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# The interactive effect of endogenous and exogenous institutions on forest use practices in socio-culturally diverse landscapes of Cameroon

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## Abstract

In resource-dependent communities of sub-Saharan Africa, it is widely held that endogenous institutions either countervail or complement exogenous institutions, indicating inconsistency in empirical evidence. This has re-ignited interest to establish the independent and/or interactive effect of both endogenous and exogenous institutional structures. This paper quantitatively analyses the independent and interactive effects of community-based (endogenous) and state-based (exogenous) forest management institutions (FMIs) on the exploitation of forest resources, drawing from a representative sample of 446 households from three socio-culturally diverse landscapes of Cameroon. The paper introduces a multiplicative interaction term and used the heteroscedasticity-based instrumental variables approach to estimate the direct and indirect effects of exogenous and endogenous institutions on the behaviour of users of forest-based resources. The results indicate that: (i) Both exogenous structures of FMIs and the interaction term significantly constrain the extractive behaviour of forest resource users; (ii) endogenous structures and not rules are vital in improving the role of exogenous structures in forest resource management; (iii) while traditional rules are less significant in shaping forest resource exploitation, their effectiveness is highly significant across the study sites and (iv) institutional compatibility and complementarity was observed in landscapes that were formerly shaped by British colonial influence (Bakossi and Kilum-Ijim). This paper does not only establish the relative influence of exogenous and endogenous FMIs, it also highlights future research pathways on institutional change in the context of environmental resource management in sub-Saharan Africa.

**Keywords** Institutions · Interactions · Forest resources · Compatibility · Complementarity

## 1 Introduction

Forests constitute important livelihood support systems for many communities in sub-Saharan Africa (SSA) (Kimengsi et al., 2020; Nuesiri, 2022), despite their significant exposure to rapid landscape transformation. Landscape transformation in SSA is triggered by changes in ecological conditions, economic, social and politico-cultural forces, including governance issues (Haller et al., 2016, 2018; Avagyan, 2018). At the heart of

governance is the role of institutions—the rules-in-use which enhances or constrains the intentions and actions of forest actors (Ostrom, 1990). Historically, SSA experienced the exogenous versus endogenous institutional interactions (Jusrut, 2022; Ntuli et al., 2022). Endogenous institutions denote structures (rules and customs) which are engrained in communities and which define the access, appropriation and management of forest resources (Colding et al., 2003). This is different from exogenous institutions; formally-crafted laws, rules and policies which are backed by the state. Although there are variations in the level of exogeneity and endogeneity, in the case of this study, we consider endogenous as local communities rule/structures and exogenous as those which were introduced from outside the study communities (Owusu et al., 2023). Significant evidence points to the fact that both forms of institutions could play functional and/or complementary roles (Ntuli et al., 2022; Yeboah-Assiamah et al., 2017).

Considering the diversity of actor constellations, either exogenous or endogenous institutional arrangements have been given priority in SSA's forest resource management (Owusu et al., 2023). While exogenous institutions are blamed for virtually suppressing endogenous ones in some cases, there is also evidence that endogenous institutions continually countervail exogenous ones (Buchenrieder & Balgah, 2013; Kimengsi, 2014; Sikor & Nguyen, 2007; Teffo, 2012). Consequently, the present-day forest management shows signals of sub-optimal outcomes, as exogenous and endogenous institutions impede each other. Additionally, there is the lack of empirical substantiation on the conditions under which the interaction of both institutional forms shape forest use and management decisions. This is relevant especially when multiple cases are used to support analytical generalizations in SSA. SSA is considered a useful 'living laboratory' to analyse the relative dominance of exogenous and/or endogenous institutions since both forms of institutions virtually compete—with the scars of colonialism still persisting (Kimengsi & Balgah, 2021; Osei-Tutu, 2017). SSA hosts the Congo Basin—the second largest forest ecosystem in the world which has been subjected to significant transformations. Such transformation is linked to the sometimes counterproductive effects of both forms of institutions (exogenous and endogenous). Furthermore, SSA is ethnically diverse, thus validating the multiplicity of exogenous and endogenous institutions shaping the appropriation and management behaviour of forest users. Studies show that SSA is ranked high in terms of its ethnic fractionalization score (0.71) which is far above global average-0.48 (Fearon, 2003; Kimengsi et al., 2022a). In SSA, Cameroon is chosen as a useful epistemological example.

Cameroon is one of the Congo Basin countries which has numerous national parks, wildlife sanctuaries and forest reserves—generally known as protected areas (Kimengsi & Balgah, 2021). The country has more than 250 ethnic groups (Yenshu, 2011) and a high ethnic fractionalization score (0.89) (Fearon, 2003). In this study, evidence is derived from three forest landscapes (Santchou, Bakossi and Kilum-Ijim). The choice is based on socio-cultural diversity; purely grassfield communities (Kilum-Ijim), coastal communities (Bakossi) and transitional communities—a mix of grassfields and coastal cultures (Santchou). These landscapes have existed for over five decades,<sup>1</sup> and are located in both the predominantly English and French speaking regions, having both British and French colonial histories (Yenshu, 2011). The study sites are veritable settings to enhance understanding of the interactions between both institutional forms (exogenous and endogenous) and for comparing their potentials in shaping forest appropriation and management.

<sup>1</sup> In 1956, the Bakossi forest reserve was established, while in 1964, the Santchou reserve was created. Also, efforts to conserve the Kilum-Ijim forest started in 1931 (FAO 2002).

Despite the growing body of the literature on forest management institutions (Ingram et al., 2015; Djenontin & Zulu, 2021; Owusu et al., 2023) including cases from these landscapes in Cameroon (Kimengsi & Balgah, 2021; Kimengsi et al., 2022b, 2023), an inconclusive debate exists with respect to the dominance of either exogenous or endogenous institutions (Ntuli et al., 2022). This has thus re-ignited scientific interest to establish the independent and/or interactive effect of both endogenous and exogenous structures. To achieve this, the current paper quantitatively analyses the independent and interactive effects of community-centred and state-centred FMIs on forest resource exploitation—proxy by NTFP harvesting—in 10 villages in these three landscapes in Cameroon. It employs a multiplicative interaction term and the heteroscedasticity-based instrumental variables to estimate the direct and indirect effects of both forms of institutions (exogenous and endogenous) on the behaviour of forest resource appropriators. The heteroscedasticity-based instrumental variable estimation approach minimizes the problem of simultaneity bias between forest use practices and institutions. The evidence derived from this analysis provides new insights on the relative dominance of either forms of institutions in the face of significant transformation of forest landscape in SSA. It also provides evidence to support analytical generalizations on institutional interaction and their expected change pathways and outcomes.

## 2 Research methods

### 2.1 Study cases

Cameroon has a very significant cultural diversity in sub-Saharan Africa (SSA)—the number of ethnic groups exceed 250 (Egute, 2012; Yenshu, 2011). Forming part of the Congo Basin, Cameroon is ranked the 8th most forest endowed country in the world. This makes it an important ‘living laboratory’ to explore the interplay of exogenous forest-linked institutions and endogenous ones. This paper focuses on the Santchou, Bakossi and the Kilum-Ijim landscapes (Fig. 1). They were selected based on their ecological and socio-cultural diversity. For instance, Bakossi (coastal setting) and Kilum-Ijim (montane) were influenced by British colonial rule, while Santchou (transitional setting) was influenced by French colonial institutional arrangements. The Bakossi landscape (formerly Bakossi Forest Reserve) was created during British colonial rule (1956) and covers an area of 29,320 ha (Wild, 2004). The landscape hosts endemic animal and plants species (Gardens, 2010; Ngea, 2011). Its key objective is to enhance the regulation of forest use activities (Wild, 2004). Bakossi ethnic groups located on the flanks of the Muanenguba and Kupe Mountains are the main ethnic group (Ejedepang-Koge, 1986; Wild, 2004).

The Santchou landscape was established in 1947 with the intention to enhance reforestation and biodiversity protection. It was later transformed into a Wildlife Reserve in 1986—hosting important animal species such as *Loxodonta pumilio*, also known as the dwarf elephant. The mbos are the original ethnic group here (Mbeng & Buba, 2017). The Kilum-Ijim landscape (20,000 ha) is located in Bui and Boyo Divisions. It has unique biodiversity (FAO, 2002; Fogwe & Kwei, 2015). Kom, Oku and Nso are the main ethnic entities here (FAO, 2002; Ndenecho, 2012).



Fig. 1 Cameroon map showing the study sites

## 2.2 Data collection and sample

This paper constitutes an important component of an on-going study on the role of institutions (exogenous and endogenous) on forest resource management in Cameroon. The study targets ten communities selected from the Santchou, Bakossi and the Kilum-Ijim landscapes. Interest, forest use practices, availability of gatekeepers and community reliance on the forest formed the basis through which the communities from each site were selected. In the Bakossi landscape, 116 households were sampled from three communities, 150 households from three communities in the Kilum-Ijim landscape and 200 households from four communities in the Santchou landscape (Table 1).

**Table 1** Target villages and their HHs sizes in the three landscapes

Targeted villages	Total number of HHs	Sampled HHs
<i>Bakossi</i>		
Ekaku	105	42
Muaku	85	23
Eloum 2	63	51
Total	253	116
<i>Santchou</i>		
Bale	150	50
Mboukou	55	50
Mankang	105	50
Mokot	102	50
Total	412	200
<i>Kilum-Ijim</i>		
Manchok	123	20
Elak	250	52
Mbam	40	3
Total	655	150

The study made use of primary data (through a structured questionnaire). The main data collection instrument was designed between May and June 2020 and pre-tested in Santchou. The first phase of data collection (Santchou) was performed using a random survey of 200 households in three communities (Table 1). The second phase in Kilum-Ijim ran between March and May 2021, whereas the third phase (Bakossi landscape) was performed between November 2021 and February 2022. This was achieved using a structured questionnaire with 60 main items. The structured questionnaire provided information on respondents' social and demographic characteristics, forest use practices, attributes of exogenous and endogenous institutions, institutional evolution and effectiveness. The KOBO collect software was used to record quantitative data. The simple random sampling technique was employed for communities in Santchou and Bakossi landscapes, while the snowball sampling was used for the Kilum-Ijim landscape—due to security challenges. During random sampling, the households were numbered on an ad hoc basis. Then, raffle draws were done to randomly select households. The selected numbers guided the enumerators to identify the precise location of the house for data collection. Respondents were then guaranteed that the information provided will be handled confidentially. Snowball sampling technique is effective for respondents who reside in sensitive and crisis-ridden locations (Gwan et al., 2022). In each landscape, research assistants were recruited, and they received training on how to serve as enumerators. The data collection process provided relevant data on exogenous (state structures) and endogenous (traditional structures) and processes (rules) and the forest use practices in each study site.

### 2.3 Data analysis

In this paper, we investigate the independent and interactive effects of both institutions (exogenous and endogenous) on forest resource extraction. In order to characterize the prevalence

of forest-linked endogenous and exogenous institutions around the study sites, a descriptive approach was used. An instrumental variable approach with heteroscedasticity-based instrumental variable estimation technique was used to estimate the interactive effect of these institutional processes and structures on forest resource exploitation. This approach mitigates the likely simultaneity bias between forest use practices and associated institutional structures. The literature on institutions and natural resource use argues that reverse causality between institutions and resources use is the main source of endogeneity (Kimengsi et al., 2022b). The argument is that, while institutional processes and structures are used to ensure optimality in the exploitation of forest resources around communities, behavioural changes towards forest resource extraction also influence the establishment of new institutions and/or enforce existing institutions. In addition, unobservable heterogeneity and the omission of variables are another potential source of endogeneity. It is, therefore, important to address this problem in order to generate unbiased and consistent parameter estimates. The two-stage least square with a standard set of good instruments for institutions could be more appropriate. However, the standard instrumental variables (IV) technique cannot be used. The heteroscedasticity-based instrumental variable approach is arguably superior (Ntuli et al., 2022) and is adopted for this paper. Lewbel (2012) provided a detail description of this approach. Heteroscedasticity-based instrumental variable technique has been used in scholarly works to address the endogenous relationship between institutions and the use of environmental resources (Kimengsi et al., 2022b; Ntuli et al., 2022). The model is specified as follows:

$$Y = X_1\beta_1 + X_i\beta_i + \varepsilon \quad (1)$$

where  $X_1$  represents the institutional variables—the endogenous variable(s), and  $X_i$  is a list of other control variables used in the analysis (see Table 2). Using the standard 2SLS or three-stage least square (3SLS), the model can be specified as follows:

$$X_1 = Z\gamma_1 + X_i\gamma_i + \mu \quad (2)$$

where  $Z$  is the supposed instrumental variable in the case of a standard 2SLS. The key assumption in the heteroscedasticity-based instrumental variable technique is that for  $\beta_1$ , there are some variables  $Z_2$  probably in  $X_i$  for which:

$$E(V\varepsilon) = 0 \quad (3)$$

$$E(V\mu) = 0 \quad (4)$$

$$E((Z_2 - \mu_2)\mu\varepsilon) = 0 \quad (5)$$

$$E((Z_2 - \mu_2)\mu^2) \neq 0 \quad (6)$$

where  $V = (X, Z)$  are exogenous variables including  $Z_2$ . In Eqs. (3) and (4),  $V$  is assumed to be exogenous. The product of the error term  $\mu\varepsilon$  and demeaned  $Z_2$  in Eq. (5) is expected to be zero. When  $\sigma_{\mu,\varepsilon}(Z_2)$  is constant,  $E((Z_2 - \mu_2)\mu\varepsilon) = E((Z_2 - \mu_2)\text{cov}(\mu, \varepsilon|Z_2)) = E((Z_2 - \mu_2)\sigma_{\mu,\varepsilon}(Z_2)) = 0$ . In this case, and conditional on  $Z_2$ , the covariance between  $\varepsilon$  and  $\mu$  will be independent of  $Z_2$ . In relation to  $Z_2$ , the correlation component does not allow for any heteroscedasticity. The illustration in Eq. (6) suggests that  $(Z_2 - \mu_2)\mu$  can be regarded as a valid instrument for  $X_1$ . However, the error  $\mu$  in the first stage needs to be heteroscedastic in the demeaned  $Z_2$ .

**Table 2** Description of NTFPs, institutions and other controls

Variables	Description
Gender of respondent	0: If the respondent is female and 1: if male
Age of respondent	Respondent's age in years
Education attainment of respondent	0: no formal education; 1: completed primary and 2: at least secondary education
Main activity of respondent	0: If farming is the primary activity of respondent and 1: otherwise
Household size	Total number of people living the household
Migration	1: If household migrated into the area and 0: if an indigene
Income of household	The average monthly income of the household (in CFA)
Indices for exogenous and endogenous institutions	Functional indicators
Traditional (endogenous) structures	Indicators of forest-linked institutional structures include vigilante groups, cultural groups, youth groups, traditional council, secret society and village forest management committee are used
Traditional (endogenous) rules (ER)	Forest-linked traditional rules including values, beliefs, norms, taboos and customs are used
Endogenous structures and rules combined (ECI)	Forest-linked institutional structures including village forest management committee, vigilante groups, traditional council, secret society, youth groups and cultural groups as well as traditional rules—values, beliefs, customs, taboos and norms are used
Index of exogenous institutions (EI)	Exogenous formal structures including local council, civil society, forestry delegation, conservation service and others are used
Effectiveness of tradition rules (EECI)	Traditional rules such values, beliefs, norms, taboos and customs with an effectiveness scale of 1 (lowest)–5 (highest) are used
Dependent variable	
An index for forest use practices	The index is made up of seed-based NTFP (penja pepper, bush pepper, njangsang bitter cola and kolanuts), vegetal NTFP (ngongo leaf, medicinal plant and eru), wood-based NTFPs (chewing stick and fuel wood) and other NTFPs (snails, bush meat, mushroom, honey extraction and others)

## 2.4 Definition and measurement variables

Generally, communities living around forest resource protected areas (irrespective of the status of such systems) depend on timber<sup>2</sup> and non-timber forest products (Ostrom, 2009). Therefore, households extract environmental resources—timber and a range of non-timber

<sup>2</sup> However, harvesting for commercial purposes is carried out in the guise of meeting these objectives (see Kimengs & Balgah 2021).



forest products (NTFPs)—for either household consumption or for the market (Angelsen et al., 2014). Timber harvesting forms an important forest use practice in this landscape, as community members depend on timber for household construction and for the construction of social infrastructure such as bridges, schools and community halls (Kimengsi & Balgah, 2021; Kimengsi et al., 2020). Besides timber, key NTFPs are harvested by forest-adjacent communities. The NTFPs species vary across forest resource systems, while the pattern of harvesting is shaped, among others, by institutional and socio-demographic characteristics. In addition, the conversion of forest areas into farmlands is another dimension of forest resource use which is common in many forested areas around the world (Robinson et al., 2013; Vázquez-García & Ortega-Ortega, 2017), including in SSA (Osei-Tutu et al., 2015). In Table 2, we present the NTFPs used in computing the composite index for forest resource extraction and the indicators for institutional processes and structures as well as the socio-demographic characteristics.

In Table 2, we describe both the dependent and independent variables that are employed in the empirical analysis. This includes information on forest use practices—measured by NTFPs, structural attributes of forest-linked institutional variables and household socio-economic variables. The dependent variable is forest use practices measured in terms of non-timber forest products (NTFPs) harvesting. Rules and structural attributes are used to generate an index for exogenous and endogenous institutions. Structures refer to cultural groups, traditional councils, village forest management committees, secret societies, youth and vigilante groups. These were identified as the key institutional structures linked to the forest. These structures have a series of functional attributes which include the organization of NTFP collection, the setting of traditional days, the enforcement of access rules, the settlement of disputes and the provision of support to forest officials among others. The min–max rescaling transformation was used to summarize the indicators of institutions and forest resource extraction (NTFPs) in Table 2 into indices. This method decomposes the indicators of each variable into a single index that ranges between zero and one, with a score of 1 being the best rank and a score of 0 being the worst rank. In this paper, a positive score indicates that the respondent harvested a specific NTFP within 12 months before the survey and zero signals that the respondent did not harvest the NTFP. For exogenous and endogenous institutions, the score is positive if the respondent perceived the presence of a given indicator of institutional structures and rules and zero if they did not perceive the presence. Yoon (2012) highlighted that with this scaling procedure, differentially-scaled indicators can be standardized into indices. The approach has been employed extensively to aggregate variables and create composite scores (Kimengsi et al., 2022b; Mukong, 2022; Nghipandulwa & Mukong, 2023). The indicators are freed from assuming their initial measurement units by standardizing the generated indices. The standardized indices range between 0 and 1. With more than one indicator for each NTFPs, the standardization required the calculation of average values. The composite indices for NTFPs harvest and/or the prevalence of endogenous and exogenous institutions each range between 0 and 1, and the interactive effect of these institutions is estimated using the heteroscedasticity-based instrumental approach. It should be noted that high values denote higher levels of forest resource extraction and/or the presence of institutional processes and structures.

**Table 3** Household and individual demographic and socioeconomic characteristics

Variable	Bakossi		Santchou		Kilum-Ijim	
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Age of the respondent	38.8	10.66	50.95	9.84	42.85	15.83
Individual is male	0.49	0.50	0.60	0.49	0.78	0.42
Household monthly income (000)	74.5	138	34.6	34.2	81.22	163.6
<i>Education of the respondent</i>						
Completed primary education	0.50	0.50	0.62	0.49	0.42	0.50
At least secondary education	0.44	0.50	0.28	0.45	0.47	0.50
Main activity is non-farming	0.41	0.49	0.11	0.31	0.23	0.33
Household size	10.14	5.29	7.27	2.80	6.29	2.84
Individual is a migrant	0.31	0.47	0.20	0.40	0.07	0.26
Observations	116		200		130	

### 3 Results

#### 3.1 Descriptive statistics on household socioeconomic characteristics

In Table 3, the summary statistics on individual and household characteristics of the sampled respondents from each study sites are presented. According to the results, majority of the respondents in Kilum-Ijim (78%) were male, compared to 60% in Santchou and 49% in Bakossi. Approximately, over 31% of the sample from the Bakossi landscape is made up of migrants relative to 20% from the Santchou landscape and 26% from the Kilum-Ijim landscape. This indicates that majority of those interviewed are indigenes. The average age of a respondent from Santchou is 51 years compared to 43 years for those from Kilum-Ijim and 39 years for the Bakossi sample. The majority of the interviewees in Santchou (89%), Kilum-Ijim (77%) and Bakossi (59%) reported that farming is their main occupation, suggesting that farming is the main activity of individuals residing in each study site. The average number of people per household in the Bakossi landscape is 10, 6 in the Kilum-Ijim landscape and 7 in the Santchou landscape. The average household income for those from Kilum-Ijim is estimated at about CFA81,000 compared to CFA75,000 for households from Bakossi and CFA34,000 for households from Santchou.

#### 3.2 Characterization of endogenous and exogenous forest-linked institutions

The distribution of endogenous (community-based) structures as well as exogenous structures of forest-linked institutions in each study site is reported in Table 4. Regarding traditional rules, the majority of the sample (94%) from the Bakossi landscape perceived norms, beliefs and customs to be essential for forest resource management compared to 93% and 90% who, respectively, viewed taboos and values as key traditional rules in this study site. While 58% of the respondents in Santchou perceived that beliefs are key for forest use practices, only 32%, 20%, 13% and 5%, respectively, perceived customs, taboos, norms and values to be key in forest resource conservation. However, majority of those

**Table 4** Endogenous and exogenous institutions linked to forest use practices

Variable	Bakossi		Santchou		Kilum-Ijim	
	Mean	Std	Mean	Std. Dev	Mean	Std. Dev
<i>Panel A: Traditional rules linked to forest use practices</i>						
Beliefs	0.94	0.24	0.58	0.50	0.66	0.47
Customs	0.94	0.24	0.32	0.47	0.66	0.47
Norms	0.94	0.24	0.13	0.33	0.50	0.50
Taboos	0.93	0.25	0.20	0.40	0.66	0.47
Values	0.90	0.31	0.05	0.21	0.26	0.44
<i>Panel B: Traditional structures linked to forest use practices</i>						
Traditional council	0.76	0.43	0.98	0.14	0.28	0.45
Secret society	0.70	0.46	0.98	0.16	0.37	0.48
Village forest management committees	0.60	0.49	0.32	0.47	0.50	0.50
Cultural groups	0.25	0.44	0.06	0.23	0.19	0.39
Youth groups	0.00	0.00	0.13	0.33	0.00	0.00
Vigilante groups	0.20	0.40	0.82	0.39	0.17	0.37
<i>Panel C: Exogenous structures linked forest use practices</i>						
Local council	0.75	0.44	0.12	0.31	0.25	0.43
Civil society	0.44	0.50	0.02	0.14	0.06	0.23
Forestry delegation	0.37	0.49	0.02	0.14	0.17	0.37
Conservation services	0.53	0.50	0.38	0.49	0.53	0.50
Others			0.60	0.49		
Observations	116		196		124	

from Kilum-Ijim (66%) reported that beliefs, customs and taboos are key traditional rules in this study site, compared to 26% for values and 50% for norms. Overall, the results suggest that the identified traditional rules are significantly more enforced in the Bakossi landscape than in the Santchou and Kilum-Ijim landscape communities.

The results further suggest that traditional councils, village forest management committees and secret societies are key traditional structures linked to forest resource extraction in Santchou, while cultural and vigilante groups are the least—with no youth group available. Traditional councils, vigilante groups and secret societies are perceived in the Bakossi landscape as key forest-linked institutional structures, while youth and cultural groups are the least. While 50 and 37% of the sample in Kilum-Ijim, respectively, perceived village forest management committees and secret societies as key forest-linked traditional structures, less than 30% viewed traditional councils, cultural and vigilante groups as essential. Generally, youth and cultural groups do not seem to play an important role in forest resource management in all three sites. Concerning exogenous structures, majority of the respondents (75%) perceived that local councils are more prevalent in Bakossi relative to 12% for Santchou and 25% for Kilum-Ijim. Based on the perception of the respondents, conservation services, civil society and forest delegations are more prevalent in Bakossi and Kilum-Ijim than in the Santchou landscape. However, according to 60% of the sample, other exogenous structures are key in shaping forest resource management in the Santchou landscape.

**Table 5** The interactive effects of endogenous and exogenous institutions

	Kilum-Ijim		Bakossi		Santchou	
	(1)	(2)	(3)	(4)	(5)	(6)
Endogenous cultural institutions (ECI)	−0.08 (0.09)	0.36 (0.25)	−0.21*** (0.08)	−0.32 (0.25)	0.09 (0.09)	−0.26*** (0.06)
Exogenous institutions (EI)	−0.04*** (0.01)	0.04 (0.04)	−0.17*** (0.06)	−0.43 (0.28)	−0.40*** (0.12)	−0.78 (0.62)
Interaction between ECI and EI		−0.18* (0.09)		−0.91** (0.40)		0.70 (1.10)
Constant	0.76*** (0.10)	0.59*** (0.13)	0.20** (0.10)	0.57*** (0.19)	0.75*** (0.14)	0.85*** (0.20)
Observations	92	92	112	112	195	195
R-square	0.19	0.22	0.25	0.28	0.12	0.12

*Note:* Additional controls in each specification include household size, sex, education and age of the respondent, household monthly income per capita and migration status. The standard errors are presented in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$  and \*  $p < 0.1$

### 3.3 Interactive effects of forest-linked endogenous and exogenous institutions

This section discusses the empirical findings of the study. It should be noted that the proxies for endogenous institutions are traditional structures and rules, and exogenous institutions are state structures. Tables 5, 6 and 7 present results on the interactive effects of forest-linked endogenous and exogenous institutions on forest use practices (NTFP harvesting) obtained from the heteroscedasticity-based instrumental variable approach. The results show that the impact of exogenous structures on NTFP harvesting was largely negative and significantly different from zero. This suggests that exogenous structures reduce the harvesting of NTFPs. This holds irrespective of the study site under investigation. For instance, a unit increase in exogenous structures reduces NTFP harvesting by 0.04, 0.17 and 0.40 units in Kilum-Ijim, Bakossi and Santchou, respectively. Thus, the enforcement of forest-based exogenous institutions spurs forest resource conservation. The effect of exogenous structures become insignificant after the inclusion of the interaction term.

With regard to endogenous institutions, we first examine the joint effect of traditional structures and rules (the endogenous cultural institutional index is based on the indicators of both traditional structures and rules) on forest use practices (Table 5). We further estimate the independent effects of traditional structures and rules on NTFP harvesting (see Tables 6 and 7). Our findings on endogenous institutions and forest use practices nexus are, however, inconsistent across the different study sites. For instance, we find that the effect of endogenous cultural institutions on NTFP harvesting is negative and significant only in communities around the Bakossi landscape. The results suggest that a unit increase in community-based (endogenous) institutions reduces NTFP harvesting by 0.21 units. While the effect of exogenous structures become insignificant after the inclusion of the interaction term in all study sites, endogenous institutions become significant in the Santchou landscape.

While scholars have shown that community structures/rules and state structures linked to natural resource management are essential in shaping natural resource exploitation, the complex manifestations of institutional processes and structures require that analytical

**Table 6** The interactive effects of endogenous structures and exogenous institutions

	Kilum-Ijim		Bakossi		Santchou	
	(1)	(2)	(3)	(4)	(5)	(6)
Exogenous institutions (EI)	−0.04*** (0.02)	0.03 (0.04)	−0.18*** (0.07)	−0.27 (0.21)	−0.40*** (0.12)	−0.27 (0.42)
Endogenous (traditional) structures (ES)	−0.16 (0.13)	0.47 (0.33)	0.06 (0.07)	−0.40* (0.22)	0.02 (0.07)	−0.17*** (0.07)
Interaction between ES and EI		−0.28** (0.14)		−0.88** (0.40)		−0.67*** (0.23)
Constant	0.80*** (0.11)	0.63*** (0.13)	0.32*** (0.09)	0.57*** (0.14)	0.81*** (0.14)	0.77*** (0.16)
Observations	93	93	112	112	195	195
R-square	0.20	0.23	0.20	0.24	0.11	0.11

*Note:* Additional controls in each specification include sex, education and age of the interviewee, household monthly income per capita, migration status and household size. The standard errors are presented in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$  and \*  $p < 0.1$

**Table 7** The interactive effects of endogenous (traditional) rules and exogenous institutions

	Kilum-Ijim		Bakossi		Santchou	
	(1)	(2)	(3)	(4)	(5)	(6)
Exogenous institutions (EI)	−0.05*** (0.02)	0.00 (0.04)	−0.21*** (0.06)	−0.19*** (0.03)	−0.38*** (0.12)	−1.24** (0.52)
Endogenous (traditional) rules (ER)	−0.02 (0.06)	0.17 (0.17)	0.09** (0.04)	−0.03 (0.13)	0.11 (0.07)	−0.27 (0.23)
Interaction between ER and EI		−0.08 (0.06)		0.19 (0.20)		1.67* (0.98)
Constant	0.76*** (0.11)	0.66*** (0.13)	0.24** (0.10)	0.34** (0.15)	0.74*** (0.14)	0.97*** (0.19)
Observations	93	93	112	112	195	195
R-square	0.19	0.21	0.24	0.24	0.12	0.13

*Note:* Additional controls in each specification include migration status, sex, education and age of the respondent, household monthly income per capita and household size. The standard errors are presented in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$  and \*  $p < 0.1$

approaches consider the interactive effect of both community and state structures (Ntuli et al., 2022; Osei-Tutu et al., 2015). The common pool resource management literature suggests that community institutions either complement or countervail state institutions. While such evidence in the context of forest conservation is limited, this paper introduces an interaction term to test for the dominance of exogenous and/or endogenous institutions in forest use practices. Thus, we examine both the direct and indirect impacts of endogenous and exogenous institutions by including a multiplicative interactive term for endogenous and exogenous institutions. At the margin, the total effect of enforcing exogenous and/or improving the effectiveness of endogenous institutions is computed by investigating the

partial derivatives of NTFP harvesting with respect to endogenous and exogenous institutions and evaluated at their respective means. The coefficient of this interactive term is negative and statistically significant for the Bakossi and Kilum-Ijim landscapes. The negative coefficient of the interaction term suggests that enforcing exogenous structures enhances the role of endogenous institutions in ensuring forest resource conservation. Similarly, it also means that the presence of endogenous institutions enhances the role of exogenous institutions in forest resource management. Therefore, exogenous and endogenous institutions are found to complement each other in enhancing forest resource management.

### 3.4 Sensitivity analysis

The extent to which endogenous institutions interact with exogenous structures to influence forest resource use is discussed in this section. We investigate the sensitivity of the results by interacting community structures and rules independently with exogenous institutions. The results are presented in Tables 6 and 7. For the most part, the results presented in Table 6 are consistent with those in Table 5. The coefficients of exogenous structures remain negative and statistically significant at 1% level, irrespective of the study site, while the coefficient of traditional structures is only significant in the Bakossi landscape. The coefficients for exogenous institutions significantly range between  $-0.04$  for Kilum-Ijim and  $-0.40$  for Santchou which is consistent with the estimates presented in Table 5. We also observe that the coefficients of the interaction term are negative and robustly related to forest resource use although the effect was not significant in the Santchou landscape in Table 5. Thus, enhancing traditional structures is vital in improving the role of exogenous structures in forest resource conservation in all the study sites. Similarly, exogenous structures are vital in enhancing the role of traditional structures on forest use practices, supporting their co-existence.

In Table 7, traditional rules are used as indicators of endogenous institutions. The results in Table 7 are generally not consistent with those reported in Table 5. However, the effect of exogenous structures remains negative and statistically significant at 1% level, irrespective of the study site, and the coefficient of traditional rules is significant in the Bakossi landscape. The coefficients for exogenous institutions significantly range between  $-0.05$  for Kilum-Ijim and  $-1.27$  for Santchou which is consistent with the estimates presented in Table 5 (in terms of the sign). However, relative to the results in Table 5, the coefficient of exogenous structures after controlling for the interaction term is now significant in the Bakossi and Santchou landscape. With regard to the interaction term, the coefficient is now positive and significant for Santchou but insignificant for the Bakossi and Kilum-Ijim landscapes. Generally, the results are not robustly consistent with those in Table 5—suggesting that the effect of endogenous institutions in enhancing the role of exogenous structures mainly stems from traditional structures. Hence, while enhancing traditional structures is vital in improving the role of exogenous structures in forest resource conservation, traditional rules help to counter the effects in the Santchou landscape. Similarly, while exogenous structures are vital in enhancing the role of traditional structures on forest use practices, they counter the role of traditional rules.

In Table 8, we examine the effectiveness of traditional rules (endogenous cultural institutions) on forest use practices. We observe similar results for both exogenous and endogenous institutions in their influence on forest resource use. On the scale of 1 (lowest)–5 (highest), respondents were asked to state the extent to which traditional rules are respected in their community. The responses for all indicators were used to create an index for the

**Table 8** The effectiveness of traditional rules, endogenous and exogenous institutions

	Kilum-Ijim	Bakossi	Santchou
Endogenous cultural institutions (ECI)	− 0.10 (0.09)	− 0.21*** (0.08)	0.08 (0.08)
Exogenous institutions (EI)	− 0.03** (0.01)	− 0.17*** (0.06)	− 0.12*** (0.05)
Effective traditional rules (EECI)	− 0.15** (0.06)	− 0.13*** (0.04)	− 0.44*** (0.06)
Constant	0.64*** (0.10)	0.17 (0.14)	0.69*** (0.12)
Observations	91	111	195
R-square	0.22	0.25	0.33

*Note:* Standard errors are in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$  and \*  $p < 0.1$ . Additional controls in each specification include sex, education and age of the respondent, migration status, household monthly income per capita and household size

effectiveness of traditional rules (see Table 2). The results suggest that while traditional rules are less significant in reducing forest resource exploitation, their effectiveness is significantly important in enhancing forest resource conservation in all the study sites.

## 4 Discussion

The level of dependence on natural resources is much more intense in many sub-Saharan African countries. Hence, forest resources are important for the well-being of communities residing around protected forest areas. However, scholars have theoretically and empirically postulated that natural resource management community- and state-based institutions have both an enhancing and constraining impact on the exploitative behaviour of environmental resource users. The institutional literature continues to explore the effect of institutional structures on the management of forest resources in sub-Saharan Africa (Kimengsi & Mukong, 2023; Ntuli et al., 2022). Institutions responsible for shaping the behaviour of forest users or natural resource use could be classified as endogenous (community) and exogenous (state) institutions (Osei-Tutu, 2017; Osei-Tutu et al., 2015; Yeboah-Assiah et al., 2017). However, it is argued that exogenous institutions dominate the natural resource landscape while endogenous institutions are largely neglected (Buchenrieder & Balgah, 2013; Kimengsi & Balgah, 2017). There is growing debate on the relative effectiveness and dominance of exogenous institutions over endogenous ones (Yami et al., 2009). This paper contributes to this debate by focusing on the independent and the interactive effects of both types of institutions in shaping forest resource extraction in three socio-culturally diverse landscapes of Cameroon. A multiplicative interaction term and the heteroscedasticity-based instrumental variables technique were employed to estimate the direct and indirect effects of endogenous and exogenous institutions on the behaviour forest resource users.

#### 4.1 Forest-linked endogenous and exogenous institutions

It is evident from the results that state-based forest-linked institutions reduce the likelihood of households participating in forest resource extraction across the three sites. While state-based forest resource institutions work independently, they also work jointly with community-based institutions to reduce forest dependence. Ntuli et al. (2022) concluded that while state-based and community-based institutional structures work independently to increase the level of dependency on environmental resources, their joint effect reduces the level of environmental dependence. With the introduction of the interaction term, the independent effect of both endogenous and exogenous is insignificant whereas the interaction is highly significant. On the contrary, Ntuli et al. (2022) showed that state-based institutions and natural resource management become positive and significant when the interaction term is introduced. However, the interaction term remains negative and significant. Interestingly, results from the Bakossi communities further converge to the premise that community-based resource management institutions are important in limiting household forest resource dependency (Kimengsi et al., 2022b; Steele et al., 2015). Specifically, Steele et al. (2015) insisted that while several factors may explain the extent to which households harvest forest resources, particularly NTFPs, the nature and robustness of local institutions should not be swept under the carpet. Evidence from existing theoretical and empirical accounts suggest that community-facilitated resource management institutions reduce environmental dependency in the absence of the role of external structures in restricting extraction (Ostrom, 2007).

#### 4.2 Interactive effect of forest-linked endogenous and exogenous institutions

On the extent to which endogenous institutional structures interact with exogenous structures to influence forest resource use, we investigated the sensitivity by independently interacting community structures and rules with exogenous institutions. We observe that the coefficients of the interaction term are negative and robustly increase forest resource conservation. However, interacting traditional rules with exogenous structures, the coefficients of exogenous structures remain negative and highly significant, irrespective of the study site—but the interaction term is positive, which is not robustly consistent. In Bakossi and Kilum-Ijim, it was reported that exogenous and endogenous institutions complement each other in enhancing forest resource management. This compatibility and seemingly complementary role could be linked to the similar colonial legacy—British colonial rule. With the presence of more organized traditional structures, it is possible that the interaction between endogenous and exogenous institutions could produce institutional compatibility and complementarity which is required to surmount the counterproductive interactions witnessed in other settings. This supports the argument that not all colonial legacies produce negative institutional outcomes in SSA. In relation to existing studies, Ntuli et al. (2022) found no evidence on the effect of state and community institutions on environmental resource conservation, while Tanguilig and Tanguilig (2009) found that both types of institutions have a constraining effect on natural resource exploitation. Ntuli and Muchapondwa (2017) empirically showed how community-facilitated natural resource management institutions constrained environmental extraction. The interaction between state- and community-based institutions results in reduced participation in resource extraction (Ntuli et al., 2022). Several other studies, however, seem to suggest that state institutions might have an amplifying



effect on environmental extraction and income generation (e.g., Beunen & Patterson, 2019; Lapatinas et al., 2019; Ntuli & Muchapondwa, 2018; Ostrom et al., 2007).

## 5 Conclusions

From the analysis, we draw the following conclusions: Firstly, both exogenous structures and their interaction with endogenous institutions significantly constraint the level of forest resource extraction of communities around protected areas. The effect of the interaction term is particularly significant when traditional structures and not traditional rules are used as proxies for endogenous institutions. Secondly, irrespective of the measure of endogenous institutions, the effect of exogenous structures remains negative and significantly reduces forest resource extraction. Thirdly, both exogenous and endogenous structures complement each other in enhancing forest resource conservation. This compatibility and seemingly complementarity role could be linked to their similar colonial legacy—British colonial rule. We also find that while traditional rules are less significant, their effectiveness significantly reduces the level of participation in forest resource extraction.

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**Data availability** Data for this study are available in Excel and STATA files and will be made available upon request.

## Declarations

**Conflict of interest** Authors declare that there are no competing interests linked to this study.

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## References

- Angelsen, A., Jagger, P., Babigumira, R., Belcher, B., Hogarth, N. J., Bauch, S., Borner, J., Smith-Hall, C., & Wunder, S. (2014). Environmental income and rural livelihoods: A global-comparative analysis. *World Development*, 64, S12–S28.
- Avagyan, A. B. (2018). Algae to energy and sustainable development. *Technologies, resources, economics and system analyses. New design of global environmental policy and live conserve industry*. Amazon, ISBN-13, pp. 978–171872255
- Beunen, R., & Patterson, J. J. (2019). Analysing institutional change in environmental governance: Exploring the concept of 'institutional work.' *Journal of Environmental Planning and Management*, 62(1), 12–29. <https://doi.org/10.1080/09640568.2016.1257423>
- Buchenrieder, G., & Balgah, R. A. (2013). Sustaining livelihoods around community forests. What is the potential contribution of wildlife domestication? *The Journal of Modern African Studies*, 51(01), 57–84.

- Colding, J., Folke, C., & Thomas, E. (2003). Social institutions in ecosystem management and biodiversity conservation. *Tropical Ecology*, 44(1), 25–41.
- Djenontin, I. N., & Zulu, L. C. (2021). The quest for context-relevant governance of agro-forest landscape restoration in Central Malawi: Insights from local processes. *Forest Policy and Economics*, 131, 102555.
- Egute, T. O. (2012). Modern law and local tradition in forest heritage conservation in Cameroon: The Case of Korup. PhD Thesis in Environmental Sciences Brandenburg University of Technology Cottbus 26.11.2012.
- Ejedepang-Koge, S. N. (1986). *The tradition of Bakossi people: a historico-socio-anthropological study of one of Cameroon's Bantu peoples*. ARC Publications.
- FAO (2002). Case study of exemplary forest management in Central Africa: Community forest management at the Kilum-Ijim Mountain Forest Region Cameroon, FAO Rome.
- Fearon, J. D. (2003). Ethnic structure and cultural diversity by country. *Journal of Economic Growth*, 8(June), 195–222.
- Fogwe, Z. N., & Kwei, J. (2015). Cameroonian protected Kilum-Ijim forests for the development of Oku forest fringe community. *Journal of Environmental Research and Management*, 6(5), 0293–0303.
- Gardens, K. (2010). *A national park: The Bakossi National Park in Cameroon* (conservation/researchdata/science-directory/teams/wet-tropics-africa, 2010).
- Gwan, S. A., Kimengsi, J. N., & Fogwe, Z. N. (2022). Landscape degradation processes and implications in the south eastern part of the Western Highlands of Cameroon. *International Journal of Environment and Climate Change*, 11(12), 525–535.
- Haller, T., Acciaioli, G., & Rist, S. (2016). Constitutionality: conditions for crafting local ownership of institution building processes. *Society & Natural Resources*, 29(1), 68–87. <https://doi.org/10.1080/08941920.2015.1041661>
- Haller, T., Belsky, J. M., & Rist, S. (2018). The constitutionality approach: conditions, opportunities, and challenges for bottom-up institution building. *Human Ecology*, 46, 1–2. <https://doi.org/10.1007/s10745-018-9966-1>
- Ingram, V., Ros-Tonen, M. A. F., & Dietz, T. (2015). A fine mess: bricolaged forest governance in Cameroon. *International Journal of the Commons* 9(1), 41–64. <https://doi.org/10.18352/ijc.516>
- Jusrut, P. (2022). Localization of elite capture in wood charcoal production and trade: Implications for development outcomes of a forest management program in rural Senegal. *Forest Policy and Economics*, 135, 102613.
- Kimengsi, J. N. (2014). Threats to ecotourism development and forest conservation in the lake Barombi Mbo area of Cameroon. *Journal of International Wildlife Law and Policy*, 17(4), 213–230.
- Kimengsi, J. N., & Balgah, R. A. (2017). Repositioning local institutions in natural resource management: Perspectives from Sub-Saharan Africa. *Journal of Contextual Economics*, 137(1–2), 149–172. <https://doi.org/10.3790/jce.137.1-2.149>
- Kimengsi, J. N., & Balgah, S. N. (2021). Colonial hangover and institutional bricolage processes in forest use practices in Cameroon. *Forest Policy and Economics*, 125, 102406.
- Kimengsi, J. N., & Mukong, A. K. (2023). Forest resource endogenous cultural institutions in rural Cameroon: Compliance determinants and policy implications. *Journal of Environmental Planning and Management*, 66(7), 1579–1600.
- Kimengsi, J. N., Mukong, A. K., & Balgah, R. A. (2020). Livelihood diversification and household well-being: Insights and policy implications for forest-based communities' in Cameroon. *Society and Natural Resources*, 33(5), 1–21.
- Kimengsi, J. N., Mukong, A. K., Giessen, L., & Pretzsch, J. (2022b). Institutional dynamics and forest use practices in the Santchou Landscape of Cameroon. *Environmental Science and Policy*, 128, 68–80.
- Kimengsi, J. N., Mukong, A. K., Giessen, L., & Pretzsch, J. (2023). Actor-driven institutional change in forest communities: insights from the Bakossi Landscape of Cameroon. *Journal of Environmental Planning and Management*. <https://doi.org/10.1080/09640568.2023.2193309>
- Kimengsi, J. N., Owusu, R., Djenontin, I. N. S., Pretzsch, J., Giessen, L., Buchenrieder, G., Pouliot, M., & Acosta, A. N. (2022a). What do we (not) know on forest management institutions in sub-Saharan Africa? A regional comparative review. *Land Use Policy*, 114, 105931. <https://doi.org/10.1016/j.landusepol.2021.105931>
- Lapatinas, A., Litina, A., & Sartzetakis, E. S. (2019). Environmental projects in the presence of corruption. *International Tax and Public Finance*, 26, 103–144.
- Lewbel, A. (2012). Using heteroskedasticity to identify and estimate mis-measured and endogenous regressor models. *Journal of Business and Economic Statistics*, 30(1), 67.

- Mbeng, E., Buba, U.H. (2017). Community livelihoods versus biodiversity conservation. Constraints to sustainability of the Santchou forest reserve in the western highland region of Cameroon. In: *6th Symposium for Research in Protected Areas 2 to 3 November 2017, Salzburg*, pp. 417–420.
- McCusker, B., & Oberhauser, A. M. (2006). An assessment of women's access to natural resources through communal projects in South Africa. *GeoJournal*, 2006(66), 325–339.
- Mukong, A. K. (2022). Estimating the health effect of cigarette smoking duration in South Africa. *International Journal of Environmental Research and Public Health*, 19(20), 13005.
- Ndenecho, N. (2012). *Indigenous knowledge and plant resources for the development of biotechnologies in Cameroon*. Bamenda: AGWECAMS Printers.
- Ngea, P. (2011). *Mount kupe and muanenguba: Custodian of tradition and biodiversity*. Washington: WWF.
- Nghipandulwa, M. T., & Mukong, A. K. (2023). Estimating income-related health inequalities associated with tobacco and alcohol consumption in Namibia. *International Journal of Environmental Research and Public Health*, 20(2), 1062.
- Ntuli, H., & Muchapondwa, E. (2017). Effects of wildlife resources on community welfare in southern Africa. *Ecological Economics*, 131, 572–583.
- Ntuli, H., & Muchapondwa, E. (2018). The role of institutions in community wildlife conservation in Zimbabwe. *International Journal of the Commons*, 12(1), 134–169.
- Ntuli, H., Mukong, A. K., Kimengsi, J. N., & Muyengwa, S. (2022). Institutions and environmental resource extraction within local communities in Mozambique. *Forest Policy and Economics*, 139, 102724.
- Nuesiri, E. O. (2022). Good governance of local forest is neither easy nor cheap: Policy learning from Bimbia-Bonadikombo. *Forest Policy and Economics*, 136, 102672.
- Osei-Tutu, P. (2017). Taboos as informal institutions of local resource management in Ghana: Why they are complied with or not. *Forest Policy and Economics*, 85, 114–123. <https://doi.org/10.1016/j.forpol.2017.09.009>
- Osei-Tutu, P., Pregernig, M., & Pokorny, B. (2015). Interactions between formal and informal institutions in community, private and state forest contexts in Ghana. *Forest Policy and Economics*, 54, 26–35.
- Ostrom, E. (1990). *Governing the commons: the evolution of institutions for collective action*. Cambridge University Press, Cambridge, UK. <https://digitalrepository.unm.edu/nrj/vol32/iss2/6>. Accessed on 12 April 2023
- Ostrom, E. (2007). A diagnostic approach for going beyond panaceas. *Proceedings of the National Academy of Sciences*, 104(39), 15181–15187.
- Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science*, 325, 419–422.
- Ostrom, E. M., Janssen, A., & Anderies, J. M. (2007). Going beyond panaceas. Centre for the study of institutions, population & environmental change. *Proceedings of the National Academy of Sciences of the United States of America*, 104(39), 15176–15178.
- Owusu, R., Kimengsi, J.N., & Giessen, L. (2023). Outcomes of Forest Landscape Restoration shaped by endogenous or exogenous actors and institutions? A systematic review on sub-Saharan Africa. *Environmental Management*. <https://doi.org/10.1007/s00267-023-01808-x>.
- Robinson, B. E., Provencher, B., & Lewis, D. J. (2013). Managing wild resources: Institutional choice and the recovery of resource rent in southwest China. *World Development*, 48(2013), 120–132. <https://doi.org/10.1016/j.worlddev.2013.04.004>
- Sikor, T., & Nguyen, T. Q. (2007). Why may forest devolution not benefit the rural poor? forest entitlements in Vietnam's central highlands. *World Development*, 2007(35), 2010–2025.
- Steele, M. Z., Shackleton, C. M., Shaanker, R. U., Ganeshaiah, K. N., & Radloff, S. (2015). The influence of livelihood dependency, local ecological knowledge and market proximity on the ecological impacts of harvesting non-timber forest products. *Forest Policy and Economics*, 50(2015), 285–291. <https://doi.org/10.1016/j.forpol.2014.07.011>
- Tanguilig, H. C., & Tanguilig, V. C. (2009). Institutional aspects of local participation in natural resource management. *Field Actions Science Reports*, 3, 1–7.
- Teffo, L. J. (2012). Traditional institutions and the rural development challenges in Africa: Gender and agricultural transformation perspectives. *International Journal of African Renaissance Studies*, 7(1), 39–49.
- Vázquez-García, V., & Ortega-Ortega, T. (2017). Gender, local governance and non-timber forest products. *The Use and Management of Satureja Macrostema in Oaxaca's Central Valleys, Mexico, Women's Studies International Forum*, 65(2017), 47–52.
- Wild, C.J. (2004). Sacred groves. Published in the introductory chapter of the plants of Kupe, Mwanenguba and the Bakossi Mountains, Cameroon. A conservation checklist. Royal Botanic Gardens, Kew, pp. 117–127.

- Wood, A. L., Ansah, P., Rivers, L., III., & Ligmann-Zielinska, A. (2019). Examining climate change and food security in Ghana through an intersectional framework. *The Journal of Peasant Studies*, 48(2), 329–348.
- Yami, M., Vogl, C., & Hauser, M. (2009). Comparing the effectiveness of informal and formal institutions in sustainable common pool resources management in sub-Saharan Africa. *Conservation and Society*, 7(3), 153–164.
- Yeboah-Assiamah, E., Muller, K., & Domfeh, K. A. (2017). Institutional assessment in natural resource governance: A conceptual overview. *Forest Policy and Economics*, 74, 1–12.
- Yenshu, E. V. (2011). Ethnicisation du domaine public et construction de l'état: pistes pour transcender une antinomie Afrique et développement. *Africa Development*, 36(2), 249–275.
- Yoon, D. K. (2012). Assessment of social vulnerability to natural disasters: A comparative study. *Natural Hazards*, 63(2), 823–843.

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