

Governing the yarshagumba ‘gold rush’: a comparative study of governance systems in the Kailash Landscape in India and Nepal

Corinna Wallrapp

Georg-August University of Goettingen, Institute of Geography, Germany
corinna.wallrapp@gmx.de

Markus Keck

Georg-August University of Goettingen, Institute of Geography, Germany
markus.keck@geo.uni-goettingen.de

Heiko Faust

Georg-August University of Goettingen, Institute of Geography, Germany
hfaust@gwdg.de

Abstract: Under present conditions of economic globalization, social-ecological systems undergo rapid changes. In this context, internal and external forces put heavy pressure on the governance systems of commons to adapt effectively. While institutional learning has been identified as a key element for the adaptive governance of social-ecological systems, there is still limited knowledge of what roles communities and governmental actors play in these processes. In this study, we take the case of yarshagumba (English: caterpillar fungus), a formerly non-valued product in the Himalayas, which has recently been transformed into a highly valuable resource within a short time. We compare the governance systems in collection sites in the Kailash Landscape in India and Nepal by using an analytical framework developed by Pahl-Wostl. Our findings show that in these remote mountain areas, communities and community-led organizations are highly flexible in responding to immediate resource value changes by establishing communal management arrangements. At the same time, however, communities have difficulties to enforce their newly developed informal and formal arrangements. During the process of learning the link between the amendment of arrangements on community-level and the revision of formal policies and frames at the state or national level is only partly established. Against this background, we argue that in the context of rapid change, adaptive governance requires the concerted

interaction of actors at the local and the national levels in order to enable the sustainable use of common pool natural resources.

Keywords: Access rights, adaptive governance of commons, Himalaya, learning, *ophiocordyceps sinensis*

Acknowledgement: We would like to thank the informants for their hospitality and time, and the information they provided during the interviews. We are also thankful to Dr. Rajan Kotru (ICIMOD), Dr. Tashi Dorji (ICIMOD), Dr. R.S. Rawal (GBPNIHESD), Ms. Eileen Lemke, Mrs. Kristin Cain, the Central Himalayan Environment Association (CHEA) and the Api Nampa Conservation Area (ANCA). We acknowledge the support of Dr. Vishwas Chitale (ICIMOD) for his work on the study area map and Mr. Ashish Chaudary for his constant assistance in the field. We like to thank the International Centre for Integrated Mountain Development (ICIMOD), Deutsche Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung/Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, the German Research Foundation and the Open Access Publication Funds of the University of Göttingen for their financial support.

I. Introduction: yarshagumba – a highly valuable resource

“Let them [the authorities] say whatever they say, we are going for collection.” (Woman from Pangla, India, April 2017 – *English translation, original language Hindi*)

Most of the high alpine grasslands in the Himalayas of Nepal and India are still used as summer pastures for livestock grazing (Bauer 2004). Traditionally, these pastures have been common properties governed by communities through local committees, guided by social norms, common beliefs and socially and culturally shared understandings (Herrera et al. 2014; Pandey et al. 2017). In the late 1990s, *Ophiocordyceps sinensis* (English: caterpillar fungus; locally known as yarshagumba¹), a highly valuable product, was discovered on these grasslands at altitudes between 3000 and 5200 m (Winkler 2009; Shrestha and Bawa 2013, 2014). Caterpillar fungus is collected by hundreds of thousands of people in the Himalayas of India, Nepal and Bhutan each year and traded by middlemen as a medicinal product, mainly to China (Shrestha and Bawa 2013; Baral et al. 2015).

¹ In Tibetan language yarshagumba is called *yartsa gunbu*, which means ‘winter worm – summer grass’ (Winkler 2008). Yarshagumba is an endoparasitic complex formed by the fungus *ophiocordyceps sinensis* and the host larva of different moth species (Negi et al. 2016). For more details on the biology and usage of yarshagumba see Winkler (2008) and Negi et al. (2016).

In the late 1990s the demand on the Chinese market for yarshagumba transformed fundamentally, leading to a tremendous rise in prices (Winkler 2008; Yeh and Lama 2013). The high prices for yarshagumba and the perceived easy cash income opportunity for locals triggered a 'gold rush' in the Himalayan Mountains. The sudden run of collectors to the yarshagumba collection sites led to conflicts about access and uncontrolled usage of the resource (Negi et al. 2006; Shrestha and Bawa 2013). Especially collectors from distant villages, hereafter called "distant collectors," have exacerbated the pressures on the social-ecological systems (Pant et al. 2017). Over the last decades the governance systems in these high alpine areas where yarshagumba is collected, have struggled to adapt to these changes and to set up and enforce management mechanisms for its sustainable collection (Cannon et al. 2009; Negi et al. 2006; Winkler 2009; Weckerle et al. 2010; Childs and Choedup 2014; Baral et al. 2015). Today, the collection is influenced by governance systems consisting of both formal governmental institutions and informal communal management arrangements (Cannon et al. 2009; Weckerle et al. 2010; Childs and Choedup 2014; Negi et al. 2015; Caplins 2016; Pant et al. 2017).

This development in the Himalayan Mountains brings up the question of how actors and institutions in remote areas govern commons when rapid changes in the social-ecological system occur. Over the last decade scientists identified adaptive governance and learning processes as essential elements for governing social-ecological systems during periods of abrupt change (Dietz et al. 2003; Folke et al. 2005; Pahl-Wostl 2009; Plummer et al. 2013; Karpouzoglou et al. 2016). However, they note, "our knowledge about resource governance systems and how they change [to deal with present and future challenges] is [still] quite limited" (Pahl-Wostl 2009, 254).

Contributing to this on-going research area, we focus our analysis on the adaptive capacity and learning processes of resource governance systems in remote mountain areas using the case of yarshagumba collection. We compare resource governance systems in the collection sites of two settings in the Kailash Landscape²: in the Kumaon region of Uttarakhand State in India and in the adjacent protected area of the Api Nampa Conservation Area (ANCA) in Nepal. These two regions differ in terms of both legal and social context. In India, the commercial collection of yarshagumba is legal only in community forests managed by *van panchayats* (community forest councils) with the approval of the State Forest Department (Uttarakhand Biodiversity Board 2017). However, collectors harvest yarshagumba wherever possible – within state forests or protected areas – regardless of property rights and legal status (Negi et al. 2016). In Nepal, in contrast, yarshagumba collection and sale in all community forests and conservation

² The Kailash Landscape comprises a transboundary region of Uttarakhand State, India, Pulan County, China and parts of far western Nepal. The landscape is part of an initiative steered and implemented by the governments of China, India and Nepal and the International Centre for Integrated Mountain Development (ICIMOD).

areas is legal (MoFSC 2017), but conflicts regarding access between villagers and distant collectors are common (ICIMOD 2015; Pant et al. 2017).

While comparing different resource governance systems we aim to understand how these systems respond to a rapid increase in the economic value of an available resource. The two types of systems we compare are (1) formal governmental institutions and (2) communal management arrangements, which consist of both formal committees composed of community members, and informal arrangements based on a variety of norms, and both of which are essentially community-led. Further, we ask what strategies governments and communities use to protect or gain access to these resources. We focus our case study on the following research questions: What developments can be identified in the institutional settings and the management mechanism in areas where yarshagumba is collected? What are the learning process of governmental actors, communities and formal and informal institutions, and how do these influence each other in the process of adapting to rapid changes in the high alpine grasslands of India and Nepal? Based on these questions we formulate the following hypothesis: When the economic value of a common resource in a remote mountain area increases and other changes are subsequently triggered, communities are relatively more flexible in adapting their management of the common resource than government authorities, irrespective of the legal setting of the area.

We apply the analytical framework of Pahl-Wostl (2009) for analysing the adaptive capacity and learning processes in resource governance systems, which is further elaborated in Section 2. Section 3 provides details about the study area and the data collection and analysis. The analysis of the changes in the governance systems in India and Nepal where yarshagumba is collected, namely, the formal and informal institutions, the involved state and non-state actors and the multi-level interactions and integration is presented in Section 4. Further, in Sections 5 and 6, we analyse and discuss the roles of governments and communities during learning processes for adapting to rapidly changing conditions and, finally, draw our conclusions.

2. Conceptual framework

Most natural resources, like forests and grazing grounds, are common pool resources (Acheson 2006). Common pool resources, like yarshagumba, are subtractable, which means the resource consumed by one person cannot be used by another. Secondly, it can be difficult to exclude other people from using the resource (Ostrom 1990). It is rational for everyone to free ride on the efforts and costs of others when incentives for sustainable usage are lacking (Ostrom 1990; Agrawal 2003; Ostrom 2005). This collective-action problem applies also to the collection of yarshagumba in the high alpine grasslands. The solution to sustainably managing such a common pool resource is to establish rules curtailing the resource access and use (Dietz et al. 2003; Acheson 2006).

Social-ecological systems are dynamic. Changes within or outside social-ecological systems demand constant adaptation and proper responses by actors and institutions (Young 2009). Sudden changes can be triggered by external factors, such as changes in market demands or the emergence of new actors, as well as internal factors, such as a change of power relations between actors or overlapping institutions (Anderies et al. 2004). Often changes trigger other changes or reinforce each other (Young 2009). In our case the price increase of yarshagumba in the Himalayas has modified access demands of governmental actors, community members and distant collectors, which has further triggered power struggles and conflicts between actors.

The search for the governance system best suited to maintaining the sustainability of resources within dynamic social-ecological systems has been under discussion for many years, whether local-level management, government regulations or private property rights (Hardin 1968; Ostrom 1990; Baland and Platteau 1996; Dietz et al. 2003; Folke et al. 2005; Acheson 2006; Pahl-Wostl 2009). Governmental actors, especially in remote areas, are likely to face challenges regarding the enforcement of regulations due to limited human and financial resources or resentments by holders of customary rights (Acheson 2006). Private property does not play a role in our case study. Dietz et al. (2003) argue that local communities could manage common pool resources effectively, but they usually have challenges when sudden changes occur. Often, the change in demand and increased value of local resources overstrain the ability of local institutions to regulate the resource use in a sustainable way. Communities usually have difficulties applying sanctions and enforcing communal arrangements outside their closed community structure (Ostrom 2010).

In the last decades, researchers have argued for more complex governance systems such as 'adaptive co-management' and 'adaptive governance' (Dietz et al. 2003; Folke et al. 2005; Olsson et al. 2006; Plummer et al. 2013; Karpouzoglou et al. 2016), 'polycentric institutions' (Ostrom 2005) or 'hybrid institutions' (German and Keeler 2010). These approaches have in common the idea that, for governance to be effective, it "should employ mixtures of institutional types that employ a variety of decision rules to change incentives, increase information, monitor use and induce compliance" (Dietz et al. 2003, 1910). They differ in terms of setting the priorities of governance structures and in the criteria they use to evaluate the performance of governance systems for sustainability of commons (Agrawal 2003; Karpouzoglou et al. 2016; Sharma-Wallace et al. 2018).

Governance systems that negotiate and share rights, responsibilities and power among different levels and sectors of government and civil society are assumed to encourage innovation, learning, adaptation and cooperation among actors to deal with unexpected changes (Folke et al. 2005; Huitema et al. 2009; Pahl-Wostl 2009; Young 2009; Ostrom 2010; Pahl-Wostl et al. 2013; Sharma-Wallace et al. 2018). Adaptive capacity is defined as the "ability of a resource governance system to first alter processes and if required convert structural elements as a response to experienced or expected changes in the societal or natural

environment” (Pahl-Wostl 2009, 355). Learning is considered to be “an exploratory, stepwise search process where actors experiment with innovation until they meet constraints and new boundaries” (Pahl-Wostl 2009, 358). The adaptive capacity of governance systems determines the learning processes and developments of institutions when sudden changes occur.

Pahl-Wostl (2009) developed an analytical framework to analyse different stages of societal learning in resource governance systems. Different from other analytical frameworks related to resource governance, such as the Institutional Analysis and Development Framework (McGinnis 2011; Binder et al. 2013), Pahl-Wostl (2009) focuses specifically on the adaptive capacity and learning processes in resource governance systems in response to changes. Her framework helps to analyse developments and learning processes within systems over time. Therefore, her approach will be used to analyse and compare resource governance systems and the associated learning processes in our study.

These multi-level and multi-loop learning processes range from incremental learning (single-loop learning) to structural change (triple-loop learning). Single-loop learning refers to a gradual improvement of actions towards a strategic goal without questioning the underlying assumptions. Double-loop learning refers to a reflection of assumptions, for example about cause-effect relationships within a value-normative framework. In triple-loop learning, one begins to reconsider underlying values and beliefs to transform the context within which the governance system is embedded. Keck (2016) calls this transformative capacity. Triple-loop learning implies a transformation by changing the strategic goals and regulatory frameworks rather than optimizing adaptation strategies. Adaptive change remains largely within the reigning paradigm and structural context set by the formal policy process. Thus, adaptive change processes are within single and double-loop learning (Pahl-Wostl et al. 2013).

Pahl-Wostl (2009) has identified elements of governance systems that are key for these learning processes including institutions and actors, the relationship of state and non-state actors, the multi-level interactions across administrative boundaries and vertical integration, and the governance modes distinguishing bureaucratic hierarchies, networks and markets. The interplay of these elements determines the adaptive capacity of governance systems to alter processes and structures (Pahl-Wostl et al. 2013). This leads us to a comparative analysis of roles of communities and governmental actors in learning processes when sudden changes occur, using the case of yarshagumba collection in remote Himalayan regions of India and Nepal.

3. Study sites and methods

3.1. Study sites

The Kailash Landscape is one of the main areas of Nepal and India from which yarshagumba is collected. According to official national data, the conservation area ANCA in Nepal provides amounts of between 629 and 954 kg of yarshagumba

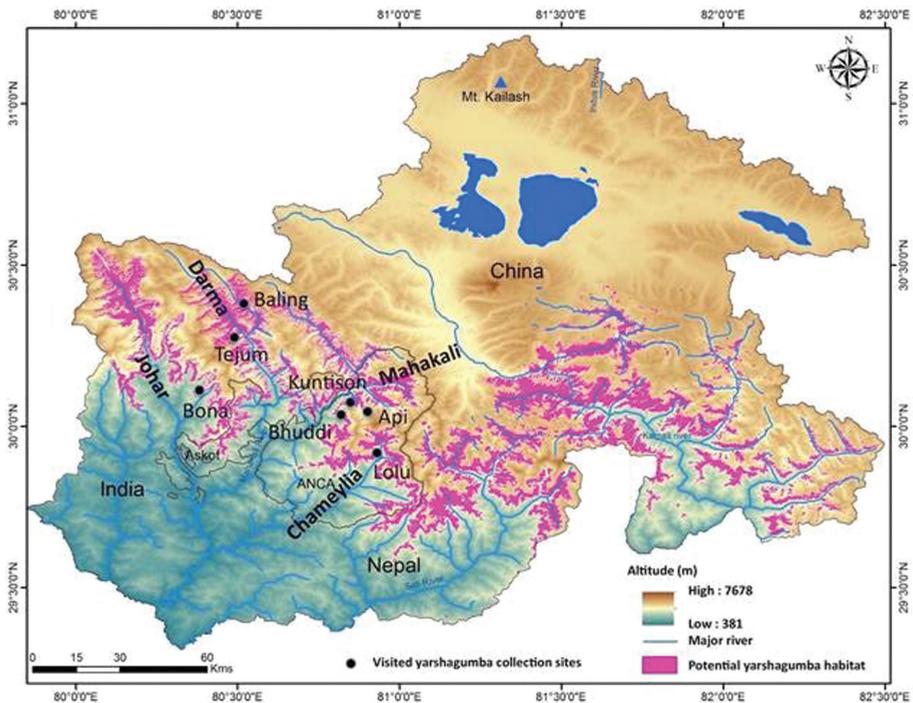


Figure 1: Map of study area and potential yarshagumba habitat (own source, based on ICIMOD (2017)).

annually (ANCA 2018 unpublished). The total harvest in the adjacent Kumaon Region, Uttarakhand State, India, amounts to around 350 to 600 kg per year (Negi et al. 2016). The study area map (Figure 1) shows the potential habitat of yarshagumba in the Kailash Landscape (total area approximately 1129 square metres)³.

In the Kailash Landscape, two ethnic groups are predominant: the Rang community, who in Nepal are known as the Shauka, located in the upper parts of the Johar, Darma (India) and Mahakali valley (Nepal), and the Hindu community, located in the Chameyilia valley (Nepal) and in the lower parts of Darma valley (India). The Rang/Shauka community traditionally practices transhumance. Over centuries, they have established strict customary laws to regulate access to and usage of their pasture areas (Hoon 1996; Leder 2003), which are now yarshagumba collection sites.

³ We calculated the potential habitat for yarshagumba in the Kailash Landscape using as basis the land cover layer of high alpine grasslands of the Kailash Sacred Landscape vegetation map (ICIMOD 2017), adding the criteria of precipitation (250 to 450mm), slope degree (0 to 15 degrees) and height (3200 to 5000masl) referring to the listed criteria for determining yarshagumba growth in Negi et al. (2015). Inaccuracy of data is possible.

Over the last decade, the rising market price of yarshagumba has influenced and changed the livelihood strategies of the majority of communities in the high Himalayan Mountains (Childs and Choedup 2014; Shrestha and Bawa 2014; Shrestha et al. 2017). Today, according to a recent study in ANCA (Nepal) the “average household cash income from *O. sinensis* is USD 2174 [...] confirming the dominant role of *O. sinensis* in cash generation“ (Pouliot et al. 2018, 65).

The empirical fieldwork was conducted in four valleys of the Kailash Landscape: in two valleys in the Kumaon Region (India) – Darma and Johar valleys – and two valleys of ANCA (Nepal) – Mahakali and Chameylia valleys, (see Figure 1). The selection of the study areas is based on different existing institutional settings, property rights and management systems in the yarshagumba collection sites. Individual sites are very remote, therefore the accessibility of the sites additionally had to be considered. Using these criteria we chose seven collection sites in four valleys for our case study: Bona, Baling and Tejum in India

Table 1: Characteristics of the surveyed collection sites.

| Location | Key characteristics of the collection site |
|----------------------------------|--|
| India | |
| Bona – Johar valley | <ul style="list-style-type: none"> – Site located within state forest – Traditional grazing institutions – Closed site – access exclusively for selected community members (Rang community) |
| Baling – upper Darma valley | <ul style="list-style-type: none"> – Site located within community managed forest – Traditional grazing institutions – Closed site – access exclusively for selected community members (Rang community) |
| Tejum – lower Darma valley | <ul style="list-style-type: none"> – Site located within state forest – Closed site – access exclusively for selected community members (mixed community of Hindus and Rang) |
| Nepal | |
| Api – upper Mahakali valley | <ul style="list-style-type: none"> – Site located within community managed forest and protected area ANCA – Traditional grazing institutions – Closed site – access exclusively for selected community members (Shauka community) |
| Buddhi – upper Mahakali valley | <ul style="list-style-type: none"> – Site located within community managed forest and protected area ANCA – Open site – access not restricted (mainly Hindu community from various villages) |
| Kuntison – upper Mahakali valley | <ul style="list-style-type: none"> – Site located within community managed forest and protected area ANCA – Closed site – access exclusively for selected community members (Shauka community) |
| Lolu – Chameylia valley | <ul style="list-style-type: none"> – Site located within protected area ANCA – Open site – access not restricted (mainly Hindu community from various villages) |

and Api, Buddhi, Kuntison and Lolu in Nepal (see Table 1 for details about the characteristics of each site).

3.2. Data collection and analysis

The empirical research is comprised of qualitative data collected through key informant and in-depth interviews, focus group discussions and participatory field observation. The interviewees included government officials on central, state and district levels, local leaders, community members, traders, collectors from various backgrounds with different gender and age and relevant researchers from the region. In total 20 interviews with representatives of higher authorities, like national and state departments, were conducted. Additionally, 30 representatives of local authorities, like *van panchayats* and ANCA Conservation Committees, and 62 community members were interviewed and 13 focus group discussions with community members and traders were organised in 2016 and 2017 (Table 2). The interviews and focus group discussions were mainly conducted at the collection sites or in nearby villages. Both men and women come for collection to the sites. However, fewer women were interviewed because they were more reluctant to answer questions and speak with outsiders.

As some aspects, like negative implications of government regulations or social conflicts between different community groups, are considered sensitive and difficult to discuss openly with interviewees, participatory field observation was used as an important method for building trust between the interviewer and community members. Additionally, several policies, guidelines and directives of India and Nepal guiding natural resource management and non-timber forest product (NTFP) collection and trade were reviewed.

For the data analysis we chose the content analysis following Mayring (2015). The interviews were translated from Hindi or Nepali into English and transcribed afterwards. Field notes were taken in order to document other observations, focus group discussions and informal conversations. Following fieldwork, the texts were categorized and coded according to defined units of analysis, like formal

Table 2: Interviews and focus group discussions conducted in 2016 and 2017.

| | Local authorities (forest department, ANCA, police) | | Community members (collectors, traders, villagers) | | Participants of focus group discussions | |
|-------|---|--------|--|--------|--|--------|
| | Male | Female | Male | Female | Male | Female |
| India | 13 | 1 | 24 | 3 | 35 | 17 |
| | Total 14 | | Total 27 | | Total 52 (7 mixed FGD) | |
| Nepal | 14 | 2 | 25 | 10 | 18 | 9 |
| | Total 16 | | Total 35 | | Total 27 (6 mixed FGD) | |
| Total | 30 | | 62 | | 13 FGDs | |

and informal institutions, types of actors and management mechanism. Finally, the results were interpreted, compared and discussed.

4. Results – development of yarshagumba governance systems

4.1. India: Kumaon Region, Uttarakhand State

The high alpine grasslands in the Kumaon Region are traditionally used as summer pastures and were never of great interest for the Indian state authorities (Gerwin and Bergmann 2012; Pandey et al. 2017). The State Forest Department hardly intervened in the local-level resource management systems for livestock grazing, although technically, all forests and grasslands in the Uttarakhand State are under their overall responsibility and supervision to manage and conserve the available resources (Singh 2016).

According to the current legislation⁴, the collection of NTFP in the wild is illegal in India. This regulation is valid for unclassified forests, state forests and protected areas, except within community forests under the management of *van panchayats*. The collection of NTFPs for personal use was never restricted, but the commercial collection and sale of the products was either prohibited (in the case of rare and endangered species) or permissible in *van panchayats* on the condition that the harvested quantity would be sold via an auction system organised by the State Forest Department (Pauls and Franz 2013; Singh 2016).

Specifically with regards to yarshagumba collection, the State Forest Department formulated a government order in 2013 to regulate its collection and sale, which falls within the remit of *van panchayats*. The Government Order of Uttaranchal State (former name of Uttarakhand State) Forest Department 1790/18.1.2002 authorised 20 *van panchayats* in Johar valley to hand out passes to community members for yarshagumba collection and provides regulations for sustainable collection and camp management.

The implementation of the Government Order has failed, however, because of the limited cooperation between the State Forest Department and local authorities. The limited support and presence of officials in the remote sites makes it difficult for *van panchayat* leaders to manage the available resources in accord with the regulations. Further, through the high level of bureaucracy and lack of consultations before issuing new guidelines or directives, the local leaders felt their demands were not recognised and valued by the state authorities, as the following two statements of community members highlight:

⁴ Relevant national policies: The Forest Conservation Act 1980, the Wildlife Protection Act 1972 with amendments in 1992, 2002, 2003 and 2005, the Scheduled Tribes and other Traditional Dwellers (Forest Right) Act 2006 and the Biological Diversity Act 2002 and Rules 2004; relevant state policies: Bhotia Grazing Rules 1927, Uttaranchal State Panchayati Forest Rules 2006. For more details about the Indian legislation related to NTFP and yarshagumba collection see Caplins (2016).

There was a new directive that we [*van panchayat* leaders] have the permission to give out passes to villagers for collection of yarshagumba. But nobody was authorised to buy it directly. It did not make sense. They did not even consult us beforehand. (*van panchayat* leader in Munsyari, India, April 2017 – *English translation, original language Hindi*)

I think, it [the policy] doesn't matter. The foresters are not present on the ground anyway. For good management it needs strong community structures. (Community leader in Dharchula, India, January 2017 – *English translation, original language Hindi*)

De-facto, irrespective of policies and governmental regulations, people in the Kumaon region – including both community members and distant collectors – collect in all possible locations where yarshagumba can be found, and sell it through their own systems (Negi et al. 2016). See Annex 1 for some photographs of yarshagumba collection in the Kailash Landscape.

The governmental institutions are weak in controlling the collectors and resource extraction. However, the local communities have a strong interest in gaining or protecting access to sites where yarshagumba is found and limiting its collection. For that they have built up communal management arrangements specific to the conditions of each site. In the following we present different examples of management arrangements that have been set up by the communities and community-led organizations as a response to the rapid changes in the high alpine grasslands due to the high value of yarshagumba (refer also to Table 1 in Section 3 for details about the key characteristics of each collection site in India and Nepal).

In Baling, upper Darma valley, the villagers are solely from the Rang/Shauka community and the local yarshagumba collection site lies with the boundaries of the *van panchayat* of Baling. The *van panchayat* plays a crucial role in regulating and managing the natural resources required on a daily basis by its community members. Their rights consist of excluding outsiders, extracting fodder and timber for personal usage, regulating grazing of livestock and formulating local management rules (Agrawal and Ostrom 2001; Singh 2016). The communities make use of these rights to regulate yarshagumba collection by excluding distant users and only enabling collection for community members from that village (closed site). The *van panchayat* of Baling has limited the collection period and set rules for managing the campsites. Also on specific religious and cultural days collection is prohibited, as the statement of a community member describes:

On the next day is a puja [religious ceremony] in the village. So, all people, who are up in the collection site will come down for that afternoon. Not everyone agrees to that, especially the youth, but there is no other option. (Community member from Baling, India, June 2017 – *English translation, original language Hindi*)

In contrast, another example shows that social norms and beliefs also change over time and some are not accepted by all community members anymore:

All these mountains are sacred to the [Rang] people. One of these beliefs is that women, especially during their period but even in general, are not allowed to go to the high mountain areas. But nowadays people do not support that belief anymore. Women and children are also collecting. (Researcher C.S. Negi, Pithoragarh, India, August 2016)

Consequently, according to the interviewee, more community members – men, women and children – go for yarshagumba collection each year and the competition between collectors therefore increases. Although the economic impact of yarshagumba has influenced and in some cases transformed local traditions, the existence of common social norms and beliefs facilitates designing, enforcing and monitoring rules as well as sanctioning collectors for violations, as the rules are socially accepted by the whole community.

Other communal management arrangements for yarshagumba collection, like in Bona, Johar valley, are built on traditional grazing rights. For centuries, local institutions have effectively regulated the limited resources in the grazing grounds (Herrera et al. 2014). The grazing system included well-defined boundaries, payments for resource usage and graduated sanctions for violations, which has historically ensured a sustainable usage of the limited resources (Negi et al. 2015). The same system is used to regulate the yarshagumba collection in Bona. The community has transferred traditional grazing rights to yarshagumba collection. Additionally, the community has designed rules limiting the collection period and area, as well as implemented entrance fees and fines for violations. They use the pre-established traditional systems and adapt them to the changing conditions.

In collection sites that are not within the official boundaries of *van panchayats*, but lie within state forests, or are not traditional grazing grounds, like in Tejum, lower Darma valley, local leaders negotiated access to a yarshagumba collection site with neighbouring communities as soon the run for yarshagumba collection started. Each community got access to one specific site. As the community leaders are socially accepted and respected by community members, these arrangements are legitimized in these communities, and therefore enforced. This has ensured that all nearby communities have access to a site, which has reduced disputes and conflicts related to it.

In addition to the State Forest Department, new governmental actors for natural resource management have emerged on state and local levels in recent years: the State Biodiversity Board and Biodiversity Management Committees (BMCs). Comparing the rights and functions of the actors on village level, the functions of the BMC overlap with rights of the *van panchayats*, especially regarding the regulation of access to resources by community members. The BMCs are legalised through the national Biodiversity Conservation Act (2002)⁵. So far 14 BMCs have

⁵ The Biodiversity Conservation Act ensures that benefits derived from the utilization of biological resources and associated knowledge by companies are shared with the claimer of the benefits including communities through the local BMC. Each BMC documents its biological and genetic resources and provides permits for each commercial sale of its resources (Uttarakhand Biodiversity Board 2017).

been established in the region, but are not yet fully functional, nor fully socially accepted and integrated into the existing local natural resource governance systems. Currently, our data show that the *van panchayats* are more influential on local level, the *van panchayat* leaders are better recognised and their decisions and actions are legitimated by the community members. However, in the future, the *van panchayats* might be replaced by the BMCs in the communities, if BMCs receive more financial resources and governmental support and therefore accumulate more authority and power.

4.2. Nepal: Api Nampa Conservation Area (ANCA), Darchula District

According to national policies in Nepal collection and sale of NTFPs including yarshagumba is legal, but the yearly total quantity of collected yarshagumba for a protected area is restricted by the Department of National Parks and Wildlife Conservation (DNPWC). In 2017, 690 kg was the fixed amount for ANCA (ANCA 2018 unpublished). The ANCA authority collects royalties for yarshagumba collection, which currently amounts to 25.000 NPR per kg (250 USD) (MoFSC 2015). Subsequently, ANCA makes approx. 17.3 Mio NPR (173.000 USD) in revenue per year only from yarshagumba collection.

Similar to India, in Nepal community-led organizations also play a key role in the management of high alpine grasslands. Since the 1990s, the Forest Department has handed over patches of government-owned forests surrounding the villages to communities who established community-forest user groups (CFUG) for the management of the forests. CFUGs are allowed to set up rules and regulations to manage their resources. They are allowed to restrict the number of users and the usage of resources, to collect fees for the extraction of timber and NTFPs and, in contrast to *van panchayats* in India, to sell their resources in the open market (Agrawal and Ostrom 2001).

In 2010, ANCA was established in Darchula District under the DNPWC. The establishment of ANCA and its community-led committees shifted most of the functions and rights of over 100 CFUGs in the area to newly formed ANCA Conservation Committees. The CFUGs were not dissolved, but new bodies were created and the ANCA office with its communal committees emerged as new player in the region. Some community members raised concerns in relation to these developments:

The establishment of the ANCA committees is a good progress, because people can raise their voice through the committees to officials in Darchula. But in the end all decisions are made in Darchula by committee leaders and ANCA, without any involvement of the community. (Community member, Dumblin, Nepal, May 2017 – *English translation, original language Nepali*)

As this statement emphasizes, according to community members, the power relation has not changed much following the designation of ANCA, as in many local

committees, community members have just switched ‘seats’ and power is still concentrated in the main town of Darchula.

The formation of ANCA has also altered the perception and legal status of access rights to resources for community members within ANCA. Yarshagumba is found in the five high mountain villages of Byash, Rapla, Khandeswori, Ghusa and Chitola. Before the ANCA was established, the CFUGs of these five villages both enabled and constrained the access to the yarshagumba collection sites. Nowadays, community members from all 21 villages within ANCA have the same rights under the umbrella of ANCA, according to ANCA policies. Therefore, members from lower villages should also have the same access rights to yarshagumba collection sites and benefit from revenues in the same way as the five high mountain villages. Consequently, the five villages are reluctant to follow the new ANCA policies. The *de-facto* scenario is that in some sites, like in Api and Kuntison, communities still restrict access for members of other communities (closed sites). The sites Api and Kuntison lie within a community forest of the Shauka community and the communal arrangements are similar to the ones in Bona and Baling, India, like regulating access, fines and the collection period.

The collection site in Lolu, Chameylia valley, is different, as traditional grazing and community forest management systems did not exist in the site before yarshagumba collection began. Additionally, the collectors coming to Lolu are from different communities and ethnic groups with different social norms. The enforcement of access rights and management regulations is challenging for the local community, as the ANCA Conservation Committee is not yet fully functional and local arrangements are often not socially accepted by all collectors and therefore not followed. Conflicts are the consequence.

A locally developed guideline for the management of yarshagumba collection in ANCA in 2016 tried to address these different conflicts and power struggles by negotiating rights and responsibilities between the local communities and distant collectors. The guideline increased the transparency regarding the rights and responsibilities of the ANCA Conservation Committees, clarified access, entrance fee collection and distribution of revenues and regulated the management of campsites. In the collection season of 2016, the committees in cooperation with ANCA authorities started its implementation. However, the higher authority, the DNPWC, did not approve this ANCA-specific guideline. Instead more general national directives for yarshagumba management in protected areas were developed in 2017 (MoFSC 2017). According to this latest national directive, it is the responsibility and right of the government authority in protected areas to control the access to yarshagumba collection sites, to distribute entrance permits, to collect entrance fees and to manage the campsites. This has shifted rights to control the access to the sites from local committees to government authorities without previous consultations and consideration of the local context. The ANCA government representatives appreciate these developments as emphasized by the quote:

We think it is better that ANCA collects the entrance fees for the moment until the system works better. Than we can hand over to the community. (ANCA warden, Darchula, Nepal, May 2017 – *English translation, original language Nepali*)

In the protected area, these changes raised tensions between local leaders and governmental actors, hindered cooperation and hampered an effective implementation of the directives in the collection season of 2017.

Nevertheless, the partial implementation of both formalised guidelines, the local one in 2016 and the national one in 2017, has already improved the transparency of fee collection and accountability through the involvement of a formal institution. Since 2016, each collector pays a fixed amount of 500 NPR (5 USD), 1000 NPR (10 USD) or 3000 NPR (30 USD) depending on his/her origin (MoFSC 2017). Beforehand, the collection of entrance fees from collectors was a very informal local arrangement made by the nearby communities. This sometimes led to threats, bribery and fraud as well as non-transparent usage of the collected fees (ICIMOD 2015). The guideline also sets up an equal distribution mechanism to all 21 communities within ANCA, but at the same time reduces the direct benefit for and the responsibility and customary rights of communities living next to the yarshagumba collection sites. A community representative of ANCA states his concerns about the latest developments:

I am not happy about the new directive. It is fine when ANCA [government authority] collects the money, but the responsibilities should be discussed and agreed between ANCA and the local committees. Monitoring will be difficult for ANCA. They are not in the sites. We can easily implement regulations. (ANCA Committee leader, Darchula, Nepal, May 2017 – *English translation, original language Nepali*)

As the statement shows, local leaders fear that management mechanisms in the collection sites cannot be sufficiently implemented by ANCA government authorities. They request cooperation and sharing of rights and responsibilities among the community-led organizations and government authorities in future for effective governance of yarshagumba collection.

5. Discussion – governance systems and their learning processes

Analysing the resource governance systems in different yarshagumba collection sites using the framework created by Pahl-Wostl (2009), our findings show that in both countries, the resource governance systems in high alpine grasslands have become more complex since yarshagumba collection started. Additional actors have appeared, power relations and interactions have changed, new institutions have been formed and others neglected. Some actors, like the distant collector, have emerged directly due to the rapidly increasing value of yarshagumba. Other actors and related institutions, like ANCA in Nepal, or the BMC in India,

developed due to decisions and policy changes on national and state levels for natural resource management. All actors have an interest in benefitting from the increased resource value and, therefore, have influenced the governance systems in the high alpine grasslands. Further, all actors and institutions interact on multiple levels, but hardly harmonize or complement each other. Bureaucratic hierarchy is still the predominant governance mode in both countries.

In both countries, several institutional and societal multi-level learning processes were initiated, which altered the structures of existing resource governance systems and consequently triggered new learning processes. In the early years of the 2000s when the 'gold rush' started, communities set up access and management rules. This can be identified as single-loop learning that changed actions to improve established routines (Pahl-Wostl 2009). In some cases these rules solved conflicts between collectors and clarified terms of resource extraction; in other cases they raised more tensions. We identify four practices of communities to legitimate these arrangements in our case study: transfer of formal institutions from one resource to another one (example: Baling), consistent strong leadership of community heads (example: Tejum), maintenance of a shared sense of community in a site (examples: Baling and Api) and retention of established customary rights and responsibilities (example: Bona). The arrangements have enabled these communities to retain most benefits for their own community and to control users and resource extraction when the design of governmental institutions is weak, as is the case in India, or when the governmental institutions override customary rights and practices, as it is the case in Nepal.

These established communal management arrangements are not necessarily legally sanctioned by law, especially in India. They are recognized as legitimate by the involved community members (c.f. Scott 1999). However in some cases, communities have difficulties to enforce these informal regulations, especially towards distant collectors. Distant collectors often do not know or neglect these informal arrangements and, therefore, do not legitimate them. Additionally, members from within the community are not always willing to respect certain traditions, as the example of women collecting yarshagumba shows. By comparing the dynamics in the different sites, we deduce that the more the local site arrangements are linked to formal community-led organizations, like *van panchayats* in India or CFUG and the ANCA Conservation Committees in Nepal, the more the collection of yarshagumba is regulated and the better regulations can be enforced by the community under both community members and distant collectors.

In India, the State Forest Department is characterised by strong bureaucratic hierarchies and limited interaction with local leaders (Singh 2016). On the one hand, the remoteness and inaccessibility of the collection sites as well as the limited human and financial resources of the State Forest Department hamper the implementation of the existing policies. On the other hand, government authorities have not yet responded to the changing situation in the high alpine grasslands with major policy revisions. Although local representatives of the State Forest Department are aware of their limitations and have an interest in further legalising

the collection and sale of yarshagumba in order to collect revenues and control the access to the resource, at the time of writing, the decision about legalisation was still pending on state level.

On local and national levels, the Nepali government has responded to the yarshagumba 'gold rush' only recently, when conflicts between actors increased. The local yarshagumba management guidelines for ANCA developed in 2016 were an attempt to involve state and non-state actors on a local level equally to negotiate and share rights and responsibilities, as well as to increase their overall cooperation. However, it lacked the acceptance of higher government authorities on the central level. The formulation of national directives a year later shows that although decentralised community-based programmes have been part of government schemes since the late 1990s (Agrawal and Ostrom 2001), power and decision-making is still situated on national level. Therefore, the vertical integration between local and national actors and institutions remains weak. Nevertheless, the local 2016 yarshagumba management guideline for ANCA provides a good example of revising the institutional frame of the governance system by integrating informal and innovative approaches as well as local knowledge of communities in formal processes. This approach linked the single-loop learning process (improvements of local actions) with double-loop learning (revisions of the governance frame).

Referring to triple-loop learning (Pahl-Wostl 2009), to date, neither state nor non-state actors in India and Nepal are tackling the communities' strong dependency on yarshagumba collection. Governmental programmes could provide incentives to reduce the communities' dependency on NTFP collection and to identify comparable income options to reduce the pressure on these natural resources. This could transform the overall socio-economic context in the high Himalayan Mountains and would contribute towards greater sustainability of natural resources.

Subsequently, referring to our hypothesis, our findings show that in comparison to government authorities, communities adapted more flexibly to protect or gain access to a common pool resource when the value of this resource increased. Irrespective of the legal status of yarshagumba collection, the resource governance systems in both countries in our case study have adapted to the abrupt changes in the high alpine grasslands. The pressures on this resource triggered innovative approaches on a community level to protect or gain access to collection sites. Following the example in Nepal, the establishment of communal management arrangements needs to be followed by and strongly linked with the revision and implementation of governmental institutions. This can stabilize and legitimate the adaptive changes in the governance systems, especially when the communities respond in ways that fall outside the bounds of formal institutions.

Going beyond this case study, we elaborate that stages of multi-level learning have to build on each other to be able to move from changing actions (single-loop learning) to revising the frame by government authorities with the cooperation of communities (double-loop learning) and, finally, to transforming the context

(triple-loop learning). Therefore, we argue that institutionally-mixed resource governance systems constituted by multi-level interaction as well as shared responsibilities and rights among different institutions and actors can better handle sudden resource value changes and other changes triggered subsequently by enabling adaptive and transformative learning processes in the governance systems.

Currently, the limited recognition of the local context in recent policies in India and Nepal, as well as the overlapping of institutional rights, such as for *van panchayats* and BMCs in India and ANCA Conservation committees and CFUGs in Nepal, has led to limited vertical and horizontal integration between state and non-state actors. This could become even more severe in Nepal when the newly established administrative units, *gaun palikas* (villages) and *nagar palikas* (municipalities), empowered through the new Nepal Constitution of September 2015, demand their rights to manage natural resources at the local level. This will most likely bring a new dynamic into the existing governance structure with outcomes, which so far cannot be predicted. A similar situation could occur in India once BMCs on local level and the State Biodiversity Board receive more human and financial resources and become more strongly socially accepted. As yarshagumba is currently the local resource with the highest value found in the Himalayan Mountains (Negi et al. 2016), struggles on state and local level between State Forest Department and State Biodiversity Board to benefit from the resource are likely. However, the new situations in Nepal and India can also provide opportunities to reflect on general questions about equity, power and authority, resource distribution and livelihood dependencies in the context of NTFP collection and sale in remote mountain villages to encourage transformative change.

6. Conclusion

Our comparative case study reveals communities' and governments' capacities to adapt to resource value changes in the high alpine grasslands of the Kailash Landscape. We conclude that neither government nor communities alone can ensure effective governance in remote mountain areas when resource values rapidly increase. During learning processes the link between the amendment of actions (single-loop learning), in our case initiated by communities, and the revision of the formal policies and the frame (double-loop learning) is essential to ensure that innovative approaches reach the policy level (vertical integration) and can spread across administrative boundaries (horizontal interaction). A complex and complementary resource governance system consisting of governmental institutions and communal management arrangements is required to adapt adequately and to ensure that learning processes are innovative, context-specific, legally sanctioned and enforced.

Building on this insight we conclude that other common pool resources in the Himalayas face similar governance challenges. For example demand and prices for medicinal and aromatic plants have increased over the last decades (Pauls and

Franz 2013). The majority of them, just like yarshagumba, are not cultivated, but harvested wild in remote areas by communities (Uprety et al. 2016). Referring to our findings, this will most likely trigger similar power struggles, adaptation and learning processes.

We recommend that the affected regions establish common platforms for actors from different levels and sectors, including the government, relevant research facilities and communities. Joint meetings could encourage exchange and understanding, create awareness and provide the opportunity to share local and scientific knowledge among relevant actors. This would also close the gap between the communal and governmental efforts for adaption and encourage transformation towards sustainable resource management.

Literature cited

- Acheson, J. M. 2006. Institutional Failure in Resource Management. *Annual Review of Anthropology* 35:117–134. doi:10.1146/annurev.anthro.35.081705.123238.
- Agrawal, A. 2003. Sustainable Governance of Common Pool Resources: Context, Methods, and Politics. *Annual Review of Anthropology* 32:243–262. doi:10.1146/annurev.anthro.32.061002.093112.
- Agrawal, A. and E. Ostrom. 2001. Collective Action, Property Rights and Decentralization in Resource Use in India and Nepal. *Politics and Society* 29(4):485–514. doi:10.1177/0032329201029004002.
- Anderies, J. M., M. A. Janssen, and E. Ostrom. 2004. A Framework to Analyze the Robustness of Social-Ecological Systems from an Institutional Perspective. *Ecology and Society* 9(1):18.
- Api Nampa Conservation Area (ANCA). 2018. *Biodiversity Profile of Api Nampa Conservation Area, Kailash Sacred Landscape Nepal*. 2nd draft prepared January 2018. Kathmandu. *unpublished*.
- Baland J. M. and J. P. Platteau. 1996. *Halting Degradation of Natural Resources: Is There a Role for Rural Communities?* Oxford, UK: Clarendon.
- Baral, B., B. Shrestha, and J. A. Teixeira da Silva. 2015. A Review of Chinese Cordyceps with Special Reference to Nepal, Focusing on Conservation. *Environmental and Experimental Biology* 13:61–73.
- Bauer, K. M. 2004. *High Frontiers, Dolpo and the Changing Wold of Himalayan Pastoralists*. New York: Columbia University Press.
- Binder, C. R., J. Hinkel, P. W. Bots, and C. Pahl-Wostl. 2013. Comparison of Frameworks for Analyzing Social-Ecological Systems. *Ecology and Society* 18(4):26.
- Cannon, P. F., N. L. Hywel-Jones, N. Maczey, L. Norbu, Tshitila, T. Samdup, and P. Lhendup. 2009. Steps towards sustainable harvest of Ophiocordyceps sinensis in Bhutan. *Biodiversity Conservation* 18:2263–2281. doi:10.1007/s10531-009-9587-5.
- Caplins, L. B. 2016. *Political Ecology of Cordyceps in the Garhwal Himalaya of Northern India*. Graduate Student Theses, Dissertations, & Professional Papers. 10913. <https://scholarworks.umt.edu/etd/10913>.

- Childs, G. and N. Choedup. 2014. Indigenous Management Strategies and Socioeconomic Impacts of Yartsa Gunbu (*Ophiocordyceps sinensis*) Harvesting in Nubri and Tsum, Nepal. *Himalaya* 34(1).
- Dietz, T., E. Ostrom, and P. C. Stern. 2003. The Struggle to Govern the Commons. *Science* 302:1907–1912. doi:10.1126/science.1091015.
- Folke, C., T. Hahn, P. Olsson, and J. Norberg. 2005. Adaptive Governance of Social-Ecological Systems. *Annual Review Environmental Resources* 30:441–473. doi:10.1146/annurev.energy.30.050504.144511.
- German, L. A. and A. Keeler. 2010. Hybrid Institutions: Applications of Common Property Theory Beyond Discrete Property Regimes. *International Journal of the Commons* 4(1):571–596. doi:10.18352/ijc.108.
- Gerwin, M. and C. Bergmann. 2012. Geopolitical Relations and Regional Restructuring: The Case of the Kumaon Himalaya, India. *Erdkunde* 66(2):91–107. doi:10.3112/erdkunde.2012.02.01.
- Hardin, G. 1968. The Tragedy of the Commons. *Science* 162:1243–1248.
- Herrera, P. M., J. Davies, and P. Manzano. 2014. *Governance of Rangelands: Collective Action for Sustainable Pastoralism*. New York: Taylor & Francis.
- Hoon, V. 1996. *Living on the Move: Bhotiyas of the Kumaon Himalaya*. New Delhi: Sage Publications.
- Huitema, D., H. Mostert, W. Egas, S. Moellenkamp, C. Pahl-Wostl, and R. Yalcin. 2009. Adaptive Water Governance: Assessing the Institutional Prescriptions of Adaptive (Co-) Management from a Governance Perspective and Defining a Research Agenda. *Ecology and Society* 14(1):26.
- ICIMOD. 2015. *Across the Mahakali*. video. <http://lib.icimod.org/record/32086>. accessed on: 28.2.2018. Kathmandu: ICIMOD.
- ICIMOD. 2017. *Vegetation Type and Land Cover Map of Kailash Sacred Landscape*. Map. Kathmandu: ICIMOD.
- Karpouzoglou, T., A. Dewulf, and J. Clark. 2016. Advancing Adaptive Governance of Social- Ecological Systems through Theoretical Multiplicity. *Environmental Science and Policy* 57:1–9. Doi:10.1016/j.envsci.2015.11.011.
- Keck, M. 2016. *Navigating Real Markets: The Economic Resilience of Food Wholesale Traders in Dhaka, Bangladesh*. Stuttgart: Franz Steiner.
- Leder, S. 2003. *Zu einer Zeit, als Bäume und Gräser noch sprechen konnten....* Frankfurt am Main: Peter Lang Europäischer Verlag der Wissenschaften.
- Mayring, P. 2015. *Qualitative Inhaltsanalyse. Grundlagen und Techniken*. Weinheim: Beltz.
- McGinnis, M. D. 2011. An Introduction to IAD and the Language of the Ostrom Workshop: A Simple Guide to a Complex Framework. *Policy Studies Journal* 39(1):169–183. doi:10.1111/j.1541-0072.2010.00401.x.
- Ministry of Forest and Soil Conservation (MoFSC). 2015. Forest Regulation 1995. *Government Gazette* 65, no. 26, part 3. Kathmandu: Government of Nepal. accessed on 20.02.2018. http://www.mfsc.gov.np/downloadfile/aanusuchif_1446967075.pdf.

- Ministry of Forest and Soil Conservation (MoFSC). 2017. *Yartsagumba Management: Collection and Transportation Directive*. Kathmandu: Government of Nepal.
- Negi, C. S., P. R. Koranga, and H. S. Ghinga. 2006. Yartsagumba (*Cordyceps sinensis*): A Call for its Sustainable Exploitation. *International Journal of Sustainable Development & World Ecology* 13:1–8. doi:10.1080/13504500609469669.
- Negi, C. S., P. Joshi, and S. Bohra. 2015. Rapid Vulnerability Assessment of Yartsa Gunbu (*Ophiocordyceps sinensis* [Berk.] G. H. Sung et al) in Pithoragarh District, Uttarakhand State, India. *Mountain Research and Development* 35(4):382–391. doi:10.1659/MRD-JOURNAL-D-14-00005.1.
- Negi, C. S., M. Pant, P. Joshi, and S. Bohra. 2016. Conserving the Caterpillar Fungus (*Ophiocordyceps sinensis* [Berk.] G. H. Sung et al): A Case Study of Habitat Ecology and Sustainability in District Pithoragarh, Western Himalaya, India. *International Journal of Biodiversity and Conservation* 8:196–205. doi:10.5897/IJBC2014.0742.
- Olsson, P., H. Gunderson, S. Carpenter, P. Ryan, L. Lebel, C. Folke, and C. S. Holling. 2006. Shooting the Rapids: Navigating Transitions to Adaptive Governance of Social-Ecological Systems. *Ecology and Society* 11(1):18.
- Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge: Cambridge University Press.
- Ostrom, E. 2005. *Understanding Institutional Diversity*. Princeton and Oxford: Princeton University Press.
- Ostrom, E. 2010. Polycentric Systems for Coping with Collective Action and Global Environmental Change. *Global Environmental Change* 20(4):550–557. doi:10.1016/j.gloenvcha.2010.07.004.
- Pahl-Wostl, C. 2009. A Conceptual Framework for Analysing Adaptive Capacity and Multi-Level Learning Processes in Resource Governance Regimes. *Global Environmental Change* 19:354–365. doi:10.1016/j.gloenvcha.2009.06.001.
- Pahl-Wostl, C., G. Becker, C. Knieper, and J. Sendzimir. 2013. How Multilevel Societal Learning Processes Facilitate Transformative Change: A Comparative Case Study Analysis on Flood Management. *Ecology and Society* 18(4). doi:10.5751/es-05779-180458.
- Pandey, A., N. Pradhan, S. Chaudhari, and R. Ghate. 2017. Withering of Traditional Institutions? An Institutional Analysis of the Decline of Migratory Pastoralism in the Rangelands of the Kailash Sacred Landscape, Western Himalayas. *Environmental Sociology* 3(1):87–100. doi:10.1080/23251042.2016.1272179.
- Pant, B., R. Rai, C. Wallrapp, R. Ghate, and U. B. Shrestha. 2017. Horizontal Integration of Multiple Institutions: Solutions for Yarshagumba Related Conflict in the Himalayan Region of Nepal? *International Journal of the Commons* 11(1):464–486. doi:10.18352/ijc.717.
- Pauls, T. and M. Franz. 2013. Trading in the Dark – The Medicinal Plant Production Network in Uttarakhand. *Singapore Journal of Tropical Geography* 34:229–243. doi:10.1111/sjtg.12026.

- Plummer, R., D. R. Armitage, and R. C. de Loë. 2013. Adaptive Comanagement and its Relationship to Environmental Governance. *Ecology and Society* 18(1). doi:10.5751/ES-05383-180121.
- Pouliot, M., D. Pyakurel, and C. Smith-Hall. 2018. High Altitude Organic Gold: The Production Network for Ophiocordyceps Sinensis from Far-Western Nepal. *Journal for Ethnopharmacology* 218:59–68. doi:10.1016/j.jep.2018.02.028.
- Scott, R. 1999. *Institutions and Organisations*. Sage Publications.
- Sharma-Wallace, L., S. Velarde, and A. Wreford. 2018. Adaptive Governance Good Practice: Show me the Evidence! *Journal of Environmental Management* 222:174–188. doi:10.1016/j.jenvman.2018.05.067.
- Shrestha, U. B. and K. S. Bawa. 2013. Trade, Harvest and Conservation of Caterpillar Fungus (*Ophiocordyceps sinensis*). *Biological Conservation* 159:514–520. doi:10.1016/j.biocon.2012.10.032.
- Shrestha, U. B. and K. S. Bawa, 2014. Economic Contribution of Chinese Caterpillar Fungus to the Livelihoods of Mountain Communities in Nepal. *Biological Conservation* 177:194–202. doi:10.1016/j.biocon.2014.06.019.
- Shrestha, U., K. R. Dhital, and A. P. Gautam. 2017. Economic Dependence of Mountain Communities on Chinese Caterpillar Fungus *Ophiocordyceps Sinensis* (Yarsagumba): A Case from Western Nepal. *Oryx*. Cambridge University Press, 1–9. doi.org/10.1017/S0030605317000461.
- Singh, S. 2016. *The Local Governance: Politics, Decentralization and Environment*. New Delhi: Oxford University Press.
- Uprety, Y., R. C. Poudel, J. Gurung, N. Chettri, and R. P. Chaudhary. 2016. Traditional Use and Management of NTFPs in Kangchenjunga Landscape: Implications for Conservation and Livelihoods. *Journal of Ethnobiology and Ethnomedicine* 12(19). Doi:10.1186/s13002-016-0089-8.
- Uttarakhand Biodiversity Board. 2017. *Study on Science-Policy Interface focusing on Access & Benefit Sharing (ABS) and Trans-boundary issues, Kailash Sacred Landscape Conservation and Development Initiative*. Dehradun: Uttarakhand Biodiversity Board.
- Weckerle, C., Y. Yang, F. K. Huber, and Q. Li. 2010. People, Money, and Protected Areas: The Collection of the Caterpillar Mushroom *Ophiocordyceps sinensis* in the Baima Xueshan Nature Reserve, Southwest China. *Biodiversity Conservation* 19:2685–2698. doi:10.1007/s10531-010-9867-0.
- Winkler, D. 2008. Yartsa Gunbu (*Cordyceps sinensis*) and the Fungal Commodification of Tibet's Rural Economy. *Economic Botany* 62(3):291–305.
- Winkler, D. 2009. Caterpillar Fungus (*Ophiocordyceps sinensis*), Production and Sustainability on the Tibetan Plateau and in the Himalayas. *Asian Medicine* 5:291–316. doi: 10.1163/157342109x568829.
- Yeh, E. and Lama, K. T. 2013. Following the Caterpillar Fungus: Nature, Commodity Chains and the Place of Tibet in China's Uneven Geographies. *Social and Cultural Geography* 14(3):318–340. doi:10.1080/14649365.2013.765025.
- Young, O. R. 2009. Institutional Dynamics: Resilience, Vulnerability and Adaptation in Environmental and Resource Regimes. *Global Environmental Change* 20:378–385. doi:10.1016/j.gloenvcha.2009.10.001.

Annex I



Picture 1: Collectors with camping luggage (June 2017).



Picture 2: Collectors searching for yarshagumba (May 2017).



Picture 3: Yarshagumba when collected (May 2017).



Picture 4: Campsite of collectors (May 2017).