Upland Rice: Cultural Keystone Species in a Philippine Traditional Agroecosystem

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ABSTRACT

This paper examines rice biocultural diversity in Sarangani province, southern Philippines through a socio-anthropological lens. Participatory rural appraisal highlighted the cultural importance of upland rice and the entire suite of farming rituals practiced by ethnic communities in the area. Further unveiled by the study were concomitant rice varietal losses, a highly eroded indigenous knowledge system, or IKS, as well as major driving forces that have significantly impacted biocultural diversity on-farm. Sociological analysis of Sarangani tribal community and resources identified upland rice as a potential cultural keystone species (CKS) whose loss can severely compromise cultural integrity and food security. However, halting biocultural erosion while ensuring human wellbeing can become complicated and constrain conservation initiatives. The CKS model, albeit potentially subjective and controversial, can provide valuable insights for the development of sustainable conservation strategies specifically suited to the Sarangani upland situation. Strengthening of awareness among stakeholders about the link between traditional culture, conservation, and food security is necessary if significant results are to be achieved.

Key words: upland rice, cultural keystone species, traditional agro-ecosystem, biocultural diversity

JEL Classification: Z0, Q1

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INTRODUCTION

Growing recognition of the inextricable link between cultural and biological diversity (Maffi 2001; Loh and Harmon 2005; Dunn 2008; Gavin et al. 2015) has given rise to a concept known as biocultural diversity, which is defined as the "relationship among traditional knowledge, biological diversity and cultural diversity" (Hladik et al. 1993; Stepp, Wyndham, and Zarger 2002; Johns and Sthapit 2004). By drawing insights from the social sciences, practitioners can better understand human dimensions of conservation whereas ignoring inputs from this discipline can seriously undermine conservation efforts (Bennet et al. 2016). In the Philippines, the Globally Important Agricultural Heritage Systems (GIAHS)-prescribed rice terraces in Kiangan, Ifugao is one example of such biological-cultural coupling. Local Ifugao communities benefit from this culture-nature integration through the agroecosystem's provision of goods and services while the Ifugaos maintain the terraces via the upkeep of terrace walls and ancient waterways (Aguilar 2018).

The harmonious link between biological and cultural diversity, however, is presently being threatened by the homogenizing effects of globalization and climate change, among other pressures (Liu et al. 2002; Nabhan, Pynes, and Joe 2002). Genetic erosion, the concomitant losses of crop landraces, is accelerated by demographic, economic and technological changes associated with modernization (Brush 1986). This situation is reflected in Sarangani province in southern Philippines where upland tribes, who rely on subsistence rice farming using age-old farming methods, regularly experience chronic food shortages. Although the crop is closely interwoven with tribal culture, genetic erosion in the rice landraces is a reality (Zapico et al. 2020). Nevertheless, the tribal farmers still maintain remaining varieties because of cultural values and individual preferences. Farming knowledge, however, seems to be rapidly eroding because of the ingress of agricultural modernization and a mindset change among the local peoples (Zapico et al. 2015). Even up to this time, geographic and technological isolation are notable challenges for resource conservationists and people in these remote areas.

In ecology, a keystone species is defined by Paine (1966) as the "keystone of biological community structure" and that "community integrity and unaltered persistence through time are determined by its activities and abundance." Like the ecological keystone species, the cultural keystone species (CKS) is a metaphorical concept defined as the "culturally salient species that shapes in a major way the cultural identity of a people" (Garibaldi and Turner 2004). A CKS is identified by its ubiquity in language, cultural practices and traditions, diet, history, subsistence, and other aspects of community life (Cristancho and Vining 2004). Oftentimes, a community or tribe identifies with an animal or plant species for cultural, spiritual, or economic reasons. The plant-people relationship, therefore, becomes vital in ensuring the wellbeing of the community, the ecosystem, and the local culture. Knowledge on the potential applications of the CKS model, especially in biodiversity conservation in the Philippines, will augur well for forestalling the continued genetic erosion of the rice landraces and will find wider application for other crops and biocultural landscapes in the country. This study was therefore carried out to (a) determine the cultural importance of Sarangani upland rice and the IKS associated with it, (b) identify causes and correlates of biocultural losses, and (c) identify the CKS in the Sarangani upland farms. As the study is approached from a socio-anthropological perspective, it does not undertake a systematic economic analysis, which is an important limitation of the study, and which could be the subject of further research to enrich the present analysis.

METHODOLOGY

This cross-sectional study was conducted in 14 rice farming villages (i.e., Datal Bukay, Kari, and New Aklan in Glan; *sitio* Mutu Ladal, Nomoh in Maasim, Kihan, and Kinam in Malapatan; *sitios*

Ihan, Cabnis, Glamang in Datal Anggas, Alabel; *sitio* Lamlifew in Datal Tampal and Malabod in Malungon; *sitio* Lampong in Upo and Angko in Batian, Maitum and Malayo in Kiamba) in the Sarangani uplands in southern Philippines. Researchers visited the abovementioned villages from October 2015 to October 2018.

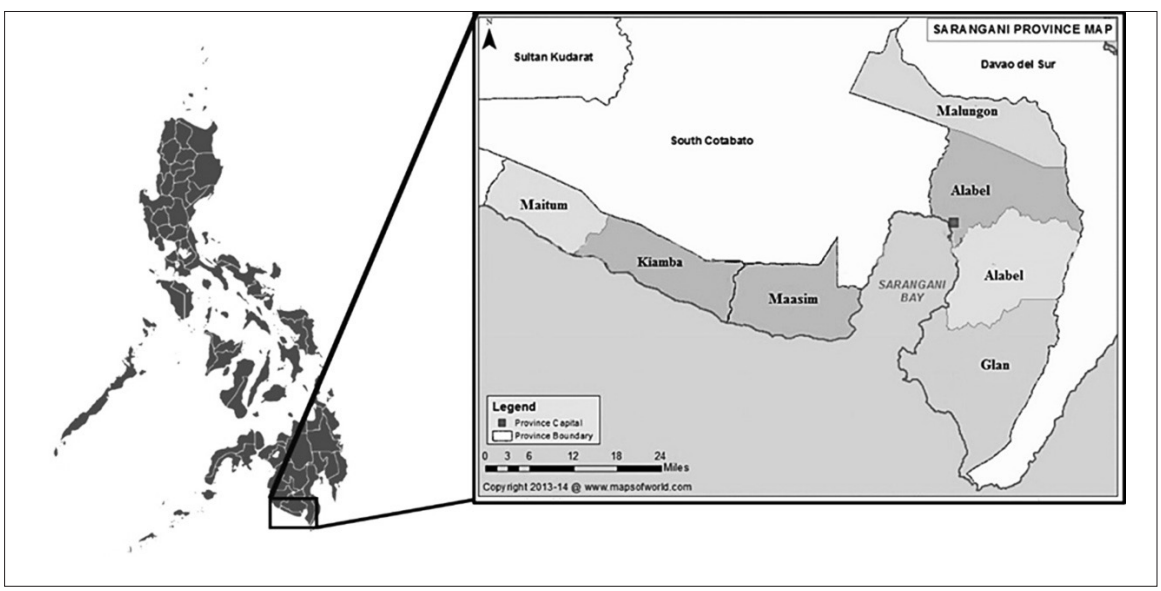
Based on the emic (insider's view) approach, researchers employed participatory rural appraisal (PRA) techniques such as focus group discussions (FGDs), key informant interviews (KIIs), semi-structured questionnaires, community immersion, and field observation. Eighty-five rice farmers who were over 30 years old, who had 10+ years of farming experience, and who gave explicit consent were chosen as respondents for the study. Detailed information about rice varietal diversity, utilization, cultural importance and losses, traditional farming rituals, and major pressures to the Sarangani upland agroecosystem were elicited. Descriptive information was classified according to thematic content while questionnaire data were collated, interpreted, and subjected to descriptive statistics.

RESULTS

Sarangani: The Province and Its Peoples

An oddly-shaped province located in the southernmost fringe of Mindanao island, southern Philippines, Sarangani lies between latitude of about 5°3341" to 6°32'4" and longitude of about 124°21'39" to 125°35'11". The province is composed of seven municipalities (i.e., Malapatan, Alabel, Glan, Malungon, Maasim, Kiamba, and Maitum), which flank General Santos City at its eastern and western fronts (Figure 1). With 45 percent of the population composed of an admixture of groups with varying ethnicities, Sarangani exhibits a high degree of cultural diversity. Collectively known as *lumad* (tribes with non-Muslim ethnicity), these tribal groups mainly reside in far-flung and dispersed villages that are difficult to access. Among the *lumad*, Blaans predominate in the Sarangani uplands, followed by Tbolis and Kaolos. Owing to their remoteness, these villages are practically unreached by basic social services and the people live under conditions of hardship and extreme poverty. Furthermore, these tribal peoples engage in upland rice cultivation as part of their cultural heritage using

Figure 1. Location map of Sarangani province and its seven municipalities



Source: www.mapsoftheworld.com (2019)

traditional farming practices passed on to them by their ancestors. Shown in Table 1 is the profiles of farmer respondents from the Sarangani uplands.

The Sarangani Rice Resource: Cultural Importance

In the Sarangani upland communities, the vital role of rice landraces (RLs) in ensuring household food security and survival of the tribal families is undeniable. In 2016, a seven-month long drought forced the provincial government to send sacks of rice to starving people in these areas (Zapico et al. 2019). Thus, tribal groups in the Sarangani uplands face a bleak future with the extinction of RLs.

Such is the importance of these landraces that their potential loss will affect not only food security but also have dire consequences for the tribal culture. Presented in Table 2 are culturally important rice varieties and their manifold uses

Table 1. Profile of farmer respondents from the Sarangani uplands (n=85)

Demographic Characteristics		
Gender (%)	Male	64.7
	Female	35.3
Marital Status (%)	Married	97.6
	Single	2.4
Average farming experience (years)		20.6
Average age of farmers (years)		43.7

Demographic Characteristics		
Ethnicity (%)	Blaan	57.1
	Tboli	16.3
	Kaolo	9.3
Education (%)	Primary	49.0
	None	27.0
	Secondary	24.0
Household Income Source (%)	Rice Farming	95.4
	Others	4.6

Table 2. Rice varieties with cultural significance

Tribe of Farmer	Name of Variety	Meaning of Name (if any)	When/How Used	Other Remarkable Features/Comments
Tboli	Bisol		Marriage/for unity	Very sticky
	Tang		Marriage/for unity	Very sticky
	Mal-an	Rice president	Should always be present in fields	Very important
	Tulon		Used for pest control	Used to improve seed quality
	Uyayang		Special occasions, visitors	Special rice
	Luwaro		Special occasions, visitors	Special rice
	Satiman	One of a kind	Special occasions, visitors	Special rice
Blaan	Kanlen	Rice ancestor	Always planted first in the field	Considered as an ancient variety
	Lagfisan	Rice soldier	Planted along rice field borders Given as first solid food to babies Used as dowry for weddings	Protects crop from pestilence Makes babies smart
	Sugen	Looks like a beehive	Consumption	Very big panicles
	Abtu Kulang	Shatters clay pot	Consumption	High volume expansion
	Bulawan	Golden grains	Consumption	Very aromatic; upsets stomach
	Bae	Sheltered/protected woman	Special rice	Panicle almost covered by leaves
Kaolo	Amihan	Rice medicine	Reconcile conflicting families	Wards off death, illness, or bad luck

Source: Zapico et al. (2020)

Table 3. Utterances by Sarangani farmers about their traditional rice varieties

English	*Blaan*
We are not used to lowland rice.	*La' me' maye' di mseh di dungan.*
If our rice will disappear, what will happen to us?	*Ku lande' nu'n fale' me' det ti nimo ne?*
Rice grown by the tribes is more nutritious than lowland rice	*To o fye ne'm mseh I da'd Blaan.*
Rice that is milled loses flavor.	*Lana' I fye Ne'm I Fale' Ku Gniling.*
Even though you are dear to us, we will not give you our seeds to be used for planting (when *asked about samples of rice seeds*)	*Balo' det kakdo Go Di Gamo La Go Ble' Mseh para fla'*
Our rice constitutes our tribal identity.	*En' fale me' enen I aldam me*
Rice is life for us.	*Mseh I Kinabuhi to.*
If our rice will be gone, we will also be gone.	*Ku lana' I fale' di gami' lana du gami*
A day without eating rice will weaken us.	*Lungay' gami kula' gamka'an dis do.*

and features. Moreover, in-depth conversations with farmers during FGD and KII revealed deep attachment to rice varieties as shown by their utterances (Table 3).

Conversations with farmers revealed that traditional farming rituals are deeply ingrained in Blaan culture and belief systems. Shown hereunder are the traditional farming rituals of the Blaans, the predominant ethnic group in the Sarangani uplands.

***Kaingin* (slash-and-burn).** Prior to planting, the farmer selects a patch of forest land (*elnigo*), cuts down bigger trees, sets fire to understory vegetation, and clears the area of burnt debris. He then lets the soil rest for several weeks. Culturally essential to the tribes, *kaingin* is believed to rid the soil of pests and makes it fertile through the nutrient-rich ash.

***Amlah* (planting).** The coming of the wet season during the month of April heralds the start of rice planting. Before the day's activities start, a tribal elder chants a *malem* to invoke the presence of a supreme being, summon the spirit of the rice plant, and make it dwell on the crop while it grows. A day before the scheduled planting, the farmer and his wife construct a *botne* (makeshift wooden altar) in the center of the *elnigo*. Early during the next day, everyone goes to the farm and planting commences with the chanting of the *lamgi* (planting song). The tempo of the *lamgi* is synchronized with dibbling by male farmers using an *ahak* (sharpened pole). Following closely behind, women-farmers drop rice seeds into the dibbled holes and cover these with soil with a sweep of the foot (Zapico et al. 2015). Interviewed farmers disclosed that singing the *lamgi* makes an otherwise tedious activity a joyous one. *Lamgi* is sung by the farmers until all seeds are planted.

***Tuke fali* (harvesting).** Once the rice plants are heavy with grain, the men construct a *fol* (traditional rice granary) for storage of rice seeds (Figure 2). Among the Blaans, harvesting rice is exclusive to women since it is believed that they imbue the crop with female qualities of productivity and fertility. Women farmers excise individual panicles using hand knives (*bansong fali*) and place them inside a *baen*, a traditional basket they carry on their backs (Zapico et al. 2015). The *baen* must be filled to the brim because when unfilled, food shortages will plague the household during the coming year. The rice grains are then put inside a hollow bamboo receptacle known as *tiral* (Figure 3), which in turn, is subsequently placed inside the *fol*. Menstruating women (considered to be unclean) are prohibited from setting foot in the fields so as not to defile the rice crop.

Figure 2. *Fol* or traditional rice granary

Figure 3. Tiral bamboo receptaclefor storing rice seeds

Figure 4. Rice panicles displayed during *tuke fali* festival

Tuke Fali Festivals

The centrality of upland rice to community life, culture, and traditions of the indigenous peoples is manifested through the annual celebration of *tuke fali* festivals in several areas of the province. The repertoire of songs, stories, and legends about the crop and the perpetuation of age-old seed-keeping and -selection by women farmers also attest to the cultural importance of the crop. Organized by the barangay (village) council, this weeklong festival involves reenactment of traditional farming rituals, dances, and other community activities. Farmers display their rice harvests, crops, and other items for sale in thatched huts (Figure 4). A replica of the *fol* is usually constructed for visitors to see. In Banlas, Malapatan, female farmers cook different rice varieties for everyone to taste. An annual event in Kinam, Malapatan, *tuke fali* festival attracts many visitors and even had extensive media mileage during the past year. On the other hand, some scheduled *tuke fali* festival did not push through in some areas because of crop failure or peace and order problems.

Traditional Rice: A Cultural Keystone Species in the Sarangani Uplands

In 2004, Garibaldi and Turner proposed the Index of Identified Cultural Influence of Cultural Keystone Species to identify a CKS based on garnered points for each of the specified categories. Among the Blaans, the three major carbohydrate staples, enumerated according to decreasing levels of importance, are upland rice, corn, and sweet potato. When rice supplies run out, farmers turn to native corn varieties for their caloric needs. Primarily a subsistence crop, native corn is currently being displaced by recycled roundup ready (*sige-sige*) corn, which is cultivated by farmers as a cash crop (Espina 2015). Sweet potato on the other hand, is a crop of last resort when all

Table 4. Index of the identified cultural influence of cultural keystone species

Elements that Indicate a Cultural Keystone Species	Ratings		
	Upland Rice	Native Corn	Sweet Potato
1. Intensity, Type and Multiplicity of Use			
Is the species used intensively (routinely, and/or in large quantities?	5	3	3
Does the species have multiple uses?	5	2	1
2. Naming and Terminology in language, including use as seasonal and phenological indicators, etc.			
Does the language incorporate names and specialized vocabulary relating to the species?	5	3	3
3. Role in Narratives, ceremonies, or symbolism			
Is it prominently featured in narratives and/or ceremonies, dances, songs or as a symbol?	5	1	1
4. Persistence and Memory of Use in relationship to cultural change			
Is the species ubiquitous in the collective cultural consciousness and frequently discussed?	5	2	1
5. Level of Unique Position in Culture			
Would it be hard to replace this species with another available native species?	5	3	2
6. Extent to which crop provides opportunities for resource acquisition from beyond the territory			
Is the species used as a trade item for other groups?	3	5	2
Total	**33**	**19**	**13**

Source: Adapted from Garibaldi and Turner (2004)
Notes: Scores are based on the flowing rating scale: 5 (yes, very high), 4 (yes, high), 3 (yes, moderate), 2 (yes, low), 1 (yes, very low or infrequent), 0 (no, not used). The highest possible score is 35 and the higher score a species obtains from this rating scheme, the higher the probability that it is a cultural keystone species (Garibaldi and Turner 2004).

other food sources are depleted. It is, therefore, a subsistence crop associated with poverty-stricken households in the area (Suarez 2017).

Shown in Table 4 is the CKS rating scale for upland rice, corn, and sweet potato based on farmers' perceptions and knowledge gleaned from FGD and administered questionnaires. Rice scored highest points owing to its myriad uses, pragmatic nomenclature scheme and its overall significance to tribal culture, indicating that it is a probable CKS for the Sarangani traditional agroecosystem.

Farmers' Perceptions About Rice Bio-cultural Losses

Discussed hereunder are correlates of biocultural losses based on farmers' perceptions and knowledge. Fifty-eight percent of respondents said that the couple jointly determine the number and kind of varieties to plant. Only 27 percent and 30 percent of the respondents divulged that husbands make decisions as to the number and kinds of rice varieties to plant, respectively. Farming duties were still allocated according to the genders with male farmers doing land preparation, *kaingin*, dibbling during planting, and *fol* construction, while women farmers were responsible for seed selection and storage, planting, harvesting, weeding, threshing, and pounding rice grains for cooking. Farmers emphasized the important role of female farmers as traditional seed keepers/custodians.

Males were more inclined to discard traditional rice varieties for *sige-sige* corn (Figure 5) and other cash crops. Furthermore, younger farmers signified their readiness to discard traditional varieties while education and farmers' ethnicity did not figure significantly in farmers' decisions to discard rice varieties. Female farmers and those with no formal education showed a distinct propensity to continue practicing farming rituals, owing to the following reasons: upholding

Figure 5. *Sige-sige* corn field

Source: Zapico et al. (2015)

of cultural identity, for better plant growth, more aromatic rice, and for better harvest. In contrast, younger farmers expressed their unwillingness to continue practicing tribal rituals, which they regarded as outmoded, irrelevant, more suited to the elderly, and because they (young farmers) are already educated, Christianized, and modern. According to the farmers, a common language is more reflective of tribal culture than antiquated farming rituals.

Younger farmers and those who had formal education did not consider tribal culture relevant in the present. Furthermore, women and Blaan/Tboli farmers responded similarly to this query on relevance. Notably, younger farmers revealed that farming rituals had been completely forgotten with the passing on of tribal elders. Other farmers were seemingly apathetic to rice varietal losses and the culture associated with the crop. In contrast, Blaan and older farmers expressed that they will personally be affected by biocultural losses. Furthermore, a significant number of farmers (46%) disclosed that since they have no cash with which to purchase lowland rice, they will surely starve if upland rice were to disappear from their farms.

DISCUSSION

Cultural Keystone Species: Connecting Cultural and Biological Systems

As the farmers revealed, upland rice plays a unique role in shaping the cultural identity of the Sarangani ethnic groups. That RLs are interwoven into the fabric of Sarangani community life is shown by the maintenance of traditional gender roles (i.e., land preparation by men and seed keeping/handling by women farmers), the continued observance of traditional farming rituals/tribal festivities, and the diverse utilization of these traditional rice varieties. Furthermore, the unique nomenclature scheme devised by farmers for traditional rice reflects rich cultural symbolism. On the pragmatic side, RLs constitute a very important role in ensuring food security and survival of the tribes, especially in these marginal areas. Unfortunately, both indigenous RLs and the indigenous knowledge system (IKS) associated with their cultivation are currently being threatened by pressures, thereby constraining food security efforts for the Sarangani upland tribes. This is especially true since IKS are, by their very nature, not static but rather dynamic and susceptible to various influences.

In the remote Sarangani uplands, rice is undoubtedly the most important crop for tribal farmers and their families. Rice scored highest points owing to its myriad uses, unique nomenclature scheme and its overall significance to tribal culture, indicating that it is a probable CKS for the Sarangani traditional agroecosystem. It is, however, sad to note that this putative CKS is currently being threatened by genetic erosion. Winter and McClatchey (2009) similarly reported that CKS in different ecosystems worldwide are dwindling in numbers (or even disappearing) because of the homogenizing effects of globalization. If the rice crop were to become extinct, Sarangani tribal culture and traditional agroecosystem will be radically altered. The Sarangani upland households will most likely shift to either corn or root crops as basic carbohydrate staples, resulting in damaging cascade effects on Blaan culture.

By and large, the CKS concept provides bases for conservation initiatives especially in traditional agroecosystems. Several studies have, however, pointed out innate limitations of this model. Platten and Henfry (2009) postulated that a predominant species might not be endemic to an area but could have been deliberately or inadvertently introduced. This study further maintains that this species became adapted and assumed an integral role in the local ecosystem and culture due to utilitarian and economic reasons. A case in point is the introduction of potato from Peru to Ireland in 1589. This exotic crop has since then spread to the rest of Europe to become a primary caloric source (Capella 1988).

Second, the inherent unreliability of peoples' memories is another point of contention against the CKS model. Olick and Robbins (1998) argued that peoples' memories change through time and are affected by many factors. Alves (2012) reiterated these views by pointing out that historical interactions of local people with a certain species may vary within the same area and may not be a valid information source. Third, the model does not clearly explain how a CKS differs from species that are "simply culturally salient or economically important" (Davic 2004). It might thus be erroneously accorded a status it does not rightfully deserve. Fourth, some studies have remarked on the subjective nature of the CKS scoring scheme. In defense of the model, Garibaldi and Turner (2004) conceded that while "absolute quantification of a particular CKS is not possible," one should not completely discount its potential contributions to biocultural conservation. Instead, Platten and Henfrey (2009) proposed that the CKS should be considered not as a single species, but complex made up of various system components (i.e., plant/animal species, IKS, environment, among others).

Sarangani Biocultural Diversity: Problems and Prospects

In Sarangani province, the cultural importance of upland rice is manifested through its continued cultivation, the persistence of traditional farming practices especially in remote farms, the annual commemoration of harvest festivals, and diverse utilization of rice for rituals and other important uses. Through personal conversations with farmers, their deep attachment to this priceless genetic resource is also expressed. Recent field expeditions to the Sarangani uplands, however, revealed concomitant losses of rice varieties (a phenomenon known as genetic erosion) in farmers' fields. Among the identified causes of genetic erosion were mindset change, pest infestation, weakening seed supply systems, market integration, natural calamities, environmental degradation, government programs, and peace and order problems (Zapico et al. 2020). Furthermore, personal conversations with farmers revealed some correlates of genetic erosion among the Sarangani ethnic groups. Among the identified correlates were gender, age, education, religion, and tribe, which were noted to affect decisions of farmers to discard varieties as well as to continue practicing traditional farming rituals.

A related study revealed that modern agriculture, encroachment of recycled transgenic corn (*sige-sige*) and other cash crops, changing preferences of upland farmers, climate change, and environmental degradation are major driving forces that had effected significant changes to the Sarangani agricultural landscape and upland rice diversity (Zapico et al. 2019). *Kaingin* (slash-and-burn farming) is generally known to cause wide scale environmental degradation and agri-biodiversity losses in the upland environments (Dove 1983; Saito et al. 2006; Southgate 1990) while the shift to *sige-sige* corn resulted in the displacement of RLs and soil quality deterioration. *Sige-sige* corn, which was nowhere to be seen in 2014, has become a conspicuous feature of Sarangani upland farms because it obviated the need for manual weeding, according to the farmers. *Kaingin*, on the other hand, worked well when upland forests were lush since it allowed for the regeneration of aging forest trees. With extensive forest denudation in the Sarangani uplands due to unregulated resource extraction through time, *kaingin* is no longer sustainable and has come to be identified as contributory to ecological degradation. Furthermore, agricultural modernization in

Sarangani province supplanted the age-old *sahul* (volunteerism) farming scheme with paid labor. At the time of the study, the farm wage was PHP 150/day (or approximately USD 3/day), a price that farmers could ill afford. With soaring prices of labor and chemical inputs, as well as the declining quality of the soil, younger farmers migrated to the lowlands or took on non-farming jobs. This tribal diaspora (especially of working age males) to the lowlands resulted in the abandonment of upland farms in these areas. Consequently, the upland population presently consists mostly of middle-aged and aging farmers, a fact that does not bode well for the future of agriculture in these areas. All these emerging realities have resulted in lowered resilience and in impaired capacities of the Sarangani tribes to adapt to climate change and other major pressures confronting them (Rellon 2018).

Another timely and controversial issue is the resource conservation-food security conundrum, which has fueled years of debate among modern-day conservationists. In the Sarangani uplands, conservation is primarily done through continuous cultivation of rice landraces in farmers' fields. Because of declining soil quality, yields are generally low, and farming is done at the subsistence level. To augment household income, many farmers turned to the cultivation of *sige-sige* corn as a cash crop, thereby displacing traditional rice in the fields. Moreover, the Special Areas of Agricultural Development (SAAD) project of the Philippine Department of Agriculture, which was instituted in 2017 to address food security problems in the impoverished Sarangani uplands, actually exacerbated rice varietal losses and forest denudation (Zapico et al. 2019). These unfortunate circumstances happen when biocultural conservation is pitted against demands for food security and human wellbeing. Consequently, win-win solutions that ensure resource conservation and food security are difficult to attain and trade-offs and compromises are usually the norm (McShane et al. 2011). Minteer, Thaddeus, and Miller (2011) reported a similar dilemma involving biodiversity/landscape protection versus poverty alleviation and human wellbeing. A recent approach that involves incorporating the social sciences into conservation initiatives has gained credence as a feasible solution to the biodiversity/ landscape preservation-human wellbeing debate. This strategy is a significant departure from the "strict preservationist or fortress conservation view" which had been the prevailing thought in past years (Minteer, Thaddeus, and Miller 2011). It is widely believed that this biocultural approach to conservation will have better chances of mitigating biodiversity and cultural losses at both the local and global levels.

CONCLUSION

In the Sarangani uplands, genetic erosion of traditional rice is primarily attributable to a paradigmatic shift among upland tribes toward agricultural modernization, among other factors. Unfortunately, Sarangani upland communities appear incapable of addressing drivers of rice biocultural losses due to lowered resilience. Conservation efforts are also hampered by important considerations involving resource/landscape preservation on the one hand and food security on the other. Intractable problems such as this necessitate making hard choices and compromises, and occasionally involve trade-offs to accomplish set goals. Identifying upland rice as a CKS will aid in the crafting of an effective conservation strategy that will be acceptable to advocates of resource conservation and of human welfare and wellbeing. This can be done by developing bottom-to-top consultative approaches, which are envisioned to conserve tribal resources while improving the quality of life of the upland tribes. The establishment of a community-managed gene bank will ensure that the farmers will not run out of planting materials, thereby helping strengthen food security in these areas. With the identification of niche markets for tribal crop resources, household income of farmers could be increased. Furthermore, indigenous knowledge transmission especially in relation to upland rice farming can be done through its incorporation in the primary school curriculum. Other strategies include the

empowerment of women as traditional seed keepers and incentivizing traditional rice farming so that the younger generation will remain in the farms. It is important to consider that the success of biocultural conservation is strongly predicated on local support of the Sarangani upland tribes. Efforts should therefore be expended to preserve and revitalize IKS especially since humankind will be rendered more impoverished by its loss especially in the face of the homogenizing effects of modernization. Finally, awareness about the link between traditional knowledge, resource conservation, and food security should be strengthened so that the continued presence of the Sarangani upland tribes will be assured in these areas for a very long time.

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REFERENCES

Aguilar, C.H. 2018. "Assessment of Globally Important Agricultural Heritage Systems (GIAHS) In Kiangan, Ifugao: Implications for Dynamic Conservation and Sustainable Management." Unpublished Master's Thesis. University of the Philippines Los Baños, Laguna, Philippines.

Alves, R.R.N. 2012. "Relationships Between Fauna and People and the Role of Ethnozoology in Animal Conservation." *Ethnobiology and Conservation* 1(2): 1–69. DOI: 10.15451/ec2012-8-1.2-1-69

Bennet, N.J., R. Roth, S.C. Klain, et al. 2016. "Conservation Soil Science: Understanding and Integrating Human Dimensions to Improve Conservation." *Biological Conservation* 205(2017): 93–108. http://dx.doi.org/10.1016/j.biocon.2016.10.006

Brush, S.B. 1986. "Genetic Diversity and Conservation in Traditional Farming Systems." *Journal of Ethnobiology* 6(1): 151–167. https://ethnobiology.org/sites/default/files/pdfs/JoE/6-1/Brush1986.pdf

Capella, W.D. 1988. *Pasos Cordilleranos, grupos sociales y procesos hegemonicos en norpatagonia hacia fines del siglo XIX. Revista de Historia-Universidad de Concepci* &#0243n 7: 215–228. (In Spanish)

Cristancho, S., and J. Vining. 2004. "Culturally Defined Species." *Research in Human Ecology* 11(2): 153–164. https://www.humanecologyreview.org/pastissues/her112/cristanchovining.pdf

Davic, R.D. 2004. "Epistemology, Cultural and Keystone Species." *Ecology and Society* 9(3): r1. http://www.ecologyand society.org/vol9/iss3/resp1/

Dove, M.R. 1983. "Theories of Swidden Agriculture, and the Political Economy of Ignorance." *Agroforestry Systems* 1: 85–99.

Dunn, C.P. 2008. "Biocultural Diversity Should be a Priority for Conservation." *Nature* 456: 315. https://doi.org/10.1038/456315c

Espina, P.G. 2015. "Status of Corn Diversity in the Marginal Uplands of Sarangani Province: Implications for Conservation and Sustainable Use." Unpublished undergraduate thesis, Mindanao State University, General Santos City, Philippines.

Garibaldi, A., and N. Turner. 2004. "Cultural Keystone Species: Implications for Ecological Conservation and Restoration." *Ecology and Society* 9(3): 1. DOI: 10.5751/ES-00669-090301

Gavin, M.C., J. McCarter, A. Mead, et al. 2015. "Defining Biocultural Approaches to Conservation." *Trends in Ecology & Evolution* 30(3): 140–145. https://doi.org/10.1016/j.tree.2014.12.005

Hladik, C.M., A. Hladik, O.F. Linares, H. Pagezy, A. Semple, and M. Hadley, eds. 1993. *Tropical Forests, People, and Food: Biocultural Interactions and Applications to Development (Man and the Biosphere Series, Vol. 13)*. Paris: UNESCO.

Iskandar, J., and R. Ellen. 1999. "In situ Conservation of Rice Landraces among the Baduy of West Java." *Journal of Ethnobiology* 19(1): 97–125. https://ethnobiology.org/sites/default/files/pdfs/JoE/19-1/Iskandar.pdf

Johns, T., and B.R. Sthapit. 2004. "Biocultural Diversity in the Sustainability of Developing-Country Food Systems." F*ood and Nutrition Bulletin* 25(2): 143–155. doi: 10.1177/156482650402500207

Liu, H.M.Z., F. Xu, Y.K. Xu, and J.X. Wang. 2002. "Practice of Conserving Plant Diversity Through Traditional Beliefs: A Case Study in Xishuang-Banna, Southwest China." *Biodiversity & Conservation* 11: 705–713.

Loh, J., and D. Harmon. 2005. "A Global Index of Biocultural Diversity." *Ecological Indicators* 5(3): 231–241. https://doi.org/10.1016/j.ecolind.2005.02.005

Maffi, L., ed. 2001. *On Biocultural Diversity: Linking Language, Knowledge, and the Environment*. Smithsonian Institution Press, Washington D.C.

McShane, T.O., P.D. Hirsch, T.C. Trung, et al. 2011. "Hard Choices: Making Trade-offs Between Biodiversity Conservation and Human Well-Being." *Biological Conservation* 144: 966–972. https://doi.org/10.1016/j.biocon.2010.04.038

Minteer, B.A., R. Thaddeus, and T.R. Miller. 2011. "The New Conservation Debate: Ethical Foundations, Strategic Trade-Offs and Policy Opportunities." *Biological Conservation* 144: 945–947. https://doi.org/10.1016/j.biocon.2010.07.027

Nabhan, G.P., P. Pynes, and T. Joe. 2002. "Safeguarding Species, Languages and Cultures in the Time of Diversity Loss: From the Colorado Plateau to Global Hotspots." *Annals of the Missouri Botanical Garden* 89: 164–175. DOI: 10.2307/3298561

Olick, J.K., and J. Robbins. 1998. "Social Memory Studies: From 'Collective Memory' to the Historical Sociology of Mnemonic Practices." *Annual Review of Sociology* 24(1): 105–140. https://www.jstor.org/stable/223476

Paine, R.T. 1966. "Food Web Complexity and Species Diversity." *The American Naturalist* 100: 65–75. https://www.jstor.org/stable/2459379

Platten, S., and T. Henfrey. 2009. "The Cultural Keystone Concept: Insights from Ecological Anthropology." *Human Ecology* 37: 491–500. DOI: 10.1007/s10745-009-9237-2

Rellon, V.C. 2018. "Resilience Assessment of the Selected Upland Communities in Sarangani Province." Unpublished Undergraduate Thesis. Mindanao State University, General Santos City, Philippines.

Saito, K., B. Linquist, B. Keobualapha, K. Phanthaboom, T. Shiraiwa, and T. Horie. 2006. "Cropping Intensity and Rainfall Effects on Upland Rice Yields in Northern Laos." *Plant Soil* 284: 175–185.

Stepp, J.R., F.S. Wyndham, and R.K. Zarger. 2002. *Ethnobiology and Biocultural Diversity: Proceedings of the Seventh International Congress of Ethnobiology.* October 2000, Athens, Ga. USA: International Society of Ethnobiology and University of Georgia Press.

Southgate, D. 1990. "The Causes of Land Degradation along Spontaneously Expanding Agricultural Frontiers in the Third World." *Land Economics* 66: 93–101. DOI: 10.2307/3146686

Suarez, G.J. 2017. "Genetic Diversity and Indigenous Knowledge Associated with Non-Rice Carbohydrate Sources of Selected Blaan Communities in Sarangani Province." Unpublished Undergraduate Thesis. Mindanao State University, General Santos City, Philippines.

Winter, K.B., and W. McClatchey. 2009. "The Quantum Co-evolution Unit: An Example of Awa (Piper methysticum G. Foster) in Hawaiian Culture." *Economic Botany* 63: 353–362. DOI: 10.1007/s12231-009-9089-0

Zapico, F.L., J.T. Dizon, T.H. Borromeo, K.L. McNally, E.S. Fernando, and J.E. Hernandez. 2020. "Genetic Erosion in Traditional Rice Agroecosystems in Southern Philippines: Drivers and Consequences." *Plant Genetic Resources* 18(1): 1–10. DOI: https://doi.org/10.1017/S1479262119000406

_____. 2019. "Traditional Agro-ecosystems in Southern Philippines: Vulnerabilities, Threats and Interventions." *International Journal of Disaster Resilience in the Built Environment* 10(4): 289–300.

Zapico, F.L., C.H. Aguilar, A. Abistano, J.C. Turner, and L.J. Reyes. 2015. "Biocultural Diversity of Sarangani Province, Philippines: An Ethno-Ecological Analysis." *Rice Science* 22(3): 138−146. https://doi.org/10.1016/j.rsci.2015.05.018