed the

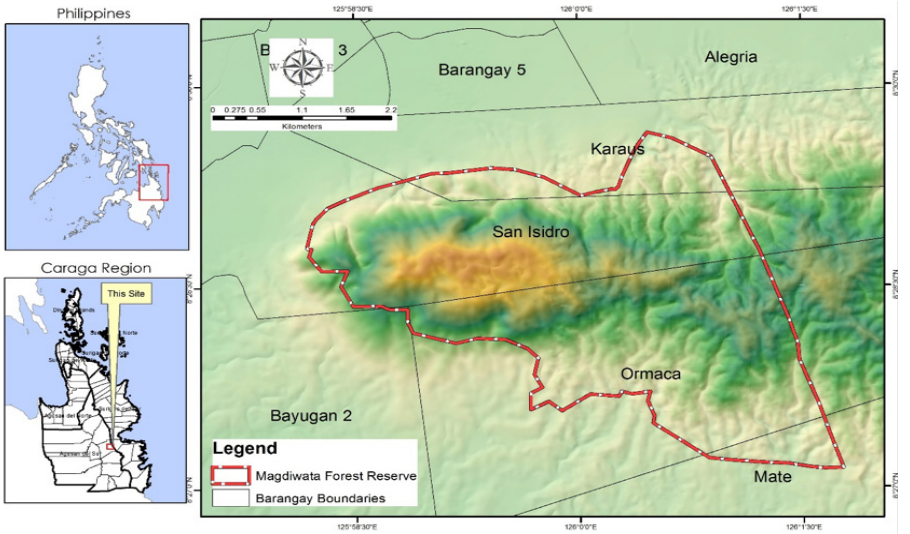

Figure 1. Location Map of Mt. Magdiwata Watershed Forest Reserve (MMWFR) in Agusan del Sur, Philippines. (Source: Philippine Statistics Authority for Political Boundaries)

METT for Forest Conservation and Sustainable Use (IUCN WCPA 2002; World Bank and WWF 2002). The METT framework comprises six distinct elements: Context, Planning, Inputs, Processes, Outputs, and Outcomes (IUCN WCPA 2002; Stolton and Dudley 2016). The methodology is a rapid assessment based on a scorecard questionnaire. The score card includes all six elements of management identified in the IUCN-WCPA framework.

The METT is composed of two main sections: 1) Datasheets that collect vital information on the protected area, its characteristics, threats, and management objectives and details of who carried out the assessment and 2) Assessment forms that provide a composite measurement across 38 parameters integrating all six components of the WCPA Framework. The form is designed around a questionnaire with four alternative responses, each with an associated score ranging between 0 (poor) to 3 (excellent). Each question also has data fields to include notes about the answers (with justification if possible), steps to improve management if necessary, and details of information sources (IUCN WCPA 2002, World Bank and WWF 2002).

The datasheets with the list of threats rank their impact on the protected area. Ranks are classified as "high" in which the threats have seriously degrading values (>10% to 100%); "medium," which are those threats having some negative impact (>5% to 10%); and "low," which threats are present but not seriously impacting values (<5% to >0%) (Apdohan et al. 2019).

The METT is widely used in assessing the management effectiveness of protected areas (PAs) in the Philippines. Since 2010, there have been 100 national PAs and 1,500 local government PAs that have been subjected to management effectiveness assessment (DENR-BMB 2014). Dizon et al. (2013) reported on the use of METT for seven nationally managed marine protected areas (MPAs). On the other hand, the Department of Environment and Natural Resources (2013) assessed twenty-seven locally managed MPAs. In 2014, Guiang and Braganza conducted management effectiveness assessments on sixty-one PAs under the National Integrated Protected Areas System (NIPAS) Act (Guiang and Braganza 2014). The METT was also used in watersheds. Apdohan et al. (2019) assessed the effectiveness of management strategies employed in the Taguibo River Watershed Forest Reserve in Butuan City.

Data gathering and analysis

Key Informant Interview (KII) using the METT survey questionnaire was conducted on February 28, 2017, to collect primary data. A total of 10 respondents were involved during the KII which comprises the representatives from San Francisco Water District (SFWD), Municipal Planning and Development Office (San Francisco), PENRO (Agusan del Sur), PENRO-DENR, MENRO (San Francisco), CENRO-DENR, Barangay Karaos, and Barangay San Isidro. The authors of this paper conducted the assessment. Moreover, secondary data, including watershed management plans and shapefiles, were acquired from different Department of Environment and Natural Resources (DENR) offices. The gathered data were analyzed using descriptive statistics.

3 Results and Discussion

Following the METT's methodology, the datasheet of MMWFR was developed in terms of its characteristics, threats, and management objectives. The assessment form was accomplished through a questionnaire with four alternative responses, each with an associated score of 0 (poor) to 3 (excellent).

A. Datasheet of MMWFR

MMWFR Baseline Conditions (based on secondary data)

a. Biophysical

The MMWFR has a general topography of moderately rolling to steep and within the range of 100-558 meters above sea level. Tributaries in the watershed lead water to the catchment area, which supplies water in all the barangays of San Francisco, including irrigation of lowland farms. The headwaters of Adlayan River located in Sitio Bugtong Lubi, Barangay Alegria is the main channel of MMWFR. All its tributaries converge in Barangay Lapinigan. Soils in MMWFR range from shale to sedimentary rocks, suitable water carriers, or aquifer. Its soil types include Butuan loam, Kidapawan loam, Mambutay sandy loam, and Mountain soils. There are nine sources of water within MMWFR namely: Lapag Spring I, Tinggangawan Spring I, Anagislan Spring, Uog Spring, Binus-agan Creek, Karaos Spring, Tinanggangawan Spring II, Lapag Spring II and Karaos Spring II. In terms of climate, the MMWFR area belongs to Type II of

the modified Corona's Classification of Philippines Climate with a very pronounced maximum rainfall from November to January. The southwest monsoon is dominant from July to October. The land in the area is classified into two: Timberland (TL), which accounts for about 5,546.0 hectares (43.5%) of the site, and Alienable and Disposable Land (A & D), which account for approximately 7,201.0 ha (56.5%) of the area. On land tenure of MMWFR, Bayugan 2 has 1,200 ha of land with Certificates of Land Ownership Award (CLOA) and 817 hectares of land with titles. In Barangay Mate, 150 are CARP beneficiaries covering an area of 793 hectares and ongoing application for Certificate of Ancestral Domain Claim (CADC) covering an area of 1,657 ha. Aside from this land-use, there are 14 sand and gravel quarry operators operating within MMWFR (Ariño n.d., DENR-CENRO 1997; and Environmental Management Plan of Mt. Magdiwata Watershed 2004-2010).

A total of 40 plant families are found in MMWFR, comprising 127 species, and 17 species are categorized as endangered and/or critically endangered. The dominant species in the brushland and grassland ecosystem are Mutha (*Cyperus rotundus*), Cogon (*Imperata cylindrica*), Hagonoy (*Chromolaena odorata*), and Makahiya (*Mimosa pudica*). Characterization report also reveals that there are a total of 201 animal species found in MMWFR wherein three species are classified as Critically Endangered (CR), seven species are Endangered (EN), 27 species are vulnerable (VU), 32 species are classified as Other Threatened Species (OTS), and 128 species are classified as Other Wildlife Species (OWS) (Ariño n.d., DENR-CENRO 1997, and Environmental Management Plan of Mt. Magdiwata Watershed 2004-2010).

b. Socio-economic

The total estimated number of populations within the watershed is 22,093, with a population density of two persons per ha. However, 42,824 persons benefit from the resources of MMWFR, giving a density of population of three persons per ha of the watershed area. Based on the Watershed Characterization Report, the source of income of the residents in MMWFR include farming, gold panning, industrial labor or construction worker, bamboo weaving, driving, and business. Some are government employees and pensioners. As a primary income source, 766 individuals (6.19%) of the labor age group are employed as technicians, supervisors, and laborers in palm oil companies and private palm oil plantations. Those who cannot withstand the labor work in the plantation are engaged in gold panning, which reaches 631 individuals. Most infrastructure projects established in the watershed area are social infrastructures like bridges, business establishments, and farm-to-market roads. Other infrastructures include communal irrigation system, potable water systems (deep well and water impounding dam), barangay hall, basketball court, health center, daycare center, school building, solar dryer, transmission lines for electricity and telecommunication (Ariño n.d., DENR-CENRO 1997; and Environmental Management Plan of Mt. Magdiwata Watershed 2004-2010).

Various human activities lead to deforestation in the forest or upland ecosystem in MMWFR. One of these is the massive conversion of forest into agricultural land due to the encroachment of oil palm plantations. Air and water pollution affect the watershed inhabitants because of the intensive chemical and fertilizer application of these plantations. Some families are engaged in cutting trees in timberland areas (for timber, fuelwood, and charcoal production) and hunting wildlife to satisfy their needs. Aside from illegal logging, slash and burn are also the area's primary concerns. These activities of the upland dwellers will lead to the deterioration of the watershed's diverse ecosystem, affecting the lives of the lowland communities. The massive conversion of the forestlands to plantation crops in the upland part of the watershed made the lowland areas susceptible to flooding. Gold panning operations in MMWFR have contributed to the siltation of streams and posed a danger to life during heavy rainfall. In built-up areas, population increase results in a shortage of safe drinking water, pollution (noise, air, and water), poor sanitation, and diseases like schistosomiasis. The freshwater ecosystem in MMWFR is also compromised due to water pollution or habitat destruction. Groundwater is contaminated because of poorly designed industrial waste ponds, leaks in underground storage banks, and seepage from the deep well injection of hazardous wastes (Ariño n.d., DENR-CENRO 1997; and Environmental Management Plan of Mt. Magdiwata Watershed 2004-2010).

Key Issues and Threats (based on the key informant interviews)

There are a lot of problems, issues, and threats existing in MMWFR based on the ten key informants' answers (Table 1). The highest possible threat value is 10 representing the total of 10 respondents involved in the Key Informant Interview. Also, the threat values can have a total of less than 10 (<10) because some of the respondents had no answer ("no data" or "not applicable"), which were not included.

The respondents have perceived the existing threats in MMWFR to have low impacts. However, as the rural population and development increase, pressure on the watershed resources also increases. As shown in Table 1, energy production and mining also pose a high threat in the watershed, probably due to illegal mining and telecommunication tower within the proximity of the watershed (DENR-CENRO 1997). In 2010, concerned citizens, the local water districts, and religious leaders protested to stop illegal mining and other destructive activities that threatened water supply (Serrano 2010). The watershed forest cover improved over time through a sustainable reforestation program initiated by San Francisco Water District. Also, residents at the foot of the mountain tapped as "social fence" were offered livelihood assistance to develop agroforestry organic farms through the "Imong Yuta Ugmara kay Bayaran Ta" (Toil Your Land and We'll Pay) program (Panganiban 2016). This program promotes collective conservation management where local stakeholders are held accountable for protecting and managing the watershed resource (Ostrom 2000).

B. Assessment of Management Effectiveness

•Management Effectiveness Score

There are different parameters in each management component or evaluation element of the WCPA Framework. In every parameter, the level of scores can range from 0 to 3 depending on which of the four criteria in the assessment form applies to the present conditions of MMWFR (WWF International 2007). The possible maximum scores in each management component are different since the number of parameters that belong to each also varies. All the mean scores of each parameter were added to get every management component's total mean or expert score. The percentage of scores (% score) was calculated by dividing the total mean with the maximum total score possible and then multiplied by 100. The average rate of scores was determined by dividing the total percentage of scores by 6 (the number of management components).

Generally, the METT scores showed a high rating. The context component had the highest score since MMWFR was formally gazetted through Presidential Proclamation No 282. Outcomes, planning, and process follow this. The existing Integrated Watershed Management Plan and established Mt. Magdiwata Management and Development Council help achieve the watershed area's objectives. Inputs and outputs have an average score due to the creation of forest rangers and other logistics. Table 2 shows the summary of METT Scores in every management component.

Table 1. Issues and Threats in MMWFR based on the answers of the 10 KII respondents

MMWFR Threats	Threat Values							
	High		Medium		Low		Overall	
	Total	Mean	Total	Mean	Total	Mean	Total	Mean
Residential and commercial development	0	0	1	0.10	5	0.50	6	0.60
Agriculture and aquaculture	0	0	1	0.10	4	0.40	5	0.50
Energy production and mining	2	0.20	0	0.00	2	0.20	4	0.40
Transportation and service corridors	0	0	1	0.10	5	0.50	6	0.60
Biological resource use and harm	2	0.20	1	0.10	3	0.30	6	0.60
Human intrusions and disturbance	0	0	2	0.20	7	0.70	9	0.90
Natural system modifications	0	0	1	0.10	4	0.40	5	0.50
Invasive and other problematic species and genes	0	0	0	0.00	0	0.00	0	0.00
Pollution entering or generated	0	0	1	0.10	3	0.30	4	0.40
Geological events	0	0	3	0.30	7	0.70	10	1.00
Climate change and severe weather	0	0	3	0.30	6	0.60	9	0.90
Specific cultural and social threats	0	0	1	0.10	4	0.40	5	0.50
TOTAL	**4**	**0.4**	**15**	**1.50**	**50**	**5.00**	**69**	**6.90**

Table 2. Summary of METT Scores, MMWFR, 10 KII respondents

Management Components/ Evaluation Elements	Maximum Total Score Possible	Total Mean/ Expert Score	% Score
Context	3	2.90	96.67
Planning	26	20.10	77.31
Inputs	25	14.80	59.20
Process	39	26.50	67.95
Outputs	3	1.60	53.33
Outcomes	9	7.30	81.11
TOTAL	**105**	**73.2**	**435.57**
	AVERAGE		**72.60**

Context

All the key informants scored 3 (excellent) in this component because they knew that MMWFR has legal status (formally gazetted or covenanted). They also emphasized that it can be seen in the existing Presidential Proclamation. The Mt. Magdiwata Watershed Forest Reserve (MMWFR) was established under Presidential Proclamation No. 282 under the presidency of President Fidel V. Ramos, dated October 25, 1993. The area covered by the reservation is under the administrative jurisdiction, supervision, and control of the Department of Environment and Natural Resources, through its Forest Management Bureau in coordination with other government agencies. It intends to maintain its usefulness as a water source for irrigation, domestic and other forestry purposes (Philippine Official Gazette 1993).

Compared to other protected areas, MMWFR is not under the National Integrated Protected Area System (NIPAS) Law and is not covered by Protected Area and Wildlife Bureau (PAWB). Thus, there has no Protected Area Superintendent (PASu). In terms of Ancestral Domain Classification, no updates or data were given during the conduct of this study. However, based on the Environmental Management Plan of Mt. Magdiwata Watershed (2004-2010), there were People's Organization who applied for Ancestral Domain. The UMAUBAO Manobo tribal clan organization resolved (Resolution No. 2, series of 2001) to use for 10,500 hectares covering the barangays of San Isidro, Bayugan 2, Lapinigan, Mate, and Ormaca, and submitted to National Commission on Indigenous Peoples (NCIP). Also, the MAKABANTIDAS applied for about 30 – 50,000 hectares of the ancestral domain that covers the six barangays of Mt. Magdiwata and the entire parcel leased by the Filipinas Palm Plantation Inc. in 2002.

Planning

Most of the key informants answered 3 (excellent), implying that the regulations for controlling land use and activities such as hunting in MMWFR are in place. The management strategies undertaken are according to agreed objectives, and there is a concrete design of the protected area. Moreover, an existing management plan includes a regular work plan and adjacent land & water use plans. All of the planned activities were being implemented. The characterization of Mt. Magdiwata was done in 1997 as a basis for watershed management planning (DENR-CENRO 1997). The Mt. Magdiwata Integrated Watershed Management Plan of Municipal Environment and Natural Resources Office (MENRO) is the existing plan of the said watershed. The Mt. Magdiwata Management and Development Council was organized to monitor and evaluate the plan implementation. The council is composed of the Local Chief Executives (LCEs) of the municipality of San Francisco, the provincial government of Agusan del Sur, along with the representatives of the regional, provincial, and municipal DENR offices, private sector, Non-Government Organizations, and the academe (Environmental Management Plan of Mt. Magdiwata Watershed 2004-2010).

One respondent said that the Sangguniang Bayan/Municipal Council had enacted an ordinance setting buffer limits. It is a zoning ordinance that declared Mt. Magdiwata as a protected zone. With this, local mining activities are controlled, and the issuance of overlapping of tenurial instruments. There are terms and conditions of the protection from the proclamation. The Local Government Units are planting fruit-bearing trees to control the occupants utilizing endemic trees. The occupants gain benefits from it in exchange for protecting the area.

Inputs

MMWFR has intermediate inputs. It can be explained by the absence of a PASu and staff and the limited monitoring personnel and logistics. The Local Government itself does not have forest rangers to protect the area; however, it still monitors the condition of Mt. Magdiwata along with the San Francisco Water District and Mt. Magdiwata Multisectoral Forest Protection Committee. Nevertheless, the Mt. Magdiwata Management and Development Council and forest rangers who are well-trained, skilled, and knowledgeable foresters abided by forestry laws were organized to manage the watershed. Furthermore, the Barangay Captain, Kagawad, other Brgy. officials, and local communities in the area help manage the protected site. In terms of resource inventory, the latest assessment of flora and fauna was in 2002.

In MMWFR, the budget is not secured since it is not covered by NIPAS. The funds are sourced out from San Francisco Water District and allocated to protect the watershed. The LGU and DENR budget depends on the national government. In the absence of enacted management plan, funding for the management of protected areas will be hard. Currently, no entry fees for tourist mountaineers have been established. However, tourists should coordinate with the local government if they enter the protected area. It depends on the tourist and how much money they will give to the local guide. Furthermore, it is prohibited to throw garbage in the area while hiking. No exact fines have been stated, and proposals of penalties depending on the level of offenses are ongoing.

Process

According to some key informants, the established 1,658 ha-boundary of MMWFR was partly unknown by residents or neighboring land users. Residents should be involved in meetings and announcements to know the area's development, especially in delineating its exact location. There are research conducted in MMWFR but not updated. These include the biodiversity assessment undertaken by the local government to protect animal species in the area. Comprehensive surveys and different research studies should be conducted in MMWFR.

Moreover, there were no indigenous people (IPs) residing inside the watershed but only religious groups with atypical practices occasionally. The IPs live outside the watershed but within the buffer zone. The local government should coordinate with IPs in protecting the area and avoid Ancestral Domain Title conflict.

Outputs

The output in MMWFR has an average score despite the absence of visitor facilities. The key informants perceived the existing establishments found within the buffer zone of the protected area as visitor facilities, hence, a high score in the output component of the METT instrument.

Outcomes

The METT Score in this component is high, which can be attributed to the economic benefits that MMWFR gives to the local communities (at least 10% of households are receiving monetary benefits). Different stakeholders are collaboratively working to maintain the area's key biodiversity, ecological and cultural values. Monitoring, research, and other activities are continually conducted to manage the watershed's objectives.

4 Conclusion and Recommendations

Based on METT with ten KII respondents, MMWFR faces a degrading threat with values ranging from low to medium. In general, the management effectiveness in MMWFR is above average (with a score of 72.60%). The context component possesses the highest score because of the Presidential Proclamation of Mt. Magdiwata as Watershed Forest Reserve. Outcomes, planning, and process follow this. The existing Integrated Watershed Management Plan and established Mt. Magdiwata Management and Development Council help achieve the objectives of managing the watershed area. Inputs and outputs have a moderate score due to the creation of forest rangers and other logistics.

An environmental management system is recommended to maintain optimal health conditions of the protected area to maintain watershed usefulness as a source for water supply and other forestry purposes. It is also recommended to create a law that will acknowledge MMWFR as a protected area under the NIPAS. The implementation of the management plan should be monitored and evaluated to determine the specific component that needs improvement. Furthermore, collecting fees from tourists, mountain climbers, and tourism

operators should be imposed to generate additional funds for the conservation of MMWFR. Other market-based mechanisms like payment for ecosystem services (PES) schemes and ecotourism promotion should also be developed. Lastly, future studies using the METT should be conducted to have a comparative analysis of the result of this study.

5 Acknowledgement

The authors would like to thank the Local Government Units of San Francisco and Patin-ay, Agusan del Sur, including different agencies involved in the Key Informant Interview. All the faculty members of the Environmental Science Division of Caraga State University are also acknowledged.

Statement of Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

6 Literature Cited

Apdohan, J. D., Briones, N. D., Alcantara, A. J., & Galang, M. G. (2019). Effectiveness of Management Strategies Employed in Taguibo River Watershed Forest Reserve for Water Supply in Butuan City, Philippines. *Journal of Ecosystem Science and Eco-Governance*, **1**(1), 25-32.

Ariño, A. C. (n.d.). The Mt. Magdiwata Integrated Watershed Management Plan. Department of Environment and Natural Resources-Municipal Environment and Natural Resources Office, San Francisco, Agusan del Sur.

Cruz, R. O. (1999). Integrated Land Use Planning and Sustainable Watershed Management. *Journal of Philippine Development,* **16**(47), 27-49. Retrieved from https://core.ac.uk/download/pdf/6506067.pdf

Cruz, R. O. (2014). Watersheds in a Changing Climate: Issues and Challenges. Policy Brief Series, *Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA),* 1-2.

DENR-BMB. (2014). 2nd National Report on the State of Protected Areas in the Philippines. Department of Environment and Natural Resources-Biodiversity Management Bureau, Quezon City.

DENR-CENRO. (1997). Characterization of Mt. Magdiwata Watershed. Department of Environment and Natural Resources-Community Environment and Natural Resources Office, San Francisco, Agusan del Sur.

Department of Environment and Natural Resources. (2013). Sustaining our Coasts: The Ridge-to-Reef Approach -- A Compilation of Technical and Policy Papers: Mangement Effectiveness Tracking Tool (METT). Quezon City, Philippines: Integrated Coastal Resources Management Project (ICRMP).

Dizon, E. C., Geronimo, R. C., & Quicho, R. (2013). Benchmarking the management effectiveness of nationally-managed marine protected areas in the Philippines and policy recommendations. Final Report for USAID CoralTriangle Support Partnership (CTSP) and Conservation International – Philippines. Conservation International, Inc.

Environmental Management Plan of Mt. Magdiwata Watershed, 2004-2010.

European Forest Institute. (2017). Mountain Watersheds and Ecosystem Services: Balancing multiple demands of forest management in head-watersheds. European Forest Institute.

Guiang, E. S., & Braganza, G. C. (2014). Report on the Management Effectiveness and Capacity Assessment of Protected Areas in the Philippines. Manila, Philippines: Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) GmbH.

IUCN WCPA. (2002). IUCN WCPA Framework for Protected Area Management Effectiveness (PAME). International Union for Conservation of Nature-World Commission on Protected Areas.

Ostrom, E. (2000). Collective Action and the Evolution of Social Norms. *The Journal of Economic Perspectives,* **14**(3), 137-158.

Panganiban, C. B. (2016, March 26). The resurrection of Mt. Magdiwata. Retrieved from Inquirer.net: https://newsinfo.inquirer.net/776307/the-resurrection-of-mt-magdiwata

Philippine Official Gazette. (1993, October 25). GovPH: Official Gazette. Retrieved from Proclamation No. 282, s. 1993: https://www.officialgazette.gov.ph/1993/10/25/proclamation-no-282-s-1993/

Philippine Statistics Authority. (n.d.). Political Boundaries of Mt. Magdiwata, Agusan del Sur.

Serrano, B. (2010, November 14). 4,000 hold protest to save Agusan watershed. Retrieved from GMA News Online: https://www.gmanetwork.com/news/news/regions/205947/4-000-hold-protest-to-save-agusan-watershed/story/

Serrano, B. (2011, April 25). Mt. Magdiwata: Another Guinsaugon in the making? Retrieved from Philstar Global: https://www.philstar.com/headlines/2011/04/25/678907/mt-magdiwata-another-guinsaugon-making

Stolton, S., & Dudley, N. (2016). METT Handbook: A guide to using the Management Effectiveness Tracking Tool (METT). Woking: WWF-UK.

World Bank, & WWF. (2002). Management Effectiveness Tracking Tool (METT). World Bank and World Wildlife Fund, UK.

WWF International. (2007). Management Effectiveness Tracking Tool Reporting Progress at Protected Area Sites: Second Edition.