# Gendered Perception of Forests Over Limestone Ecosystem Services and Conservation Actions in Guiuan Marine Reserve Protected Landscape and Seascape (GMRPLS), Guiuan, Eastern Samar, Philippines

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### Abstract

Conservation of forests over limestone (FOL), a unique and fragile ecosystem, is critical to ensure the sustainability of both nature and human communities in the vicinities. A survey was conducted to determine the gendered perception about the FOL, the importance of its ecosystem services, and conservation actions in Guiuan Marine Reserve Protected Landscape and Seascape (GMRPLS), Guiuan, Eastern Samar, Philippines. About 541 men and women of barangays Pagnamitan, Ngolos, Baras, and Sulangan, Guiuan, Eastern Samar participated. Both men (3%) and women (2%) in GMRPLS were involved in the conservation of FOL, e.g., policymaking, awareness campaigns, tree planting, and other activities. Also, about 8% of women (W) and 7% of men (M) were interested in participating in conservation actions. The men and women in GMRPLS were slightly to very well familiar (M=92%, W=90%) and aware (M=94%, W=92%) of FOL. The

men (96%) and women (94%) were also slightly to very well aware that the FOL is protected by law and managed by an agency. Also, the men and women considered the ecosystem services of FOL critical, e.g., protection against typhoons, water, fresh air, and wildlife habitat. Conservation actions such as conducting forest information dissemination, participating in conservation programs, planting seedlings, and enacting a localized biodiversity conservation strategy specific to FOL were recommended by the men and women in GMRPLS. Forest regulation and governance of all concerned are necessary to ensure the FOL's sustainability and the continued enjoyment of the communities of its ecosystem services. Moreover, the study suggests extension activities, e.g., information and education campaigns in these barangays, to increase their awareness and appreciation of FOL and encourage their engagement in FOL conservation.

### Keywords

awareness, conservation action, Forests over limestone (FOL), gender role, Kaigangan

# 1. Introduction

Lamentably, the environment is undergoing degradation all over the world, and in tropical areas, deforestation is still rampant. Along with disappearing tropical forests, their ecological services are also lost or deteriorated (Ranlund, 2011). This is observed as well in critically important forests over limestone (FOL). FOL is a type of forest formation found in tropical rainforest regions along with limestone hill areas. Forests over limestone are geomorphologically unique (Tolentino et al., 2020) but are seen to be lower in stature than other forest types (Struebig et al., 2009). Like other forest ecosystems, FOL provides ecosystem services to all lives and communities nearby (Laosuksri and Qi, 2014). Limestone landscapes are known worldwide as areas of great biological importance (Struebig et al., 2009), for they serve as habitats for rich but fragile flora and fauna (Fernando et al., 2008; Laosuksri and Qi, 2014). The FOL also provides other ecosystem services, e.g., mineral and aquifer resources, aesthetic, cultural, and tourism value (Tolentino et al., 2020). However, the limestone forest ecosystem is very vulnerable to disturbances, and restoring FOL is difficult (Long and Trien, 2020). In this fragile ecosystem, the unique species and other valuable resources, e.g., forest products, limestone, and water, make the conservation of FOL of utmost importance (Tolentino et al., 2020). The conservation and management of the forests over limestone is the key to sustainability (Laosuksri and Qi, 2014). Yet, the lack of knowledge about tropical limestone ecosystems impedes conservation efforts (Ranlund, 2011).

Research on FOL is a significant conservation action (Tolentino et al., 2020) due to the increasing number of natural and anthropogenic disturbances (Sodhi et al., 2010). The study of ecosystem services is also called upon to contribute to informed decision-making for planning and conserving the territory and improving the community's well-being (Cifuentes-Espinosa et al., 2021). Moreover, a gendered understanding of ecosystem services could create practical institutional arrangements and management interventions for ecosystems and biodiversity (Kelemen et al., 2016). Understanding the differences is critical to ensure that the policies aimed at improving access to and use of ecosystem services can benefit all genders (Yang, Passarelli, Lovell, and Ringler, 2018). Yet, research on ecosystem services rarely incorporates a gender dimension (Cruz-Garcia et al., 2019). Exploring gender dimensions in forest conservation could also pave the way for more context-specific gender-inclusive policies (Yang et al., 2018). Gender mediates how humans view and interact with their environment. It often influences the use (Cruz-Garcia et al., 2019; Sunderland et al., 2014), knowledge, management, and access to environmental resources (Sunderland et al., 2014). Disregarding gender differences in conservation efforts may result in unsustainable (Fonjong, 2008) and inefficient management (Agarwal,



2000) of FOL. The conservation of FOL needs the active participation of both men and women (Muigua, 2021). Thus, this study was conducted to determine the men's and women's awareness about forests over limestone (FOL), the importance of its ecosystem services, and conservation in Guiuan Marine Reserve Protected Landscape and Seascape (GMRPLS), Guiuan, Eastern Samar, Philippines.

# 2. Methodology

### 2.1 Study Site

Guiuan, Eastern Samar, is considered to have the most diverse species of marine flora and fauna. Among these sources is the Guiuan Marine Protected Landscape and Seascape (GMPLS), designated as part of the National Integrated Protected Area System (NIPAS) on September 26, 1994, with an area of 60,448 hectares. It is an extensive interconnection of diverse ecosystems covering forest, terrestrial, coastal, mangrove, and marine environments. The protected area encompasses 38 barangays, 17 of which are island barangays (Local Government of Guiuan, Eastern Samar, Comprehensive Land Use Plan, 2018-2027). FOL is primarily found in coastal areas, where limestone of marine origin was lifted above the sea level by tectonic processes (Göltenboth, Langenberger, and Widmann, 2006:pp.390). The forests over limestone (FOL) at Calicoan Island, Guiuan, Eastern Samar, covers barangays Pagnamitan, Baras, Ngolos, and Sulangan, where the study was conducted.



Fig 1. Study Site Map of the Selected Barangays in Guiuan, Eastern Samar, Philippines



# 2.2 Data Collection and Analysis

The study's respondents were the men and women of Barangays Pagnamitan, Ngolos, Baras, and Sulangan. The respondents were also categorized according to age groups; (1) 18-30 years old, (2) 31-50 years old, and (3) 51 years old and above to capture the viewpoints of these men and women of various age groups. About 10% of the men and women of the four barangays from each age group (Table 1) were surveyed using a questionnaire to determine their awareness of FOL, the importance of its ecosystem services, and conservation in Guiuan Marine Reserve Protected Landscape and Seascape (GMRPLS), Guiuan, Eastern Samar, Philippines. The profile of the respondents, such as age, gender, education, income, and household's primary source of income, was asked. The respondents were asked to rate their awareness of the FOL and the importance of the FOLs ecosystem services based on a 0-4 Likert scale, where 0 means not at all and 4 means very well aware or very important. The respondents were also asked to respond whether they strongly agree (SA), agree (A), undecided (U), disagree (D), or strongly disagree (SD) with statements that determine their perception of the effect of unsustainable management of FOL and their recommended actions to protect and conserve the FOL.

Results from the survey were analyzed using appropriate descriptive statistical tools. Frequency analysis, percentages, and mean were used to describe the socio-economic characteristics of the respondents, awareness, and perception of the FOL. The chi-square test of independence was used to determine the significant association of gender and age with awareness about FOL. The chi-square test of independence can be used to analyze any level of data measurement but is particularly useful in analyzing nominal data. After the statistical significance was established, the degree of association was evaluated using Cramer's V. Moreover, the rank-biserial coefficient was calculated to determine the relationship between gender and the level of importance of FOL's ecosystem services. Spearman rank correlation was also used to determine the relationship of other socio-demographic variables with the perceived level of importance of FOL's ecosystem services.

# 3. Results and Discussion

## 3.1 Awareness of men and women about forests over limestone

The men and women respondents from all age brackets were surveyed to attain the study's objectives (Table 1). A total of 541 respondents were able to participate, wherein 285 were male and 256 were female. About 19% of men and 18% of women were 18-30 years old, and about 19% of men and 15% of women were 31-50. Also, 15% of men and 14% of women were 51 years old and above. Only a few men (12%) and women (9%) have elementary education. About a quarter of men (23%) and women (21%) have secondary education, while about 18% of men and 17% of women have tertiary education. Almost all (99%) men and women have been residing in their barangays for over ten (10) years. More than half (57%) of the respondents have household members of 5 and below, while only about 4% have members of more than 10. Moreover, the primary source of income of the respondents was fishing, and the majority were earning Php5000.00 and below. Barangays Pagnamitan, Baras, Ngolos, and Sulangan are coastal barangays along the Guiuan Peninsula.



Sacia demographia profila	Gender						
Socio-demographic prome	Male (	n=285)	Female	(n=256)			
	М	%	F	%			
Age							
18-30	103	19.04	96	17.74			
31-50	102	18.85	82	15.16			
51 and above	80	14.79	78	14.42			
Education							
Elementary	67	12.38	50	9.24			
Secondary	123	22.74	112	20.70			
College	95	17.56	94	17.38			
Years of Stay							
≤ 10 years	22	4.07	30	5.55			
≥ 11 - 20 years	55	10.17	38	7.02			
≥ 21 - 30 years	61	11.28	75	13.86			
≥ 31 - 40 years	39	7.21	34	6.28			
≥ 41 - 50 years	44	8.13	32	5.91			
≥ 51 years and above	64	11.83	47	8.69			
Household members							
≤ 5	161	29.76	145	26.80			
≥ 6 - 10	114	21.07	100	18.48			
≥ 11 and above	10	1.85	11	2.03			
Household income							
≤ 5000	241	44.55	211	39.00			
≥ 5001 - 10000	31	5.73	34	6.28			
≥ 10001 and above	12	2.22	11	2.03			
Household's primary source of income							
Fishing	194	35.86	153	28.28			
Selling goods and other commodities (e.g., sari-sari store owner, fish vendor, etc.)	13	2.40	34	6.28			
Employed, e.g., teacher, security guard, barangay official, etc.	25	4.62	21	3.88			
Construction works, e.g., laborer, construction worker, mason, carpenter	22	4.07	15	2.77			
Transport service, e.g., driver	11	2.03	4	0.74			
Farming	5	0.92	9	1.66			
Others, e.g., remittance, pension, allowance, etc.	15	2.77	20	3.70			

#### Table 1. Socio-demographic Profile of the Respondents (n=541)

Table 2 shows the respondents' awareness of the forests over limestone (FOL) according to gender and age group. They are aware that FOL is a forest formation type thriving on limestone karst outcrops mainly composed of calcium carbonate (Tolentino et al., 2020). Preliminary studies indicated that the Philippine karst landscapes cover about 35,000 km<sup>2</sup> of the country's total land area, about 29% of which is protected by law (Wagner 2013). As shown in Table 2, the men and women (90%) in GMRPLS were slightly to very well familiar (M=92%, W=90%) and aware (M=94%, W=92%) of FOL. The men (2.23) and women (2.37) aged 18-30 were slightly more familiar with FOL than the other age groups. Also, about 8% of men and 10% of women were unfamiliar with FOL, while about 8% of men and 12% of women were very familiar with FOL. Moreover, the men aged 51 and above were slightly more aware than the other age groups, while the women aged 31-50 were the least aware of the FOL compared to different age groups. A weak association between gender and awareness about FOL was found at a .01 significance level (Table 3). Also, a weak association of age (.136)

and gender (.142) with familiarity and awareness about FOL, respectively, was found at a .05 level of significance (Table 3).

The awareness of the respondents about FOL is critical in conservation management. The men and women in the community need to be aware of their environment, as this is the foundation and starting point (Burchett, 2015) of their local engagement in conservation and protection efforts. Moreover, environmental awareness can be utilized for environmental policymaking and management (lizuka, 2000). Policymakers can translate and incorporate men's and women's awareness of the FOL's benefits, priorities, and preferences in local development plans, programs, and policies (Nyangoko et al., 2021). The study suggests environmental extension activities of concerned institutions involving more women of various age groups to increase their awareness about FOL, e.g., information and education campaigns about FOL, environmental management, and other information relevant to its practical conservation and protection. Mobilizing biodiversity information is essential in transforming conservation knowledge into action, which requires the collective effort of all stakeholders.

	Gender								
Awareness statement		Male (	n=285)		Female (n=256)				
	18-30	31-50	51-above Average mean		18-30	31-50	51-above	Average mean	
Familiar with FOL	2.23	1.95	2.16	2.11	2.39	2.02	1.87	2.11	
Aware of the FOL in the area	2.20	2.20	2.51	2.29	2.28	2.15	2.23	2.22	
Aware that FOLs are protected by law	2.52	2.37	2.56	2.48	2.48	2.39	2.36	2.41	
Aware that an agency oversees FOLs management and conservation	2.42	2.38	2.49	2.42	2.38	2.43	2.38	2.39	

Table 2. Awareness of FOL according to gender and age group (n=541)

Furthermore, about 96% of men and 94% of women were slightly to very well aware that the FOL is protected by law. The men (2.48) and women (2.41) of the various age groups were moderately aware that the FOL in Guiuan Marine Reserve Protected Landscape and Seascape (GMRPLS) is protected by law. There is no direct and specific law for the conservation and protection of the FOL in the study site. The FOL in Guiuan, Eastern Samar, is under the Guiuan Marine Reserve Protected Landscape and Seascape (GMRPLS), a protected area (PA) established through Presidential Proclamation 469, s.1994. Tolentino et al. (2020) stated that many karst areas in the Philippines are indirectly protected and are included in more expansive areas specified for protection.

Moreover, the men (96%) and women (94%) were also slightly to very well aware that an agency oversees the management and conservation of Kaigangan forests. The men aged 51 and above (2.49), and the women aged 31-50 (2.43) were slightly more aware that an agency is mandated to oversee the FOL in the area. Table 3 also shows that age was moderately associated (.239) with their awareness that an agency oversees the FOL in the area. The Protected Area Management Board (PAMB) is managing the FOL in Guiuan Marine Reserve Protected Landscape and Seascape, a multisectoral body composed of representatives of Local Government Units (LGUs), National Government Agencies (NGAs), People's Organizations (POs), Non-government Organizations (NGOs), and the Department of Environment and Natural Resources (DENR) responsible for policy formulation and general administration of the protected area. PAMB policies and programs are carried out by the Protected Area Superintendent's Office, headed by a Protected Area Superintendent (PASu). Awareness of environmental laws is critical to ensure compliance and engagement of the community in conservation efforts, which is strongly influenced by their perceptions and opinions of environmental management and governance (Bennett and Dearden, 2014).



Awaranaaa		Gender	Age		
Awareness	X <sup>2</sup>	Measure of Association	X <sup>2</sup>	Measure of Association	
Familiar with FOL	6.183	.107	19.932	.136**	
Aware of the FOL in the area	15.212	.169***	21.876	.142**	
Aware that FOLs are protected by law	5.570	.101	11.580	.103	
Aware that an agency oversees FOLs management and conservation	7.274	.116	30.980	.239***	

Table 3. Association of the awareness about FOL of the respondents with gender and age

\*\*\*p=<.01 \*\*p=<.0.05 \*p=<.10

## 3.2 Importance of the ecosystem services of the FOL

Table 4 shows the ecosystem services of the FOL considered important by the men and women in the study. FOL provides water, which is essential for maintaining an adequate food supply and a productive environment for all living organisms (Kılıç, 2020). The limestone karst is a rock that dissolves and drains readily. The groundwater under the limestone layers plays a significant role for all living in the areas and nearby communities, e.g., water consumption (Laosuksri and Qi, 2014). FOL also provides fresh air by filtering air pollution. The trees in the FOL filter air through the "interception of particulate matter on plant surfaces and the absorption of gaseous pollutants through the leaf stomata (Nowak et al., 2014)." The women considered FOL important in providing water (3.54) and fresh air (3.57) slightly more than men, which obtained a mean score of 3.47 for water and 3.50 for fresh air. Yang et al. (2018) found that in most cases, women are perceived to put more importance on the value of water than men maybe since women and young girls are the primary collectors and users of domestic water. Moreover, education was related to the perceived importance of water and fresh air provided by FOL. Income was also associated with the perceived importance of fresh air provided by FOL (Table 5).

	Gender									
Awareness statement		Male (	(n=285)		Female (n=256)					
	18-30	31-50	51-above	Average mean	18-30	31-50	51-above	Average mean		
Clean water	3.51	3.43	3.45	3.47	3.61	3.46	3.51	3.54		
Fresh air	3.52	3.48	3.50	3.50	3.68	3.51	3.51	3.57		
Soil stability	3.49	3.41	3.40	3.44	3.57	3.45	3.56	3.53		
Wildlife habitat	3.41	3.36	3.38	3.38	3.61	3.46	3.55	3.55		
Climate change impact amelioration	3.46	3.36	3.34	3.39	3.53	3.39	3.50	3.48		
Place for meditation	3.34	3.24	3.93	3.19	3.36	3.16	3.32	3.29		
Ecotourism	3.41	3.30	3.16	3.30	3.46	3.38	3.44	3.43		
Food and medicine	3.43	3.33	3.35	3.37	3.53	3.41	3.44	3.46		
Timber	3.29	3.21	3.18	3.23	3.41	3.17	3.37	3.32		
Industrial raw materials like resin	3.29	3.16	3.00	3.16	3.32	3.07	3.23	3.21		
Ornamentals	3.24	3.10	2.94	3.11	3.28	3.11	3.23	3.21		
Firewood	3.17	3.13	3.03	3.12	3.31	2.88	3.19	3.14		
Income	3.34	3.22	3.30	3.32	3.43	3.34	3.45	3.32		
Protection against typhoon	3.41	3.32	3.41	3.38	3.60	3 51	3 47	3.46		

Table 4. Level of importance of FOLs ecosystem services according to gender and age (n=541)

The men (3.39) and women (3.48) considered FOL vital for climate change amelioration. However, forests have a dual effect on the environment, especially climate change. Forests help mitigate climate change (Brack, 2019) by acting as



carbon sinks (Dida et al., 2021; Nivithra and Shoba Jasmin, 2020), but when trees are cut, they release CO<sub>2</sub>, affecting climate change's variability (Brack, 2019). FOL also functions as a buffer zone from storms. The men (3.38) and women (3.46) considered FOL important as protection against a typhoon. Limestone forests also provide habitat, protection, and safety to numerous species (Tolentino et al., 2020), many of which are endemic (Long and Trien, 2020) and have adapted to their conditions (Laosuksri and Qi, 2014). Fernandez et al. (2020) documented different fauna and flora in the FOL of Calicoan Island, Guiuan, Eastern Samar, including a new locality record of the Philippine endemic tree species *Hancea wenzeliana*, and new island records for fauna such as *Varanus samarensis* and *Cyrtodactylus sumuroi*, among many others. The women considered FOL important as a wildlife habitat with a mean score of 3.55, slightly higher than the mean score of men, which is 3.38. The results also showed that gender is weakly related to the perceived level of importance of the protection function against typhoons (.157) and the provision of habitat for wildlife (.135) by FOL (Table 5).

Table 5. Relationship between selected socio-demographic characteristics	s of the respondents and the level of importance of FOLs ecosystem services
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Importance of FOL a accounter convision	Variables						
importance of FOL's ecosystem services	Gender	Age	Education	Income			
Clean water			.102**				
Fresh air			.115***	.100**			
Soil stability			.090**	.085**			
Climate change impact amelioration							
Protection against typhoon	.157***						
Wildlife habitat	.135***						
Income	.099**		.087**	.102**			
Place for meditation		106**	.127***				
Ecotourism	.101**		.095**				
Food and medicine							
Timber	.085**		.088**				
Industrial raw materials like resin		.113***	.135***				
Ornamentals	.090**	111**	.116***				
Firewood							

\*\*\*p=<.01 \*\*p=<.0.05 \*p=<.10

Moreover, forest conservation is meaningful and sustainable if people see the economic benefits of conserving forests (Wickramasinghe, 2013). Both men (3.32) and women (3.32) considered FOL important in generating income. Forests are a vital economic resource, and forest-related income is crucial in poverty alleviation and rural development. Forests contribute to poverty reduction by providing food, fuelwood, construction timber, and forest-based products (Biland, Zeb, Ullah, and Kaechele, 2021). While firewood is a significant energy source, especially in developing countries (Kyaw, Ota, and Mizoue, 2020), firewood was perceived as less vital by men (3.12) and women (3.14) in the study, for it obtained one of the lowest mean scores. FOL also provides cultural services, e.g., recreation and a place for meditation that were considered by the respondents critical. Forest provides all atmospheres of solitude, freshness, pleasure, and natural beauty of trees and wild animals, mountains, caves, and others suitable for meditation exercises conforming to the foundations of mindfulness (Nuarhnwan and Phramaha, 2021). Ecotourism can create awareness and motivate the community to conserve and protect the FOL (Ali et al., 2021). The Linao Cave within the FOL of GMRPLS is an ecotourism site managed by the DENR. The results showed that women obtained a slightly higher mean score for their perceived importance of FOL as an ecotourism (3.43) site and a place for meditation (3.29) than men. Moreover, gender (.101) and education (.095) were slightly related to the perceived importance of ecotourism services of FOL. A negative



and slight relationship (-.106) was found between age and the perceived importance of FOL as a place for meditation. Also, education (.127) was slightly correlated with the perceived importance of FOL as a place for meditation.

### 3.3 Perceived effect of unsustainable management of FOL

Table 6 shows the perceived effect of unsustainable management of FOL according to age and gender. Most men and women from various age groups agreed that reducing trees in FOL can impact climate change and cause landslides, flooding, and river pollution. Forests are a primary natural factor that regulate and determine an area's climate and weather patterns (Ali, Riaz, and Iqbal, 2014) and act as a carbon sink (Dida et al., 2021; Nivithra and Shoba Jasmin, 2020). Forests also play a particular role in regulating landslide susceptibility (Zhang, Shen, Zhou, and Luo, 2022). Moreover, they prevent floods in downstream areas, regulate seasonal flows, and ensure high water quality (Dessie and Bredemeier, 2013). However, most forests (Khalid et al., 2019), including FOL (Tolentino et al., 2020), are threatened by deforestation, which disturbs the ecosystem, the services they provide, and the area's climatic conditions (Khalid et al., 2019). Table 6 also showed that a higher percentage of women from different age groups strongly agreed that losing FOL may impact climate change. This implies that women are more concerned about forest degradation. Several studies also suggest that women, regardless of age, are more concerned than men about the environment (Strapko et al., 2016; Xiao and McCright, 2012; Zelezny et al., 2000) and express more concern over potential environmental degradation (Tindall, Davies, and Mauboules, 2003).

		Gender											
Statement	Age			Male (r	ı=285)			Female (n=256)					
		SA	Α	U	D	SD	Total	SA	Α	U	D	SD	Total
The loss of FOL may impact climate change.	18-30	23 (22.33)	64 (62.14)	16 (15.53)	0 (0.00)	0 (0.00)	103 (100.00)	31 (32.29)	52 (54.17)	10 (10.42)	2 (2.08)	1 (1.04)	96 (100.00)
Reduction of trees in FOL can cause landslides.		28 (27.180	66 (64.08)	8 (7.77)	1 (.97)	0 (0.00)	103 (100.00)	35 (36.46)	51 (53.13)	6 (6.25)	1 (1.04)	3 (3.13)	96 (100.00)
Unsustainable removal of trees in FOL can lead to flooding		23 (22.33)	70 (67.96)	7 (6.80)	3 (2.91)	0 (0.00)	103 (100.00)	31 (32.29)	50 (52.08)	10 (10.42)	3 (3.13)	2 (2.08)	96 (100.00)
The decrease of trees in FOL can cause river pollution.		21 (20.39)	66 (64.08)	12 (11.65)	2 (1.94)	2 (1.94)	103 (100.00)	31 (32.29)	53 (56.21)	8 (8.33)	2 (2.08)	2 (2.08)	96 (100.00)
The loss of FOL may impact climate change.	31-50	28 (27.45)	59 (57.84)	12 (12.75)	1 (0.98)	1 (0.98)	102 (100.00)	31 (37.80)	42 (51.22)	5 (6.10)	2 (2.44)	2 (2.44)	82 (100.00)
Reduction of trees in FOL can cause landslides.		30 (29.41)	62 (60.78)	9 (8.82)	1 (.98)	0 (0.00)	102 (100.00)	34 (41.46)	38 (46.34)	3 (3.66)	3 (3.66)	4 (4.88)	82 (100.00)
Unsustainable removal of trees in FOL can lead to flooding		25 (24.51)	62 (60.78)	11 (10.78)	3 (2.94)	1 (.98)	102 (100.00)	31 (37.80)	39 (47.56)	4 (4.88)	4 (4.88)	4 (4.88)	82 (100.00)
The decrease of trees in FOL can cause river pollution.		24 (23.53)	63 (61.76)	13 (12.75)	0 (0.00)	2 (1.96)	102 (100.00)	34 (41.46)	38 (46.34)	6 (7.320	2 (2.44)	2 (2.44)	82 (100.00)
The loss of FOL may impact climate change.	51 and above	30 (37.50)	38 (47.50)	7 (8.75)	4 (5.00)	1 (1.25)	80 (100.00)	32 (41.03)	38 (48.72)	6 (7.69)	0 (0.00)	2 (2.56)	78 (100.00)
Reduction of trees in FOL can cause landslides.		28 (35.00)	41 (51.25)	8 (10.00)	1 (1.25)	2 (2.50)	80 (100.00)	36 (461.5)	35 (44.87)	4 (5.13)	1 (1.28)	2 (2.56)	78 (100.00)
Unsustainable removal of trees in FOL can lead to flooding		25 (31.25)	42 (52.50)	8 (10.00)	3 (3.75)	2 (2.50)	80 (100.00)	31 (39.74)	40 (51.28)	4 (5.13)	2 (2.56)	1 (1.28)	78 (100.00)
The decrease of trees in FOL can cause river pollution.		17 (21.25)	44 (55.00)	14 (17.50)	2 (2.50)	3 (3.75)	80 (100.00)	24 (30.77)	39 (50.00)	9 (11.54)	2 (2.56)	4 (5.13)	78 (100.00)

Table 6. Perceived effect of unsustainable management of FOL according to gender and age (n=541)



## 3.4 Recommended Actions to Protect and Conserve the Kaigangan Forests

About 2% of women and 3% of men in GMRPLS were involved in conserving the FOL, e.g., policymaking, planning, awareness campaigns, tree planting, seedling distribution, and other conservation activities. Also, 16% (84) of the respondents were interested in participating in conservation efforts of the FOL, wherein a slightly higher number of women (45) were interested than men (39). About 79% of the respondents were not involved in the conservation of FOL, either because they were unaware, not interested, not their priority, or because of old age. Thus, the men and women recommended several actions to heighten the conservation of FOL in GMRPLS.

Most men (86%) and women (84%) recommended forest information dissemination (Table 7). Local communities' awareness and participation (Truong, 2022) are crucial in implementing conservation and protection actions. Lack of proper information dissemination limits appropriate management (Mbah and Ayegba, 2013) of FOL. The absence or insufficiency of information about FOL, including its biodiversity, hinders conservation efforts since they are crucial in developing management strategies. Equipping local communities with knowledge generated through research increases their awareness of what forests over limestone can offer (Tolentino et al., 2020), which will lead to the establishment of rational strategies regarding karst, e.g., appropriate land management, sustainable land use planning, and maintenance of protected areas (Day, 2010), and sustainable use of resources (Tolentino et al., 2020). Also, most men (89%) and women (95%) agreed that they should participate in conservation programs or seminars (Table 5). The study suggests the conduct of IECs involving men and women at the barangay level to engage and empower them to take an active part in the conservation and protection of FOL. Effective environmental education goes beyond the mere transfer of information, for it helps develop and enhance the environmental attitudes, values, knowledge, and skills of men and women to collaboratively undertake positive environmental action (Ardoin, Bowers, and Gaillard, 2020).

The DENR is the primary agency mandated in the conservation of the natural resources of the country. The FOL is under the management of PAMB-GMRPLS. The men (90%) and women (92%) in GMRPLS recommended the agencies' active involvement in conserving the FOL. The respondents also suggested the strict implementation of environmental laws for conserving the FOL in GMRPLS. Implementing forest laws is not the duty of the government alone but requires the participation of the community (Juan and Vargas, 2021). However, the involvement of different sectors in environmental governance in the Philippines is limited (Arcenas et al., 2017). The Philippine forest-related laws also have weaknesses and limitations, e.g., incomplete devolution to LGUs of forest management activities and conflicting policies, which hinder successful forest governance (Arcenas et al., 2017). The men (90%) and women (91%) in GMRPLS suggested enacting a localized biodiversity conservation strategy specific to FOL. As mentioned, no specific policy for conserving and protecting FOL in GMRPLS exists. The study recommends evaluating forest laws and enacting a particular provision focusing on the fragile limestone forest ecosystem in Guiuan, Eastern Samar, and other FOLs in the country. Forest regulation and governance are necessary to ensure the FOL's sustainability and the continued enjoyment of the communities of its ecosystem services.

The communities are also responsible for conserving and protecting the forests by forming organizations (Agarwal, 1997) and engaging in conservation actions. Most men (88%) and women (87%) in the study recommended strengthening and organizing People's Organizations in the forest communities. Empowering People's Organizations (PO) has been the development approach in the Philippines for several decades (Duthy and Bolo-Duthy, 2003). The study encourages the communities to establish a PO that preserves and protects FOL in GMRPLS. Conservation actions of the communities are crucial in the conservation of the FOL. For example, there is a pressing need to conserve plant diversity to prevent extinctions and enable sustainable plant material for current and future generations (Breman et al., 2021). The



men (M) and women (W) also suggested the seed collection of native plants and their distribution to the neighbors (M=86%, W=82%), sowing seeds in the backyard or garden (M=84%, W=93%), planting seedlings (M=86%, W=95%), caring and maintaining the plants (M=86%, W=92%), and harvesting resources sustainably (M=79%, W=80%). The overall results showed that a slightly higher percentage of women recommend protecting and conserving FOL in GMRPLS. Empowering the men and women in local communities to take a more active role in sustaining the natural resources they depend on (Luder, Lyons, and Marshall, 2016) is critical in promoting conservation actions.

	Gender												
Recommended Actions	Male (n=285)							Female (n=256)					
	SA	Α	U	D	SD	Total	SA	Α	U	D	SD	Total	
Forest information dissemination	68	177	34	5	1	285	84	130	38	3	1	256	
	(23.86)	(62.11)	(11.93)	(1.75)	(0.35)	(100.00)	(32.81)	(50.78)	(14.84)	(1.17)	(0.39)	(100.00)	
Participating in conservation	65	190	27	2	1	285	86	158	12	0	0	256	
programs or seminars	(22.81)	(66.67)	(9.47)	(0.70)	(0.35)	(100.00)	(33.59)	(61.72)	(4.69)	(0.00)	(0.00)	(100.00)	
Strengthening or organizing POs	54	198	26	6	1	285	66	156	32	2	0	256	
	(18.95)	(69.47)	(9.12)	(2.11)	(0.35)	(100.00)	(25.78)	(60.94)	(12.50)	(0.78)	(0.00)	(100.00)	
Active involvement of agencies concerned	69	188	22	5	1	285	86	150	18	2	0	256	
	(24.21)	(65.96)	(7.72)	(1.75)	(0.35)	(100.00)	(33.59)	(58.59)	(7.03)	(0.78)	(0.00)	(100.00)	
Strict implementation of environmental laws	81	181	21	1	1	285	110	133	12	1	0	256	
	(28.42)	(63.51)	(7.37)	(0.35)	(0.35)	(100.00)	(42.97)	(51.95)	(4.69)	(0.39)	(0.00)	(100.00)	
Enactment of localized biodiversity conservation strategy	73	184	26	1	1	285	97	135	20	4	0	256	
	(25.61)	(64.56)	(9.12)	(0.35)	(0.35)	(100.00)	(37.89)	(52.73)	(7.81)	(1.56)	(0.00)	(100.00)	
Native plant seed collection and distribution to neighbors	55	189	30	10	1	285	72	138	33	7	6	256	
	(19.30)	(66.32)	(10.53)	(3.51)	(0.35)	(100.00)	(28.13)	(53.91)	(12.89)	(2.73)	(2.34)	(100.00)	
Sowing of seeds in the backyard or garden	62	177	40	4	2	285	99	139	16	0	2	256	
	(21.75)	(62.11)	(14.04)	(1.40)	(0.70)	(100.00)	(38.67)	(54.60)	(6.25)	(0.00)	(0.78)	(100.00)	
Planting of seedlings	76	170	33	4	2	285	106	136	13	0	1	256	
	(26.67)	(59.65)	(11.58)	(1.40)	(0.70)	(100.00)	(41.41)	(53.13)	(5.08)	(0.00)	(0.39)	(100.00)	
Care and maintenance of the plants	76	170	34	3	2	285	105	132	18	1	0	256	
	(26.67)	(59.65)	(11.93)	(1.05)	(0.70)	(100.00)	(41.02)	(51.56)	(7.03)	(0.39)	(0.00)	(100.00)	
Sustainable harvesting of resources	69	157	39	15	5	285	78	126	28	12	3	256	
	(24.21)	(55.09)	(13.68)	(5.26)	(1.75)	(100.00)	(30.47)	(49.22)	(10.94)	(4.69)	(1.17)	(100.00)	

Table 7. Recommended actions to protect and conserve the FOL according to gender and age (n=541)

# Conclusion and Recommendations

Forests over limestone (FOL) conservation is critical to ensure sustainability since this type of forest formation is vulnerable to disturbances. A gendered perception about the forests over limestone, the importance of its ecosystem services, and conservation actions in Guiuan Marine Reserve Protected Landscape and Seascape (GMRPLS), Guiuan, Eastern Samar, Philippines are of paramount importance in the development and strengthening of policies and programs for its conservation. The awareness of the FOL and their understanding of the relevance of its ecosystem services are critical in engaging the community to participate in conservation actions. The men and women in GMRPLS were moderately familiar with and aware of FOL. The men and women were also moderately aware that the FOL is protected by law and managed by an agency. Also, men and women considered the ecosystem services of FOL important, e.g., protection against typhoons, water, fresh air, and wildlife habitat. Conservation actions such as conducting forest information dissemination, participating in conservation programs, planting seedlings, and enacting a localized biodiversity conservation strategy specific to FOL were recommended by the men and women in GMRPLS. Forest regulation and governance of all concerned are necessary to ensure the FOL's sustainability and the continued enjoyment of the communities of its ecosystem services. Moreover, the study suggests extension activities, e.g., the conduct of higher education institutions of information and education campaigns in these barangays in collaboration with other



concerned agencies, to increase their awareness and appreciation of FOL and encourage their engagement in FOL conservation. Further study about the extension needs of the communities to support FOL conservation efforts is also recommended.

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