Traditional Medicine

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11. Traditional medicine

1. Introduction

The contribution of biodiversity and ecosystem services to our health care needs is significant, both for the development of modern pharmaceuticals (Chivian and Bernstein 2008; Newmann and Cragg 2007; see also chapter on contribution of biodiversity to pharmaceuticals in this volume) and for their uses in traditional medicine (WHO 2013). Long before the rise of pharmaceutical development, societies have been drawing on their traditional knowledge, skills and customary practices, using various resources provided to them by nature to prevent, diagnose and treat health problems. Today, these practices continue to inform health-care delivery at the level of local communities in many places around the world (WHO 2013). In socioecological contexts such as these, several resources used for food, cultural and spiritual purposes are also used as medicines (Unnikrishnan and Suneetha 2012). Traditional medicine practices provide more than health care to these communities; they are considered a way of life and are founded on endogenous strengths, including knowledge, skills and capabilities.

Despite noteworthy advances in public health, modern health-care systems worldwide still do not adequately meet the health-care needs of large sections of the population across the globe, and the health and development goals of many communities remain unrealized (Kim et al. 2013; Anonymous 2008). Consequently, health-seeking behaviour in both urban and rural contexts around the world is increasingly becoming pluralistic or a mix of different medical systems. For example, in Peru, the plant knowledge of patients both at herbalist shops and allopathic clinics was largely identical. This indicates that traditional medicinal knowledge is a major part of a people’s culture that is being maintained, while patients also embrace the benefits of western medicine (Bussmann 2013; Vandebroek & Balick 2012; Vandebroek 2013). Given the interlinked nature of conservation, health and development, it is relevant to consider community-focused approaches⁴ that also address traditional health knowledge and conservation strategies as a way to complement mainstream health systems, and fulfil the basic human right to health and well-being.

1.2 Traditional medicine and biological resources

Biological resources have been used extensively for health care and healing practices throughout history and across cultures. Such knowledge is often specific to particular groups living in distinct

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⁴ A community here is defined as a group of people sharing a common ecosystem/landscape and associated knowledge.
environments, and is usually passed on over generations (Etkins 1988; 2001; Shankar 1992; Balick and Cox 1996; Vandebroek 2013; see also the chapter on mental health in this volume).

Traditional knowledge in health care can range from home-level understanding of nutrition, management of simple ailments (see also the chapter on nutrition in this volume) or reproductive health practices, to treating serious chronic illnesses or addressing public health requirements. In local communities, health practitioners trained in traditional and non-formal systems of medicine often play an instrumental role in linking health-related knowledge to affordable health-care delivery (e.g. Stephens et al. 2006; Montenegro and Stephens 2006; Reading and Wien 2009). There are also formally recognized practitioners of traditional medical systems, often referred to as complementary and alternative medicine (CAM) practitioners, formally trained in different systems of medicine such as Ayurveda, Traditional Chinese Medicine, Kampo, Siddha, Tibetan medicine, Unani and several others (WHO 2002; WHO 2005, Bodeker et al. 2005; Payyappallimana 2010). Such systems have been institutionalized and integrated into health systems in their respective regions or countries. These have led to the evolution and standardization of local pharmacopoeias that capture the uniqueness of biological diversity and cultural practices of specific socioecological regions, and have specific and well-organized epistemological bases.

Unfortunately, both biological products and health-related traditional knowledge are increasingly threatened (Reyes-García 2010). Overharvesting, land-use change, and climate change are among the major drivers of the decline in wild plant resources, including those used commercially for food and medicinal purposes (Hawkins 2008; FRLHT 1999; 2009; Ford et al. 2010). Analysing the individual and combined impact of these drivers on the biological resources used for food and medicine at different spatial scales is also an important area for further research. Research in the area of medicinal plants and climate change is already emerging (e.g. Zisca et al. 2005, 2008). Although use of faunal resources is not as profuse as that of plant resources, illegal poaching and unwise use of these resources for traditional medicine and hobby pursuits has also taken a toll on the population and diversity of fauna (Milliken and Shaw 2012). Combined, the drivers of change pose a dual threat to wild species and to the livelihoods of collectors, who often belong to the poorest social groups. In this chapter, we highlight the various dimensions related to the conservation of biological resources and promotion of traditional health-care practices, illustrating the relevance of significant areas with case study examples.

2. Trends in demand for biological resources

Plants used in traditional medicine are not only important for local health practices, but also for international trade, based on their broader commercial use and value (Fabricant and Farnsworth 2001). Globally, an estimated 60 000 species are used for their medicinal, nutritional and aromatic properties and, every year, more than 500 000 tonnes (UN Comtrade 2013) of material from such species are traded. A complete list of all plants used in traditional medicine does not exist, but at least 30 000 species of plants with documented use are included in the Global Checklist; an extension of earlier efforts of the World Health Organization (WHO) and Natural Products Alert Database (NAPRALERT) WHO Collaborating Centre at the University of Illinois in Chicago. It is estimated that the value of the global trade in plants used for medicinal purposes may exceed US$ 2.5 billion, and is increasingly driven by industry demand (UN Comtrade 2013).

Fauna and their products are also extensively used in traditional medicine; assessments of the use of fauna and their products are mostly region-, country- or taxa-specific (Alves and Alves 2011; Nunkoo et al. 2012). A variety of animal body parts and secretions are included in traditional medicine pharmacopoeia (Alves and Rosa 2005). Overall, in fact, there is often not a clear line between the consumption for food or medicine, with some species also being consumed for their “tonic” properties.
Increasingly, there is a reverse “re-engineering” or “reverse pharmacology” process being undertaken by researchers, where novel medicines or medical therapies are being developed using traditional processes. Furthermore, institutionalized traditional medicine manufacturers are investing in developing new products that are value additions over existing forms of medicinal formulations (Unnikrishnan and Suneetha 2012).

The demand for herbal medicines is rising drastically, fuelled by factors such as cost–efficacy and higher perceptions of safety. In countries like India, it has been estimated that approximately 80% of medicinal plants are collected from the wild, leading to an increasing pressure on natural resources (FRLHT 1999; 2009). Due to overharvesting and habitat loss, approximately 15 000 species (or 21%) of the global medicinal plant species are now endangered (Schippmann et al. 2006). With rising demand and reducing populations, problems of substitution, adulteration and mistaken identities between species are also on the rise, as illustrated by the example in Box 1.

Box 1. Traditional medicine in a changing world: the example of Peru

The demand for traditional medicine is increasing in Peru, as indicated by the increase in number of herb vendors in recent years, in particular, in the markets of Trujillo. A wide variety of medicinal plants from northern Peru can also be found in the global market. While this trend might help to maintain traditional practices and give recognition to traditional knowledge, it poses a serious threat, as signs of overharvesting of important species are becoming increasingly apparent.

More than two thirds of all species sold in Peruvian markets are claimed to originate from the highlands (sierra), above the timberline, which represent areas often heavily used for agriculture and livestock grazing. The overall value of medicinal plants in the markets of northern Peru alone reaches US$ 1.2 million/year. Medicinal plants contribute significantly to the local economy. Such an important market raises questions around the sustainability of this trade, especially because the market analysis does not take into account any informal sales.

Most striking, perhaps, is the fact that seven indigenous and three exotic species, i.e. 2.5% of all species traded, account for more than 40% of the total sales volume. Moreover, 31 native species account for 50% of all sales, while only 16 introduced plants contribute to more than a quarter of all material sold. About one third of this sales volume includes all exotic species traded. None of these species are rare or endangered. However, the rising market demand might lead to increased production of these exotics, which in turn could have negative effects on the local flora (Bussmann et al. 2007b).

A look at the indigenous species traded highlights important conservation threats. Croton lechleri (dragon’s blood), and Uncaria tomentosa (cat’s claw) are immensely popular at a local level, and each contributes to about 7% to the overall market value. Both species are also widely traded internationally. The latex of Croton is harvested by cutting or debarking the whole tree. Uncaria is mostly traded as bark, and again the whole plant is normally debarked. Croton is a pioneer species, and apart from C. lechleri, a few other species of the genus have found their way into the market. Sustainable production of this genus seems possible, but the process must be closely monitored, and current practice does not appear sustainable because most Croton is wild harvested. The trade

http://www.traffic.org/wild-meat/
While in-situ and ex-situ approaches to conservation are adopted to address the loss of medicinal resources, the success of conservation strategies often depends on the comprehensive involvement of different stakeholders. In this context, the example from India in Box 2 illustrates the potential of in-situ conservation through public–private partnership (PPP) arrangements.

Notwithstanding the inclusion of multiple stakeholders in the implementation of conservation programmes, the sustainability of such initiatives is also dependent on the value of a resource that can be captured by the different actors. It is possible to address some of these concerns through market-based mechanisms such as certification to foster sustainable use standards for medicinal plants, as is being piloted through the FairWild example (Box 3).

in cat’s claw is so immense that, in fact, years ago collectors of this primary forest liana began to complain about a lack of resources and it was found that often other Uncaria species, or even Acacia species have appeared in the market as “cat’s claw”. This is clearly not sustainable.

Some of the other “most important traditional medicinal” species in northern Peru are either common weeds (e.g. Desmodium molliculum), or have large populations (e.g. Equisetum giganteum). Nevertheless, a number of species are very vulnerable: Gentianella alborosea, G. bicolor, G. graminea, Geranium ayavacense and Laccopetalum giganteum are all high-altitude species with very limited distribution. Their large-scale collection is clearly unsustainable. In the case of Laccopetalum, collectors indicate that finding supplies is becoming increasingly difficult. The fate of a number of species with similar habitat requirements raises comparable concerns. The only species under cultivation at present are exotics, and a few common indigenous species.

There are profound challenges when it comes to the safety of the plants employed, in particular, for applications that require long-term use. Some studies found that various species were often sold under the same common names. Some of the different fresh species are readily identifiable (botanically), but neither the collectors nor the vendors make a direct distinction between species. Often, material is sold in finely powdered form, which makes the morphological identification of the species in the market impossible, and greatly increases the risk for the buyer. The best way to ensure correct identification would be DNA bar-coding. The necessary technical infrastructure is, however, not available locally. The use of DNA bar-coding as a quality control tool to verify species composition of samples on a large scale would require careful sampling of every batch of plant material sold in the market. The volatility of the markets makes this a very difficult task from a logistical standpoint. Furthermore, there is no consistency in the dosage of plants used, and vendors do not agree on the possible side-effects. Even in the case of plant species used for clearly circumscribed applications, patients run a considerable risk when purchasing their remedies in the local markets. Much more control is needed, as well as stringent identification of the material sold in public markets, and those that enter the global supply chain via Internet sales.
It is estimated that in India, around 300 plants and a few faunal species are in various threat categories and their cultivation is not yet a viable economic option due to the preference for wild sourcing, given lower costs (FRLHT 2009). There is also a general lack of information on agrotechniques (Hamilton 2004).

To address these pressing issues, the Foundation for Revitalisation of Local Health Traditions (FRLHT) in India initiated the establishment of the largest global in-situ conservation network by establishing medicinal plant conservation areas (MPCAs) – as an integrated approach to in-situ and ex-situ conservation programmes. The rationale is to conserve and study medicinal plants in their natural habitats and preserve their gene pool, and to further develop strategies for the management of rare, endangered and vulnerable species. The areas not only provide a good locale for studies on threat assessment, population studies and mapping, but also for participatory forest management, as well as for policy-makers, the community and civil society organizations. Between 1993 and 2014, FRLHT, jointly with the State Forest Departments, established 110 MPCAs across 12 Indian states in a globally unique model of PPP. The programme has been spearheaded in collaboration with the Indian Ministry of Environment and Forests, and through the support of organizations such as the Danish International Development Assistance (DANIDA), United Nations Development Programme (UNDP) and Global Environmental Facility (GEF). Due to its success, the Planning Commission of India recommended the establishment of 200 MPCAs across the country (Tenth Five-Year Plan, 2002). ³

There is also a recent move to recognize these locations as biodiversity heritage sites. A related initiative is the establishment of medicinal plant conservation parks (MPCPs) – a community-based ex-situ conservation initiative aimed at sustainable use of medicinal plant resources and preserving knowledge associated with their use. Coordinated by FRLHT along with other nongovernmental organizations (NGOs) and community-based organizations, a chain of MPCPs has been set up in various parts of India.⁴ Attempts have also been made in pilot locations to integrate such medicinal plant-based practices in formal primary health-care centres, apart from promoting them through community health programmes. Within a geographical region, communities have been mobilized to create:

- ethnomedicinal forests and resource centres housing herbaria and crude drug collections;
- local pharmacopoeia databases based on community knowledge;
- community and home herbal gardens and seed banks;
- outreach nurseries for the promotion of cultivation and a sustainable wild collection of medicinal plants;
- trade and enterprise development that aids in income generation.

Moving up the value chain, FRLHT also established a medicinal plant conservation network (MPCN) jointly with a number of NGOs working with different rural communities. As part of this effort, traditional healers’ associations have been formed at different levels of administration from the province downwards. The associations conduct regular meetings and exchange of information

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³ See: http://planningcommission.nic.in/plans/planrel/fiveyr/10th/volume2/10th_vol2.pdf

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Box 2. Conservation and sustainable use of medicinal plants in India
among healers and act according to self-regulatory guidelines, which have been evolved through a participatory process based on the contextual peculiarities of each province. Healers’ associations along with NGOs and forest departments have been actively engaged in supporting medicinal plant conservation programmes in various states.

The MPCN is also working on the following issues:

• establishing herbal gardens;
• developing appraisal systems of healers’ capacities and training programmes;
• conducting action research interventions in key health areas such as malaria;
• facilitating networking through organizing medical camps, and district- and state-level conventions of healers’ associations, but also healer exchange visits within the country and among other Asian and African countries.

Box 3. Sustainable harvest and standards – The FairWild Standard example

The FairWild Standard provides a set of best practice guidelines for the sustainable use and trade of wild harvested medicinal plants. It provides a basis for assessing the harvest and trade of wild plants against various ecological, social and economic requirements. It was developed through a multistakeholder consultation process that has engaged a wide range of organizations and individuals involved with the harvesting and trade of these resources.

Use of the FairWild Standard helps support efforts to ensure that plants are managed, harvested and traded in a way that maintains populations in the wild and benefits rural producers. Version 2.0 of the Standard was developed following the merger of two initiatives: International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP), which focused on ecological conservation and some social/ethical aspects, and the original FairWild Standard, which focused on social and fair trade aspects. The resulting set of principles and criteria covers eleven key areas of sustainability. It is designed to be an applicable framework in a variety of implementation contexts, as well as to be used as the basis for a third-party certification scheme.

During the development of the FairWild Standard, a number of pilot projects were carried out in locations around the world to test its applicability. These projects included the collection of ingredients used in traditional medicine; for example, the pilots of ISSC-MAP in India under the project “Saving Plants that Save Lives and Livelihoods”, supported by the German Federal Ministry for Economic Cooperation and Development (BMZ), and implemented by FRLHT and TRAFFIC India. One of the first studies was conducted in Karnataka, India. Through a participatory planning approach involving various stakeholders such as scientists and community members, a task team was set up for mapping resources and elaborating a sustainable harvesting strategy. As part of the methodology involved documentation of medicinal plant-related knowledge and non-timber forest product (NTFP) collection practices, resource assessments were conducted for selected species. Training was provided for mapping and assessing different harvesting methods. It was found that a well-organized stakeholder group can plan and implement an effective participatory resource management strategy. Apart from
standardizing and field-testing the methodology, training modules for wider user groups have been developed. This will be a useful strategy for biodiversity or joint forest management committees through a community-to-community training programme (Unnikrishnan and Suneetha 2012).

Innovation with the FairWild Standard continues in India, with a certification pilot now under way in the Western Ghats. With financial support from the United Kingdom (UK)’s Department for International Development (DFID)/Department for Environment, Food and Rural Affairs (DEFRA) Darwin Initiative and the Keidanren Nature Conservation Foundation, the project intends to increase the capacity of targeted local communities to adapt to climate change and participate in biodiversity conservation through the improved management of socioecological landscapes. It is implemented by the Durrell Institute for Conservation and Ecology (DICE), the Indian NGO Applied Environmental Research Foundation (AERF), UK manufacturer Pukka Herbs Ltd. and TRAFFIC. The project aims to establish supply chains for sustainable harvesting and fair trade in fruit of two tree species used in Ayurvedic medicine (Terminalia bellirica and T. chebula). A FairWild certification protocol is to be developed for the collection of these species and for establishing a community-regulated mechanism for access and benefit sharing.

The FairWild Standard has also been implemented in other countries of Asia, South America, Africa and Europe (Kathe et al. 2010). In addition to being used by communities for the management of medicinal plant resources, the principles of the FairWild Standard can be used by industry for the development of a sourcing policy to support the development and/or strengthening of national resource management policies and regulations. Of particular relevance to the topic of biodiversity and traditional health is a project that is currently under way as part of the European Union (EU)–China Environmental Governance Programme, which experiments with promoting the adoption of sustainable sourcing according to the FairWild Standard in the traditional Chinese medicine sector, as part of a corporate social responsibility framework. In the international arena, it has also been drawn upon in the development of best practice methodologies for carrying out non-detriment findings (NDF) by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and as a practical tool for implementing and reporting against the sustainable use objective of the Global Strategy for Plant Conservation (GSPC), as well as the Convention on Biological Diversity (CBD)’s Aichi Targets 4 and 6.

2.1 Socioecological systems

The survival and vitality of knowledge and resources depend on the sociocultural contexts in which they are embedded. Typically, such knowledge and resources are found to be most vibrant among communities (specifically, indigenous and local communities) close to culturally important landscapes. These could relate to socioecological production landscapes (e.g. satoyama in Japan) or conservation systems (e.g. sacred groves, ceremonial sites) or therapeutic landscapes (e.g. sacred healing sites). Such landscapes and related traditional knowledge practices make important contributions to health and well-being, therefore necessitating a close inquiry into the functional interlinkages within such systems, and maintenance of their dynamism (Unnikrishnan and Suneetha 2012; Posey et al. 2000; see also the chapter on mental health in this volume). Highlighted below is the case of the Mayan people and their relationship with nature and resources. A sensitive understanding of the cultural ties between societies and nature is required to ensure sustainability of both knowledge and practices.
Mayan people maintain a healthy or whole relationship with mother earth and the cosmos through an intricate system of practices and knowledge known as Maya Science (Monterroso & Azurdia Bravo 2008). This divine relationship is enacted by the measure of time using the stars and constellations but also through the use of sacred sites and traditional medicine (Gomez & Caal 2003). The sacred sites (natural and constructed) are places to connect with the ancestors and to contemplate one’s role in relation to the social and natural world, but they are also places for healing in the landscape (Gomez et al. 2010). In Guatemala as well as in many other countries, these sacred places are often viewed as a biocultural network that spans land and seascapes, and embody a spiritual dimension of well-being and often underrecognized healing potential (Dobson & Mamyev 2010; Delgado et al. 2010; Verschuuren et al. 2014).

Reyes-García (2010) reviewed the literature on traditional medicine and concluded that the holistic nature of traditional knowledge systems helps to not only understand a plant’s efficacy in its cultural context but also improves our understanding of how ethnopharmacological knowledge is distributed in a society, and who benefits from it. In Guatemala, spiritual leaders, midwives, paediatricians, naturopaths, and other traditional healers help counteract the various health problems in communities. To the traditional Mayan healer, the body is composed of the sacred elements; earth, water, fire and air, which correspond to the sun, moon and stars. Therefore, use of traditional medicine is practised based on the date of birth in the sacred Mayan calendar (Monterroso & Bravo 2008).

Within the context of the Mayan calendar, traditional healers know that diseases stem from the spiritual, physical and psychological imbalance of a person, either from wilful violation of proper conduct or due to lack of awareness. Due to colonization and consequent impacts on local and indigenous communities, many traditional practices are fragmented and often combined with elements of western medicine. They are often under ideological pressure and suspicion for the lack a homogeneous theory, while resource scarcity is also an increasing problem underlying the production of many traditional medicines (Delgado & Gomez 2003). Viewing these problems as part of the erosion of cultural knowledge and practices can help in determining suitable and culturally appropriate solutions. For example, Pesek et al. (2009), who researched Maya Q’eqchi’ knowledge on medicinal plants and their ecosystems, concluded that traditional ways of protecting plant diversity were better suited to medicinal plant conservation than external conservation solutions based on conservation biology.

Garcia et al. (1999) describe how Mayan medicine in Mexico was reinforced by systematizing the knowledge and experience of 40 traditional healers, and comparing these with other medical traditions, such as Chinese health systems. Striking similarities were encountered, both in concepts as well as practices, such as acupuncture, massage and the use of certain herbs and spiritual healing techniques. This was used to reinforce the local traditional health system, as well as to disseminate the experiences among traditional healers elsewhere in Central America. The exchange of healers’ knowledge and practices is generally valued as an invigorating experience that can also provide a platform for the legal recognition of traditional health practitioners (Traditional Health Practitioners 2010).
3. Traditional medicine and traditional knowledge at a crossroads

With increasing urbanization and integration of mainstream worldviews, communities often experience alienation from the natural environment (Roe 2010). Cultural systems, including traditional health-care practices, are concomitantly being eroded. As a result, despite the wealth of traditional knowledge that exists, the practice of traditional medicine is declining (Payyappalli 2010). This is further accentuated by institutionalized education systems that often fail to recognize the relevance of these practices, thereby distancing younger generations from exploring such areas (Battiste 2010). The dominant education and research systems tend to emphasize knowledge and technologies with universal standards, rather than supporting the needs of specific regions or populations, and available resources and capabilities (Haverkort et al. 2003).

A large part of traditional medical knowledge is experience based and passed on through the oral tradition, and such knowledge is not easily transmitted in classroom-based learning. The institutionalized traditional medical knowledge either gets harmonized with mainstream systems or is not adequately integrated in public health care (Bodeker and Burford 2007), which indicates inefficient use of knowledge and trained human resources.

Access to essential modern health care continues to be a major challenge in many parts of the world. Infectious diseases (such as HIV, malaria, tuberculosis, pneumonia, diarrhoeal diseases and several other neglected conditions), coupled with chronic noncommunicable diseases (such as diabetes and ischaemic heart disease), persistently affect lives in these regions (see also the infectious disease chapter in this volume). Indomitable challenges such as high maternal and child mortality, and emerging and re-emerging diseases (infectious, chronic, and lifestyle-related), are typical constraints to well-being. For these reasons, the role of traditional health-care practitioners in community health is understood as filling a gap in access to modern health care. However, it has to be recognized that in most societies they do play a critical complementary role in parallel with the mainstream health system, an aspect that needs to be better appreciated. This calls for a multipronged approach where various resources need to converge, including those related to local health traditions. Experiences over the past two decades show that there is high relevance in aligning biodiversity conservation goals with a community health approach (Miththapala 2006).

The customary absence of comprehensive approaches to assess the role, economic potential and policy implications of traditional knowledge have also been noted as key reasons due to which traditional cultures are frequently disregarded in development programmes, making sustainable development objectives among vulnerable populations more difficult to attain (Jenkins 2000; Haverkort 2003). These issues must all be considered in the context of a global health sector, which predominantly relies on universal models of modern medicine, and continues to be inadequate for large sections of the population around the globe.

New policy forums, such as the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), are exploring ways of including traditional and mainstream perspectives and methods to undertake an assessment of biodiversity and ecosystem services, and consequent impacts on human well-being. Guidance on the need to understand different kinds of values held by people towards biodiversity and ecosystem services to inform methods of valuation and assessment are being developed, with a specific focus on adequate attention to public health (www.ipbes.net). This calls for stronger partnerships between stakeholders.

A number of leading international NGOs are conducting capacity development activities for traditional health practitioners, such as training, and facilitating networks. One of these NGOs is the Promotion of Traditional Medicines...
which has been working to alleviate poor health conditions and services utilizing traditional medicine since 1971. Its unit in Uganda conducts a wide range of capacity development activities for healers, addressing issues such as exposure to potential value addition and income generation activities, culturally sensitive disease prevention and management of environmental conservation. A unique initiative includes training programmes designed for healers and youth from communities on the use of traditional medicinal resources and practices under the banner of Buyijja Forest Schools. PROMETRA also works on integrating traditional medicine in national health systems to improve free choice of medicine for citizens, protect biodiversity and participatory forest management, promote research on medicinal plants, protect traditional knowledge and reinforce institutional capacities of civil society organizations for a healthy environment and sustainable development. Another relevant best practice example is “Friends of Lanka” based in Sri Lanka. It has promoted documentation of practices, and research and networking of traditional health practitioners. For this reason, around 75 healers have been identified among a population of 8000, who treat various conditions such as snake- and insect bites and certain food or natural poisons, which are considered as leading causes of morbidity and mortality in rural areas of developing countries. Friends of Lanka also formed an association of healers, which initiated an assessment of natural resource availability, and methods for conservation and sustainable use through home and community gardens.

Networks such as the MPCN and associations of healers established within its framework are a successful approach to facilitating knowledge and experience exchange among traditional healers nationally, regionally and internationally, resulting in better health and conservation outcomes.

4. Strengthening traditional health practices and addressing loss of resources

To date, there have been several concerted efforts in the international arena to promote both the conservation of biological resources, as well as traditional knowledge. What has been lacking, however, is a comprehensive effort to emphasize the linkages between these elements using an integrated approach that draws on traditional knowledge to complement and supplement modern health-care systems.

With the Earth Summit and adoption of the Convention on Biological Diversity (CBD) at Rio de Janeiro in 1992, significant steps were taken towards political recognition of the relevance of traditional knowledge. In compliance with Article 8 (j) of the Convention, the respect, preservation and maintenance of traditional knowledge, and innovations and practices of indigenous and local communities are related to the recognition of the practices by these communities of their traditional knowledge. Other important aspects of these obligations include promoting the wider application of such knowledge, innovations and practices with the approval and involvement of knowledge holders; and encouraging the equitable sharing of the benefits arising from the use of such knowledge, innovations and practices. These obligations are also applicable to traditional medicine as it relates to traditional knowledge. Furthermore, Article 10 (c) of the CBD states that Parties shall, as far as possible and as appropriate:

“Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements.”

Principle 22 of the Rio Declaration on Environment and Development calls for the recognition of, and respect for the knowledge and practices of local and indigenous communities in environmental management towards the achievement of sustainable development.⁶ Agenda 21 further specifically calls for an appropriate integration of

traditional knowledge and experience in national health systems, and for conducting research into traditional knowledge related to preventive and curative health practices (Chapter 6 of Social and economic dimensions – protecting and promoting human health) (United Nations 1993). Over the past six decades, two areas where the contemporary relevance of traditional knowledge has been fairly well acknowledged include the management of the environment and natural resources, and the delivery of health care (WHO 2002, 2005, 2013). The need to re-integrate traditional medical approaches into healthcare armamentarium is gaining more political and social acceptance (UN 2010).

4.1 Validation, safety and efficacy of traditional medicine

When a traditional recipe is scientifically validated in terms of safety and effectiveness, and is affordable, available and sustainable, it provides valuable information. It may lead to an officially recommended phytomedicine as well as improvement in the provision of health services to households. In both cases, the aim remains to improve the quality of care in the community.

Integration of modern and traditional treatments is common today. Plural therapeutic itineraries are followed by large numbers of those seeking care. However, this process is often disordered and defined by factors completely extraneous to a rational choice of effective and safe treatment. Scientific and clinical studies may provide essential information to adequately respond to the situation. Research strategies can be based on various methods such as intercultural population studies, historical accounts or biological tests. Beginning with a collection of clinical data during ethnopharmacological field studies may be a good start.

Many users of traditional medicines and practitioners claim that the effect of a treatment is obvious when there is an improvement in the health status. However, most ailments tend to get better over time even without any care. In clinical studies (with human subjects), observations are organized in a way that makes it possible to know whether observed outcomes can be attributed to a given treatment. This can be obtained through a dose-escalating prospective study (comparing outcomes with different doses of a treatment), or with the leading benchmark of medical research and evidence-based medicine: a randomized controlled trial.

Before doing so, it is relevant to determine which is the best among the various treatments used to treat the same ailment in a population. The “bedside-to-bench” approach has been used with some success to answer this question; it is based on precise clinical information on real cases and statistical analysis of correlations between treatments and outcomes (Willcox et al. 2011). The clinical effects of medicinal plants should be studied using sound methods that are, insofar as possible, the same as or compatible with methods used for testing conventional medicines. This could produce results that are understandable and more widely acceptable to the scientific community, health professionals and policy-makers. It can also provide information useful for the quality of care in the community. However, it is also important to acknowledge that traditional formulations might sometimes require testing within traditional epistemologies and methods, to avoid the potential misrepresentation of effectiveness due to incommensurability of methods (Shankar et al. 2007). The examples in Boxes 5, 6 and 7 illustrate examples of good practices in Palau, Mali and India to validate and revitalize traditional medicinal practices, mindful of the safety, quality and efficacy of the practices, and an inclusive approach with practitioners of traditional medicine.

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*This observation is based on field work conducted by the authors of this chapter.*
A relevant example linking traditional medicines and noncommunicable diseases (NCDs) is the survey performed in Palau on traditional medicines (or health practices) and NCDs – chiefly diabetes and high blood pressure. A nationwide survey was carried out to determine which traditional medicines are most commonly used to treat these conditions, and what was the perceived effectiveness. Data were collected as part of a training course on scientific research. A distinctive feature of the results obtained was that, among 30 plants used for diabetes, two were the most common (Table 1).  

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**Box 5: Participatory approaches to validation: experiences from Palau and Mali**

For a review of herbal medicines used to treat diabetes, see also Rao et al. 2010.

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### Table 1: Ingredients of traditional treatments most commonly used for diabetes

(mentioned ≥4 times, among 45 respondents with diabetes) in Palau (unpublished, 2014)

<table>
<thead>
<tr>
<th>Name of the plant</th>
<th>Palauan name</th>
<th>No. of reported uses</th>
<th>N (%) reported “lower sugar level in blood”</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Phaleria nisidai</em></td>
<td>delal a kar</td>
<td>13</td>
<td>6 (46%)</td>
</tr>
<tr>
<td><em>Vitex trifolia</em></td>
<td>kelsechedui</td>
<td>4</td>
<td>1 (25%)</td>
</tr>
<tr>
<td><em>Scaevola taccada</em></td>
<td>korai (kirrai)</td>
<td>4</td>
<td>1 (25%)</td>
</tr>
<tr>
<td><em>Morinda citrifolia</em></td>
<td>ngel/noni</td>
<td>12</td>
<td>0 (0%)</td>
</tr>
<tr>
<td><em>Phyllanthus palauensis</em></td>
<td>ukelel a chedib</td>
<td>4</td>
<td>1 (25%)</td>
</tr>
</tbody>
</table>

The difference between the reported outcomes with the two most commonly used plants was statistically tested. When comparing reported outcomes of *P. nisidai* and *M. citrifolia*, *P. nisidai* was statistically more often associated with the reported outcome “lower blood sugar” (*P*=0.01). None of the patients using *M. citrifolia* reported the outcome “lower blood sugar”, even though this plant was the second most frequently used.

Following the identification of *P. nisidai* through this brief survey, a literature search was performed to identify a potential link between the results obtained and what is known about the antidiabetic properties of the plant. It was found that the high mangiferin content of *P. nisidai* could explain the observed effects. Indeed, in vitro and animal studies on this substance showed improvement in the glucose tolerance test, inhibition of alpha amylase, alpha glucosidase and dipeptidyl peptidase IV (as with some of the most recent antidiabetic drugs), increased insulin secretion and a hypolipidaemic effect (Kitalong 2012).

In a study on traditional treatments for malaria in Mali, use of the retrospective treatment outcome (RTO) method resulted in a database of treatments taken for malaria cases in 952 households. From the 66 plants used, alone or in various combinations, one was clearly associated with the best outcomes: a decoction of *Argemone mexicana* (Table 2) (Diallo et al. 2007).

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* For a review of herbal medicines used to treat diabetes, see also Rao et al. 2010.
There are a number of successful models and programmes for preventive and curative health interventions that use traditional medicine and practices to achieve the desired goals. In the field of malaria treatment, there is the Research Initiative on Traditional Antimalarial Methods (RITAM), which was initiated in 2001 (Willcox et al. 2003; Willcox & Bodeker 2004 www.gifts-ritam.org). This initiative is based on a group of international researchers exploring ways to increase the relevance of including traditional medicine in the repertoire of choices available for the prevention and cure of malaria. As such, RITAM is working on traditional antimalarials with more than 200 members from over 30 countries. A systematic literature review by RITAM indicates that numerous plant species are used to treat malaria or fever.

In India, FRLHT has been assessing the effectiveness of traditional medicine for malaria prevention through a participatory community-based approach. This includes conducting a literature survey on plant drugs used for malaria management, as well as documenting traditional antimalarial remedies and dietary rules for malaria prevention. Finally, pharmacological references of the toxicology and efficacy of these practices from Ayurvedic and modern medical literature are compiled. As part of FRLHT’s malaria prophylaxis approach, communities in selected endemic areas follow a regimen of malaria prevention (mainly consisting of an herbal decoction) during the monsoon season for a selected period. The safety of the practice is assured and the remedy is prepared fresh on specific days at a community centre. By using a cohort study approach, groups based in several regions that do not follow this regimen are compared with those that do. Data gathered in the documentation has shown positive results for malaria prevention, indicated by statistically significant positive outcomes.

Table 2: Correlation between plants used and reported outcome in a study on traditional treatments for malaria in Mali

<table>
<thead>
<tr>
<th>Plant</th>
<th>Total number of people used on</th>
<th>Healed</th>
<th>Failed</th>
<th>% Healed (95% CI)</th>
<th>P (Fisher exact)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argemone mexicana</td>
<td>30</td>
<td>30</td>
<td>0</td>
<td>100% (88–100)</td>
<td>Reference</td>
</tr>
<tr>
<td>Carica papaya</td>
<td>33</td>
<td>28</td>
<td>5</td>
<td>85% (68–95)</td>
<td>0.05</td>
</tr>
<tr>
<td>Anogeissus leiocarpus</td>
<td>33</td>
<td>27</td>
<td>6</td>
<td>82% (64–93)</td>
<td>0.03</td>
</tr>
</tbody>
</table>

The recipe that showed the best outcomes in patients, a single plant in its traditional mode of preparation and utilization, was selected for a further dose-escalating observational study, followed by a randomized, prospective, comparative clinical trial (randomized controlled trial with the selected local remedy versus the standard, imported treatment). After these clinical studies, the search for active compounds was undertaken. The whole research process was labelled “reverse pharmacology” or, more specifically, “bedside-to-bench” approach.

Box 6: Traditional antimalarials – RITAM experience

There are a number of successful models and programmes for preventive and curative health interventions that use traditional medicine and practices to achieve the desired goals. In the field of malaria treatment, there is the Research Initiative on Traditional Antimalarial Methods (RITAM), which was initiated in 2001 (Willcox et al. 2003; Willcox & Bodeker 2004 www.gifts-ritam.org). This initiative is based on a group of international researchers exploring ways to increase the relevance of including traditional medicine in the repertoire of choices available for the prevention and cure of malaria. As such, RITAM is working on traditional antimalarials with more than 200 members from over 30 countries. A systematic literature review by RITAM indicates that numerous plant species are used to treat malaria or fever. In India, FRLHT has been assessing the effectiveness of traditional medicine for malaria prevention through a participatory community-based approach. This includes conducting a literature survey on plant drugs used for malaria management, as well as documenting traditional antimalarial remedies and dietary rules for malaria prevention. Finally, pharmacological references of the toxicology and efficacy of these practices from Ayurvedic and modern medical literature are compiled. As part of FRLHT’s malaria prophylaxis approach, communities in selected endemic areas follow a regimen of malaria prevention (mainly consisting of an herbal decoction) during the monsoon season for a selected period. The safety of the practice is assured and the remedy is prepared fresh on specific days at a community centre. By using a cohort study approach, groups based in several regions that do not follow this regimen are compared with those that do. Data gathered in the documentation has shown positive results for malaria prevention, indicated by statistically significant positive outcomes.
The case of the RITAM initiative (in Box 6) highlights that utilizing traditional medical knowledge through community-based participatory approaches is feasible and urgently needed to find solutions to the continuing high incidence of preventable and curable diseases such as malaria in regions where it is endemic. This also requires the consideration of ethical factors, e.g. free, prior and informed consent (Unnikrishnan and Prakash 2007). Home herbal gardens is a successful model to promote access to health care through sustainable natural resource management of medicinal plants. According to observations, it has successfully reduced poverty in rural areas and revived local knowledge of medicinal plants and traditional health practices. Today, 200,000 home gardens across 10 states in India are used to meet the primary health-care needs of some of the poorest households, while reducing their health expenditure. A majority of participants are now contributing fully to meet the costs of raising their medicinal plants. Some studies show that there is substantial health cost saving due to the use of home remedies (e.g. Hariramamurthi et al. 2006; Bode and Hariramamurthi 2015).

5. Challenges to the protection of traditional medical knowledge

Many pharmaceutical drugs used today have been derived from plants that were initially used in traditional systems of medicine (Fabricant and Farnsworth 2001). According to WHO, approximately 25% of these are plant derived. Health-related traditional knowledge has been commonly accessed for developing new medicines, although knowledge, practices and resources have often been misappropriated (Timmermans 2003). The extent to which traditional medicine can guide drug discovery has been subject to controversy, contributing to fluctuations in investment in bioprospecting informed by ethnobotanical data (Saslis-Lagoudakis 2012).

5.1 Databases for health-related traditional knowledge

Searchable databases for health-related traditional knowledge, which ensure the protection of related resources and knowledge, are currently being developed. A unique database project is the Traditional Knowledge Digital Library, which was developed through collaboration between the Council for Scientific and Industrial Research, the Indian Ministry of Science and Technology, and the Ministry of Health and Family Welfare (Department of AYUSH). An interdisciplinary team of experts from Ayurveda, Uniani, Siddha and Yoga as well as from information technology (IT), law and scientists manages the digital library. It involves documentation of the traditional knowledge available in the public domain in the form of existing literature related to Ayurveda,

**Box 7: Home herbal gardens as a self-reliant community health programme**

A self-reliant approach to managing simple, common health conditions can reduce the health expenditure of poor rural households and rural indebtedness in many developing countries (Van Damme et al. 2003). Home herbal gardens, as conceived by the FRLHT, are a collection of 15–20 prioritized medicinal and nutritional plants, and have become a successful model for a self-reliant community health programme. Apart from being a conservation milieu for medicinal plants, it also addresses nutritional challenges. In most rural communities, knowledgeable women take care of certain primary health needs of the family members and the gardens become a handy resource for them. Some women, by taking on the role of suppliers of seedlings for the programme, also earn supplementary incomes.

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* For other health benefits of home gardens, see also the nutrition chapter in this volume.

¹⁰ [http://www.who.int/mediacentre/factsheets/fs134](http://www.who.int/mediacentre/factsheets/fs134)
Unani, Siddha and Yoga, in digitized format in five international languages: English, German, French, Japanese and Spanish. Furthermore, for the purpose of systematic arrangement, dissemination and retrieval, the Traditional Knowledge Resource Classification, an innovative structured classification system, has been developed for about 25 000 subgroups related to medicinal plants, minerals, animal resources, their therapeutic uses, clinical applications, methods of preparation, modes of administration, etc.

By providing information on traditional knowledge existing in the country, in languages and formats comprehensible to patent examiners at international patent offices, the database contributes significantly to preventing the grant of wrong patents. In parallel, various organizations are undertaking a similar exercise to document oral knowledge or knowledge in the informal domains through the development of community knowledge registers. Chiefly led by NGOs, these registers attempt to rally community members to discuss and document their knowledge and practices in different categories of resource use or practices based on two premises: (1) that by documentation, they establish prior art over the knowledge and resource use, and (2) it promotes greater use and practice of the knowledge within the community, eventually reinforcing such use as strong social traditions.

Community biodiversity registers have been developed and promoted as *sui generis* documentation systems to protect biodiversity-related traditional knowledge (Gadgil et al. 2000). These have been incorporated in the national laws of various countries. In India, for example, these registers have been further executed through biodiversity management committees (the lowest level of governance unit) that are engaged in systematic documentation of local resources and knowledge. More recently, communities have been articulating their rights over their knowledge and resources by developing their own biocultural community protocols. Defined by communities, these highlight the legal rights that are vested in communities by virtue of international and national laws, and provide a self-description of the community profile, their resources, rights and responsibilities. They also provide an indication of the terms of engagement with external agents. These documents therefore can be viewed as legal tools to foster protection of the rights of communities.

These databases are useful for exemplifying the value of encouraging the development and improvement of community knowledge registers and biocultural protocols, and linking them with national databases for protection. They also show that it is necessary to build on and scale up good practices of ethical and equitable agreements with international collections and industries related to the use of traditional knowledge and natural resources for research or commercial purposes. Moreover, despite all their inherent challenges, web-based databases can also be an important tool for the exchange of information between ethnopharmacological studies and the public, and for the dissemination of information between researchers, planners and other users (Ningthoujam et al. 2012).

More recent trends show a process of “reverse engineering”, where traditional processes and methods are deployed for the development of mainstream novel products. This again raises questions of the commensurability of attributions to existing knowledge with the novelty definitions of intellectual property laws.

As most of the traditional environmental and medical knowledge among communities is oral in nature, revival of the social processes of their generation, preservation and transfer within communities needs to be well studied, despite all the inherent challenges associated with this. Furthermore, traditional medical knowledge can inspire industrial research and development processes in bioresource-based sectors, which require mechanisms to secure appropriate attribution and sharing of rights and benefits with knowledge holders, as set out in the text of the CBD and the Nagoya Protocol on Access to genetic
resources and equitable sharing of benefits arising from their commercial utilization.\textsuperscript{11} The example in Box 8 illustrates an initiative that attempts to integrate these issues while raising the capacities of multiple stakeholders in achieving better public health outcomes in Africa.

\textbf{Box 8: Capacity building on plant research for better public health in Africa}

The Bamako Global Ministerial Forum on Research for Health organized by WHO was held in November 2008 to strengthen research for health, development and equity. The Bamako call to action notably prioritized the development of policies for research and innovation in health, especially related to primary health care and the strengthening of research capacity by building a critical mass of young researchers (WHO 2008). It was this call to action that led to the creation of the Multidisciplinary University Traditional Health Initiative (MUTHI): Building Sustainable Research Capacity on Plants for Better Public Health in Africa, initiated in January 2010 and set to be finalized in December 2014.

The MUTHI project was established with European Union funding (Framework 7 Programme) to build more sustainable plant research capacity and research networks between key institutions in Africa (Mali, South Africa and Uganda) and a group of partner research institutions in Europe (Norway, UK and the Netherlands) to attain better health in Africa (MUTHI 2013). The project has provided a four-year capacity-building programme, in which African researchers are trained in all the necessary skills to produce and commercialize safe and standardized improved traditional medicines (ITM), and are trained in intellectual property rights (IPR) regulations and principles of access and benefit-sharing (ABS). The project is based on the needs of the African partner institutes to strengthen their ethnopharmacological research capacities in the area of ITM.

For more effectiveness, the MUTHI project has been divided into work packages that each focus on a different aspect of the project: (1) training in medical anthropological and ethnopharmacological research skills to conduct high-quality ethnobotanical and ethnopharmacological research on medicinal plants; (2) quality control of phytomedicines and nutraceuticals; (3) investigative bioactivity and safety of phytomedicines and nutraceuticals, with the objectives of assessing the needs of African institutes and developing the capabilities of researchers for bioassays, data management, quality assurance, bioactivity evaluation, safety aspects and developing guidelines; (4) identify researchers’ needs for clinical and public health training, and build the capacity of traditional medicine researchers on all aspects of the subject, including writing and data analysis; (5) examine ethics and IPR, aiming to assess training and education requirements for stakeholders on IPR, biodiversity legislation and regulation, ABS, and ethics of traditional medicine and research methods (Bodeker et al. 2014, Bodeker et al. 2015). A sixth work package is charged with project management.

The benchmark referenced in the MUTHI project is the Code of Ethics of the International Society of Ethnobiology (ISE), initiated in 1996 and completed in 2006. Contrary to other frameworks, the ISE Code of Ethics addresses the rights of the individual knowledge holders. Participants of the first work package conducting an ethnobotanical and retrospective treatment outcome study have been trained through workshops focused on research skills, ethics and IPR, and have received online guidance in writing their research proposals, including a section on research ethics and free prior informed consent (FPIC). The latter had to be established at individual and collective levels.

\textsuperscript{11} The Nagoya Protocol on Access to genetic resources and equitable sharing of benefits arising from their commercial utilization (Nagoya Protocol), adopted by the Tenth Conference of Parties to the CBD, was concluded on 29 October 2010 in Nagoya, Japan. It provides the framework to facilitate access and benefit sharing. See http://www.cbd.int/nagoya/outcomes/
6. Ways forward

Despite the multiplicity of policies, goals and targets to address health, environment and development challenges, we are still far from achieving the stated objectives of policy forums, chiefly because of a lack of synergy and integration in policy implementation. Moreover, mainstream health sector practices often continue to neglect broader determinants of health or intersectoral linkages to health. There is increasing recognition from the academic community and public alike that no single system of knowledge can solve the mounting problems of humanity (Rai et al. 2010; Bodeker and Burford 2007), and a more comprehensive multidisciplinary and pluralistic strategy is needed.

One possible way forward to address the interconnected issues of conservation (of knowledge and biological resources), and equitable and affordable health-care provision is to undertake an integrated approach with the full involvement of communities. However, there is no universal way to achieve this goal and no homogeneous methodology that can be applied (Wage et al. 2010). Traditional knowledge on health and biological resources is by its very nature context specific. Culturally sensitive and locally appropriate approaches are required (see also the chapter on mental health in this volume).

Some multipartner initiatives, such as the Biodiversity and Community Health (BaCH) Initiative, attempt to pool the individual strengths of different agencies to synergize multiple efforts to achieve biodiversity conservation, and health and development, especially at the local levels of implementation. Launched as a global multistakeholder initiative in 2012 during the eleventh Conference of the Parties to the CBD in Hyderabad, India, it primarily aims to develop and mainstream community health approaches by supporting traditional knowledge and biodiversity conservation, and promoting the sustainable use of biological resources by building on lessons learned. It also aims to exchange knowledge with partners from both the government and nongovernment sectors, as well as international organizations.

The Initiative underscores the role of the ecosystem as a reliable and low-cost service provider, and supports sustainable natural resource management. It also revitalizes effective traditional medical knowledge and local remedies by developing knowledge, skills and capabilities of the populations living in close proximity to biological resources. Under the coordination of the United Nations University Institute for the Advanced Studies of Sustainability (UNU-IAS), the BaCH is simultaneously addressing the following objectives: (i) the integration of conservation priorities in health system planning; (ii) raising the contemporary relevance of traditional medicinal practices; (iii) identifying and piloting best practices for local innovations through livelihood programmes and for self-reliant health systems; and (iv) operationalizing a comprehensive health and well-being approach by working with relevant stakeholders and actors.
6.1 Innovations and incentives

It is important to leverage and strengthen the high patronage for traditional medical care to improve public health outcomes and achieve the reemerging broader objectives of “Health for All” (WHO 1998) and “Good Health at Low Cost” (Balabanova et al. 2013). This requires enabling decentralized approaches that allow better access to health care, are culturally sensitive and contribute to more comprehensive knowledge on the use of biological resources and health.

Implicit to decentralized conservation measures is the need to strengthen local innovation. This may be achieved through awards, assistance for livelihood programmes based on medicinal resources and local enterprises, appropriate intellectual property protection, and relevant cross-sectoral collaboration at all levels. It is further relevant to develop the capacities of traditional health practitioners to provide safe and effective health care, and build sustainable partnerships with different collaborators (Brewer 2014). Mechanisms for the protection of such traditional knowledge resources, prevention of their erosion and linking them with scientific research are related areas that also need further attention.

The value chains of traditional medicine and, generally, medicinal resources are often linked to various sectors, with much of the primary supplies provided by local communities reliant on the same ecosystems and life-supporting services they provide. Harnessing their knowledge on the identity and use of medicinal resources, and their sustainability can be strengthened by improving the economic returns from their efforts by promoting value-added activities at the local level. Encouraging the development of enterprises based on medicinal and nutritional resources and services, and of new, appropriate and feasible technologies that could enhance productivity and quality of resources would further complement conservation measures, as they serve as economic and social incentives. Examples of innovative strategies and initiatives linking conservation and community health are described in Boxes 9 and 10.

Box 9. Community livelihoods – linking conservation with community health

There are several successful cases that highlight how the sustainable management of medicinal plants can impact community livelihoods, leading to income generation and improved community health (see, for example, Hamilton 2004; Hamilton & Hamilton 2006).

One such initiative is the Muliru Farmers Conservation Group, a community-based organization located near Kakamega forest in western Kenya. The group generates income through the commercial cultivation and secondary processing of an indigenous medicinal plant, *Ocimum kilimandscharicum* to produce the Naturub® brand of medicinal products.

The enterprise reduces pressure on the biodiverse Kakamega forest by offering an alternative to the exploitation of forest resources, while the commercialization of the medicinal plant has heightened local appreciation of the value of the forest’s biodiversity. Over half of the project participants are women and 40% of participants rely entirely on this initiative for their income. The enterprise invests a portion of its revenues in forest conservation and biodiversity.

Since the processing facility opened, over 770 tons of community cultivated *O. kilimandscharicum* leaves have been processed. Over 400 000 units of Naturub® products have been sold in both urban and rural areas of Kenya. The products have received wide acceptance in the market. The total revenue from the project thus far has been over US$ 70 000. Currently, over 360 rural households cultivate the plant on smallholder farms.
Cape Town, South Africa is home to a vast trade in medicinal plants, with 262 tonnes of wild medicine being harvested from within the city annually (Petersen et al. 2014a; Reid 2014). The illicit harvest of plant material from the city’s protected areas, prompted by local demand and the economic marginalization of many healers, has brought herbalists and conservation authorities into conflict. The intersection of conservation priorities, livelihoods based on wild-harvested plants, and health and well-being has resulted in a conservation conundrum (Petersen 2014b). It was in light of this conundrum that the Sustainable Livelihoods Foundation, a nongovernmental organization based in Cape Town, collaborated with Rasta bushdoctor (herbalist) partners to establish “Herbanisation”.

Herbanisation is an open-access, medicinal street garden project based in Cape Town. The project aims to green degraded streetscapes in economically marginalized areas while contributing to the livelihoods of local Rasta and Khoi herbalists, and reconnecting community members with medicinal plants and indigenous knowledge. Herbanisation began as a pilot project of 250 medicinal plants in 2012. Originating in Seawinds, an area of high unemployment and many social ills such as gangsterism, drug abuse and violence, the garden was established on a pavement beside an existing community nursery, with open access to local healers and the community. The project wanted to connect, heal and green the community through plants. Since the inception of the pilot project in 2012, Herbanisation has expanded to include approximately 1700 plants in Seawinds, Cape Town, and is set to reach 4500 by mid-2015.

Herbanisation has already resulted in groundbreaking engagement between Rasta herbalists, conservation bodies and local botanical organizations. In addition, the project is strengthening linkages between park activities and urban conservation efforts, making local nature a key driver of urban renewal efforts. In terms of the impact on the local neighbourhood, many Seawinds residents and local traditional healers harvest from the Herbanisation street gardens in order to treat themselves and their families. Not only does this contribute to the health and well-being of the local community, but it also empowers individuals to take their health into their own hands and feel proud of their role as indigenous knowledge bearers.

Three guiding principles have been key to the success of the project to date. First, work with local champions: our project was born out of a partnership with Neville van Schalkwyk, an accomplished gardener and Rasta herbalist elder in Seawinds. Working with established, respected and dependable individuals is key to project longevity and success. Second, use gardens as vehicles: while providing herbalists and the community access to medicinal plants is a key aspect of the project, the gardens also serve as places and processes through which conversation is enabled between herbalists, conservation authorities and the government. This is vital in linking grass-roots community efforts with regional policy design and implementation. Third, apply open-access principles: we have chosen to establish gardens on disused public open spaces where plants are freely accessible to the local people. This model encourages interaction between people and plants, while stimulating knowledge exchange and fostering a sense of community participation and ownership.

Box 10. Herbanisation: an open-access, medicinal street garden project for greening, healing and connecting in Cape Town, South Africa
These cases highlight that promoting enterprises through traditional medicinal resources and products – where stakeholders in close proximity to biological resources and knowledgeable about their use also gain a fair share from the value chain – are successful models that can address both improved livelihoods and sustainable natural resource management.

6.2 Capacity and research needs and development approaches

Sustainable medicinal resource management for both captive breeding and wild collection is important for the future of traditional medicine. It should involve all stakeholders, including conservationists, private health-care sector, medical practitioners and consumers. It is important to increase partnerships at the local, national, regional and global levels by supporting/facilitating enhanced networking among various stakeholders, such as in value chain partnerships, and learning partnerships among and between peer groups. Good examples include the development of standards and certification schemes, such as the FairWild Standard developed by TRAFFIC, International Union for Conservation of Nature (IUCN), World Wildlife Fund (WWF) and other partners in a multistakeholder, inclusive consultation process as a best practice tool to verify that the wild collection of plants is ecologically sustainable and trade is equitable. A complementary initiative is the BioTrade Verification Framework for Native Natural Ingredients developed by the Union for Ethical BioTrade. These efforts enable monitoring of collection and trade practices, and tracing the movement of resources, in addition to fostering sustainable use practices that allow benefits to different actors in the supply chain. Furthermore, such partnerships could potentially enable the facilitation of financial support mechanisms to promote research and development, capacity development and awareness activities related to traditional medical knowledge.

Traditional approaches to health care have been tested empirically, albeit without adequate documentation. Documenting such experiences and thereby fostering a participatory learning process to identify and supplement current practices in a culturally sensitive way is a significant challenge. As seen from the examples from Palau, Mali and India, there is also value to be gained from reflexive methods of capacity development, which foster learning between experts external and internal to the traditional medical systems, at various levels of operation, including the sustainable use and protection of the resources.

Further research is also needed to assess the individual and combined impact of drivers of change at the local, national and global scales, which lead to the loss of species used for food, traditional medicines or as the basis for pharmacological compounds. Unsustainable harvest, land-use change, urbanization, illegal trade and climate change are among the key drivers that have already hindered access to and the potential long-term viability of these resources. It is important to examine the response of medicinal plants and other pharmacological compounds to climatic changes. Interdisciplinary research in this area can provide valuable insights to public health and conservation scientists, policy-makers and local communities, who depend on them for their health, livelihood and well-being.