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ORIGINAL PAPER

Conservation and development through medicinal plants: a case study from Ludian (Northwest Yunnan, China) and presentation of a general model

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Abstract A model for community-based conservation and development is presented, potentially applicable wherever communities rely on locally collected medicinal plants. The motivational foundation for conservation offered by these plants relates to people's interests in health support, financial income and cultural identity. The model is based on experiences in the Medicinal Plants Conservation Initiative, a four-year programme (2005–2008) of Plantlife International with national partners, involving 14 projects in 8 countries in East Africa and the Himalayas. All projects provide evidence on the question "How best can communities conserve their medicinal plants?". One of the projects (in China) is described to illustrate the types of evidence offered by the projects. The model consists of three social elements (community groups, project teams, policy makers), the relationships between them, and types of activity suggested for each group. Not all types of activity are relevant in all contexts. It is suggested that faith-based organisations, women's associations and indigenous people's groups are often well placed to take the model forward in terms of practical application at the landscape scale. The (on-going) project in China is at Ludian, a Naxi community in Northwest Yunnan. There is a secondary project site at Yongzhi, a Tibetan and Lisu village. The Ludian project is notable within the modern Chinese context for establishment of the first community group concerned specifically with the conservation of medicinal plants and the first community protected areas for medicinal plants.

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Keywords China · Conservation model · Ecosystem-based approach · Medicinal plants

Abbreviations

AV	Administrative Village
CBD	Convention on Biological Diversity
EU	European Union
KIB	Kunming Institute of Botany
MPCA	Medicinal Plants Conservation Area
NGO	Non-governmental conservation
NTFPs	Non-timber forest products
TCM	Traditional Chinese Medicine
TNC	The Nature Conservancy
UNESCO	United Nations Educational, Scientific and Cultural Organisation
US	United States of America

The special conservation opportunities offered by medicinal plants

In an earlier volume of this journal, one of us suggested (Hamilton 2004):

> "Probably the single most important role for medicinal plants in biological conservation is their 'use' to achieve conservation of natural habitats more generally. This stems from the special meanings that medicinal plants have to people, related to the major contributions that they make to many people's lives in terms of health support, financial income, cultural identity and livelihood security". It was recommended that "most work by conservationists on medicinal plants should be with those people who own, manage or make use of these species, or else own or manage the land where they grow."

Here we follow up this suggestion by presenting results from the Medicinal Plants Conservation Initiative, a 4-year programme of Plantlife International (2005–2008) involving 14 projects and 8 countries in East Africa and the Himalayas (Hamilton 2008) (Appendix 1, in Supplementary material). All field projects (carried out by national partners) provide evidence on the question: "How best can communities conserve their medicinal plants?". Based on this evidence, we present a general model for conservation and development based on medicinal plants. We conclude with suggestions on how to take the model forward in terms of practical application.

A description of one of the projects (in China) is provided to illustrate the types of evidence used to construct the model. This is an (on-going) project of the Ethnobotanical Laboratory, Kunming Institute of Botany (KIB), Chinese Academy of Sciences. The project site is Ludian which, along with Yongzhi (an extension project site), lies within the Three Parallel Rivers region of Northwest Yunnan, famous for its biological and cultural diversity (Pei et al. 2009b) (Fig. 1). As an initiative of KIB, the project represents the continuation of a long-standing interest in relationships between botanical and cultural diversity, supplemented by practical efforts to enhance conservation and sustainable development at particular places. The project is the most comprehensive yet attempted by

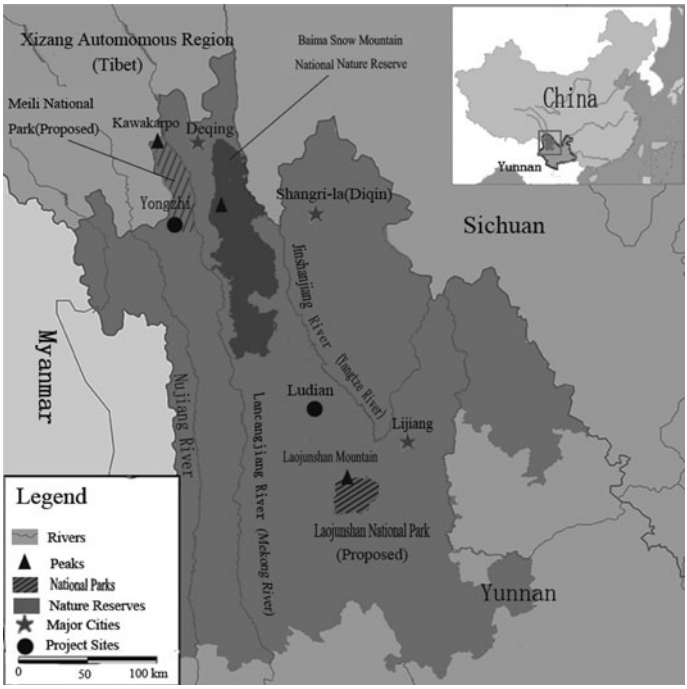

Fig. 1 Map of Northwest Yunnan, China, showing locations of the project sites of Ludian and Yongzhi

KIB in terms of the broadness of its coverage of issues of conservation and development relating to medicinal plants.

The use of plants as medicines represents by far the biggest use of biodiversity globally in terms of number of species (50,000–70,000) (Schippmann et al. 2006), representing around 20% of the world's flora. The cultivation of medicinal plants is limited in terms of the number of species usually grown and the extent of engagement by most communities, and the majority of medicinal plants are generally collected from more natural habitats. Consequently, the use of medicinal plants provides a foundation of knowledge and interest in the details of the local natural world upon which (we propose) it may be possible to build enhanced conservation as needed for modern times. Because the conservation of wild plants requires conservation of their habitats, a focus on medicinal plants has the potential to conserve many other (non-medicinal) species too.

Measures designed to promote community-based conservation must be carried out within the context of aspirations for development if they are to succeed. From the community perspective, the conservation of medicinal plants is about maintaining or enhancing valued resources. Whether these resources are obtained from wild or cultivated plants can be of secondary concern. Totally wild, 'managed wild', 'wild cultivated' and fully cultivated plants can all contribute to the resource base of the community and all must be taken into account in community initiatives. Projects cannot be confined just to those species and habitats of greatest interest to the biological conservationist—often, in the case of medicinal plants, species endangered by commercial trade and the most natural habitats. In the broadness of the approach needed, projects on community-based conservation dealing

with medicinal plants must be ecosystem-based, thus standing fully in line with the stipulation of the Convention on Biological Diversity that this type of approach should be the primary framework used for its implementation (CBD 1992; Hamilton and Hamilton 2006; Pei et al. 2009a).

Exploitation and conservation of medicinal plants in China

See Appendix B in Supplementary material for more detailed information on the history of exploitation and conservation of medicinal plants in China. To summarize, there have been a number of major changes in policy over the last 60 years with major impacts on the fate of these resources. They include some major political and economic measures which have encouraged the immediate exploitation of medicinal plants with little regard to sustainability (e.g. the Great Leap Forward in 1958 and market liberalisation since 1986). There have been several major shifts in forestry policy which have impacted on these plants, most recently the application of the Household Responsibility System to forests, including at Ludian. A logging ban following disastrous flooding along the Yangtze River in 1998 has led to an increase in unsustainable collection of wild medicinal plants and fungi related to rural underemployment (Buntaine et al. 2007; Melick et al. 2007; Yang et al. 2008).

Many species of medicinal plants have become threatened in China as a result of habitat destruction, commercial over-harvesting and a decline in traditional conservation practices (Pei 2001, 2007; Xu and Wilkes 2004). Both in situ and ex situ measures have been applied, though the authorities have found it difficult to control the illegal collection of medicinal plants in protected areas.

The Ludian project

The site

Ludian is a Township of 17,000 people distributed over 7 Administrative Villages, lying within Lijiang City Prefecture, Northwest Yunnan. The extension project site of Yongzhi is also within Northwest Yunnan (a term used for the five most northwesterly prefectures of the province), but rather in Diqing Tibetan Autonomous Prefecture. Much of Northwest Yunnan, including both Ludian and Yongzhi, falls within the region known as Three Parallel Rivers, recognised by UNESCO as a World Natural and Cultural Heritage Site for its outstanding bio-cultural diversity. Situated within the Hengduan Mountains at the eastern end of the Himalayas, Northwest Yunnan exhibits an exceptional altitudinal range (2000–6740 m) and great topographic and climatic diversity. It is a priority global site for conservation of biodiversity and a major centre of endemism for Chinese plants (Ying et al. 1993; Ma et al. 2007). The rural economy is based on agriculture, pastoralism and the collection of NTFPs, including medicinal plants for sale (Arora 2008; Yang et al. 2008). Five hundred and seventy-four species of medicinal plants have been recorded in local markets (many, though not all, originating locally) (Pei et al. 1996).

Most of the project's work has been concentrated in Ludian Administrative Village (AV), one of the five AVs of Ludian Township. According to a recent count, the population of Ludian AV is 5686, distributed over 1374 households in 8 villages. Ninety percent of the

Fig. 2 View of Ludian Administrative Village showing cultivation on more level ground and forest on the surrounding slopes. The field in the foreground is planted with the medicinal herb *Gentiana* (probably *G. robusta*). May 2008

people are ethnically Naxi, with Pumi, Yi and Lisu also represented. Altitudes range between 2400 and 3800 m. Twelve per cent of the total area (2700 ha) is under agriculture, mostly on more level ground, with forest, scrub and pasture covering most of the remainder (Fig. 2).

Ludian Township, especially Ludian AV, is famous within Yunnan as a source for medicinal plants, with trade and cultivation dating back over 200 years. Ludian is known within Yunnan as the 'Home of Medicinal Plants', being a Di Dao locality for certain raw drugs used in Traditional Chinese Medicine (TCM). Recognition as Di Dao means that plant material coming from Ludian is seen as especially 'authentic'—adding value to the produce and making its sale more reliable. Both cultivated and wild medicinal plants are traded. Most households in Ludian AV are engaged in farming, 90% growing some medicinal plants for sale (providing 10–70% of household income). However, only a few species (about 10) are grown extensively, currently including *Aconitum stapfianum*, *Gentiana robusta*, *Paris polyphylla* var. *yunnanensis* and *Saussurea costus*. The production of medicinal plants at Ludian reached 8000 tonnes in 2008, believed to be among the highest total for any single community in China. Among wild medicinal plants collected at Ludian, mention may be made of *Taxus yunnanensis*, which was subject to a 'goldrush' during 1995–1997, with local people scouring the forests looking for trees to debark and uproot. The harvesting of wild *Taxus* has been illegal in Yunnan since 2002 (Pei 2007).

Naxi Dongba Medicine, the traditional medical system of the Naxi people (Guo 1989; He and Mawen 2006), is still widely practiced in Ludian AV, mainly through consultation with Naxi doctors, mostly elderly. Three hundred and sixty-three local species of plants have been recorded in medicinal use at Ludian, nearly all wild-collected (Wang 1999). About 45 of these species are commonly used. Surveys in two sample villages in 2007 revealed that 13% of the people rely exclusively on herbal medicine, 26% use western medicine and 61% resort to a mixture of both. Naxi healers were found to collect 60% of the species they use from the wild and 30% from their home gardens, with the remaining 10% purchased in markets.

Project objective, activities and results

Project objective

The objective of the project is to explore how the potential for conservation postulated for medicinal plants can be released.

Site selection and project team

Ludian was selected as the field site for the project following a literature survey and field reconnaissance to identify Important Plant Areas for medicinal plants in the Himalayas (Pei et al. 2006). The KIB team responsible for the project is led by Professor Pei Shengji, with most day-to-day tasks handled by Mrs Yang Lixin, a Naxi speaker.

Community organisation formed

Work at site level work began in August 2006, when initial discussions revealed a generally low level of community concern about the conservation of medicinal plants. However, some individuals proved to be exceptions, especially Naxi doctors and the then headman of Ludian AV, Mr He Yun. Mr He Yun has developed a 50 ha plantation of the high priced medicinal plant *Paris polyphylla* at Ludian (market price in 2009 US \$30 kg^{-1}). This nucleus decided to form a society, the Ludian Medicinal Plants Conservation Association, and instigate activities within the community. The association was registered (February 2007), a constitution agreed (March 2007) and Mr Yang Shengguang (a local herbal doctor and pharmacist) elected as the first chairman. The initial membership was 20.

Later (May 2009), the association was expanded to cover the whole of Ludian Township (not just Ludian AV) and the name changed to Ludian Medicinal Plants Conservation and Development Association. These changes followed a growing recognition of the project's value by the local government, realization that conservation here must be seen to be linked directly to development to receive much public support, and indications that the social basis of the association should be widened from an initial over-bias towards the interests of traditional doctors. Responding to a recent call by central government for communities to choose themes in their development, Ludian Township opted for 'medicinal plants', so building on Ludian's fame as the 'Home of Medicinal Plants'. The favourable reception seemingly offered by the community to the project probably owes something to local concerns about the state of the environment. Highly destructive logging during 1980–1998 is blamed for an increase in soil erosion, the drying up of streams, and a less favourable (hotter and drier) climate.

Identification of project priorities and sample villages

Since its formation, the association has taken a leading role in guiding and delivering the project, working closely with the team from KIB. The association quickly identified two major concerns relating to medicinal plants, the increasing rarity of some species and a lack of interest among the young generation in becoming herbal doctors. Awareness-raising and education in Naxi Dongba medicine were identified as project priorities, along with finding ways to push the government into taking the conservation of medicinal plants more seriously. Two villages were selected as pilots for project activities, Diannan and

Dianbei, the former somewhat more prosperous. There are eight Naxi doctors at Diannan, but only one at Dianbei.

Development of herbal home gardens

The association decided to encourage the development of herbal gardens, intended to provide convenient sources of herbs for local treatments, educational centres to promote Naxi Dongba knowledge and sources of planting material when new species become popular in the market. There were 2 herbal home gardens (both belonging to Naxi doctors) in the pilot villages at the start of the project, containing in total 63 species of medicinal plants. By May 2009, the number of herbal home gardens had expanded to 29, plus two 'wild cultivation' gardens (medicinal plants planted within natural vegetation). The number of species of medicinal plants now cultivated in total was 98. Most new plants in the gardens have been transplanted from the wild. Market demand has been an important factor influencing the choice of species to cultivate. For instance, about half of the areas of five of the new home gardens are planted with *Bletilla sinensis*, currently enjoying a high price.

Building awareness of botanical heritage

One of the 'wild cultivation' sites (in Dianbei) is conveniently close to the village water source, well situated for awareness-raising when the villagers gather for the Spring Festival. This garden (and others) have been used as the sites of several training workshops held for villagers. There have been four workshops on Naxi Dongba medical knowledge and five on the sustainable harvesting of wild medicinal plants (demonstrating traditional, relatively sustainable, harvesting techniques). Interestingly, considerable interest in traditional Naxi botanical and medical knowledge has been expressed by local youth. The project may prepare a picture book on how to use 15–30 species of medicinal plants for the safe home treatment of common ailments following Naxi Dongba tradition.

Medicinal Plants Conservation Areas

Three projects in Plantlife's *Medicinal Plants Conservation Initiative* (Projects 11-13, Appendix 1—see Supplementary material) brought together participants from China and India (plus other countries) to discuss their conservation experiences. In India, a national system for the in situ conservation of medicinal plants is being established, based on a network of sites known as Medicinal Plants Conservation Areas (MPCAs) (Kinhal and Rao 2008). Together, the MPCAs are designed to embrace a good representation of Indian species of medicinal plants, which in total number about 7500 (44% of the national flora). The average size of the MPCAs (about 300 ha) is a compromise between the desirability of ensuring the inclusion of viable populations of species within the reserves (from a genetic perspective) and the practicalities of management. The MPCAs are mostly situated within forest reserves and managed by teams drawn mainly from local communities. The KIB team working at Ludian wondered if an adaptation of this concept might be suitable for China and discussed this idea with the association at Ludian. The reaction was positive and soon two areas of species' rich forest were proposed for MPCAs, one at Diannan (Zhen Gutai MPCA, 330 ha) and the other at Dianbei (Hanjing Ke MPCA, 300 ha) (Fig. 3).

Fig. 3 Sign erected at the edge of Zhen Gutai Medicinal Plants Conservation Area at Ludian Administrative Village. Zhen Gutai, the traditional name for this place, means 'Holy Place'. The group includes local villagers, members of the Kunming Institute of Botany and a visiting group of Japanese journalists. Mr He Yun, the current Chair of the Ludian Medicinal Plants Conservation and Development Association is seated centre foreground. August 2009

Eighty species of medicinal plants have so far been recorded from the two sites, taken together.

The MPCAs were granted legal recognition by Ludian Township in November 2007 and a Ludian MPCA Management Committee established for oversight. This committee consists of a representative of the Ludian Medicinal Plants Conservation and Development Association, the headmen of the two villages and two elected community members. It is responsible for deciding which plants may be collected from the MPCAs (for local medical use or for planting—commercial collection is not allowed) and how the benefits from such collection are to be distributed. Two community members have been hired for each site as full-time workers, initially paid from project funds. Regulations governing the management of the MPCAs have been agreed between the association, Ludian Township and the local forest station (Table 1). Local people report that there has been an increase in abundance of several species of medicinal plants in the MPCAs since their creation, some not seen for several years (e.g. *Aristolochia moupinensis*). A more formal monitoring

Table 1 Summary of regulations governing Medicinal Plants Conservation Areas at Ludian

1. Management and monitoring is the joint responsibility of the Ludian Medicinal Plants Conservation and Development Association, Ludian MPCA Management Committee and Ludian Township Forest Station.
2. The Ludian MPCA Management Committee is responsible for the direct management of the MPCAs, including conservation, sustainable harvesting following traditional methods and ensuring the guaranteeing of community benefits. The Ludian Medicinal Plants Conservation and Development Association has an overseeing and wider coordination role.
3. The harvesting of rare, endangered and endemic medicinal plants is prohibited (a list is provided—this includes *Eucommia ulmoides*, *Taxus yunnanensis*, etc.). A fine of 500 Yuan will be imposed for violations.
4. Logging, grazing and cutting firewood are prohibited.
5. Fire is prohibited in the MPCAs. A fine of 50 Yuan will be imposed for those starting fires or failing to assist in their control.

system was established in August 2009 based on transect lines through the MPCAs with ten species selected to monitor. The latter are all locally rare or endangered and include *Actaea asiatica*, *Bletilla sinensis*, *Gastrodia elata* and *Taxus yunnanensis*.

The forests chosen for the MPCAs were Community Forests when the MPCAs were created, but were transferred to Household Responsibility Forests in 2008. This resulted in 42 households at Diannan and 12 households at Dianbei coming into possession of certain exclusive rights of resource use within their MPCAs. The KIB team then held a meeting with 38 of the new rights' holders, all of whom expressed an interest in continuing with the MPCAs. Their opinion was that that the new arrangement would strengthen the conservation of medicinal plants within the MPCAs, there now being an added incentive to ensure sustainable use.

Marketing improvements

Farmers and collectors at Ludian sell medicinal plants to traders on an individual basis. Prices received are very low, typically about 10% of those prevailing in the major regional market for medicinal plants in Dali City. Prices can also be fickle. Prices in 2008 were particularly low. For instance, the selling price for *Saussurea costus* at Ludian declined from the equivalent of US \$3.4 kg^{-1} in 2007 to US \$ 0.7 kg^{-1} in 2008, while that for *Gentiana robusta* dropped from US \$2.9 kg^{-1} (2007) to US \$ 0.6 kg^{-1} (2008). Uncertain pricing is a feature of another important non-timber forest product from Northwest Yunnan, the fungus matsutake (*Tricholoma matsutake*), which sold for US \$19–25 kg^{-1} in 2000 (Winkler 2004; Arora 2008), but fetched just US \$0.7 kg^{-1} in 2009.

The Ludian Medicinal Plants Conservation and Management Association, in discussion with the KIB team, decided that it would be useful to assist producers at Ludian by increasing their access to market information. Accordingly, a workshop on marketing was held (21 February 2009) attended by 28 farmers, at which the idea of using the internet to gain information about market prices was raised and welcomed. A follow-up workshop on cultivation (23 February), attended by 53 farmers, showed their high level of confidence in cultivation techniques, but again revealed concerns about marketing. Since then, the project has donated a computer to the association (May 2009) and two farmers have received training on use of the internet. A website for Ludian producers to advertise their wares is being developed (www.ylyc.web.17jzw.com). A university graduate soon to be sent to Ludian under a national scheme to relieve graduate unemployment will be assigned to develop the website.

The local government is prepared to donate land for the building of a physical ('hard') market for medicinal plants to back up the measures already taken to develop the 'soft' market. Further, it is keen to send representatives from Ludian to the wholesale markets for medicinal plants in the cities of Dali and Kunming in Yunnan Province and the major national markets for medicinal plants at Bozhui in Anhui and Anguo in Hebai. One of their tasks will be to evaluate the usefulness of establishing a marketing cooperative for Ludian.

Influences of the Ludian project

The Ludian project has attracted attention in Northwest Yunnan for its innovative approach to conservation. Unique features for modern China include the establishment of the first community group concerned with the conservation of medicinal plants and the first community protected areas for medicinal plants.

TNC interest and developments at Yongzhi

The Nature Conservancy (TNC), an international non-governmental conservation organization (NGO), is assisting the Forest Department develop a new model of conservation for Northwest Yunnan based on the concept of the national park. A key difference with existing protected areas (as implemented in China) is greater attention given to meeting the needs of the local people. Knowing of KIB's work at Ludian (which it has partly funded), TNC wondered whether the 'Ludian model' might be applicable more widely in Northwest Yunnan, including at buffer zone villages associated with proposed national parks at Laujunshan and Meili Snow Mountain.

Consequently, TNC requested KIB to assist with the introduction of its conservation technologies to a trial village (Yongzhi) on the lower slopes of Meili. The population at Yongzhi is 600, grouped into 106 households and three sub-villages, two ethnically Tibetan and one Lisu. It was selected because of its familiarity to TNC and richness in medicinal plants, and because it is conveniently situated for wider awareness-raising, lying close to a pilgrimage route around Kawakarpo (6740 m, the highest peak of Meili). Kawakarpo is the second most holy mountain in Tibetan Buddhism, receiving tens of thousands of pilgrims annually.

Yongzhi is a mountainous place where productive agriculture is restricted to the few areas of more level land. There are many abandoned fields on steeper slopes, the result of government discouragement for cultivation in such places, following the introduction of the Sloping Land Conversion Programme in 1999 to protect catchments (Weyerhaeuser et al. 2005). There are numerous sacred sites, providing effective protection to old growth trees, and useful and endemic plants (Anderson et al. 2005; Salick et al. 2007). Cultivation of medicinal plants was not practiced at Yongzhi prior to KIB's intervention, but local people collect a variety of wild medicinal plants on request to sell to visiting traders (including *Cimicifuga foetida*, *Cordyceps sinensis*, *Dioscorea panthaica*, *Fritillaria cirrhosa* and *Paeonia delavayi*). Most people at Yongzhi who use local plants medicinally have only limited herbal knowledge themselves, but rather consult the single herbal doctor living in the village or Dr Wu Xue when available (see below).

As with Ludian, the KIB project team at Yongzhi has been led by Pei Shengji. Gao Fu has undertaken most day-to-day activities and regularly visited the site. An initial visit by KIB in September 2008 allowed project ideas to be discussed with the community and for baseline surveys to be carried out on the local socio-economy and the uses of medicinal plants. The community expressed an interest in being engaged in a project on the basis that it might enhance the conservation of their habitat (which would then be more attractive to tourists) and that it might increase the quantities of valuable commercial species, such as *Panax japonicus* var. *major* and *Paris polyphylla* var. *yunnanensis*.

The next visit by KIB in April–May 2009 (after the winter) resulted in the formation of a new community organization (Yongzhi Community Medicinal Plants Conservation Group) with representation from 30 households. A leading member of the group is Dr Renqing Wu Xue, whose home is a short distance (3 km) from the village. He is a highly respected Tibetan doctor with an interest in conservation, and a member of the Deqing County Tibetan Medical Doctor Association (see "Traditional medicine association" section). Training sessions were provided on the cultivation of medicinal plants and basic Tibetan Medicine (with help from Dr Wu Xue). Additionally, six villagers decided to develop herbal gardens and a site was selected for a Medicinal Plants Conservation Area (MPCA). Plants for the herbal gardens have been transplanted from the wild. The most developed of these gardens has 27 species of medicinal plants (August 2009). The MPCA,

with an area of over 1000 ha, covers a wide altitudinal range (2280–3500 m) and several vegetation zones, including abandoned farmland (at the base), pine and broad-leaved forest, spruce and bamboo forest with a grove of yew (*Taxus wallichiana*) and dwarf alpine forest. A survey in July 2009 recorded 86 species of medicinal plants within the MPCA, several common (e.g. *Dipsacus* sp., *Gentiana crassicaulis*). Regulations for the management of the MPCA have been agreed. They are similar to those at Ludian.

Traditional medicine associations

Influenced by TNC and events at Ludian, a group of Tibetan doctors in Deqing County (within Diqing Tibetan Autonomous Prefecture) decided in February 2007 to form a new society, the Deqing County Tibetan Medicine Doctor Association. The dual objectives are to sustain Tibetan medical knowledge and conserve medicinal plants. Most of the 36 members are Tibetan doctors working in hospitals or clinics. Similar associations have proved valuable for conservation in India and Nepal (Thomas et al. 2005; Hamilton 2008). Tibetan Medicine is officially supported in China, with Tibetan medical facilities in some hospitals, a medical school at Lhasa and factories producing proprietary medicines.

Unlike Tibetan Medicine, Naxi Dongba Medicine is not recognized officially in China, which is disadvantageous for its further development including conservation of its medicinal plants. Currently, Lijiang City Nationality Technical College in Lijiang City (the capital of Lijiang City Prefecture) teaches some Naxi Dongba Medicine within its courses on Traditional Chinese Medicine (TCM). A meeting was held at the college in May 2008, attended by college staff, an official from the Lijiang City Sanitary Bureau (responsible for health policy), members of the KIB project team and traditional doctors from the prefecture. It was agreed that a useful step would be the creation of a traditional medicine association at prefectural level covering all local medical traditions. Such an association has now been formed (Lijiang City Ethnomedicine Association) and is being registered. The college plans to establish a Naxi Dongba herbal garden and Naxi hospital.

Conservation and development through medicinal plants: a general model

Target 3 of the Global Strategy for Plant Conservation (2002), part of the CBD, calls for the 'Development of models with protocols for plant conservation and sustainable use, based on research and practical experience'. Here we present a general model for the promotion of conservation and development based on medicinal plants. The model is based on lessons from Ludian and thirteen other projects carried out in East Africa and the Himalayas during 2005–2008 under Plantlife's Medicinal Plants Conservation Initiative (Hamilton 2008) (Appendix 1, Supplementary material). All projects provide evidence on the question: "How best can communities conserve their medicinal plants?". Ten of the projects (in six countries) were field projects, in one case (in Kenya) active at three distinct localities, so that the total sample size for field projects is effectively twelve. The other four projects were exercises to share experiences between the countries and develop ideas on best practice.

The model consists of three social elements, the relationships between them (Fig. 4), and types of activity suggested for each group (Tables 2, 3 and 4). The community is taken as the level of social organization relevant to the direct field use and management of medicinal plants. The district is considered to be the level of socio-political organization associated with the local headquarters of government agencies (such as forestry

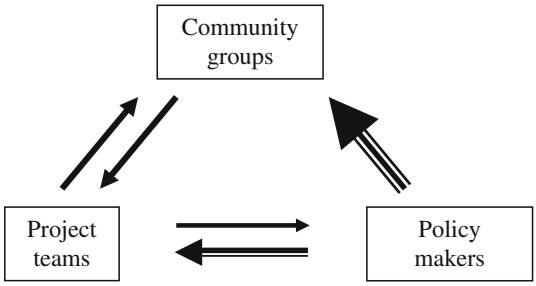

Fig. 4 Social elements and their inter-relations relevant to conservation and development through medicinal plants. The widths of the arrows indicate relative degrees of influence. *Black arrows* indicate personal relationships. *Barred arrows* indicate institutional control

Table 2 Conservation and development through medicinal plants: recommendations for community groups

A. Essential steps
Ensure that the whole community is served by the group's activities.
Identify local developmental concerns relating to medicinal plants.
Provide greater recognition and roles to primary stakeholders, such as housewives using herbal remedies and commercial collectors of wild medicinal plants.
B. Choice of steps, depending on the local context
Strengthen the conservation of wild medicinal plants:
Identify priority species and sites for improved management.
Develop local teams to take care of these sites (this may require an umbrella group if communities are collecting in each others' areas).
Seek recognition of community rights over the medicinal resources of the sites (this may require negotiation with landowners, such as forestry departments).
Establish adaptive systems of management, based on cycles of monitoring, reflection, and decision-making on management (e.g. rotational harvesting, quotas, restoration, distribution of tasks and benefits).
Encourage the cultivation of medicinal plants identified as local priorities.
Develop home herbal healthcare by identifying best practice within the community and seeking advice from research centres.
Seek information on medicinal plant markets and negotiate improved terms with traders (assured high quality materials in exchange for better prices).
Seek technical guidance on how to add value to medicinal plants and products (e.g. proper drying, making powders).
Record local knowledge of medicinal plants, develop a cultural centre, and encourage educational programmes to raise appreciation of local culture.

departments) and which is often dominated by people of a particular ethnic or cultural type. In actuality, each place will have its own peculiarities in the way that society is organized and so the specific institutions relevant to conservation and development based on medicinal plants. Not all types of activity are relevant in all contexts. We suggest that protocols for practical action be drawn up based on this model, as appropriate to particular circumstances (see "Application and testing of the model" section). Details of the reasoning behind the model are available (Hamilton 2008).

The most fundamental of the social elements is the community group, considered to consist of members of the local community with a special interest in medicinal plants and who are prepared to work within their communities to foster conservation and development based on these resources. In Plantlife's case studies, it was found that the pre-existence of suitable community groups was very useful for accelerating progress. Further, it was found

Table 3 Conservation and development through medicinal plants: recommendations for project teams

Ensure that the project team has multi-disciplinary skills.
Include community members with practical knowledge in the project team.
Learn about local medicinal plants, livelihoods and stakeholders before starting community work. Identify institutions that support local ecological knowledge.
Form a cross-disciplinary advisory group.
Provide in-service training to team members.
Raise awareness at community and district levels about the usefulness of medicinal plants and the need to conserve them.
Make long-term commitment to particular communities.
Identify community groups with a special interest in medicinal plants. If lacking, assist in their formation.
Undertake joint research with community groups to identify key local concerns relating to medicinal plants and find practical ways to solve them.

Table 4 Conservation and development through medicinal plants: recommendations for policy makers

Support national centres of excellence for medicinal plants (orientated towards community development). The types of support useful to communities will be apparent from the section 'Recommendations for community groups' above. Support may be channeled through district resource centres (see below).
Develop district resource centres to serve community needs relating to medicinal plants, including provision of information on the identification, management, use and marketing of medicinal plants, nurseries to supply seedlings, and training programmes.
Develop protocols for the propagation and cultivation of priority medicinal plants, and ensure the availability of high quality seed.
Integrate herbal medicine based on local medical traditions into national healthcare systems.
Encourage communities to record and maintain their traditional knowledge.

that the primary concerns of such groups need not necessarily be medicinal plants, though they have to have an interest. The primary concerns of community groups in Plantilfe's sample included agriculture, tree planting, forest management, healthcare and women's affairs, as well as medicinal plants directly.

Project teams are groups of co-operating individuals having multi-disciplinary skills, willing to make efforts to help communities achieve conservation and development based on medicinal plants. In Plantlife's sample, project teams came from research institutes (as with the Ludian project) and non-governmental organizations (NGOs). Some members of project teams were often well placed to influence government policy. Because of the way that Plantlife's programme was structured (always channeling support for community activities through project teams), we cannot be sure from our sample alone how much progress would have been made if the communities had acted independently. However, we believe that project teams will often be critical for success because they bring an outside perspective to bear on community concerns and therefore can be relatively objective, they can potentially introduce new ideas, information and appropriate technologies, they can provide useful external contexts, and they can sometimes act as channels to influence government policy.

Interactions between project teams and community groups are founded on personal contacts, which need to develop into relationships of mutual understanding, respect and trust for effectiveness. Each party should be able to bring its own special knowledge and skills to identify and seek answers to questions of conservation and development relating to

medicinal plants (Law and Salick 2007). The partnerships should be able to draw on the strengths of both scientific understandings and methodologies, and local knowledge, skills and wisdom. This type of 'participatory action research' has been proposed in numerous conservation and development contexts, including the improved management of natural habitats, the development of new cultivation practices, the development of improved healthcare systems, pest control in agriculture, and the selection and breeding of new varieties of crops (Berlin and Berlin 2000; Uniyal 2000; Cunningham 2001; Jones and Garforth 2002; Song and Jiggins 2003).

The importance of government policy for determining conservation possibilities at the community level is clear from the example of China, as from many other international experiences (Wells and McShane 2004). Relevant policy fields include: policies towards indigenous groups and local autonomy; national healthcare; natural resource management; and the orientation of research institutes. The impact of policy changes should be monitored carefully, because there will inevitably be unpredicted side-effects, sometimes deleterious.

Application and testing of the model

We suggest that progress based on our model is potentially possible wherever communities rely on locally growing wild medicinal plants. In those regions covered by the Medicinal Plants Conservation Initiative (East Africa and the Himalayas), many rural people continue to rely, at least in part, on the collection of local wild plants for preparation of home medicines. From extensive experience, one of us (Pei Shengji) estimates that 20% of households in China still benefit from this practice (down from an estimated 70% in the 1960s) and that it remains most prevalent in the 12 most westerly provinces, especially among ethnic minorities. More species of medicinal plants (7000–8000) are used in ethnic minority medicine in China than in TCM (4758) (Pei 2007). On the financial side, large numbers of people in East Africa and the Himalayas are involved in the commercial collection of wild medicinal plants (Hamilton 2008), a practice best documented for India and Nepal (Kala 2000; Olsen and Larsen 2003; Kala et al. 2004; Olsen 2005).

The case studies that have contributed to the development of the model have benefitted relatively few communities. We advocate a scaling-up of efforts aimed at conservation and development based on medicinal plants. In some parts of the world, such as much of Africa and the Himalayas, a 'medicinal plants approach' has the potential to foster conservation across the landscape, as will increasingly be needed to combat the ravages of climate change. Strengthening the conservation of these resources will ensure that they will continue to be available for local benefit. The approach has the merit of building development on people's own culture, promoting self-reliance and self-confidence.

We suggest that faith-based organisations, women's associations and indigenous people's groups can be well placed institutionally and in terms of their basic interests to reach out with a 'medicinal plants approach' to rural communities on scales greater than is possible with research institutes and conservation NGOs acting alone. These groups are concerned with particularly fundamental features of local culture, which (we suggest) will often remain as enduring influences over people's lives, as government policies and economic trends come and go. They represent relatively solid foundations upon which to build lasting conservation.

Faith-based organisations are natural allies for conservationists, now that many leading global religions have jointly agreed on people's duty of care towards the environment (WWF 1986). In East Africa, churches are typically the most influential organisations

within villages and often have affiliated women's groups—which is relevant because women are the main home health-carers in African societies, as worldwide (Geissler et al. 2002; Kothari 2003). In China (and other countries), rural women are playing increasing roles in managing farms and collecting medicinal plants, as more men leave villages to seek paid work elsewhere (Xu et al. 2005). The new Deqing County Tibetan Medicine Association in China (with strong roots in Tibetan culture and Buddhism) is matched by groups having similar objectives in India and Nepal (Ladakh Society for Traditional Medicines; Himalayan Amchi Association). For Yunnan, Yang and colleagues (Yang et al. 2004) have written: "The sacred plants, sacred animals, sacred forests and holy mountains are common phenomena in the mountain areas of the region, which have played an important role and can be effectively incorporated into modern conservation". For tropical southern Yunnan, Liu et al. (2002) have proposed the formation of an 'Association of Religious Plant Conservation' to organise local people to participate in conservation by means of religious activities. Although, in some ways, China today is a strongly materialistic and economically expansionist country, there are also deep roots in the traditional philosophies of Daoism and Confucianism, preaching the oneness of people and nature. The attainment of a 'harmony society' is a government objective.

For practical purposes, faith-based organisations, women's associations and indigenous people's groups will need to develop protocols to translate the general recommendations given here into specific steps suitable for the use of village leaders. These protocols should be appropriate for the particular organisations and local conditions, and in formats meaningful to local people. We suggest that it will often be useful for central teams from these organisations to work with concerned scientists to develop the protocols.

The development of conservation in the 'real world' (outside the confines of strict nature reserves and ex situ collections) is a complex challenge, because of the uniqueness of nature, societies and the relationships between them at every place, and the many factors influencing the state of the natural world. Both theory and further practical examples of attempts at conservation and development based on medicinal plants can be expected to improve our model, though we caution against over-complication.

Possible future developments at Ludian and Yongzhi

The complexities and uncertainties inherent in in situ conservation raise the importance of careful monitoring of progress on projects and periodically reviewing priorities (Hamilton and Hamilton 2006; Pei et al. 2009a). There are outstanding questions at our project sites. At Ludian, a watch is needed on the effects of recent changes in resource rights in the Medicinal Plants Conservation Areas (MPCAs), especially given the changeability of forestry policy in recent years, known to be corrosive of local institutions (Miao and West 2004; Xu et al. 2005). To ease the burden and expense of managing the MPCAs at Ludian, it may be suggested to the new rights' holders that they start rotational patrolling. New initiatives to provide economic benefits directly linked with the MPCAs are being considered—the development of agroforestry, and nurseries for medicinal plants. The latter, situated close to the MPCAs, would be designed as intermediate stations for moving plants from the MPCAs into home gardens or fields. It is thought that 5 years of KIB involvement might be needed before the MPCAs are thoroughly embedded in local culture. Financially, it may be possible to raise money for the management of the MPCAs, as well as construction of a 'hard' marketplace, from funds generated from improved marketing.

From our experience, the progress made at Ludian on conservation and development based on medicinal plants is exceptional for the Himalayas. We advocate Ludian as a regional training centre, where ideas can be exchanged between Bhutan, India, Nepal and Pakistan.

Despites its very recent establishment, it is thought that the MPCA at Yongzhi stands a good chance of survival even without further project involvement, because of the conservation-friendly nature of the local Tibetan culture. However, the Lisu community at Yongzhi is not yet adequately engaged, especially given that the Lisu sub-village is the settlement closest to the MPCA. Research is needed to better understand the whole system of local community use and management of medicinal plants to give a better conceptual context to the MPCA and efforts to encourage cultivation. The potential of abandoned fields for 'wild cultivation' of medicinal plants should be explored, to make greater use of local knowledge and values attached to plants than is currently the norm in the Sloping Land Conversion Policy (Weyerhaeuser et al. 2005).

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