

# Shared and Separate Knowledge among Eight Cultural Groups Based on Ethnobotanical Uses of *Rhododendron* (Ericaceae) in Yunnan Province, China<sup>1</sup>

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**Shared and Separate Knowledge among Eight Cultural Groups Based on Ethnobotanical Uses of *Rhododendron* (Ericaceae) in Yunnan Province, China.** Yunnan, a province in southwest China, is known for its cultural diversity of 25 ethnic minorities and its vast Himalayan biodiversity, especially of *Rhododendron*. Previous literature has shown that some cultural groups share ethnobotanical knowledge while other cultural groups keep their knowledge separate. We investigated factors that may lead to the sharing of knowledge based on the uses of rhododendron among seven cultural minorities (the Bai, Dulong, Lisu, Naxi, Nu, Tibetan, and Yi) and the Han majority. Semistructured interviews about rhododendrons were conducted with approximately 30 individuals in each cultural group. Cluster analyses and a new analysis method were conducted to determine the within-group homogeneity of knowledge of rhododendron uses to test hypotheses related to strength of cultural traditions. The Dulong, Lisu, and Nu were compared with each other as these groups share villages and languages. The Naxi, Tibetan, and Yi live predominantly with members of their cultural group, and are often monolingual; thus, these three cultural minorities were compared. The Bai and Han compose the final comparison as the Bai are increasingly interacting with the local Han majority as tourism grows in that area. The Bai, Dulong, Han, Lisu, and Nu had variable answers within each group, while the Naxi, Tibetan, and Yi have homogeneous knowledge of uses of rhododendron within their cultural group. Among the eight cultural groups compared for this study, factors such as sharing of language, overlap of living situation, and sharing of markets leads to non-homogenous knowledge of rhododendron uses among members of the same cultural group.

中国云南省八个民族对杜鹃花属植物认识与利用的共性及差异。中国南部的云南省位于喜马拉雅区域,拥有25个少数民族,以其丰富的文化多样性和以杜鹃花属植物为代表的生物多样性闻名于世。前人的研究表明一些民族之间在民族植物学的常识方面存在共性,而另一些民族在这些方面却有独立的认识。通过对每个民族中约30人的半结构访谈,我们在七个少数民族(白族、独龙族、傈僳族、纳西族、怒族、藏族、彝族)和人数众多的汉族共八个民族之间进行了杜鹃花利用方式和此类知识在民族之间共享原因的调查。聚类分析和一种新的分析方法被用于评估同种民族内杜鹃花利用方式和相关知识的差异程度,以显示对文化传统的继承强度。独龙族、傈僳族和怒族因具有共同居住的村庄和共通的语言,因此对三者进行比较。纳西族、藏族和彝族各自为居,并且有独立的语言,因此在它们之间进行比较。另外比较的是白族和汉族,随着当地旅游业的发展,白族越来越多的与汉族之间产生相互影响。结果表明,白族、独龙族、汉族、傈僳族和怒族在本民族内部对于杜鹃花属植物有多样化的认识和不同的利用方式;而纳西族、藏族、彝族对杜鹃花属植物的认识和利用具有民族内部的一致性。在本研究涉及的八个民族中,语言共通程度、居住地重叠、共用农贸市场等因素导致了相同民族内部对杜鹃花属植物认识和利用的差异。

**Key Words:** *Rhododendron*, cultural cohesion, Yunnan, China, cultural groups.

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<sup>1</sup>Received 3 November 2012; accepted 28 May 2013; published online 14 June 2013.

## Introduction

Through globalization, ethnic groups throughout the world are coming in contact with new people who bring with them new ideas, cultural information, and practices. Yunnan Province, known in mainland China as the “wild frontier” due its high concentration of ethnic minorities, intertwined with its incredibly diverse natural habitats, provides a perfect location to study cultural exchange. Northwest Yunnan holds the status as a biodiversity hotspot, due to extreme richness of flora and fauna as well as high risk of danger to this diversity (Myers et al. 2000). Approximately 25 of the 55 ethnic minorities in China reside in Yunnan. Some of these ethnic minorities live in villages consisting predominantly of members of their own ethnic group, while other minorities have frequent contact with other nearby ethnic minorities and/or the Han majority.

Many studies focusing on cultural ecological knowledge exchange due to contact with outside groups have been conducted world-wide. For example, adoption of other cultures’ ethnobotanical knowledge and practices was shown among the Piaroa of Venezuela, who increasingly came in contact with other ethnic groups, missionaries, and majority ethnicities (Zent 2001). Similarly, Iquito speakers in Peru have incorporated uses of medicinal plants from other cultures into their own pharmacopoeia (Jernigan 2012). A study conducted in the Doñana region in Spain shows that an increase in participation with a market economy has impacted traditional agricultural knowledge (Gomez-Baggethun et al. 2010). Additionally, loss of traditional ecological knowledge was also evident in Shoshone of the Great Basin due to loss of language and general change in diet and medicinal use (Fowler 2000). Weckerle et al.’s (2009) research in Shaxi Valley, Yunnan, suggested that the Han and Bai have spent many years living in close contact and, as a consequence, the Bai people have adopted some of the local Han majority’s use of medicinal plants described in Traditional Chinese Medicine (TCM) practices and have little separate medicinal knowledge.

Increased contact, however, does not always lead to exchange of cultural knowledge. For example, research conducted by Pieroni et al. (2011) in southwest Serbia compares the ethnobotanical knowledge of Serbians and Albanians who have been in contact with each other for approximately 300 years. The Serbians and

Albanians in this area have maintained separate, unshared knowledge (Pieroni et al. 2011). Likewise, research with Senegalese immigrants in northwest Italy showed that those interviewed did not vary their medicinal plant uses despite living in a different country (Ellena et al. 2012). Zarger and Stepp (2004) illustrated, through a comparative study with Tzeltal Mayan children conducted over a span of 30 years, that despite many changes to the community, children have retained consistent knowledge about plants. In a study conducted with the Tsimane’ of Bolivia, respondents from villages of varying distances from a market town share a high cultural consensus of ethnobotanical knowledge, despite having a higher income and increased contact with outsiders (Reyes-Garcia et al. 2005). In Yunnan Province, research by Huai et al. (2011) found that homegarden area, types of species, and number of species among eight different ethnic groups were significantly different between ethnic groups. The authors stated, “In China different ethnic groups have lived many generations in close proximity to each other while still retaining their own cultures and traditions” (Huai et al. 2011).

Our study expands on previous work conducted on knowledge exchange between ethnic groups by focusing on seven ethnic minorities as well as the Han majority in Yunnan Province, China. The cultural groups studied here are the Bai, Dulong, Han (majority), Lisu, Naxi, Nu, Tibetan, and Yi. We examined different factors that may affect sharing of knowledge. Groups sharing similar languages (Bradley 1997) and/or who live in close contact with other ethnicities are the Bai and Han (live in heterogeneous settlements), and the Dulong, Lisu, and Nu (share similar languages and live in heterogeneous settlements). Groups with individuals that are generally mono- or bilingual and have ethnically homogeneous settlements are the Naxi, Tibetan, and Yi. Groups that have factors that suggest they are likely to share cultural knowledge may have a weak cultural identity and risk a change in cultural knowledge.

To test cultural exchange we conducted surveys to determine the ethnobotanical knowledge surrounding *Rhododendron* (Ericaceae) and the response heterogeneity within and among ethnic groups. *Rhododendron* spp. is a useful tool to determine response heterogeneity because worldwide evidence suggests that *Rhododendron* is important ethnobotanically to various ethnic

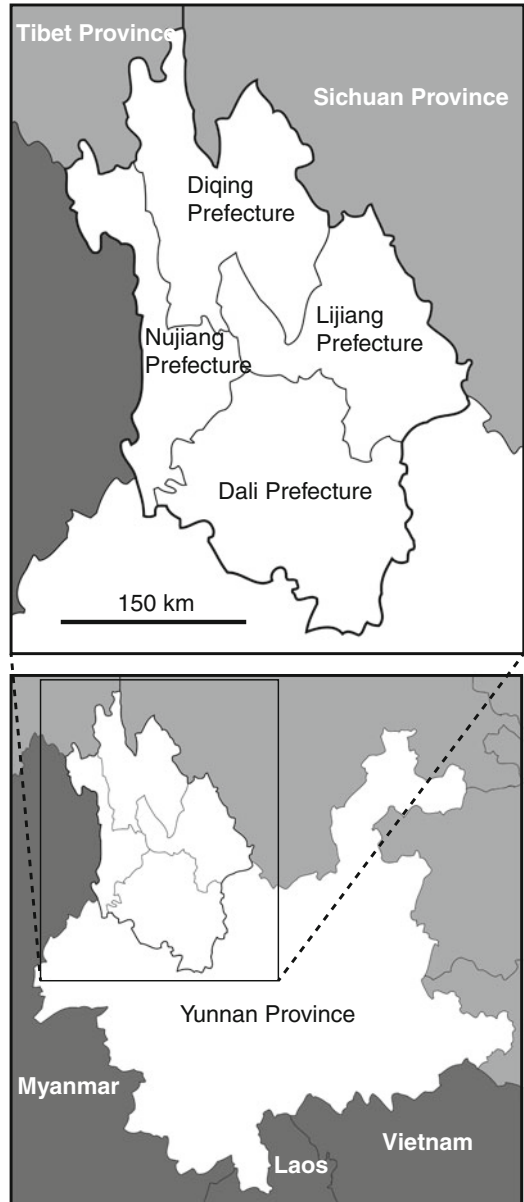
groups (Koca and Koca 2007; Kunwar et al. 2006; Pei 1989; Skinner 1903). *Rhododendron* is a large genus of approximately 1,000 species of evergreen or deciduous shrubs to trees with showy flowers, and over 500 species are native to China (Fang et al. 2005).

An ethnobotanical survey of uses of *Rhododendron* in Yunnan Province, China, was used to test the contrasting hypotheses that ethnic groups either extensively exchange cultural practices (Weckerle et al. 2009) or that they retain separate cultures (Huai et al. 2011). The objectives of this study were to 1) test the contrasting hypotheses laid out by Weckerle et al. 2009 and Huai et al. 2011, and 2) determine which groups have heterogeneous responses to interview questions suggesting that they are less culturally cohesive than groups with homogeneous responses.

## Methods

### STUDY SITES

Interviews were conducted by E.G. in Dali Prefecture (Dali City, Eryuan County, Midu County), Diqing Prefecture (Deqen County, Shangri-La County, Weixi Lisu Autonomous County), Lijiang Prefecture (Gucheng district, Ninglan Yi Autonomous County, Yulong Naxi Autonomous County), and Nujiang Prefecture (Fugong County, Gongshan Dulong, Nu Autonomous County) in Yunnan Province's northwest. Fig. 1 highlights the Prefectures where these cultural groups are mainly concentrated, but exact interview locations (including village names) are withheld to protect the anonymity of our interviewees. Bai, Han, Naxi, Tibetan, and Yi villages were easily reached by roads (sometimes paved), while Dulong, Lisu, and Nu villages often were reached on foot. Bai and Han interviews were conducted in the same area so that they would be comparable. Bai and Han interviews were mainly conducted in village markets as the high tourism pressures create a strong divide between locals and foreigners, making it challenging to conduct interviews in homes (E.G. field notes 2011 and 2012). Dulong, Lisu, Naxi, Nu, Tibetan, and Yi interviews were often conducted in the home or farm plot of the interviewee. The homes visited of members in the latter six ethnic groups had electric lights, but no indoor heating and typically no indoor plumbing. Fire was used for cooking. Water is piped to houses from nearby rivers through a series of hoses. The



**Fig. 1.** Map of Yunnan highlighting the regions where interviews were conducted.

vast majority of homes visited had a functioning television, and members of the household had cell phones with reception.

The descriptions of these seven ethnic minorities and the Han majority are based on observations by E.G. during fieldwork (May 2010–August 2010, January 2011–August 2011, February 2012–June 2012) in particular villages. They are thus not

necessarily representative throughout Yunnan. For example, the Yi ethnic group is widespread throughout Yunnan, and their language and dress vary depending on the location (Harrell 2001). However, the information presented is valid for the specific areas where this research was conducted.

#### FIELDWORK

An interview pilot study was conducted in northwest Yunnan in June–August 2010 and February 2011 to test the validity of the questions asked and the relevance of the study. Interviews used for this research were conducted in March–July 2011 and February–June 2012. A total of 252 interviews were conducted during these two field seasons (30 Bai, 29 Dulong, 24 Han, 45 Lisu, 32 Naxi, 32 Nu, 29 Tibetan, 31 Yi). All interviews were conducted in Mandarin Chinese or a minority language by E.G. and a trained local field assistant, which allowed for a comfortable atmosphere for the interviewee (trained by E.G. following the University of Wisconsin-Madison’s Social and Behavioral Science [SBS] Internal Review Board [IRB] guidelines; this interview protocol was qualified as exempt as of June 10, 2010). E.G. speaks the Yunnan dialect of Mandarin Chinese, and the field assistants usually spoke a minority language (Dulong/Nu, Naxi, Tibetan, Yi) and Mandarin Chinese. Throughout the course of this fieldwork eight different field assistants, who are kept anonymous, aided in this research.

To avoid confusion due to different words for “rhododendron” the Mandarin Chinese word (杜鹃花) was avoided, and instead interviewees were shown a contact sheet of a compilation of photographs of numerous *Rhododendron* species (different contact sheets were shown for different areas with local species pictured). If the interviewee recognized the flowers (typically by describing the habitat), the interviewee was included in the survey. The interviews were semistructured and conducted with adults (18 years or older) of the eight different groups. Here we report on the structured interviews only, which were limited to ten Yes or No questions (Table 1). The interview questions were printed on separate sheets and were filled out for each individual either during or directly after the interview. Snowball sampling was conducted with no more than five people per snowball to prevent similarity of answers based on familiarity of individuals.

#### CLUSTER ANALYSIS

Using a spreadsheet, the ten initial Yes/No interview questions were coded as numbers (1 = Yes; 0 = No; 0.5 = Maybe/Ambiguous; 3 = No response or I don’t know). Interviewees were given the option to not answer questions if they 1) felt uncomfortable responding to a question, 2) did not understand the question, 3) did not know the answer, or 4) did not have enough time to complete the interview (all coded as 3). Only a few interviewees chose to decline to answer some questions.

The program Primer 6 (Clarke and Gorley 2006) was used to conduct cluster analyses, to visualize similarities within and among cultural groups. The cluster analysis was square root transformed and resembled using a Euclidean distance distribution. The data were transformed in order to increase the statistical power of the analysis. A Euclidean distance resemblance is a multidimensional Pythagorean Theorem that calculates the differences in data. The specific cluster analysis conducted was a group average (UPGMA). Three analyses were conducted to allow for comparison of cultural groups. Analysis one allows for a comparison between the Dulong, Lisu, and Nu ethnic groups who live in close contact with one another (Fig. 2). Analysis two allows for a comparison between the Naxi, Tibetan, and Yi ethnic groups who live in homogeneous settlements of their own ethnic group (Fig. 3). Analysis three allows for a comparison between the Bai minority and Han majority within Dali Prefecture (Figs. 4).

#### CULTURAL COHESION

For a finer analysis of the within-ethnic-group variation of answers (compared to the cluster analysis), a new analysis method was designed, evaluated, and utilized. This calculation was conducted individually for each ethnic group.

Step 1: Count the number of Yes responses as 1 unit and Maybe/Ambiguous responses as 0.5 units. Yes and Maybe responses were counted rather than the No responses because we wanted to focus on the known uses for rhododendrons. Counting of Yes answers is similar to McMillen’s (2012) Local Ecological Knowledge (LEK) scores, yet different because we also counted Maybe/Ambiguous responses. Answers

Table 1. INITIAL YES AND NO QUESTIONS ASKED DURING THE INTERVIEWS.

Yes/No	Question
1.	Can you eat rhododendrons?
2.	Can rhododendrons be used as dyes?
3.	Are rhododendrons used to make anything?
4.	Are rhododendrons used for medicine?
5.	Do you know any stories or poems or sayings about rhododendrons?
6.	Do you know any songs about rhododendrons?
7.	Are rhododendrons used for incense?
8.	Are rhododendrons important in religion or customs or festivals?
9.	Do you plant rhododendrons at your house or put them in a vase in your home?
10.	Are rhododendrons important for tourism?

Additional, more detailed questions were asked; however, those data will be included in another forthcoming publication.

scored as 0.5 included responses such as, “We think that rhododendrons will be important for tourism in the future, however they are not now” or, “I know people who use rhododendrons for medicine but do not know how to use them myself.” Another difference from McMillen (2012) was that these numbers were not counted as 0 = No Knowledge and 1 = Knowledge, because with our data 0 = No could mean either no knowledge of that kind of use or no use of rhododendron for that question.

Step 2: Divide the sum of Yes and Maybe responses by the total number of interviewees for each ethnic group because the total number of interviews completed for each ethnic group was not equal. The division of Yes answers by the total number of interviewees is similar to the calculation of use values in Shen et al. (2010b), although they did not turn their final numbers into percentages.

Step 3: Turn the product from divisions in Step 2 to percentages. Percentages allow for easy comparison of each ethnic group’s shared knowledge. A high percentage of Yes responses indicates that interviewees share similar knowledge about rhododendrons within their ethnic group. A very low percentage of Yes responses also indicates that interviewees share similar knowledge about rhododendrons in that they do not have uses for rhododendrons in a particular use category.

Step 4: Include the percentages from Step 3 in a table and highlight the cells for percentages of 10% and below and 70% and above (see Table 2). Middle percentages (11% to 69%) would be inappropriate to include in this cultural cohesion analysis because an ethnic group with 50% Yes responses to a question would show that the group does not share knowledge for that question. If an ethnic group had all responses with middle percentages, it would suggest that the ethnic group does not share knowledge among their members and may not be culturally cohesive. We tested several different threshold percentages (20% and below and 70% and above, 50% and above, 10% and below and 50% and above, etc.), but these percentages did not prove informative. For example, 20% and below and 70% and above was not informative because counting 20% and below increases the number of cultural cohesion units drastically, especially in groups that have high heterogeneity of answers, thus showing false homogeneity.

Step 5: For these data, a group was said to be culturally cohesive with a number of five because that is just over the average of our cultural cohesion numbers (4.9). Five is also half of the maximum score of ten cultural cohesion units that is theoretically possible because ten questions were asked of each ethnic group. A score of ten cultural cohesion units would represent a percentage of 70% or above or 10% and below for

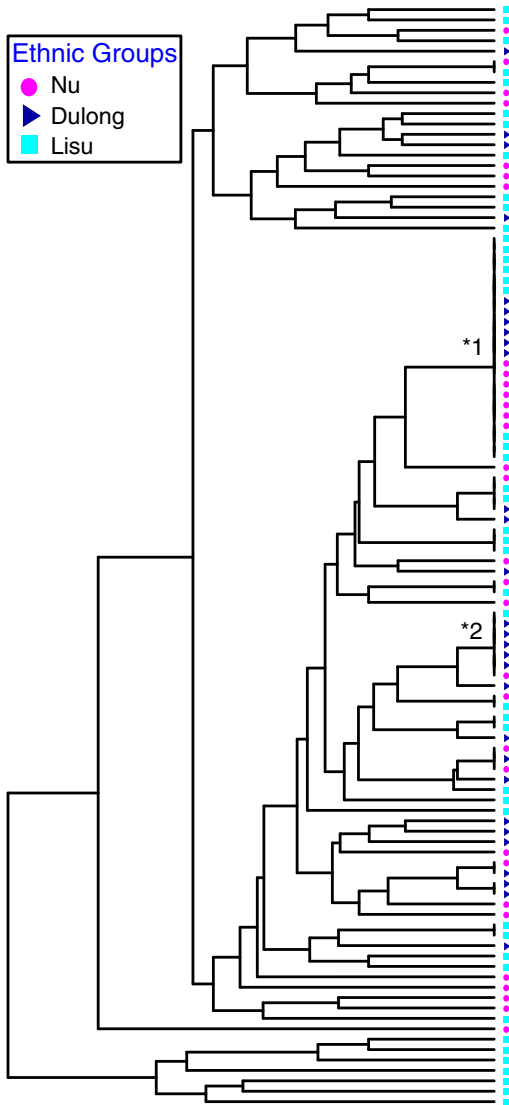


Fig. 2. Cluster analysis of Dulong, Lisu, and Nu interview responses.

all answers. Numbers below five showed low cultural cohesion.

This measurement was used in place of Romney et al. (1986) Cultural Consensus Analysis because we aimed to calculate the “cultural cohesion” of each ethnic group. In this study cultural cohesion is the knowledge of uses of rhododendron shared within an ethnic group suggesting a strong cultural tradition. The Cultural Consensus Analysis (Romney et al. 1986) is used to look at patterns of heterogeneous responses to questions within an ethnic group, whereas we are looking at patterns of

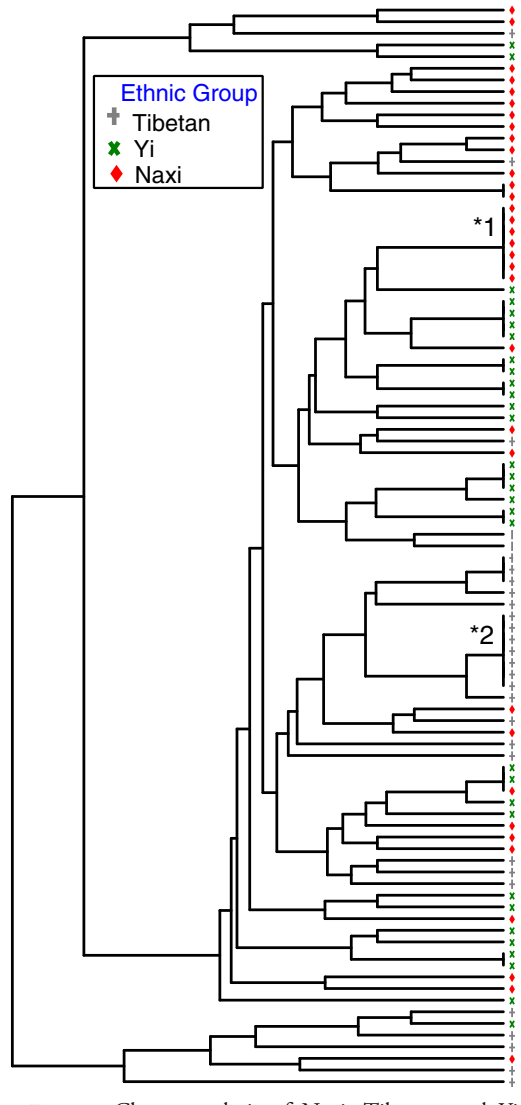


Fig. 3. Cluster analysis of Naxi, Tibetan, and Yi interview responses.

heterogeneous responses among multiple ethnic groups.

Furthermore, calculating the culturally correct answer (using the Cultural Consensus Analysis) may limit the data by creating conflicts with the answers of the “experts” we interviewed (e.g., religious specialists or traditional medicine doctors; Zent 2001). This does not happen with calculating the cultural cohesion because total counts of answers are combined for every question. A conflict with specialist vs. general knowledge would only occur when interviews with specialists equal those of generalists in the community, or if a very small



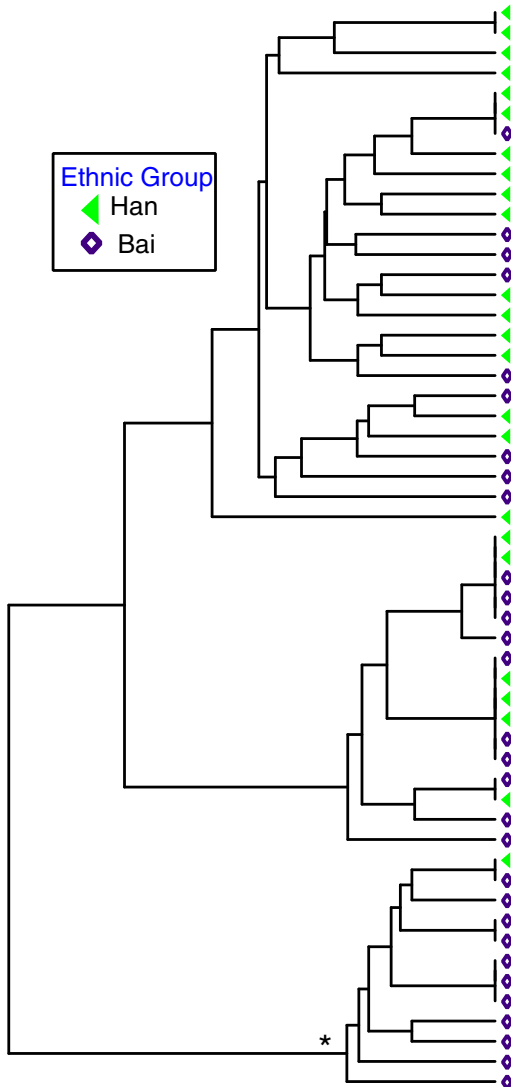


Fig. 4. Cluster analysis of Bai and Han interview responses.

number of interviews were conducted. This analysis would not be appropriate for those data unless generalist and specialist knowledge were calculated separately. This analysis is appropriate for categorical data that can be summed and where approximately 30 (or more) interviews have been conducted in each culture.

## Results

### CLUSTER ANALYSIS

Three different cluster analyses from the structured interview data were conducted. Figs. 2, 3,

and 4 show results of cluster analyses of the interview responses, which were used to test the extent to which these cultures' uses have remained distinct (Huai et al. 2011) or have been extensively exchanged through contact (Weckerle et al. 2009). A cluster analysis was conducted of the Dulong, Lisu, and Nu ethnic minorities, which live in close proximity to each other in Nujiang Prefecture (Fig. 2). Ethnic groups living in distinct groups (Naxi, Tibetan, and Yi) were included in a separate cluster analysis (Fig. 3). Fig. 4 shows the results of a cluster analysis of the interview responses of the Bai minority and Han majority. In the three cluster analysis figures, the tips connected with a line indicate respondents answering questions with all the same responses to all ten questions.

### CULTURAL COHESION

No interviewed ethnic group scored a maximum cultural cohesion number (ten units) or a minimum cohesion number (zero units). Four ethnic groups scored cultural cohesion numbers of five units and above (Dulong: 7 units; Tibetan: 7 units; Naxi: 6 units; Yi: 5 units), and four cultural groups scored cultural cohesion numbers of four units and below (Bai: 4 units; Nu: 4 units; Han: 3 units; Lisu: 3 units; Table 2). This analysis allowed for a comparison of the questions for which each ethnic group had homogeneous or heterogeneous interview responses.

### KNOWLEDGE OF USES

Ethnic minorities often have vast knowledge about the plants that grow around them (Campas and Ehringhaus 2003), including the ever-present *Rhododendron*. The interviews conducted for this research identified uses for rhododendrons by cultural groups in Yunnan, some of the uses previously undescribed, and others that expand on previously described uses from China and other parts of the world. Uses of *Rhododendron* that were stated by the interviewees are summarized in Table 3, and selected uses will be described in more detail in a forthcoming manuscript.

## Discussion

### INTERMINGLING OF CULTURAL GROUPS

The Dulong, Lisu, and Nu ethnic minorities live in close contact with one another, frequently intermarry, can often speak each other's minority languages, and live in the poorest prefecture (Nujiang Prefecture; Shen et al. 2010b). Fig. 2

illustrates the effect close contact can have on these ethnic minorities' responses to interview questions about rhododendrons. Dulong, Lisu, and Nu have intermixed representation among the branches as well as cases of different ethnic minorities answering questions with the exact same responses (see Fig. 2 \*1 and \*2). When interviewees responded to all questions the same way, indications are that these groups share similar knowledge of uses despite being different cultural groups. In contrast, the Naxi, Tibetan, and Yi ethnic minorities do not live in close contact with one another or with other cultural groups. In many cases, these ethnic groups answer questions similarly to others within their same ethnic group (Fig. 3 \*1 and \*2). This suggests that knowledge is shared among members within an ethnic group but not between these ethnic groups.

The responses that unite the Bai cluster to the bottom in Fig. 4 (denoted by an \*) are due to interviewees responding Yes to a few questions (mostly eating and tourism) but had No Response (coded as 3 in the spreadsheet) to the other questions. In Dali, Prefecture Bai and Han are often in contact with one another at markets and in the tourist destination of Dali Old Town, and have a long history of contact (Weckerle et al. 2009). It is possible that this ever-increasing contact due to rapid development of the area is causing exchange of knowledge of uses between the Bai and Han (e.g., Han people eating *Rhododendron* corollas). Because of the challenges interviewing Bai and Han individuals at home, we acknowledge that the Bai and Han results may be biased because

people frequently exchange knowledge in markets (Reyes-Garcia 2001; 197).

The evidence provided from Figs. 2, 3, and 4 refute hypotheses, such as those described by Huai et al. (2011), which suggest that ethnic groups that frequently intermingle do not share ethnobotanical knowledge, at least for this area of Yunnan. The data collected from the ethnic groups interviewed for these analyses suggest that living in close contact with other ethnic groups encourages sharing of knowledge, as Weckerle et al. (2009) suggested (Figs. 2 and 4), while isolation of ethnic groups may prevent sharing of knowledge among groups (Fig. 3). Ethnic groups experience cultural exchange not only due to contact with a majority culture, but with other minority groups through adoption of other, outside knowledge, ideas, and beliefs.

#### CULTURAL COHESION

The cultural cohesion analysis was used to test which cultural groups answer questions related to rhododendrons more similarly within or among the group. Results of the cultural cohesion analysis generally show that ethnic groups that share languages and live close together have heterogeneous knowledge of uses within groups, thus a low cultural cohesion number (Table 2; Bai, Han, Lisu, and Nu). The Dulong, Naxi, Tibetan, and Yi answer questions similarly to those within their ethnic group and thus have higher cultural cohesion numbers. Additionally, the Naxi, Tibetan, and Yi are the only ethnic groups that had cultural cohesion percentages

Table 2. CULTURAL COHESION.

Ethnic Group	Bai	Han	Dulong	Lisu	Naxi	Nu	Tibetan	Yi
Total # of interviews	30	24	29	45	32	32	29	31
Eat?	43%	33%	0	16%	44%	9%	7%	90%
Dye?	0	0	0	7%	0	6%	0	13%
Wood?	17%	21%	38%	13%	56%	28%	86%	74%
Medicine?	13%	25%	10%	13%	13%	31%	10%	35%
Stories, Poems, Sayings?	13%	4%	7%	7%	9%	13%	21%	26%
Songs?	3%	13%	10%	12%	13%	22%	41%	55%
Incense?	0	4%	3%	0	0	3%	21%	0
Religion, Customs, Festivals?	3%	21%	0	16%	72%	6%	7%	77%
Horticulture/ornament?	23%	38%	21%	22%	72%	22%	7%	32%
Tourism	43%	50%	52%	31%	72%	34%	76%	77%
Number of Cultural Cohesions (in units):	4	3	7	3	6	4	7	5

The blocks above show the cultural cohesion percentages calculated from sums of Yes and Maybe/Ambiguous responses. The italicized data show the numbers 70% and above and 10% and below which correspond to high cultural cohesion.



Table 3. SUMMARY OF KNOWLEDGE OF USES OF *RHODODENDRON* BY THE EIGHT ETHNIC GROUPS INTERVIEWED.

Are rhododendrons used for . . .	Bai	Dulong	Han	Lisu	Naxi	Nu	Tibetan	Yi
Food?	Process and cook in numerous ways	Do not eat	Process and cook in numerous ways	Occasionally eat corolla base as sweet	Occasionally eat	Occasionally used in tea	Do not eat for fear of poisoning	Process and cook in numerous ways
Dyes?	Do not use	Do not use	Do not use	Old people have knowledge of how to process for dye	Do not use	A few people have knowledge of how to process for dye	Do not use	A few people have knowledge of how to process for dye
Wood?	A few people use wood for household items	A few people use wood for weaving implements	Some people use wood for household items	Rarely used	Used to make household items	Rarely used	Used for household items and firewood	Used for household items and firewood
Medicine?	A few people use	A few people use	Occasionally used by non-specialists	A few people use	Traditional medicine doctors have many uses	A few people use	A few people use	Occasionally used by non-specialists
Stories, Poems, Sayings?	Rare	Rare	Rare	Men can use as love potion towards women	Incorporated into their creation myth	Rare	Outlining religious taboo	Rare
Songs?	Rare	Rare	Rare	Equates people in love with rhododendron	Rare	Rare	Outlining religious taboo	About the beautiful time of year
Incense?	No use	Rare use for incense	No use	No use	No use	Rare use for incense	Occasional use for incense in Buddhism	No use
Religion, Festivals, Customs?	Rare	Rare	Rare	Occasionally used in festivals (Christmas)	Used to remove spirits from homes	Occasionally used in festivals	Taboo to use in front of the Buddha	Used to remove spirits from home and to bless for buckwheat planting
Horticulture / Ornament?	Plant at home	Plant at home	Plant at home	Occasionally collected to put in vases	Often planted at home	Occasionally collected to put in vases	Do not plant at house due to fear of poisoning	Occasionally plant at house

TABLE 3. (CONTINUED).

Are rhododendrons used for . . .	Bai	Dulong	Han	Lisu	Naxi	Nu	Tibetan	Yi
Tourism?	Many rhododendrons attract tourists	Could be important in tourism	Many rhododendrons attract tourists	Not very important	Many rhododendrons attract tourists	Not very important	Many rhododendrons attract tourists	Many rhododendrons attract tourists

above the 70% threshold. The Naxi, Tibetan, and Yi live in villages comprised of other members of their own ethnic group and frequently are monolingual or bilingual, speaking only their own ethnic language and potentially also Mandarin Chinese. Dulong, Lisu, and Nu are often multilingual, speaking their own language, languages of other nearby ethnic groups, and Mandarin Chinese (Goodman 2008; E.G. field notes). For example, Dulong people can speak Dulong and often Nu and/or Lisu languages as the Dulong and Nu languages are very closely related (Bradley 1997). Speaking other languages and living in ethnically heterogeneous settlements appears to create heterogeneous knowledge of uses about *Rhododendron*. Nujiang Prefecture is the poorest in Yunnan Province and is where Dulong, Lisu, and Nu people are concentrated (Shen et al. 2010b). This lack of wealth may also cause correlation of results where Dulong, Lisu, and Nu have little knowledge of uses of *Rhododendron*.

The high cultural cohesion score for the Dulong may be misleading, because all of the cultural cohesion percentages show that the Dulong do not have many uses for *Rhododendron* (Table 2 and 3). This may be due to a lack of traditional uses of the plant or severe erosion of traditional environmental knowledge of *Rhododendron* uses (or a combination of both). Despite being located in a rural, mountainous area on the border of Myanmar and Yunnan, it may be that Dulong ethnobotanical knowledge has been shrinking over time (Luo 1995; Shen et al. 2010a). Preliminary discussions with Dulong people suggest a rapid and intense change of their culture during the past 50 years (E.G. field notes 2012). An example of this may be the extinction of the practice of face tattooing of women of the Dulong ethnic group (Luo 1995). This practice was common before the Cultural Revolution but has completely stopped, rather than gradually losing fashion (E.G. field notes 2012).

### Conclusions

Ethnic groups living in the cultural and biodiversity hotspot of northwest Yunnan commonly exchange knowledge of uses of rhododendrons. Ethnic groups that have heterogeneous knowledge often live in settlements with multiple ethnic groups, are multilingual, and some live in the poorest prefecture in Yunnan. Ethnic groups that have homogeneous knowledge of uses of

rhododendrons may be mono- or bilingual and generally live in settlements of members of their own ethnic group. There are many factors that affect cultural exchange, though in northwest Yunnan it appears that living in close proximity and being multilingual are the largest influences for cultural exchange.

### Acknowledgments

E.G. thanks the ethnic groups of Yunnan Province for participation in these interviews, graciously welcoming me into their homes and becoming my dear friends. E.G. thanks the many field assistants involved, here kept anonymous, for their tireless work in often less than ideal conditions. The manuscript was improved by suggestions from members of the Emshwiller lab, colleagues in China and the U.S.A., family members, and two anonymous reviewers. This dissertation research was supported by grants to E.G. from the Botany Department at the University of Wisconsin-Madison, a Biodiversity Conservation and Sustainable Development in Southwest China NSF-IGERT traineeship and individual grant (DGE#0549369), an NSF GRFP fellowship, and a National Geographic Young Explorer Grant (9009-11).

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