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Narratives of change: first-, second-, and third-order adaptive processes in Nepal and the Maldives

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Adaptation is becoming increasingly significant for public policy and practice in dealing with climate change-related risks and achieving sustainable development. Consequently, the exploration of different ways of assisting successful adaptation has brought under scrutiny the different lifestyles of communities all around the world. Most frameworks adopted to understand adaptation among societies keep climate change at the centre of inquiry and often, if not always, give little consideration to other changes of socio-economic and cultural nature that communities have adapted to over centuries. We argue that adaptation is not something new to communities and neither is dealing with risk and uncertainty. The adaptive processes of households and communities entails dealing with risks to what they consider valuable and important to protect in relation to a hazard or sudden, seasonal, or steady change. This paper builds on earlier works that place emphasis on adaptation of livelihoods to changes beyond but inclusive of climate. We suggest an empirically informed analytical framework to study such adaptation, keeping society instead of climate change at the centre. It is based on comparative case study research with life narratives collected through qualitative interviews in Nepal and in the Maldives. The findings also suggest a re-conceptualisation of adaptive processes used in influential frameworks, and suggest a qualitative distinction to identify explicitly how different adaptive processes deal with risks; by adapting livelihoods directly, adapting the means of adaptation, or adapting the ends of adaptation. It is contended that applying this theoretical framework when studying adaptation facilitates comprehensive analyses and a nuanced understanding of how households and communities adapt to deal with risk. Hence, proposing a way to open up a broader repertoire of policy and practical support for adaptation to match local contexts and strategies.

Introduction

Confronted with the escalation and convolution of change since the mid 20th century (Heylighen, 2008; Rudel and Hooper, 2005; 2015), adaptation has claimed centre stage in both policy and scientific dialogues about

sustainability (Simonet, 2010). This is particularly true for climate change discourse (Adger et al., 2005; Berkes and Jolly, 2001; Smit and Wandel, 2006; Tompkins and Eakin, 2012), where state sponsored adaptation

strategies have emerged as solutions to assist communities to deal with climate related risks (IPCC, 1990; Schipper, 2006). However, climate change may only be *one* of the complex combination of changes that communities adapt to (Thornton and Manasfi, 2010; Parsons and Nalau, 2016). Such prevailing views contain an implicit assumption that adaptation requires assistance from state agents (Wisner, 2010), as the autonomous adaptation done independently is generally seen as inherently inefficient (Forsyth and Evans, 2013). Despite widespread acknowledgement of the problems with these views, commitments towards global sustainability issues continues to consider adaptation predominantly in technical terms and focusing on climate alone (Boyd, 2017). Thus running the risk of distracting attention from other developmental challenges and root causes that put people at risk in the first place (Pelling, 2011; Kelman, 2014; Mercer, 2010). This is particularly problematic in Small Island Developing States and Mountainous Landlocked Countries, which are considered most vulnerable to contemporary global change (UNCSD, 2012).

For a more nuanced understanding of adaptation, this paper suggests using society as a vantage point rather than climate, to avoid a narrow construction of adaptation in relation to *a* particular stimulus (see Nightingale, 2017). Thus, supporting the view that wider social, political and economic contexts shape peoples' abilities to adapt to everyday risks (Hewitt and Burton, 1971; Lewis, 1999; Leichenko and O'Brien, 2008; Smucker and Wisner, 2008; Wisner, 2010), and that people adapt to complex combinations of changes in them (Parsons and Nalau, 2016). While adaptation can be considered either as an outcome, action, or a process (Smit and Wandel, 2006), it is here considered a set of processes to deal with risk over time. Existing frameworks of such

adaptive processes vary significantly in scope and very few relate their adaptive processes to risk or consider how they are connected to each other (see Agrawal, 2010; Jodha, 2005; Batterbury and Forsyth, 1999).

Hence, this paper concerns itself with the adaptive processes of households and communities to deal with risk to what they consider valuable and important to protect in relation to a hazard or sudden, seasonal, or steady change. The purpose of the paper is to suggest an empirically informed analytical framework that contributes towards facilitating understanding of how communities adapt to deal with risks, based on life narratives of change and adaptation in living memory among communities in Nepal and the Maldives.

Conceptual framework

Adaptation is a contentious concept with various definitions (Simonet, 2010). Many, if not most, define adaptation in relation to climate change (Adger et al., 2005; Grothmann and Patt, 2005; IPCC, 2014; Pielke Jr., 1998; Smith et al., 2000; Tompkins and Eakin, 2012). However, focusing only on climate change disregards the complexity of the human experience. Human beings base their decisions on their perception and understanding of the entire situation, not just on one factor. Although a changing climate is a notable factor and likely to be of paramount importance to adaptation in the future, there is a whole range of other changes that combine to form the complex situation to which human beings adapt (Becker, 2014; Parsons and Nalau, 2016).

There are a number of more general definitions of adaptation that relate it to coping (Brooks, 2003; O'Brien and Holland, 1992), while others distinguish between coping and adapting (Berkes and Jolly, 2001; McCay, 1978). Where the former denotes a system's immediate or short-term responses in particular

to typically abnormal situations of stress, while the latter denotes the ways in which the system adjusts its values, rules, institutions and activities to reduce risk over time. At the same time, evolution of coping strategies of households are reflective of adaptation to long term societal changes (Smucker and Wisner, 2007). The present paper approaches adaptation as the processes through which a society achieves a "working relationship" with its environment (Agnew, 1981), in the broadest possible sense. The environment refers here not only to nature, but also ideology (Hall, 1986; Sztompka, 1993), political and economic context (Hall, 1986), and technology (Elias, 1995), and adaptive processes are "bound up with power relations, social structures, technologies, economies, beliefs, values, and narratives" (Parsons and Nalau, 2016).

A number of scholars have proposed sets of adaptive processes (Table 1), although they may refer to them as "adaptive strategies" (McCay, 1978; Agrawal, 2010), "buffering mechanisms" (Halstead and O'Shea, 1989), or "adaptation processes" (Thornton and Manasfi, 2010). It is important to note that the frameworks included in this paper is not an exhaustive list, but have been selected because of their focus on livelihoods and their influence on other available frameworks. For instance, Ingty (2017) and Gómez-Baggethun and colleagues (2012) base their frameworks mainly on Agrawal (2010) and Thornton and Manasfi (2010), with influences from Halstead and O'Shea (1989) for the latter. The adaptive processes they do add to these influential frameworks are institutional capital and forecasting (Ingty, 2017) and forecasting and selection (Gómez-Baggethun et al., 2012), which are not as straightforward to relate to risk reduction.

McCay (1978) identifies *diversification* and *intensification* (Table 1), where the former

entails "expanding alternative modes of coping with environmental problems" and the latter involves "increased commitment to an investment in one or another mode of resource procurement" (p. 410). Halstead and O'Shea (1989) also includes *diversification*, but is more explicit in defining it not only as the broadening of alternative livelihood activities, but also as the space used for particular activities (Table 1). Furthermore, they include *mobility* and *physical storage*, where *mobility* refers to the simplest of adaptive processes and "works by taking advantage of the spatial and temporal structure of resource failure in effect to move away from scarcity" (Halstead and O'Shea, 1989). *Physical storage*, in turn, entails stabilizing resource availability by reserving resources from relatively better times to be used in relatively worse times (p. 4). Finally, Halstead and O'Shea (1989) incorporate *exchange* into their set of adaptive processes, but limit it to reciprocity, making it "similar to storage, in that present abundance is converted, this time via social transactions, into a future obligation in time of need" (p. 4).

Agrawal (2010) explicitly links adaptive processes to distributing the risk of resource scarcity (Table 1). He defines *mobility* and *storage* similarly to Halstead and O'Shea (1989), but describes the former as pooling risk across space and the latter as pooling risk across time (Agrawal, 2010). *Diversification* is described as pooling risk across assets and resources (Agrawal, 2010), but it lacks the explicit spatial aspect of Halstead and O'Shea's (1989) approach. Agrawal (2010) also introduces *communal pooling* and *market exchange* as adaptive processes, but he does not include Halstead and O'Shea's (1989) reciprocal exchange. *Communal pooling* entails joint ownership of specific resources (land, tools, produce, labour, income, etc) and distributes risk across households as long as not

all households are negatively affected simultaneously (Agrawal, 2010). *Market exchange* is described as the most versatile adaptation process capable of substituting the others as long as households have access to markets (Agrawal, 2010). It pools risk across space, time, resources and households by allowing the purchase and sale of risk via

contracts. Finally, Thornton and Manasfi (2010) propose a set of eight adaptive processes – *mobility, exchange, pooling, diversification, intensification, rationing, innovation, and revitalization* – of which the final three are not found explicitly in the frameworks presented above (Table 1).

Table 1. Descriptions of adaptive processes as found in literature.

	McCay (1978)	Halstead and O'Shea (1989)	Agrawal (2010)	Thornton and Manasfi (2010)
Diversification	Expanding alternative ways of coping with environmental problems	Expanding alternative livelihood activities and the space used for particular activities	Expanding alternative livelihood activities, pooling risk across assets and resources	Similar to Agrawal (2010)
Intensification	Increased commitment to a livelihood activity			Increasing resource yield within a certain space or time
Mobility		Using the spatial and temporal structure of resource failure to move away from scarcity	Similar to Halstead and O'Shea (1989), pooling risk across space	Seasonal movement and permanent migration to avoid risk or to search for opportunities
Storage		Stabilizing resource availability by reserving resources from better times for worse times	Similar to Halstead and O'Shea (1989), pooling risk across time	Similar to Halstead and O'Shea (1989) and Agrawal (2010)
Pooling			Joint ownership of specific resources, pooling risk across households	Similar to Agrawal (2010)
Exchange		Reciprocity: Present abundance is converted via social transactions into a future obligation in time of need	Market exchange: Pooling risk across space, time, resources and households via contracts	Flows of material and symbolic goods and services between people
Rationing				Extending the supply of resources by controlling their circulation and consumption over time and space
Innovation				Generating new ways to address particular needs
Revitalization				Reconfiguration of ideologies, practices, and organization to reduce stress

Mobility is specified as involving both seasonal movement and permanent migration to avoid risk or to search for opportunities, much in line with Halstead and O'Shea (1989) and Agrawal (2010). However, they are more ambiguous in their description of exchange. Here they start by defining exchange as "[f]lows of material and symbolic goods and services between people" (Thornton and Manasfi, 2010), which could incorporate Halstead and O'Shea's (1989) reciprocal exchange, Agrawal's (2010) market exchange, and other forms of exchange (see Polanyi, 2001). However, then they discuss only market exchange, making their account closer to Agrawal (2010). Thornton and Manasfi (2010) are also close to Agrawal (2010) in their description of pooling and diversification. They include intensification, like McCay (1978), and describe it as "a means of increasing the utilization of resources by boosting their yield within a certain space or time" (Thornton and Manasfi, 2010). They mention *extensification* as the inverse of *intensification*, but do not include it explicitly as an adaptive process in their framework. Thornton and Manasfi (2010) introduce *rationing* as an adaptive process with the objective "to extend the supply of resources by controlling their circulation and consumption over time and space" (p. 138), but include Halstead and O'Shea (1989) and Agrawal's (2010) *storage* as its most basic form.

Their most significant additions in their set of adaptive processes is, however, *innovation* and *revitalization* (Thornton and Manasfi, 2010). *Innovation* is here described as generating new, but often unpredictable ways to address particular needs. *Revitalization*, on the other hand, is described as "a structured reconfiguration of ideologies, practices, and organization in order to reduce stress and create a more satisfying culture" (Thornton and Manasfi, 2010).

Methodology

Case study methodology was deemed suitable to answer the research question (Yin, 2002). The aim is not to arrive at statistical generalizations, but instead analytical generalizations. Case studies have proven well-suited for this purpose (Flyvbjerg, 2001). The knowledge developed from selected cases cannot be generalized "through abstraction and loss of history and context", but might be transferred to other situations through "conscious reflection on similarities and differences between contextual features and historical factors" (Greenwood and Levin, 2007).

Cases were selected to study communities in a mountainous landlocked- and a small island developing state that are deemed particularly vulnerable to contemporary global change (UNCSD, 2012). Although several countries resort in these categories, Nepal and the Maldives were chosen to limit the geographical distribution of the selected countries. Purposive sampling continued when choosing communities within the two countries in an effort to select cases that may have experienced different changes in living memory (Bernard, 2006). One major change in both Nepal and the Maldives that has affected communities differently across the countries is globalization, epitomized by the tremendous relative growth of tourism over the last four decades or so.

Sites were selected as cases based on the extent of tourism development (Figures 1 and 2). For Nepal, Khumjung was selected for being located on the main tourism trek route towards Mount Everest, Kengma and Buksa for being located slightly off the same track, while Ingla was selected for being negligibly affected by tourism, being located in the far east of the country. The Maldives is even more restricted by geographical remoteness and cost. Maafushi was selected for being a main tourism island

and Kudaafari for still being relatively untouched by tourism, although that may be changing in the future.

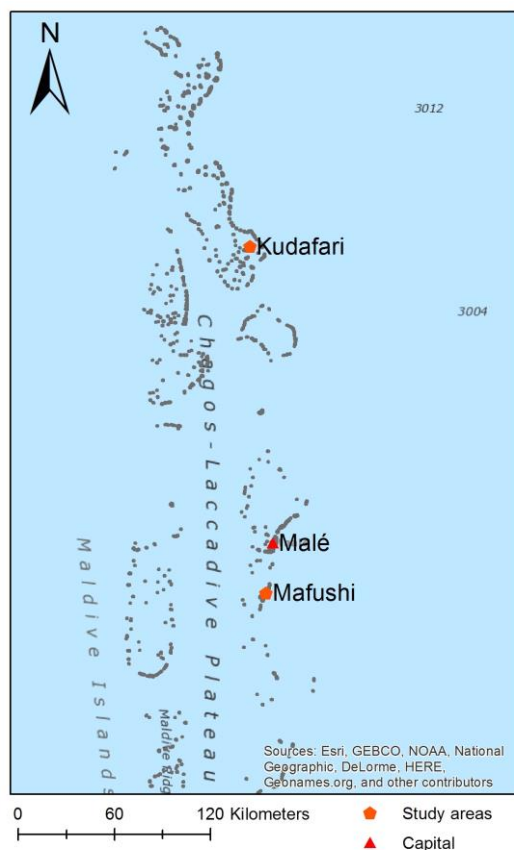


Figure 1. The location of the selected cases in the Maldives.

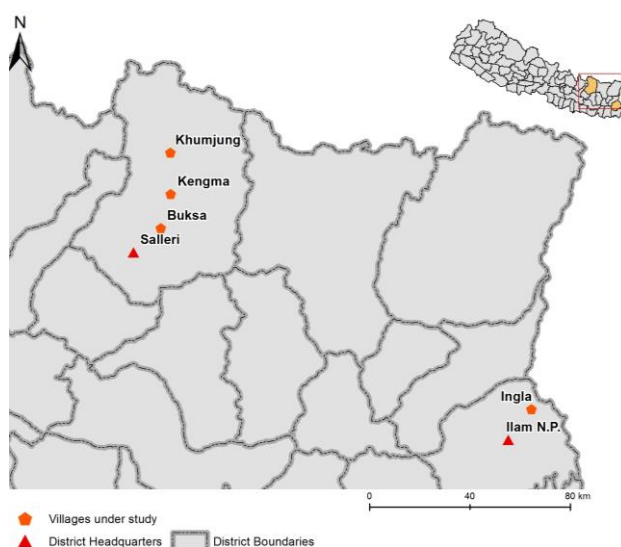


Figure 2. The location of the selected cases in Nepal.

Data was gathered using qualitative interviews with community members and others residing in the communities. These started with collecting narratives about life and change in the communities in living memory, followed by semi-structured interview themes to steer interviews to relevant topics related to changes and adaptive processes, if not already covered. This sequencing allowed respondents to get acquainted with the interviewers while narrating in the beginning and gave the interviewers the opportunity to include specific issues, especially when a narrative diverted from the purpose of the interview (Scheibelhofer, 2008). Older respondents were purposively selected to study changes in their communities over time, with narration of significant life episodes to help explain and understand these changes in depth (Sandelowski, 1991). In some instances, the intended interviews turned into group discussions, with between four and seven participants, especially when interviewing women, as they were more often found in groups. There were also instances where men replied on behalf of women, which posed problems. These instances were analysed separately. Key informant interviews were also conducted. These were more structured compared to the in-depth interviews. Key informants comprised individuals holding official and traditional posts in relation to the community.

Data were collected between December 2014 and March 2016. Khumjung, Kengma and Ingla in Nepal were visited in early 2015 and in 2016 to study the impact of the 2015 earthquakes and the changes they brought. A total of 52 respondents (22 women and 30 men) were interviewed in Nepal during the first round of interviews, while 37 respondents (20 women and 17 men) contributed to the second round of interviews there. Two group

discussions ensued in Ingha (Nepal) during the first round of interviewing; with a youth sports club head and with a female respondent. A total of 37 respondents (17 women and 20 men) were interviewed in the Maldives. Group discussions took place on the island of Kudafari (comprising of females) and Maafushi (males working in the guest house tourism industry) respectively. The interviews were recorded, transcribed, and analysed using a sequence of open coding, axial coding, identification of adaptive processes, and thick description of adaptive processes. The analysis was conducted using the NVIVO software.

Setting the context

The role of global processes has been seminal in shaping present day adaptation practices in Nepal and the Maldives. These interactions are not limited to changes in the economy, but include cultural, political and environmental changes. Tourism and a commercialisation of the primary sector have been notable in this regard. Trekking tourism in Nepal and resort tourism in the Maldives, in combination with the commercialisation of cardamom production in Nepal and fishing in the Maldives, have been largely responsible for tying local economies to global flows of capital.

Nepal opened its economy in the 1950's and soon received financial support from international organisations, particularly in the area of infrastructural development (see Bista, 1999). The opening of Nepal borders to the outside world also shaped mountain tourism (Stevens, 1993). In 1964 there were 20 trekkers, which rose to almost 150 000 in 2018 (Nepal Tourism Statistics, 2018). The development of Lukla airstrip by the Hillary Foundation in 1960's played a major role and Nepal later set up a National Tourism Board and became member of the World Tourism Organisation (Dhakal, 2013). Tourism brought

a demand for and supply of commercial services in remote regions of the country (Shrestha and Shrestha, 2012). Trekking tourism is thus not only responsible for creating employment opportunities, but is an important factor that has shaped the social, cultural and environmental landscape of Nepal, particularly in remote mountainous regions (Stevens, 1993; Fürer-Hamendorf, 1984). Spoon (2011) notes a shift in thinking of Sherpas from spiritual and agropastoralist values to market and tourism centred views. Cash crops have also played a key role here, particularly cardamom due to its high market value (Rijal, 2014). However, the volatility of market prices, the geopolitical setting and climate change have come to shape local livelihood risks and expose vulnerabilities in engaging with external markets (Takahatake, 2001).

In the case of the Maldives, the major transitions in the economy started to occur in the late 1960's, and had a major effect on the tourism and fishing sector (Phadnis and Luithui, 1981; Fulu, 2014). These changes entailed commercialisation and mechanisation of the fishing sector (Adam et al, 2003) and exposed the Maldives to international tourism (Sathiendrakumar and Tisdell, 1989). Religious and environmental concerns have been part of this developments, which the local population has responded to in their own way (Scheyvens, 2011; Brown et al 1997).

Results

The analysis of the case study data resulted in the identification of 13 distinctive but related adaptive processes. They are presented one by one in this section. The emphasis is on describing each adaptive process, which is difficult considering the limited space of a journal paper. There is only room for introducing and exemplifying them in this

section, so please bear with us until the discussion.

Mobility

A very common way of reducing a range of different risks found in all the cases is to move, either away from particular sources of risk or towards what is perceived as better opportunities. Transhumance has been common practice among the Sherpa in Khumjung for as long as people can remember, although the traditional winter homestead in lower or sun-facing locations has been substituted by a second home in the capital city of Kathmandu among the more affluent. The younger generation often stay in Kathmandu for longer, studying or working, but most Sherpas eventually get involved in the tourism industry up in the mountains.

In the case of Kengma, Buksa and Ingla, the most widespread type of migration is labour migration further afield. The quote below succinctly summarises a gender gap where it is mainly men who migrate to popular destinations; like India or the countries around the Persian Gulf.

“There are only females in this ward as all the men have gone either to Kathmandu or to Arab countries for work” (Female, 80, Ingla).

Migration is often initially seen as temporary, but may continue for longer periods, extending to several years. Being mobile for work is also a common practice in Maafushi and Kudaafari in the Maldives, particularly between islands for sale of food produce and working in resorts; activities also mainly involving men.

Design

Perhaps the most common way to adapt found in all studied cases is to design particular

artefacts to address particular challenges and meet particular purposes. For example, in Khumjung many respondents recollected how in the past they had more land for potato, buckwheat plantation and rearing yaks, which has largely been transformed into tourism infrastructure since then.

“Earlier there were isolated houses and were small in size [...] it is only now that they have houses with two stories and made of cement” (Male, 73, Khumjung).

Similarly, in Ingla, the steady turn towards cash crops, in particular cardamom production, has caused a transformation of land use away from food crops and livestock. In both Maldivian cases, the former dense tropical shrubs were first mixed with small vegetable gardens, but they have now almost entirely given way to houses and backyards.

In addition to redesigning the landscape, all people use tools and other artefacts that are designed for various purposes. For example, the use of mechanized boats, fish aggregating devices (FADs), and flood lights, causing unprecedented fishing capacity in the Maldives in relation to traditional fishing techniques. Or the construction of a community mill for buckwheat churning in Khumjung, without which they would not be able to engage in a range of important activities. However, the type and relative importance of artefacts have changed over the years, as livelihoods have changed.

Extensification

Another way the studied communities adapt to deal with particular risks is to increase the output of specific resources by spatially expanding production, which may or may not be continuous. Examples from the data include increasing number of lodges for tourists in

Khumjung, or the increasing area used for fishing in Maafushi and Kudaafari.

“Now if the tourist come regularly it is advantageous for us but if god forbid something happens then we don’t know what to do as our potato plating lands have been converted into sites for lodge construction” (Female, 50, Khumjung).

“Earlier we used to go fishing in the nearby islands and had small boats and came back at night. Now we have big boats and use fish to catch bait” (Male, 57, Kudaafari).

Having several locations for fishing in Maafushi and Kudaafari, or for farming in Kengma and Buksa, reduces vulnerability by distributing the production of vital resources across space; since an isolated environmental disaster or local overfishing, or a landslide in the case of Nepal, would only impact some areas and leave others untouched.

Intensification

Increasing the output of vital resources is also achieved in the studied communities by increasing the yield from the same production source. This adaptive process is referred to as intensification and is found in several of the studied cases. For instance, several tourism lodges in Khumjung were provided with a second floor to cater for the growing number of tourists. At least until the earthquakes in 2015, which reduced the number of tourists temporarily and proved many of these buildings to be particularly vulnerable to earthquakes.

The use of fish aggregating devices (FADs) is a common example of intensification in the Maldives, while the introduction of fertilization increased harvests in Ingla; although the participants in Ingla view a

government-sponsored fertilization project as the cause of pest attacks and soil fertility depletion.

“Skip jack tuna was done until late but now with increasing demand reef fish and yellow fin tuna fishing is done [...] It is business, and competitive, fish aggregating was supported by the government” (Male, 62, Kudaafari).

“We earlier we use to put a lot Urea but now we don’t [...] we have again started using cow dung as it is organic” (Female, 68, Ingla).

Diversification

The studied communities also dealt with the risk of resource scarcity by increasing the number of different livelihood activities and strategies in which they engage. This adaptive process is referred to as diversification and reduces risk by diffusing it across different vital resources. All studied cases traditionally had very diversified livelihood bases, with subsistence agriculture of multiple crops combined with trans-Himalayan trade in Nepal, and artisanal fishing combined with vegetable gardening and shellfish picking in the Maldives. These combinations of livelihood strategies were initially further diversified with the coming of tourism, but they then gradually became less and less diversified.

“In the past women on the island collected shells, coir ropes (rope made of coconut husk), clean around the island for money. Now we don’t do much [...] Now women perform only housework. No, there is no longer fish cooking or anything of the kind of activities done in the past” (Female, 56, Kudaafari).

People instead started specializing in tourism-related activities as this new cash-based livelihood source proved viable.

Storing

In addition to changing the production of resources, the studied communities also reduce risk of resource scarcity by storing particular resources. This adaptive process is referred to simply as storing and reduces risk by diffusing consumption of vital resources across time. The most obvious examples of this are the storing of food and water in Nepal and water in the Maldives.

“All the food was stored during the winter time in the past [...] now we keep food stock for tourists” (Male, 43, Khumjung).

“We usually buy and keep stock rice, lentils and sugar are bought in bulk and this helped us after the earthquake” (Female, 27, Khumjung).

Food has always been stored to ensure basic nutrition in times of hardship in Khumjung, Kengma, Buksa, and Ingla. However, a massive amount and variety of food is now being stored in Khumjung, mainly to ensure food for tourists. This proved incredibly valuable to sustain the community in the aftermath of the 2015 earthquakes. Cattle feed, dried leaf litter (component of organic manure), firewood, and dried animal dung (for fuel) are also stored in the Nepalese communities.

In the studied Maldivian communities, food is not stored to any significant degree, which could be due to the relatively easy access to fish and seafood over millennia. Instead, fresh water is more critical. After relying on often increasingly salinized wells, the communities of Maafushi and Kudaafari are now mainly harvesting rainwater and storing it in tanks.

Rationing

Another way the studied communities adapt to reduce the risk of resource scarcity is by regulating the consumption of vital resources.

This is referred to as rationing and is found in different forms in all cases. The main example of rationing in Nepal concerns forests, which provide vital resources and are increasingly exposed the higher the altitude where they grow.

“To ensure that the forest is not destroyed and the animals there are kept safe, we have the traditional Nawa system [...] and now we have the Nawa grazing management system” (Male, 58, Khumjung).

This is the main reason behind the Sherpas' traditional resource management system (*Nawa*), which predates and exists in parallel with the current formal restrictions on forest resource use. These formal restrictions are the most heavily enforced in the large national park around Mount Everest, even if there are restrictions on logging across the country.

The main example of rationing in the Maldives concerns fish, which is a vital resource that is more difficult to monitor and ration. Although there are outright bans in place for catching certain fish, especially sharks and rays, the main strategy for rationing the use of vital marine resources is to restrict the technology used for fishing, for instance by banning fishing nets, while allowing pole fishing, line fishing, and long-line fishing.

Restoring

Although less prevalent, there are examples in the studied communities of reducing risk by attempting to restore previously consumed vital resources. This is referred to as restoring and is mainly found in the harsher living conditions in Nepal. For example, the decline in cattle in Khumjung, Kengma, and Buksa, combined with restrictions on collecting leaf litter in the forests (particularly in Khumjung), has reduced the availability of manure, which over time has

diminished the soil fertility for agriculture. This is a major problem that the community in Khumjung is attempting to address by reintroducing traditional toilets that produce manure (and conserve water) that could be used for restoring soil fertility. Another example is the replanting of alder trees (*Uttis*) in Ingla, which had been removed during earlier agricultural expansion.

“There was a lot of deforestation and still continues [...] but we have Uttis (Alder trees), which is grown mainly to provide shade to the cardamom as it requires cold temperature” (Female, 67, Ingla).

It is more difficult to find examples of restoring in the Maldives, aside of the community restoring coral growth on Kudaafari and individuals being hired to work in the governmental or NGO run marine conservation projects. These outside-led activities often have restoring results, but the engagement of the community members ends as soon as the money runs out.

Pooling

There are many examples of community members sharing particular resources among themselves. This reduces risk by pooling these vital resources across social groups. The most concrete examples of this is the communal ownership or management of forests in Nepal and fishing grounds in the Maldives. There are also other examples mainly practiced by women.

“We have a women’s organisation called Bachaat (savings) [...] mainly to give out loans. Even I took to buy cardamom seeds (Female, 37, Ingla).

There is also the long but dwindling traditions in both Nepal and the Maldives of pooling labour, which now mainly comprise women pooling their labour for managing significant ceremonies, such as weddings, funerals, and festivals.

“Long time ago it was very peaceful and we helped each other [...] Everybody helped build the house and take sand coral (community bonds). And now everything has changed” (Male, 37, Kudaafari).

Exchange

In addition to pooling resources, the studied communities reduce risk by exchanging vital resources across social groups. The most prevalent way of exchange in all cases is market exchange, in which actors sell the goods or services they can supply on a common market and use the money to buy the goods and services needed. This happened also in the past, but to a less degree.

“Earlier when I was 14, I remember that we had Yak and Nak (female) and travel to Tibet for trade was common” (Male, 73, Khumjung).

The closest physical markets to which the studied communities have access are still more or less isolated, but connected to global markets, which make them vulnerable to fluctuations in supply and demand that are determined by distant actors. This is most notable in the immediate decline of tourists in Nepal after the 2015 earthquakes and the steeply increasing costs of vital resources during the 2015 Indian trade embargo on Nepal.

The other two main forms of exchange are redistribution and reciprocity, which were the dominant forms of exchange in all the studied cases before the coming of market exchange.

Now, redistribution mainly occurs on ceremonial occasions, such as the practice of redistributing grains between households for the celebrations of a religious festival in Khumjung. Similarly, reciprocity is also rare outside the immediate family and largely confined to special occasions, such as help to manage marriages and deaths, or in times of crisis (e.g. the earthquake).

Innovation

Innovation in relation to livelihoods has been an important part of adaptation, as it reduces risk by coming up with new means for adaptation. These efforts have generally been aimed at providing improved means to intensify or extensify the production of vital resources, and indirectly reduce the risk of resource scarcity. Without innovation, people would all still be living as hunter-gatherers. This is a fundamental aspect of the human experience and all the cases are full of such examples, e.g. greenhouses in Khumjung, and Fish Aggregating Devices (FAD) in Maafushi and Kudaafari.

“Now due to greenhouse technique we can grow a variety of food but it is not suitable for winters” (Female, 81, Khumjung).

“Earlier we had to travel long distances to fish but now we just have to near the device (FAD) [...] it has made fishing easier but it is also quite destructive” (Male, 80, Kudaafari).

Rediscovery

In addition to coming up with new ways to improve the means of adaptation, there are also examples in the studied communities of reducing risk by reintroducing old means of adaptation. This is referred to as rediscovery and is best exemplified in Nepal by the reintroduction of traditional compost toilets in

Khumjung and use of litter leaves and animal dung in Inga, as the use of urea is largely seen as a cause of the devastating pest attacks on the vital cardamom plantations there.

“They say open defecation is not good and then we need safety tank to dispose [...] but this is not useful to us as water and manure is scarce so we started re-using traditional toilets but we have flush as well” (Male, 58 Khumjung).

The main example of rediscovery in the Maldives is somewhat different. Here, traditional thatch making has been reintroduced, but for a different purpose than in the past. In the past, thatch making was mainly for household related activities, and used for making mats and for the construction of houses. Today, it is only used for making tourist resorts look exotic and for souvenirs for the visitors to take home.

Re-evaluation

It is clear in the narratives of the respondents that it is not only their environment and livelihoods that have changed, but also their aspirations, preferences, and expectations for the future. A clear example is the change in attitudes towards resource use. In Nepal, despite instances of spiritual influences on forest use and management, after the 2015 earthquake there was a spike in logging to rebuild houses, largely to cater for the tourist that the community wanted back.

“It’s the offseason now. So we are trying to rebuild as soon as possible so that we are ready for the season” (Female, 80, Khumjung).

The interviews reveal that leaving the subsistence livelihoods of the past for income-based livelihoods—centred on tourism or commercial agriculture or fishing—has

resulted in a range of positive outcomes that the inhabitants now desire and expect. This includes decreased malnutrition and increased access to improved drinking water and sanitation, healthcare, education and transportation. However, these changes have also rendered these communities more vulnerable to shocks triggered by natural hazards or political disruptions, but rooted in the integration of their livelihoods with external market forces. This is most vividly exemplified by the 2015 earthquakes that temporarily reduced the number of tourists in Khumjung when the income was needed the most, and the pest attacks on cardamom in Ingla that destroyed their main income source more or less completely.

Although it is complex to ascertain the direction of the impact on risk, as some risks may be reduced while other risks increase, adjusting the aspirations and expectation for the future can reduce risk. This is referred to as *re-evaluation* and it reduces risk by altering the preferred ends of adaptation.

Discussion

The results of the study reveal a range of different adaptive processes (Table 2), some of which bear semblance to the established conceptualization in literature, and others that emerge out of the study itself. The novel conceptualisation of adaptive processes drawn from the study is supported by a closer examination of their purposes and connections, in relation to how each reduces risk. When analysing this latter aspect, three main categories emerge based on a conceptual ordering of purpose. First-order adaptive processes focus on adaptation directly, comprising the majority of the identified adaptive processes. Second-order adaptive processes focus instead on adapting the means of adaptation. Third-order adaptive processes

focus on adapting the ends of adaptation. The discussion concludes with the introduction of a process-oriented theoretical framework of adaptation.

First-order adaptive processes (focus on adaptation)

The vast majority of the adaptive processes identified in the study focus on reducing risk directly; 10 out of 13 to be exact (Table 1). These first-order adaptive processes reduce risk in five overall ways, which are presented in separate subsections below.

Changing the scenery

The first and arguably the most basic overall way to reduce risk is by changing the location. This can be done either by moving to another location, here referred to as *mobility*, or by purposefully adjusting the original location, here referred to as *design*. *Mobility* is a fundamental aspect of humankind (Kelly, 1992) and it is unsurprising to find temporary, seasonal, and permanent migration in all studied cases. It is equally unsurprising that *mobility* is included in several available frameworks of adaptive processes (Agrawal, 2010; Halstead and O'Shea, 1989; Thornton and Manasfi, 2010). The presents study, however conceptualizes *mobility* explicitly in relation to risk. Agrawal (2010) does suggest that *mobility* reduces risk by distributing it across space. Although we sympathize with that notion in principle, it glosses over a crucial distinction that emerged in our findings. While *mobility* is a common response to potential hazards, such as cold spells, blizzards, and droughts, it is at least equally common to get a job or education. We therefore suggest that *mobility* reduces risk by moving away from the source of risk or towards better opportunities (Table 2).

Table 1. Overview of the first-, second-, and third-order adaptive processes found in the study

	Adaptive process	Purpose
First order	Mobility	Reduce risk by moving away from its source or towards better opportunities
	Design	Reduce risk by designing artefacts to meet specific purposes
	Extensification	Reduce risk by increasing the output of vital resources and distributing their production across space
	Intensification	Reduce risk by increasing the output of vital resources within same space
	Diversification	Reduce risk by diffusing it across different vital resources
	Storing	Reduce risk by diffusing consumption of vital resources across time
	Rationing	Reduce risk by regulating the consumption of vital resources
	Restoring	Reduce risk by restoring previously consumed vital resources
	Pooling	Reduce risk by pooling vital resources across social groups
	Exchange	Reduce risk by exchanging vital resources across social groups
Second order	Innovation	Reduce risk indirectly by coming up with new means for adaptation
	Rediscovery	Reduce risk indirectly by reintroducing old means for adaptation
Third order	Re-evaluation	Reduce risk indirectly by adjusting aspirations and expectations for the future

What is more surprising is that none of the available frameworks of adaptive processes that we have found explicitly include purposeful adjustments of the local environment as an adaptive process in itself (Agrawal, 2010; Halstead and O'Shea, 1989;

McCay, 1978; Thornton and Manasfi, 2010). It is obvious that some such adjustments are implicit in the descriptions of *diversification* (Agrawal, 2010; Halstead and O'Shea, 1989; McCay, 1978; Thornton and Manasfi, 2010) and *intensification* (McCay, 1978; Thornton and Manasfi, 2010), but such *design* reduce risk in other ways as well. For instance, terracing of slopes not only reduces risk of food scarcity by increasing the output of vital resources in a given space (*intensification*), but also by reducing erosion and landslide hazard. We therefore deem it necessary to include the adaptive process of *design* explicitly in any framework of adaptation, as some of its central aspects are likely to be overlooked if merely categorized as an implicit part of other processes.

Applying technology

The adaptive process of *design* not only reduces risk by changing the environment, and in the present study the landscape but also by designing artefacts to meet specific purposes. There are few things that are more symptomatic of the human condition than designing and applying technology, in the broadest possible sense (Elias, 1995). The results of the study are rife with illustrations of this, even if there is only room for a few examples in this paper. This is oddly enough not included in any of the identified frameworks, at least not explicitly. A plausible reason for this oversight might be the common focus on direct livelihood resources among the identified frameworks (Agrawal, 2010; Halstead and O'Shea, 1989; McCay, 1978; Thornton and Manasfi, 2010), or perhaps it is simply too commonsensical to attract explicit attention.

Adjusting production or consumption

Another fundamental group of adaptive processes that reduce risk focuses on adjusting

the production or consumption of vital resources. It is interesting to note that *diversification* is the only adaptive process included in all four identified frameworks (Agrawal, 2010; Halstead and O'Shea, 1989; McCay, 1978; Thornton and Manasfi, 2010). Additionally, *intensification* is included as an adaptive process on the production side in two of the frameworks (McCay, 1978; Thornton and Manasfi, 2010). However, the meaning of *diversification* and *intensification* differs in these frameworks, requiring the introduction of the adaptive process of *extensification* when considering how each reduces risk.

The *diversification* found in this study reduces risk by diffusing it across different vital resources, as suggested by Agrawal (2010) and Thornton and Manasfi (2010) as well as Halstead and O'Shea (1989). But Halstead and O'Shea (1989) add a second part that entails expanding the space used for particular livelihood activities. This reduces risk by increasing the output of vital resources and distributing their production across space, which is qualitatively different. We refer to this as *extensification*, which mitigates resource scarcity and increases redundancy if one location is affected by some hazard. However, Thornton and Manasfi (2010) do mention *extensification* in their publication, but for some reason omit it from their framework of adaptive processes. We argue that all three processes—*diversification*, *intensification*, and *extensification*—are needed to make the different ways that adjustments in production can reduce risk explicit (Table 2).

There are also two adaptive processes identified in the results that reduce risk by adjusting the consumption of vital resources: *storing* and *rationing*. These may at first appear to overlap considerably, but we maintain the importance of keeping them separate even if there are interconnections between them. *Storing* is not only included in three of the four

identified frameworks of adaptive processes (Agrawal, 2010; Halstead and O'Shea, 1989; Thornton and Manasfi, 2010), it is defined in remarkably similar ways (Table 1). *Rationing*, on the other hand, is only included by Thornton and Manasfi (Thornton and Manasfi, 2010), but deserves in our mind explicit attention for its more normative and regulatory quality that is significant in our studied cases and elsewhere in other resource scarce contexts (Gómez-Baggethun et al., 2012; Ingty, 2017; Thorn et al., 2015).

Conservation

Rationing is about preserving vital resources, which is a constituent part of the literal meaning of the concept of conservation. The results also include activities in the studied cases that reduce risk by *restoring* previously consumed vital resources, which is the last of the constituent parts of conservation. The adaptive process of *restoring* is not part of any of the included frameworks (Table 1), which is particularly noteworthy considering the importance of conservation in adaptation literature in general (Deressa et al., 2009; Hughes et al., 2003; Urwin and Jordan, 2008). *Restoring* depleted vital resources is of utmost importance for reducing long-term risk (Lynch et al., 2017; Sietz and Van Dijk, 2015), although strict conservation regimes may constrain adaptive capacity (Ruiz-Mallén et al., 2015).

Sharing or trading resources

The two last first-order adaptive processes identified in the case studies focus on reducing risk by sharing or trading resources. *Pooling* is here very similar to both Agrawal (2010) and Thornton and Manasfi (2010). *Exchange*, on the other hand, is included in all but McCay's (1978) framework, but in very different ways. While Agrawal (2010) focuses exclusively on

market exchange and Thornton and Manasfi (2010) mainly on market exchange (except blurring the concept by using the same word to also include intergenerational transfer of traditional knowledge), Halstead and O'Shea (1989) focus on reciprocity. It is obvious that market exchange has become the dominant mode of exchange in the studied cases, as expected with the coming of modernity (Polanyi, 2001), but it is important to note that some vital resources are still exchanged through reciprocity and redistribution. This occurs particularly within families and close-knit communities, and especially in times of stress or crisis. We therefore suggest that all forms of *exchange* be included when considering a process-oriented framework for adaptation.

Second-order adaptive processes (focus on the means of adaptation)

When analysing the results from the case studies, it becomes clear that people are also adapting the means for adaptation. These are referred to as second-order adaptive processes and include *innovation* and *rediscovery*. Although *innovation* is introduced as an adaptive process by Thornton and Manasfi (2010), it is qualitatively different from the other adaptive processes discussed above. People have always innovated, but this process has accelerated tremendously over time (Elias, 1995; Gellner, 1989) and in modern society it has become where most people place their hopes for addressing pressing sustainability challenges. At the same time, even if *innovation* is vital for sustainability, not all new ways of doing things lead in the right direction and sometimes old ways are instead rediscovered.

The process of *rediscovery* reduces risk indirectly by reintroducing old means for adaptation. It is not mere nostalgia. The

examples of *rediscovery* in the studied cases are all seen as ways forward, and there are many examples of this in the literature (Barão et al., 2019; Kremen et al., 2012). We therefore consider it necessary, not only to make an explicit distinction between first- and second-order adaptive processes, but also to complement the more commonly included process of *innovation* (Rodima-Taylor et al., 2012; Thornton and Manasfi, 2010), with *rediscovery*.

Third-order adaptive processes (focus on the ends of adaptation)

Finally, it is not only the means of adaptation that are adapted to reduce risk indirectly, but also the ends. Only one such third-order adaptive process was identified in the studied cases; here referred to as *re-evaluation*. This is somewhat related to Thornton and Manasfi's (2010) revitalization—as the reconfiguration of ideologies, practices, and organization to reduce stress—but more specific and focuses on risk. Making such adjustments can either increase or reduce risk, since risk is inherently defined in relation to some preferred expected outcome (Kaplan and Garrick, 1981; Luhmann, 1995, 307-310; Zinn, 2008, 4). Although the direction of the effect of change on risk is ambiguous in the studied cases, there are many explicit examples of *re-evaluation* in literature. For example, the scaling back and conserving core functionality of Norse settlements in Iceland (Streeter et al., 2012), the Moriori reverting from agrarian to hunter-gatherer livelihoods on Chatham Island (Pryor, 2004, 23-24), or contemporary individuals adopting low-carbon lifestyles by limiting much of what they previously enjoyed (Klintman, 2013). We argue therefore that *re-evaluation* is at least as fundamental as any of the first-order adaptive processes commonly discussed and must not be ignored.

An ordered process-oriented framework of adaptation

When analysing the identified adjustments to reduce the risk of the households and communities in the studied cases, two main contributions to existing theory emerge. First of all, focusing explicitly on adaptive processes that reduce risk necessitates the introduction of several new processes (Figure 1). These are *design*, *extensification*, *restoring*, *rediscovery*, and *re-evaluation*, which are all central for understanding adaptation in living memory in the studied cases. The results also demand some reconceptualization of the already suggested process of *exchange*, so it comprises all three types of exchange of reciprocity, redistribution, and market exchange.

Secondly, and perhaps more theoretically important, we suggest a qualitative distinction between first-, second-, and third-order adaptive processes (Figure 1). Only Thornton and Manasfi (2010) and the people citing them include second- and third-order adaptive processes, but they do not distinguish between them. We therefore do not only advocate for the inclusion of second- and third-order adaptive processes, but also for explicitly marking the distinction between them. This is because they are distinct in their ways of facilitating risk reduction, but not independent of each other. If we include such adaptive processes without this distinction—like Thornton and Manasfi (2010) does when they list *innovation* among *mobility*, *intensification*, *storage*, etc.—the intrinsic connections between them and the first-order adaptive processes become obscured. For instance, it is by coming up with new ways to be mobile, to intensify the production of a vital resource and to store that vital resource that *innovation* contributes to reduce risk. Innovation cannot reduce risk its own.

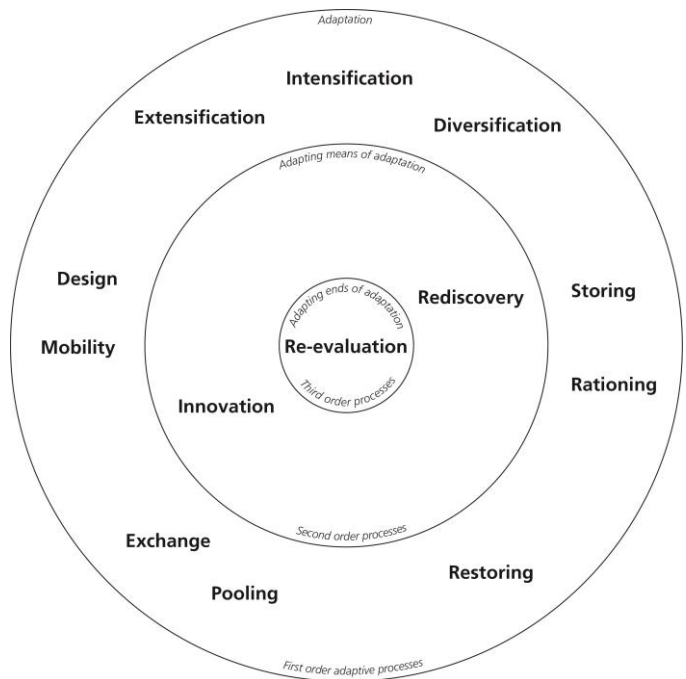


Figure 1. An ordered process-oriented framework for adaptation to reduce risk

Conclusion

The purpose of this paper was to investigate the adaptive processes that have taken place in living memory in vulnerable communities and to suggest a process-oriented framework of adaptation. There are several influential frameworks of adaptive processes, but focusing explicitly on processes that reduce risk entails the introduction of several new processes and some reconceptualization of already suggested processes. It also entails a qualitative distinction between first-, second-, and third-order adaptive processes, which we consider fundamental for understanding adaptation in vulnerable communities. The resulting process-oriented framework of adaptation includes 10 first-order adaptive processes that reduce risk directly by changing locality (*mobility*, *design*), using technology (*design*), adjusting the production (*diversification*, *intensification*, *extensification*) or consumption of resources (*storing*, *rationing*), conserving vital resources (*rationing*, *restoring*), or sharing or trading

vital resources (*pooling, exchange*). The results also include two second-order adaptive processes that reduce risk indirectly by adapting the means of adaptation—either by coming up with new means (*innovation*) or reintroducing old means (*rediscovery*)—and one third-order adaptive process that reduces risk indirectly by adapting the ends of adaptation (*re-evaluation*). Applying this theoretical framework when studying adaptation facilitates comprehensive analyses and understanding of how households and communities adapt to reduce risk, which in turn may open up a broader repertoire of policy and practical support for adaptation towards more sustainable futures.

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