

Article

Exploring the State of Retention of Traditional Ecological Knowledge (TEK) in a Hani Rice Terrace Village, Southwest China

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Abstract: Traditional Ecological Knowledge (TEK) is one of the components of the Globally Important Agricultural Heritage Systems (GIAHS), which are good examples of evolutionary adapted socio-ecosystems in human history. The Hani Rice Terraces System, located in China's southwestern Yunnan Province, is a living example of GIAHS. The Hani Rice Terraces system has existed for more than one thousand years, following TEK related to cultivation and natural resources management, which was collected and practiced continually. Over this long time period, TEK has enabled the Hani people to manage their terraces and other natural resources in a sustainable way. This paper concentrates on the TEK transferring in the current Hani community, taking a small village, Mitian, as an example. Grouping the interviewees into three different age groups (young group,

0–30 years old; middle-age group, 31–50 years old; old group > 50 years old), we investigated their understanding and participation in 13 items of TEK in relation to rice cultivation and water utilization. The items of TEK were divided into four categories, namely “Festivals”, “Beliefs”, “Folk Songs”, and “Water Management”. From the data collected, it was learned that all the items of TEK are well known, but not necessarily practiced. Age and gender have significant influences on farmers’ understanding and participation in TEK. Our analysis suggested that both the knowledge and the practice showed declining trends from the older to the younger age group. Men and women behave differently in practices. In general, it is shown that TEK is declining in the Hani villages which will affect the rice terrace system in ways that are yet unknown. It is likely that a blended TEK, with old and new knowledge and practices, will emerge to sustain the upland rice terrace systems of Yunnan.

Keywords: TEK (Traditional Ecological Knowledge); knowledge and practices; rice cultivation; water utilization; transferring status; Hani Rice Terraces System

1. Introduction

Globally Important Agricultural Heritage Systems (GIAHS) are living models of agricultural, ecological and societal sustainability [1]. They are characterized by a combination of outstanding landscapes and ingenious management practices of natural resources for agricultural production, including land and water resources, as well as important agricultural biodiversity at various ecosystem levels. GIAHS foster and conserve a combination of biophysical, economic, and socio-cultural resources that have been evolving under specific ecological and socio-cultural constraints and opportunities [2]. These heritage systems have been passed down for generations, due to excellent local traditional knowledge and practices. Up until February 2014, there were 27 agriculture system pilot sites listed as GIAHS worldwide, with eight of them in China. GIAHS pilot sites usually exist in marginal, remote or specific areas, where the local inhabitants, for various reasons, have established complex, innovative, and useful practices for land use and management. Most of them are located in mountainous areas, such as the Hani Rice Terraces System in China’s southwestern Yunnan Province.

The GIAHS sites have evolved over many years, in some cases many centuries. In such traditional agricultural systems, the inhabitants have adapted parts of the environment based on how they understand and are able to adapt to or take advantage of the constraints and opportunities, as they see them, of the socio-ecosystem. Traditional Ecological Knowledge (TEK), is a “way of knowing” that is somewhat different from normal science. It is collected and encoded by the farmers in their cultivation and cultural practices in everyday life [3]. In this paper, TEK is used to represent the farmers’ knowledge about the ecosystem (biodiversity, environment, management, techniques, beliefs, rules, *etc.*), which is derived from traditional agriculture practices, particularly used by ethnic groups [3–5]. Recently, studies on TEK have recognized that this kind of knowledge, applied in these farming systems, contributes very well in these poor rural areas. Today, these are the targets of GIAHS as they represent outstanding examples of human ingenuity and the ability to survive in different

environments. GIAHS include biodiversity conservation [6], environmental protection [7], landscape maintenance [8], adaptation to local climate or environmental change [4,9], as well as the sustainable management of natural resources [10,11]. TEK is also important in alleviating poverty [12] and balancing the socio-ecosystem [13–15]. Conceptually, Traditional Ecological Knowledge refers to the understanding of knowledge, as well as how to practice it. In many cases, TEK is passed down orally or by acting from generation to generation by stories (including legends), songs, folklore (festivals, life etiquettes), and beliefs (rituals and sacrificial activities) and rules (taboos and sanctioned law). Possessed only by local inhabitants, TEK contributes to the specific decisions and actions of the community. TEK indicates the relationships between the natural ecosystem and society, as well as themselves [16,17]. Consequently, TEK is of high importance to local sustainability, and thus the exploration of the present states and practices of all the traditional knowledge in the Hani Terraces System is the subject of this paper.

The Hani Rice Terraces System in Honghe Prefecture, Yunnan Province, in Southwest China, was selected as a GIAHS pilot site in 2010 and is taken as the case study in this paper. With 1300 years of history, the Hani terraces are the home of the Hani and Yi peoples, who live in the Ailao mountain area. The system is famous for its unique “Forest–Village–Terrace–River” landscape, which combines eco-agriculture cultivation with ecosystem conservation in a harmonious system [18]. Local inhabitants today still manage their terraces in the traditional way, following their specific cultural beliefs and practices. TEK guides the cultivation and natural resources management, especially the traditional eco-agriculture and water consumption [12,19–21]. Working well in terms of ecosystem sustainability, the Hani Rice Terraces System, a vital sample of GIAHS, has been passed down for generations and also benefits the Hani people. In addition to food production, this system offers multiple ecosystem services, such as disaster mitigation, soil and water conservation, soil improvement, and aesthetic values [5,22–24]. Thus, the Hani terraces area is of great significance for research on the traditional agriculture practices of rice cultivation and corresponding water utilization for irrigation and consumption.

Since the 1980s, access to the Hani society has been opened up. Migration from the rural areas to towns has occurred and modern agricultural techniques have been introduced there. The mass use of pesticides and fertilizers, as seen across China, occurs here also. Consequently, less TEK is applied to terrace cultivation. However, with the help of the distinct TEK and its practices, the terrace system runs well. For example, although a severe drought occurred all over Southwest China in the past four years [25], the system has continued unabated and has run well, albeit at a slightly lower level of productivity. As a GIAHS pilot site, the Hani Rice Terrace System is considered an evolutionary adapted socio-ecosystem. It has always adapted and changed, which leads to the sustainability of this system. Thus, traditional ecological knowledge has been one of the keys to keeping the system sustainable.

This paper explores how TEK is being transferred and changed by current generations, by analyzing the knowledge and practice of TEK, taking a small Hani village as an example. Our aims are to: (1) summarize the TEK and the traditional agriculture practices on rice cultivation and corresponding water utilization in the Hani Terrace area; (2) find out the state of transference of knowledge and participation in these practices; and (3) analyze differences among villagers by gender, age, and education.

2. Materials and Methods

2.1. The Expression of TEK and its Practices

In the ethnic community, TEK is expressed indirectly. It is in what the Hani people know and practice, respect, and value, and what enables them to remain in their villages as a cohesive community. The TEK represents the belief of an ethnic group. Knowing and practicing traditional knowledge helps to maintain the belief system in the community. Both knowledge and practices work as an operating system [13,20]. To explore the transference of Traditional Ecological Knowledge, this research measures both how the Hani people perceive nature, agriculture and their culture and in what ways they practice farming and related activities to make a living.

2.2. Study Area

Honghe County is one of the four core counties of the Hani terraces area, located in Honghe Hani and Yi Autonomous Prefecture, Yunnan Province. It covers $101^{\circ}49'$ – $102^{\circ}37'E$, $23^{\circ}05'$ – $23^{\circ}26'N$, with an area of 2057 km^2 , and has a range of elevation from 259 m to 2745.8 m. The average annual rainfall is 1340 mm, 76%–84% of which occurs from May to October. Due to the geographical and environmental features of this specific area, there are many local variations of the Hani terraces farming system. Fieldwork was undertaken in a typical village in Honghe County, called the village of Mitian. Mitian is typical in that it is located in a valley with several other similar villages in terms of size, function and culture. It was selected after a series of visits to many villages in the area. The map below shows the location of this village (Figure 1).

Figure 1. The Mitian village: location and environment (A) Map showing location of Mitian in Yunnan Province; (B) The location of Mitian [26]; (C) Photograph of the environment of Mitian [27].

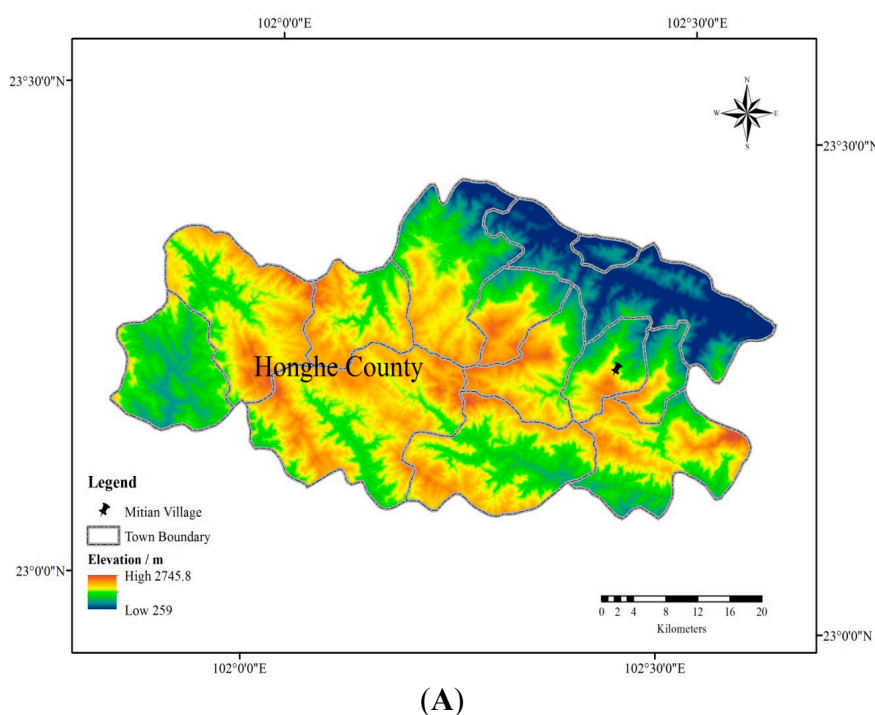
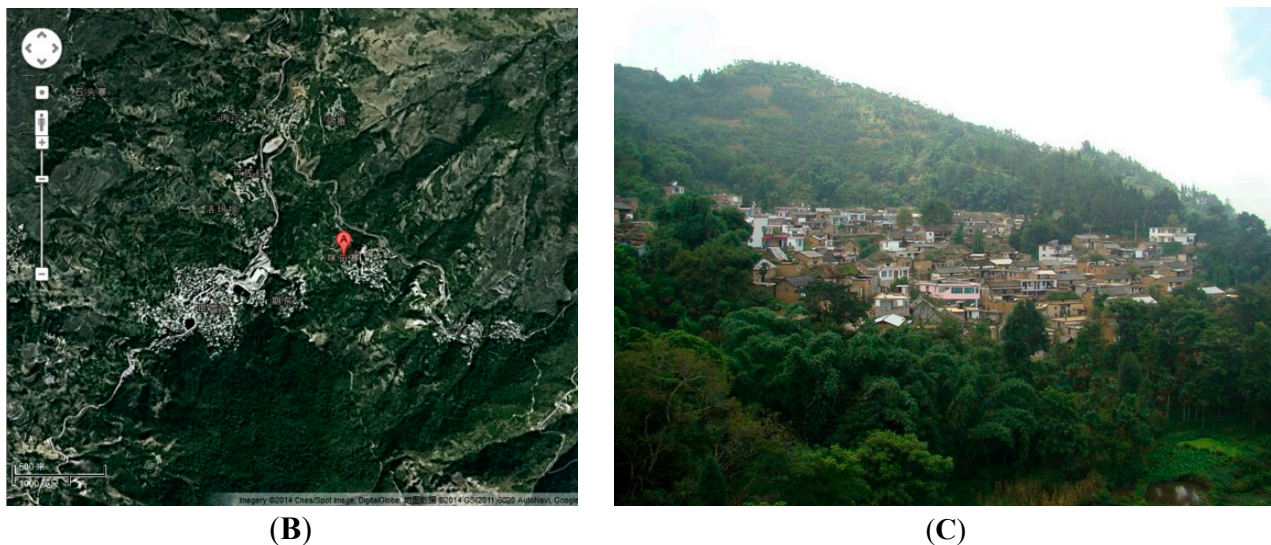


Figure 1. Cont.



Mitian belongs to Jiayin town, Honghe County. The altitude is 1780 m, the average temperature is 14.1 °C, and the annual average rainfall is 1310.8 mm. Mitian Village has a total area of 42.28 ha of arable farmland, about 54.6% of which is in rice terraces. There are 851 residents in 184 households, all of whom are Hani people. About 41.3% (76 households) are still living in a traditional house, known as a “mushroom house”. In 2009, the average income per household from terrace rice production was 5326 yuan, accounting for 44.67% of a family’s total average income. Clearly, the terrace rice farming plays a central role in the livelihoods of the inhabitants. The Hani people make their livings mainly by cultivating their terraces and raising livestock, just as they did many generations ago. They currently also do other jobs for whole or part of the year. Plenty of traditional practices are undertaken, mainly but not limited to rice cultivation, and corresponding water and land uses, that keep the system running.

2.3. Field Survey

Field surveys were conducted in Mitian, during the period of June to July 2011. The data were collected by questionnaire survey, interviews, and observation.

Information about traditional Hani practices in rice cultivation and corresponding water utilization in the terrace area was collected by reviewing the local yearbooks, statistics, and searching government reports, books, papers and a related official website. Features presented in the study area by observation and key informant interviews were then noted. Several key informants are responsible for identifying most activities (10 out of the 13 activities) in the village. Three of the key informants, who are well known for mastering the richest knowledge about life in the village, were interviewed in depth: the village priest (the *mopi*), the spiritual specialist (the *migu*), and the manager of water allocation (the *shuizhang*). A list of traditional practices was prepared, and a questionnaire survey was constructed to learn systematically what traditional practices Hani people know about and participate in. Interviewers went to the village of Mitian to conduct the questionnaire survey in structured interviews. In the interviews, inhabitants were asked whether they had learned about these traditional practices or not. If they had, they were asked whether they regularly had taken part in them. Out of

184 total households in Mitian, 45 households were visited, making up 24.5%. In each family, one person was selected randomly for the interview.

2.4. TEK and the Practices in Mitian Village

The literature reviews and in-depth interviews illustrate that traditional practices exist in all aspects of people's lives. According to the review results, 13 different traditional practices in rice cultivation and corresponding water utilization were summarized. These 13 practices are the main expressions of Hani Traditional Ecological Knowledge in Mitian. Based on the local form of literary expression of these 13 practices, four categories were identified: *Festivals, Beliefs, Folk Songs, and Water Management*. Basic descriptions are summarized in Table 1.

Table 1. Traditional practices in rice cultivation and corresponding water utilization in Mitian village, Yunnan Province, China, 2011.

Type	The description of traditional practices
Festival	1. Water Worship Festival: July, people collect spring water from known places in the village and take it home in order to worship the Water God.
	2. New Rice Festival: In July of the lunar calendar, the families harvest rice from their paddy field and cook it in order to celebrate the rice harvest and express their thanks to the land and hopes for good weather. The first bite of the rice after the harvest must be taken by a dog. The Hani people regard the dog as the one who brought the rice seed to them in the first place.
	3. Dragon Tree Worship Day: Hani people regard the trees as the source of fresh water. In January of the lunar calendar, people go to worship the Dragon Tree in order to ask it to save enough water for their village, terraces and paddy fields.
	4. Sacred Forest Worship Festival: Every village owns a special forest, called the Sacred Forest. Hani people consider that all things have their own spirit. The Sacred Forest is the representative of all kinds of the natural gods, such as a tree, an animal, the hill, land, water, and so forth. The native inhabitants believe that their forest can protect them and keep their paddy rice fields safe for a good harvest. People will worship the forest at one special festival when the Chinese new year is coming. This practice is limited to the men in the village.
Beliefs	5. Pray for Rain: When drought occurs, local people will pray for rain through one very special ritual. With a sacrifice, like rice, meat, hen, or something else, music and dance are usually presented in this practice. Villagers believe that the nature gods will be satisfied and will balance the climate.
	6. Pray for Sun: When it rains heavily for a long time, people will pound the glutinous rice in order to pray for sunny days. The practice form is similar to the "pray for rain" ritual. However, the expressions of music and dance are different from the "pray for rain" ones.
Beliefs	7. Exorcism: When pests and diseases break out in the area or in a family, people will do an exorcism to get rid of them. Sticky rice, birds, leaf of Japanese banana, spirits and animal blood make a special offering. People who will do the exorcism for a relative put the offering by the road, pray in silence for one or two hours, and then set fire to the offering. Hani people regard kindness and evil as tangible beings. Single-hearted confession could be forgiven. Doing good deeds can distance them from the devil.
	8. Throwing Rice Seedlings: Native inhabitants can do this before transplanting rice in order to express their respect to the land god and ask for a good harvest.

Table 1. Cont.

Type	The description of traditional practices
Folk Song	9. Songs in prayer: The <i>mopi</i> sing songs in some festivals and pray to illustrate the harmonious relationships among the native inhabitants, water, rice and the forest.
	10. The Hani Season Production Song: This illustrates that terraced rice production depends on the farming season and the phenophase.
Water Management	11. Shuizhang Institution: The “ <i>shuizhang</i> ” is the master of the water ditches and use his knowledge about the relationship between forest and water to determine dates and flows. This position is voted on by the villagers. He manages the water allocation in order to distribute water adequately for daily life and irrigation.
	12. Water Wooden/Stone Barriers: A special water-allocation technique, carving different width grooves on the wood or the stone, named wooden/stone barriers, is still used in Mitian and other villages, around the village, to effectively allocate water resources.
	13. Rice Terraces Water Control: Depending on their knowledge about how much water the paddy rice needs and the rainfall in different periods, farmers modify the size of the water outlet to control the water volume in the terraces.

Data sources: Three key informants.

2.5. Data from the Questionnaires

After setting the 13 different practices, a survey with 24 questions was constructed. The first 13 questions (about knowing) were to establish whether local inhabitants have learned about the 13 traditional practices or not. The remaining 11 questions (about participating in practices) focused on whether respondents had taken part in any of these practices (that is excepting No.4 and No.9 practices). Structured interviews were used to fill in the questionnaire in Mitian during the period of June to July 2011.

In order to learn about generational levels of knowing and participating in these traditional practices, interviewees were divided into three groups by age. The first group (young) represents the new generation, aged 30 and under, who are very much influenced by modern culture. The second group (middle) is the middle-aged generation aged 31–50, who have spent most of their adult lives after the reform and opening-up period in China. The third group (old) is the generation older than 50, who know the traditions well and practice them with tacit knowledge. The three age groups represent major generations living in Mitian. This division was designed to show the different ways of knowing and the state of retention of TEK and related practices in different generations, so that the trends of TEK transference over the last 50 years could be analyzed. Table 2 illustrates the basic information of all the interviewees.

Table 2. Basic information on the interviewees in Mitian Village, 2011.

Group		Young	Middle	Old	Total
Total Number		12	16	17	45
Gender	Male	5	6	15	26
	Female	7	10	2	19
Main work	Farmer	0	9	14	23
	Worker	6	5	3	14
	Other profession	2	2	0	4
	Student	4	0	0	4
School Educational level	No Education	0	2	3	5
	Primary School	1	4	11	16
	Middle School	5	5	3	13
	High School	6	5	0	11

Table 2 presents the sample sizes in different gender/profession/school education levels for the three different age groups. As shown, there were 12 young interviewees, 16 middle-aged, and 17 older interviewees, accounting for 26.7%, 35.5% and 37.8%, respectively. More middle-aged women were interviewed than men, because men aged 31–50 worked outside their village pursuing off-farm incomes, leaving their wives to do the farming. The older women, who are more than 50 years of age, rarely worked in the paddy fields. Therefore, we chose more males than females to interview in the older generation group. Compared to 14 old interviewees working in their terraced fields, there were only eight middle-aged farmer interviewees. No young respondents worked as farmers. The villagers like to work off-farm to make more money in towns or cities. Moreover, there were four interviewees under the age of 16, who were students and not involved in formal work. School education level reflects how much science knowledge people have had. The mean education level in the village was below the average level in China. For the older group, most of the respondents only finished primary school, and some of them had no chance to go to middle school. However, the middle-aged and young interviewees had more years of education in school than the older people.

In general, the methodology conducted for this research was considered adequate, except for the sample size, which limited the analysis a little, but which does not affect the validity of the findings.

3. Results and Discussion

3.1. Structured Interview Results

According to the structured interviews (Table 3), 85% of interviewees stated that they knew about 11 traditional practices, while on average 78% of them took part in 8.6 different practices out of the 11 known practices. More precisely, most of the old Hani inhabitants interviewed knew all of the traditional practices and had been engaged in all the 11 related activities, which indicates that these practices are maintained very well for the old generation. Although the middle-aged generation knows most of these traditional practices as well, there was a clear gap between them and the old in exercising these practices. Young people had, on average, only heard of about 8.3 practices out of the 13, accounting for 64%. Moreover, they rarely had participated in any traditional practices. In summary,

it was illustrated that the condition of knowing and conducting traditional practices showed a significant intergenerational decline in the village of Mitian.

Table 3. Structured interview results for Traditional Ecological Knowledge (TEK) and Participation in Mitian.

Generation	Knowledge (0–13)		Participation (0–11)	
	Mean	SD *	Mean	SD
Old	12.41	1.06	10.94	1.56
Middle	11.63	1.78	8.31	2.44
Young	8.33	2.74	5.58	1.83
Total	11.04	2.50	8.58	2.90

* SD = standard deviation.

3.2. Analysis of Traditional Practices

Based on the interview results, the traditional practices in Mitian reflect the status of knowledge transference. When more than 70% of people from one generation know or participate in any one practice, it was marked as a good transference with the symbol “+”. Conversely, when less than 70% of the generation could understand and do the practice, the symbol was “-”. According to this principle, we marked all of the 24 questions for all generations were marked, and the results are shown in Table 4.

Table 4. The condition of knowing and participating in the traditional practices of Mitian.

	Knowledge Question	Knowledge			Participation Question	Participation		
		Old	Middle	Young		Old	Middle	Young
Festivals	1	+	+	+	1	+	+	+
	2	+	+	+	2	+	+	+
	3	+	+	+	3	+	-	-
	4	+	+	+				
Beliefs	5	+	+	-	5	+	-	-
	6	+	+	-	6	-	-	-
	7	+	+	-	7	-	-	-
	8	+	+	-	8	+	-	-
Folk Songs	9	+	-	-				
	10	+	+	-	10	-	-	-
Water Management	11	+	+	-	11	+	+	-
	12	+	+	+	12	+	+	-
	13	+	+	+	13	+	+	+

The results indicate that the old and middle generations are familiar with the traditional practices, while the young only know about “Festival” and “Water Management” practices. Compared with the first 13 questions, the inhabitants have attended fewer practices than what they know, especially for the “Belief” and “Folk Song” categories. For the older generation, eight traditional practices were actively used in the village, most of them belonging to the “Festival” and “Water Management” categories.

Although some practices (like “Water Worship Festival” and “New Rice Festival”) were preserved well, there was still a clear and significant decline among the new generation. Even worse, only about three practices were known well by the youth. There was a decreasing trend from the old to the young, especially in the categories of “Beliefs” and “Folk songs.” Most of the traditional practices were under threat of being lost in the youth group.

All the questions were classified into four-point scales for measuring the degree of knowledge and participation more closely: “Perfect”, “Well”, “Poor”, and “Bad”. The mark “+++” refers to the level “Perfect”. If the question is marked with “+++”, it means that all the interviewees in different generations were familiar with it and at least took part in the practice once. While the level of understanding or participating declined, the category level also decreased. The questions marked with “+++”, “+—”, and “——” therefore refer to the levels of “Well”, “Poor”, and “Bad”, respectively. The classified results are shown in Table 5. Except for the 9th question, all the informants were familiar with the other 12 traditional practices, which belong to level “Perfect” or “Well”. However, there is a significant gap between knowing and participation. Due to high participation levels, the practices 1, 2, and 13 belong to the Level “Perfect”. It is noticeable that all of three practices had a high correlation with people’s daily lives. In this situation the practices would be preserved and transferred well. Although the 11th and 12th practices belonged to the level “Well”, the young had few chances to be engaged in them because of changes in their livelihoods, which reflect their working off the field instead of planting crops and raising livestock. The “Belief” and “Folk Song” practices fell into the levels of “Poor” or “Bad.” This may be because there was no clear scientific significance of such rituals for rice cultivation and water utilization, and they mainly showed the older people’s hopes and wishes for harvesting and good weather.

Table 5. Utility classification of the 13 traditional practices.

Knowledge	Level	Participation
1, 2, 3, 4, 12, 13	Perfect +++	1, 2, 13
5, 6, 7, 8, 10, 11	Well ++—	11, 12
9	Poor +—	3, 5, 8
	Bad ——	6, 7, 10

According to Table 4 and Table 5, we can review the main characteristics of the transfer statuses in the four categories. For the diversity of situations there are many probable reasons.

Knowledge and participation in traditional festivals is high in the study area. The festivals are the days when people get together to celebrate and provide offerings to their ancestors and the gods. The festivals reunite families, and thus each person can take part in these activities, leading to honoring the traditional practices. Furthermore, these traditional festivals can also attract tourists and that can increase village income. Therefore, the festivals play an important role in maintaining the TEK and practices, as well as establishing and holding together the relationships in the community.

Beliefs and related practices are in the spiritual category. However, beliefs are also the most vulnerable to the outside culture; they are also well understood by the farmers who will continue to protect the Intangible Cultural Heritage of the area. With the popularizing of science, the activities related to the beliefs are considered as superstitious and are being abandoned by the younger

generations. Therefore, the belief about how people depend on spiritual things, which stood behind all of these activities, is slowly diminishing as well.

Folk songs are one of the traditional ways to record and pass down the TEK and other traditional customs to manage the ecosystem in the Hani language, especially the “Four-Season Song”, which comprehensively describes the method of cultivating the terraces. However, the songs are barely sung now. This kind of practice combines the language and the farming activities into an oral tradition. The mastery of the knowledge is different between males and females, which might be mainly because of the gender division of labor.

The level of knowledge and participation in water management practices show a declining trend from the old to the young, as young inhabitants choose to work in town for better incomes. However, water management is very important for water collection, storage and rational water utilization, which maintains the water balance in the terraces. This kind of practice should be maintained at all costs.

3.3. The Relation between Age/Gender and Traditional Practices

3.3.1. The Influences of Many Factors

Many factors, such as age, gender, education, and profession, can influence the willingness and ability of the inhabitants to learn about and use traditional practices. The correlation between the factors of age, gender, education level and profession and the awareness of the traditional knowledge and practices were analyzed using varied methods.

Age is correlated to the knowledge level and the participation in activities, as tested by Pearson correlation: values of 0.663 and 0.782, respectively, and significant at the 0.01 level (2-tailed).

The correlation between genders and knowledge level/participation activities was 0.663 and 0.782. Correlation between gender and knowledge/participation was tested by T-test in 95% confidence interval of the difference. The significances of T-test for equality of means were 0.009 and 0.002, and both were less than 0.01. There is a significant difference in the traditional knowledge level and participation in practices in different genders.

Educational attainment level and profession also influence both knowledge level and participation in traditional activities, as tested by the Kruskal-Wallis Npar Test. In the analysis, educational level was grouped into four categories: no school education, primary school education, junior school education and senior school or higher education. The observations data in the four groups were 5, 16, 16, and 8, with the mean rank of knowledge level being 31.40, 27.78, 15.25, and 23.96, respectively, and for participation was 33.90, 28.41, 17.88, and 15.62. The Chi-Square values were 10.648 and 11.264. Correspondingly, the asymptotic significance values were respectively 0.014 and 0.010. Based on the results, the four groups of different educational levels were differentiated. The “no school education” group had the most influence on both traditional knowledge level and the participation in TEK activities. The second was the “primary school education” group. The “senior school or higher education groups” master traditional knowledge more than the “junior school” group did, but participated less in TEK activities.

In the analysis on main occupation, we divided the informants into four groups, which were farmer, worker, student and the other. The data size in the four groups was 22, 16, 3, and 4, the mean rank of

knowledge level was 28.27, 21.00, 9.33 and 12.25, and for participation it was 31.64, 15.91, 16.83, and 8.50. The Chi-Square values were 10.742 and 19.984. Correspondingly, the asymptotic significance values were respectively 0.013 and 0.000, less than 0.05, which means the influences of the four groups are different. As expected, farmers knew about traditional knowledge most and took part in the practices more often. Students knew the least about traditional knowledge, while the “other” work group engaged in traditional practices the least.

Age, gender, education and profession all have some influences on participation in traditional practices, but age affected the traditional knowledge level in the village of Mitian. It was easy to see that farmers who work in the terraces have a better understanding of and make more use of these traditional practices, compared with other people in the village. These farmers are usually older and have little formal education. Traditional knowledge and practices were the main way to manage their lands. To find out if there was one key influence on knowledge and participation, the correlations between age and education level as well as between age and profession were analyzed. The coefficients of Pearson Correlation were -0.559 and -0.639 , with the significance level at the 0.01 (2-tailed). This means that older residents had a greater probability of being farmers, and were less school educated than the others.

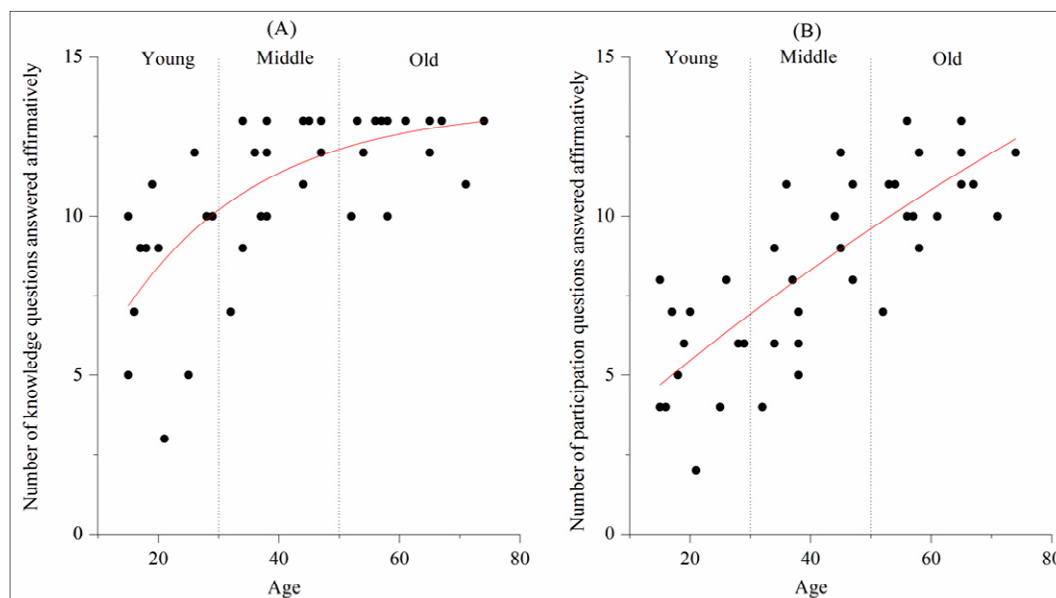
Gender is an independent variable in the discussion. Therefore, age and gender were taken as two influential variables to analyze further.

3.3.2. The Correlation between Age and TEK

As a result of this analysis, we focused on the relationship between age and traditional knowledge and practices in Mitian, and the results are shown in Figure 2A,B. Figure 2A indicates the result of knowledge transfer for three generations. It can be seen that older people have more traditional knowledge than the young. For those people aged more than 40, two-thirds of them knew all of these traditional practices, which means that all of the practices have been passed down to this generation. Although the younger generation had heard of the traditional practices, few of them were familiar with them. The trend of the correlation of age to knowledge increases logarithmically. Figure 2B shows that there is a clear correlation between age and participation in these practices. It can be stated that the older the inhabitants are, the more practices they have used. The young generation group had seldom participated in the traditional practices, and none had been engaged in more than eight practices. In addition, the older generation group (except two individuals) had exercised more than 10 of the 11 practices, accounting for 91% of the total. Furthermore, two of the old interviewees had participated in all of the 11 traditional practices. This result shows a big decrease in the middle generation taking part in TEK practices.

Because of economic and cultural reasons, fewer individuals in the young group than in the middle and old groups were willing to practice TEK. The young individuals stated that they prefer to work in the town or a city to get better incomes. Only the old people, due to their experiences with water allocation and the other resource management practices, used some of the TEK practices. The young people took less part in the traditional practices than the middle group. When most people of a generation have no idea about the traditions, TEK and the practices of water utilization and terrace management will begin to fade away.

Figure 2. The scatter plots of the correlations between age and the number of knowledge/participation questions answered affirmatively. **(A)** The result of number of knowledge questions answered affirmatively for different age groups; **(B)** The result of number of participation questions answered affirmatively for different age groups.



From the survey and key informant discussions, it is evident that more and more young people choose to work in non-agricultural jobs and give up farming the terraces. At the same time, with the improvement of educational level, young people have more chances to master modern knowledge, and thus they may prefer modern methods (such as machinery, advanced techniques, and the use of chemicals in their terraces), instead of traditional practices. They may believe that some of the traditional practices have no scientific value (such as the many “Beliefs”), and thus the young may abandon TEK and its associated practices.

In the questionnaire survey, the number of participation questions answered affirmatively was usually less than the number of knowledge questions answered affirmatively. It can be concluded that some people might know about the traditional practices, but they are not willing to practice them. The average ratio of the number of TEK practices to TEK awareness in the old group is 88% in average, which is the highest. The ratio in the middle and young groups are 71.2% and 68.0%. It suggests that participation in traditional knowledge practices is consistently less than the number of people who have some awareness of TEK. The ratio shows the different interests of people in different age groups in the practice of TEK: the old attach the most importance and the young pay least attention to traditional practices.

3.3.3. Differences of TEK and Its Practices between Genders and Age

The correlation between gender and the Traditional Ecological Knowledge and practices was also observed in Figure 3 and Table 6. Although the number of informants in each gender is not the same, the general idea of knowledge transference is displayed.

Figure 3 presents the differences in knowledge of and participation in the traditional practices between men and women. Men know an average of 12 practices and undertook an average of 9.7 of all of them,

compared with the average of 10 and 7.0 practices for women. Overall, the old and middle-aged men and women had similar experiences with TEK, while numbers were different in the younger generation group.

Figure 3. Correlation between gender and traditional practices by age.

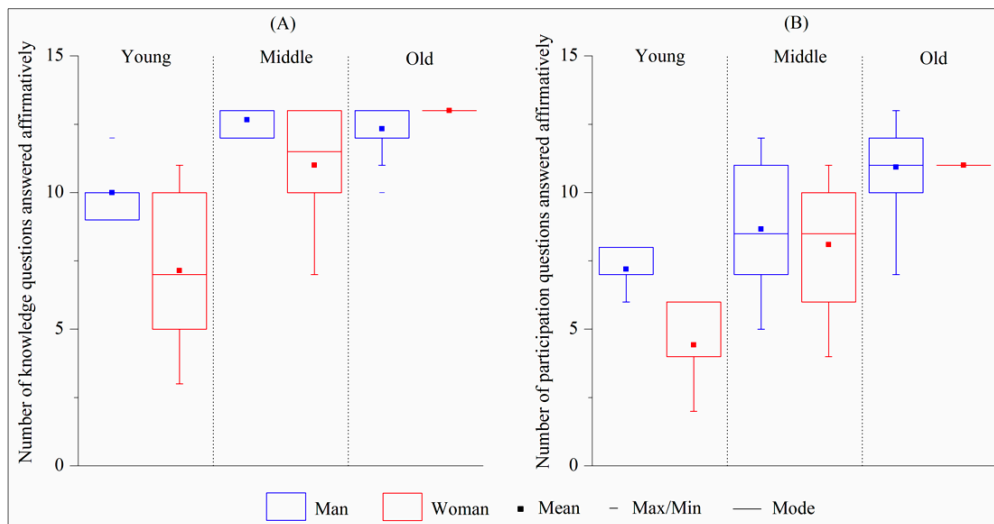


Table 6 shows the condition of knowing about and participating in the four categories of traditional practices for men and women in different age groups. The results suggest that men and women know very well about the “Festival” practices, followed by the “Water Management” practices. There were no significant differences in learning about the two types of practices between men and women. However, men participated in more practices than women in these two types, partly because some practices can only be undertaken by men in Hani society, such as the “Worship of Dragon Tree” practices. Furthermore, the “shuizhang” is also traditionally dominated by men. Compared with their male counterparts, women know less about “Belief” practices, due to having less opportunity to take part in them. Both men and women seldom sing “Folk Songs”. In brief, out of the four categories of TEK in Mitian, women have a good understanding (knowing or participating more than 80% TEK or practices) of the Festivals and the Water Management categories, while men score well in all of the four categories. The local inhabitants prefer participating in the practices of “Festivals” and “Water Management” to singing “Folk Songs”. For the practices of “Festival” and “Beliefs”, men have more chance to take part, while women are more willing to sing folk songs than men are.

Table 6. The gender differences in knowing and participating in different categories of traditional practices in Mitian Village (%).

Gender	Festivals		Beliefs		Folk Songs		Water Management	
	K	P	K	P	K	P	K	P
Male	100.0	74.0	83.8	53.8	84.5	13.5	95.0	66.3
Female	92.0	50.0	65.8	35.5	52.5	23.5	80.7	63.0

* K represents Knowledge; P represents Participation.

4. Conclusions

In the paper, we established 13 different traditional practices concerning rice cultivation and corresponding water utilization in a typical village in the Hani terrace area of China’s southwest

Yunnan, which we divided into four parts: “Festivals”, “Beliefs”, “Folk Songs”, and “Water Management”. From a structured survey in Mitian, we found that the “Festival” and “Water Management” practices are preserved well, while the young were not familiar with “Beliefs” and “Folk Song” practices, not to mention participating in them. Meanwhile, there was a great intergenerational decline in both knowledge and practice of these traditions. The results also show that age, gender and profession have strong influences on learning about and participating in these traditional practices in the study area. There was a clear gap between men and women when taking part in these practices. Age and gender are the two most significant impact factors. According to the status of TEK and traditional practices in the three age groups, there is an obvious gap among the generations. Young people, relative to the other age groups, with multiple job options and modern school education, have little Traditional Ecological Knowledge and are less likely to take part in practices. This change began in the middle age group, which relates to China’s national strategy and related policies introduced in the 1980s. It has impacted at least two generations. The declining trend of participating in traditional practices is sharper from the old to the young. Men and women behave differently in terms of traditional practices. In the same age group, women take part in fewer practices than the men do, even though their traditional knowledge levels are similar.

Taking this one village as an example, we find declining trends in the transfer of Traditional Ecological Knowledge. This village represents a view of fragile TEK transference in a marginal area in the context of rapid social and economic change in China, which is mainly expressed by migration and a change in values. The decline of TEK reminds people about their self-identity and prompts their awareness to keep close to nature. Traditional Ecological Knowledge is expressed in traditional practices. Changes in the conditions of TEK happen together with the change of traditional practices. Other studies point out that traditional knowledge and practices appear to be declining in many parts of the world due to complex factors, such as acculturation and loss of local languages, changes in land use, and transition to market economies [28,29]. As one key aspect of a GIAHS, TEK is linked to other parts of the system. Change here is driven by youth and it might or might not result in a negative change to the agro-cultural system, but is likely to cause some changes to the local culture and to area policies. This change will lead the system to a new form in order to keep the Hani Rice Terraces sustainable.

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Author Contributions

This paper represents a result of teamwork. All the authors designed the research together; Zheng Yuan, Fei Lun, Lu He, Zhi Cao, Qingwen Min, Yanying Bai and Moucheng Liu performed the

research; Zheng Yuan, Fei Lun and Lu He analyzed the data and wrote the manuscript; all authors read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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