

Community-based Reforestation: An Innovative Approach for Building Resilience in Nepal's Rural Communities?

An exploration of community reforestation programmes in Central and Southern Nepal

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Foreword and acknowledgements

Writing these few words will be amongst the final acts to close my time studying at Utrecht University, a period for which I will be forever grateful. The University and the city have exceeded any expectations that I harboured, allowing me to surround myself with people who would both challenge and inspire.

In regard to this work, I will first say thank you to the many respondents who took time to share their experiences and thoughts. It is thanks to these people that this project has been possible. Second, my appreciation goes to Eden Reforestation Projects. To all of the staff, national and international, thank you for tirelessly working to improve so many lives and our environment. Third, the many staff of Utrecht University who inspire so many students to go into the world to gain knowledge and tackle injustice. In particular, Dr Kei Otsuki and Dr Mucahid Bayrak.

This thesis somehow encapsulates my time in the Netherlands. It has been hugely rewarding yet challenging, and made possible by the unwavering support of friends and family. So it is to them that I also send my thanks. In particular, my brother, George, whose humour, wisdom and tenacity have guided me through both good times and bad. My Mum and Dad, who taught me to live life with compassion and curiosity, whilst embracing opportunity. Finally, my thanks go to my friends, for it is the people in this wonderful city that make it what it is.

All emissions associated with this research have been offset through certified channels.

Summary

Key concepts: Community-based reforestation, resilience, environmental change, participatory development, shock and stress hazards, vulnerability.

The central importance of forests to global ecological and social systems is scientifically and morally indisputable. They harbour some of the richest ecosystems of the planet, regulate climate systems, sequester vast amounts of carbon-dioxide and support the livelihoods of billions. It is remarkable then, that despite widespread recognition of value, forests remain exposed to degradation. This work explores community-based reforestation (CBR) in Nepal as an attempt to align the traditionally divergent objectives of environmental-conservation and community-development. Through CBR, communities are empowered to restore forests and are positioned as the chief beneficiaries of doing so. However, knowledge on the topic is limited, which prevents an accurate case being constructed for further development. This work adopts the resilience perspective as a means of analysis for CBR.

By integrating CBR and the resilience perspective this work has both practical and theoretical implications. Practically, results feed into deepening understandings of CBR impacts for communities, with social, environmental and economic dimensions. Theoretically, results support the development of the resilience perspective debate and contribute to an emerging portfolio of studies that can reflect an effectiveness and flexibility for community analysis.

To explore CBR from the resilience perspective, an adapted community-based resilience analysis (CoBRA) methodology has been utilised. The CoBRA is a qualitative community-level assessment of resilience, that explores the contextual landscape of challenges before assessing resilience. Two case-study communities, in central and eastern Nepal, have been studied to produce three primary findings. First, both communities face portfolios of shifting and exacerbated hazards. Second, CBR has aided community development and contributed to the components of resilience as defined in this work. Third, significant barriers to the approach exist at local and national levels. These findings are an indication of potential, and hope to encourage future research on the topic. However, discerning the global relevance of the approach remains an area requiring attention and is yet to be determined.

The work concludes that CBR is an effective conservation-development approach, which equips communities to more effectively cope with uncertain futures. However, the work has uncovered some key areas through which the approach could enhance its impact on resilience. It is therefore an encouraging indicator of potential which warrants further exploration.

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List of acronyms

CBFM	Community-based Forestry Management
CBNRM	Community-based Natural Resource Management
CFI	Community Forestry Institution
CO ₂	Carbon Dioxide
CoBRA	Community-based Resilience Analysis
FECOFUN	Federation of Community Forest Users in Nepal
GDP	Gross Domestic Product
HDI	Human Development Index
HIV	Human Immunodeficiency Virus
ICIMOD	International Centre for Integrated Mountain Development
JFM	Joint Forestry Management
KII	Key Informant Interview
MDG	Millennium Development Goal
MoFSC	Ministry of Forests and Soil Conservation
NAPA	National Adaptation Programme of Action
NTFP	Non-timber Forest Product
PD	Participatory Development
PES	Payment for Ecosystem Services
PFM	Participatory Forest Management
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SDG	Sustainable Development Goal
SES	Social-ecological System
UNDP	United Nations Development Programme
UNHCR	United Nations High Commissioner for Refugees

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Introduction

‘Programmes to preserve forest resources must start with the local people who are both victims and agents of destruction, and who will bear the burden of any new management scheme. They should be at the centre of integrated forest management.’

(Brundtland Commission, 1987 p.114)

The widespread degradation of the world’s forests manifests itself through local, regional and global impacts, compromising ecological systems which support billions of livelihoods. It is widely accepted that actions to conserve and restore forests are paramount for mitigating climate change, providing ecosystem services and facilitating sustainable development (Zomer et al., 2008). Despite this acknowledgement, political rhetoric is too slowly translated into meaningful action and governments around the world have struggled to reverse alarming rates of deforestation (Poudel et al., 2013). Efforts to actively restore forests through reforestation must be increased as a balancing mechanism (Zomer et al., 2008).

Nepal is a captivating example to explore reforestation initiatives, as historic rates of deforestation have exacerbated a portfolio of environmental hazards that rural communities are exposed to. As a result, communities that have lived in balance with ecosystems for generations are having their resilience tested. Framed by magnificent snow-capped mountains to the north and the steamy Indo-Gangetic Plains to the south, Nepal is characterised by diversity. The dramatic landscape, in which 118 biomes exist, is home to an array of cultures united by their close relationship with nature (Chaudhary, 1998). Nepal’s rural communities have remained insulated from much of the socio-economic development enjoyed in urban regions whilst being subjected to greater environmental hazards, perpetuating high levels of inequality (Gellner, 2007). Approaches which focus on rural livelihood development whilst aiming to conserve and enhance natural capital are therefore key interventions for Nepal. One of the central approaches influencing development studies globally, is community based natural resource management (CBNRM). The role of CBNRM in development studies has increased substantially over four decades, appearing to hold potential in aligning the often divergent goals of socio-economic development and environmental conservation (Dressler et al., 2010). Community-based forestry management (CBFM) is an important element of CBNRM.

Community-based reforestation (CBR) uses CBFM as a vehicle for deployment, with high potential for enhancing ecosystems and community development. There is momentum gathering behind grass-roots CBR programmes around the world, which are increasingly recognised as effective development-conservation approaches (Le et al., 2012). The cumulative impact of such programmes for climate change mitigation drives further interest, and warrants explorations of the approach to broaden understanding. As a greater understanding is gained and different deployment and management approaches are refined, community development and environmental conservation impacts can be improved. However, CBR is also a costly and complex intervention. Despite seemingly high potential for supporting forests and development, limited critical evaluations have resulted in a knowledge gap on impacts and outcomes.

It is with this focus that this work has been conducted. Specifically, aiming to gain a better understanding of how engagement with reforestation programmes has impacted community resilience in Nepal. This focus is primarily justified as the understanding of how engagement with such programmes relates to community resilience is limited. The potential synergy, as highlighted by Tompkins & Adger (2004), has not been given sufficient attention in literature resulting in a recognised knowledge-gap. Alongside countering uncertainties regarding resilience, results on the outcomes of CBR participation hold value for practitioners and policy-makers. As knowledge of outcomes is fortified, the potential for CBR to be deployed as an approach for addressing particular issues is made more feasible.

Community resilience is a rapidly developing field, with global attention and awareness accelerated through acknowledgements in both the Sustainable Development Goals (SDGs) and the Paris Climate Accord (Schipper & Langston, 2015). As an emerging field, definitions remain disputed and context dependent. This work adopts the perspective of Schipper & Langston (2015), in that community resilience has three components, *learning*, *options* and *flexibility*. This perspective is then explored through the use of an adapted version of the United Nations Development Programme's (UNDP) community-based resilience analysis (CoBRA) model. The CoBRA model is a qualitative approach, which aims to explore the vulnerabilities of a community before using participatory methods to determine what resilience can look like in the local context. Although optimal methods for assessing resilience remain contested (Folke, 2006), by deploying the model in this work, results are embedded in a credible and tested approach. The research focuses on two communities in Nepal, in the districts of Nawalparasi and Jhapa. While Nawalparasi is situated in the intensely terraced central mountains, Jhapa is in the sweltering sub-tropical Indo-Gangetic Plain to the south. Both have been engaged with reforestation programmes coordinated by the global reforestation organisation, Eden Reforestation Projects (Eden). Eden is the largest reforestation organisation operating in Nepal, therefore acting as a valuable platform from which to explore the topics of this research.

This thesis will first outline the major positions and debates for both CBR and the resilience perspective in a theoretical framework, followed by the introduction of the research questions. The research is then contextualised within a regional framework, before drawing into the methodology. Results are then structured by CBR findings, resilience perspective analysis and barriers to upscaling. The discussion then draws these elements together to explore the relationship.

1. Theoretical framework

The subsequent section will outline some of the major theoretical positions and debates within the fields of community forestry and resilience. First, driving forces behind the increasing decentralisation of natural resource management are introduced. Secondly, community-forestry is contextualised within literature on forestry and development-conservation approaches. This is followed by a general evaluation of the community-forestry concept, drawing upon a range of studies to outline social and ecological impacts. CBR is then discussed in greater detail, before drawing into an evaluation of the resilience perspective.

1.1 Community-based natural resource management

The CBNRM approach explores how devolution of natural resource management responsibilities can facilitate local socio-economic development and encourage environmental conservation (Gruber, 2010). It is inherently grass-roots in nature, built on values of participatory democracy and incorporating multiple perspectives. It has been broadly framed as an alternative to top-down and centralised management of natural resources, the effectiveness of which has been increasingly brought into question (Gautam et al., 2004). Through the approach, the management of natural resources is redistributed to the community-level, generating long-term vested interests from participating communities in the sustainable management of natural resources. The approach facilitates sustainable management through two basic principles. First, security of tenure is formalised for the resources in question. Second, communities are able to benefit economically from the resources. These two principles incentivise management with considerations for the future, thus avoiding the degradation of resources.

The sustainable management of resources by communities is not a new phenomenon, it has been practiced widely throughout history often to a highly effective degree. CBNRM through local institutions, such as village councils, allowed many communities around the world to sustainably manage their natural resources for generations (Berkes et al., 2000). These management approaches relied on social mechanisms (such as coordinating and sanctioning) and local ecological knowledge as a basis for highly reflexive and effective use of resources (Berkes et al., 2000). However, the twentieth-century witnessed the widespread breakdown of localised resource management. The breakdown of traditional approaches can be primarily attributed to the disruptions of colonisation, cultural interference, market-forces and globalisation (USAID, 2016). It is therefore necessary to rebuild local capacity with a recognition of the twenty-first century context. As highlighted by Dressler et al. (2010), CBNRM in its contemporary form has been gaining momentum since the 1970s. Prior to this, exclusionary and fortress environmental conservation approaches were the status-quo despite a neutral or negative impact on development (Ludwig et al., 1993). The widespread and recurrent failure of centralised resource management initiated discussions on alternatives, and increasing recognition on the value of decentralised community management (Berkes et al., 2000; Dressler et al., 2010).

1.1.1 Relationship with commons theory

CBNRM is built upon commons management theories. Rather than adopting the lessons from Hardin's (1968) (in)famous essay, CBNRM is more consistent with the influential works of Shiva (2016) and Ostrom (1990). Both authors are strong advocates for the effective management of shared-resource systems without privatisation or regulation under certain circumstances. The origins of CBNRM's success are likely to have been encouraged by Ostrom's numerous publications on the theories of commons governance, which paved the way for countering Hardin's well-entrenched arguments. Ostrom's work has been the flagship for community empowerment with regard to resource management, outlining design principles through which commons can be managed to avoid privatisation. Post-1990 literature on the topic has built on the foundations of the design principles, furthering the momentum of community-commons management (Cox et al., 2010).

While influential contributions to commons theory have highlighted the potential for intra-community management, works are coupled with the acknowledgement that this can only occur under certain conditions (Feeny et al., 1990; Ostrom et al., 1999). Contexts regarding group homogeneity, cultural and institutional influences, and the resource's abundance and characteristics all influence the likelihood of effective management. Feeny et al. (1990) raise the point that the involvement of extra-community institutions remains important in commons management. This has been translated into many CBNRM approaches, as the local authorities or governments support frameworks through which the resources are managed.

1.1.2 Drivers behind the uptake

So what has driven the rise of the CBNRM concept globally? Decentralising management has been receiving attention in many fields, with the management of resources being just one, so it is an aspect of a broader trend (Phelps et al., 2010). For instance, the Transition Movement promotes the devolution of power for communities in regard to energy, agriculture and self-determination (Hopkins, 2008). It is suggested that through increased local autonomy, communities are able to build contextual-resilience and break dependencies on external systems. The CBNRM concept is related to elements of this theory, in particular a shared belief in local capacity for more effective management.

However, CBNRM is primarily driven by environmental challenges. Across the globe, the exponential depletion of natural resources over the last century can be primarily attributed to rapid population growth, increasing affluence and technological innovations, recognised by Steffen et al. (2011) as the *Anthropocene*. The unsustainable depletion of these resources is having myriad consequences, including widespread pollution of fresh water sources (Gleick, 2003), deforestation (Bonan, 2008), and climate change (Dasgupta, 2010). Natural resource depletion is also a primary driver behind the loss of habitat around the world, and is thus a forceful influence in perpetuating the Earth's sixth great mass extinction event (Rockström et al., 2009). CBNRM has therefore gained theoretical prominence as a

means through which human development and environmental conservation objectives can be aligned (Dressler et al., 2010).

Integration of the CBNRM concept with SDGs has acted as additional driving force. The SDGs *Gender Equality*, *Clean Water*, *Climate Action*, *Life Below Water* and *Life on Land* are of particular relevance to several CBNRM approaches. The UNDP (2017) published a report on wildlife-CBNRM in Namibia, in which it emphasises the economic benefits of the approach and relationship to the SDG *Decent Work and Economic Growth*, indicative of broader applicability. More exclusive driving forces exist for localised deployments of CBNRM and are context-specific.

In summary, the CBNRM aims to decentralise the management of natural resources, so that communities gain a vested interest in their long-term sustainability. In theory this aligns development and conservation goals, and has gained momentum amongst practitioners and academics as a result. The concept has risen to prominence due to its relationship with the commons theory and potential to tackle environmental issues. While CBNRM is the overarching concept, deployments have a more practical orientation. Figure 1 outlines the focus of this work within CBNRM, the management of forests.

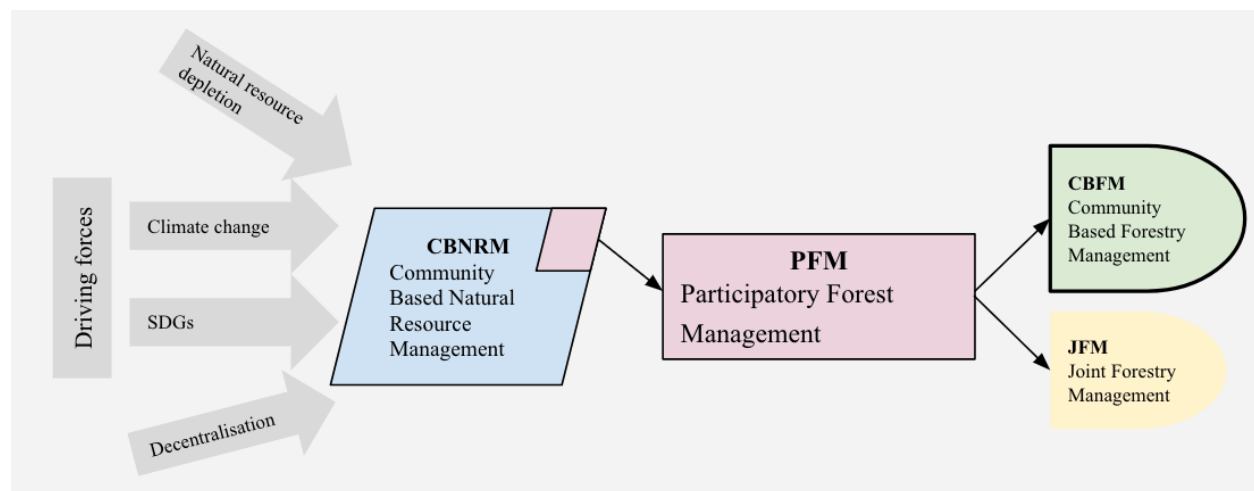


Figure 1: Key background concepts of CBFM. Author's own.

1.2 Participatory forest management

The recognition of the importance of forests has driven sustainable management higher on political agendas, introduced into the global policy arena as a clean development mechanism in the 1997 Kyoto Protocol (Zomer et al., 2008). This has been perpetuated through the Millennium Development Goals (MDGs) and SDGs, with forests retaining key places in global environmental discussions. Both sets of development goals foster the appreciation that through effective management approaches, the potential for forests to act as global carbon sinks and local development aids can be unlocked (Thomas

et al., 2010). The Brundtland Commission's *Our Common Future* (1987) was an early key influence that propelled sustainable management of natural resources higher on the global agenda, with forestry as no exception;

'...forests protect watersheds, reduce erosion, offer habitats for wild species, and play key roles in the climatic system. The crucial task is to balance the need to exploit forests against the need to preserve them.' (p.114)

How to best achieve the *balance* that the Commission refers to is what has been disputed in both theory and practice in the intervening decades. PFM has gathered momentum as an approach which engages communities in the management of their forests. Through increased responsibility comes a sense of ownership and the potential to benefit from sustainably managed forests. Engagement with management generates a concern for the forest's present and future wellbeing, breaking down walls of apathy that can separate communities from their environment (Inoue, 2000). The two variants of PFM are indicative of different levels of community responsibility and autonomy. Joint forestry management (JFM) is a partnership between authorities and the community, though the retention of government involvement can be a hindrance on effectiveness (Shackleton et al., 2002). CBFM is an approach through which communities are comprehensively engaged with the management of their forests. The forest becomes the community's responsibility, appropriate environmental stewardship training is provided and ongoing sustainable management encouraged through incentives (FAO(a), 2015). The spectrum of incentives is broad, ranging from internationally coordinated payments for ecosystem-services (PES) to local provision of firewood and non-timber forest products (NTFPs).

1.2.1 *Community-based forest management*

CBFM is differentiated from conventional and commercial forms of forestry through high involvement of communities and its emphasis on improving livelihoods, most often the rural poor. The objectives of CBFM will often be nationally (and locally) specific, though the guiding principles are to bolster rural opportunities and thus aid development while ensuring more effective management of forests. A central element of this is to secure tenure for the community, ensuring that efforts are long-term and sustainable (Molnar et al., 2011). CBFM is defined by the FAO(b) (2015) as;

'Encompassing the management of forest lands and forest resources by or with local people, individually or in groups, and for commercial or non-commercial purposes' (p.1)

The approach has been increasingly deployed around the world, with encouraging results on the positive responses (Klooster & Masera, 2000). It is estimated that 11-percent of the world's forests are under CBFM, a figure that rises to 27-percent when only developing nations are considered (Molnar et al., 2011). This trend thus amounts to a global tenure-transition, with far reaching consequences for rural development and conservation (Agrawal, 2002). It is the community forest institutions (CFIs) that directly benefit from the land tenure, consisting of community members and a management committee. As the uptake of CBFM indicates, there is considerable evidence of

numerous positive outcomes. However, beyond the waves of enthusiasm there are significant cynical voices, backed by evidence that CBFM can result in unforeseen externalities. Table 1 provides a summary of available literature on CBFM outcomes using the ecological and societal impact differentiation suggested by Gallopín (2006).

Table 1: Summary of literature on the impacts of CBFM.

	<i>Ecological</i>	<i>Social</i>
Positive	<ul style="list-style-type: none"> • Essential component in mitigating global climate change and offsetting future emissions (Larson, 2011) • Gains in the level of carbon sequestration of forests (Ruddel et al., 2007) • Localised ecosystem services in provision and regulation of water and products (Sunderlin et al., 2005; Agarwal, 2001) • Stability and nutrient levels of soils (Eckholm, 1976) • Reforestation increases the productivity of previously degraded land (Le et al., 2012) • When forests are conserved in a highly effective manner, conditions in Nepal have consistently improved (Thoms, 2008) 	<ul style="list-style-type: none"> • CFIs collect diversified income streams from NTFPs (Sunderlin et al., 2005; Lacuna-Richman, 2011) • Local decentralised management removes administrative burdens from governments (Phelps et al., 2010) • Women are disproportionately benefited as natural provisions are managed effectively closer to settlements (Hyde and Kohlin, 2000) • Stable local employment can be created (Sunderlin et al., 2005; Le et al., 2012) • Redresses the urban-bias of many development policies (Agrawal, 2001) • Reinforcing social cohesion (Tidball et al., 2017)
Negative	<ul style="list-style-type: none"> • Minimal impacts on biodiversity increases with mono-culture plantations (Ruddel et al., 2007) • Protecting some forests can increase pressures on surrounding land (Ruddel, 1998) • Failing to account for life-span of schemes can result in newly planted forests being degraded (Le et al., 2012) 	<ul style="list-style-type: none"> • Potential discrepancies in the distribution of benefits from projects, especially with regard to women (Lacuna-Richman, 2011; Agarwal, 2001; Le et al., 2012) • Poorly enforced regulations of agreements, many of which are unambitious in the expectations (Man Amartya, 2013) • Communities which have not been sufficiently engaged can result in conflicts (Le et al., 2012) • Acquisition of land can lead to marginalised and disadvantaged communities (Le et al., 2012; Man Amartya, 2013) • If restrictions are placed on forests, local people lose access to biomass source (Rudel, 1998) • CFIs can be dominated by local elites, which perpetuates localised inequalities (Thoms, 2008)

1.2.2 Relationship to participatory development

The theoretical paradigm of participatory development (PD) has been comprehensively adopted over the last three decades, to the point where it has become normalised as an orthodoxy (Mohan, 2014). Stripped to basics, PD is the involvement of local people in development activities. The theory, taken by many today as common-sense, rose as a retaliatory response to the previously dominant development conventions described as ‘Euro-centric, top-down and positivist’ (Mohan, 2014 p.132). PD has intense ties with CBNRM in general, and more specifically CBFM. As communities are brought together to manage their forests, assistance from authorities and organisations is extensive. The establishment of formal institutions, engagement in training programmes and community mobilisation are key processes in CBFM (Molnar et al., 2011). The focus of this work, CBR, has used CBFM as a vehicle for deployment, building on local institutions to delve into greater ecological and societal outcomes with potential repercussions for climate mitigation and development efforts. Therefore, CBR can be framed as an extension to CBFM, both of which are rooted in PD.

1.3 Community-based reforestation

CBR initiatives provide communities with technical and financial assistance to actively restore forests in under-utilised lands. Community members are the primary agents of change in the process with responsibilities for planting trees and the subsequent protection of the forest. Figure 2 shows the four general stages of CBR. It was estimated by Zomer et al. (2008) that around the world there are 750-million hectares (ha) that would be suitable for reforestation projects, an area two and a half times greater than Argentina. Reforestation in the Earth’s tropical zones alone could store up to 70-billion tonnes of CO₂ (Palm et al., 2005). Strategies to approach the challenge are varied, and the optimal approach to unlock potential remains contested.

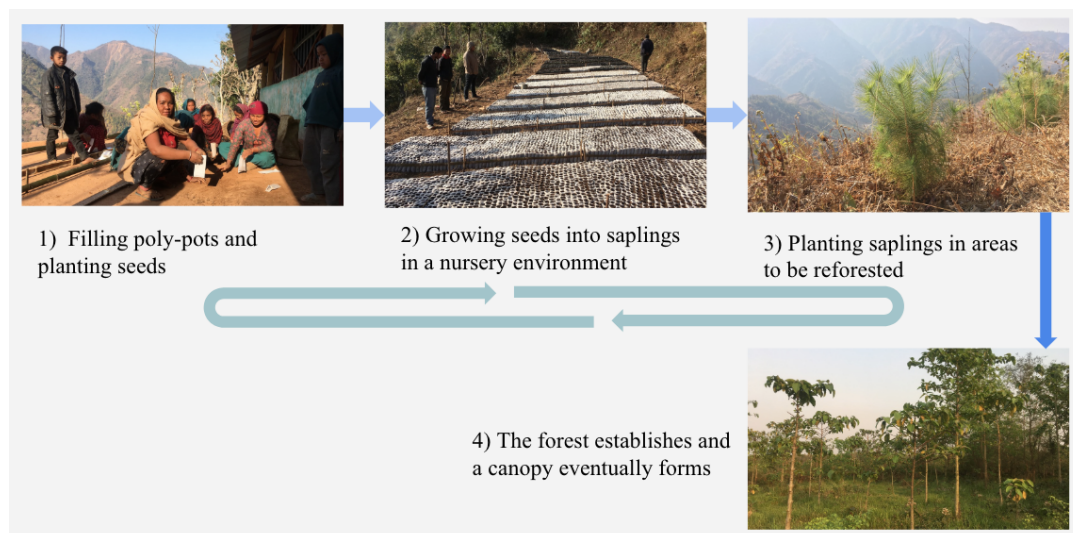


Figure 2: Summary of CBR stages. The first three stages are repeated until under-utilised areas are filled.

Top-down and centralised projects are conducted over large and undeniably impressive scales. The primary driving force behind such reforestation efforts globally is the sequestration of atmospheric CO₂ and thus the mitigation of climate change (Zomer et al., 2008). These can be in accordance with national or international targets, furthered as developed nations begin to explore options of abating emissions abroad (Barazini et al., 2016). The ratification of the Paris Agreement in 2016 is the latest major push through which reforestation is promoted as a means of CO₂ abatement and off-setting (Cléménçon, 2016). Now is the period in which national commitments must be translated into feasible and cost-effective carbon reduction strategies and actions. Reforestation programmes will play an increasingly central role in these strategies (Barazini et al., 2016).

The Loess Plateau is a vast region in northern-central China, which was the recipient of an ecological rehabilitation initiative; the *Grain to Green Programme* from 1999 (Bennett, 2008). The initiative was (in)famous for its scale, 120-million farmers were paid to retire and re-vegetate over 9-million ha of agricultural land (twice the size of the Netherlands), reverting the region to a more naturally functioning ecosystem (Lü et al., 2012). The environmental impacts have been considerable, and although precipitation has decreased in accordance to wider climatic changes, the retention of ground water and reduction of surface run-off have both improved (Lü et al., 2012). However, the livelihood impacts of the project remain contentious. Effected communities have had minimal consultation opportunities, were forced into participating and the distribution of subsidies has been ineffective (Bennett, 2008). This example encapsulates the issues associated with many mega-projects around the world; with high impacts in both intended areas and externalities. It is essential that communities are retained as key stakeholders in all project considerations, though the difficulty of this increases in accordance with scale (Botes & van Rensburg, 2000).

An alternative approach to reforestation are subtler community-based initiatives. Community-reforestation is one of multiple sub-categories of the umbrella term CBFM (Lacuna- Richman, 2011) and is defined by the FAO (2010) as the;

‘Re-establishment of forest through planting or seeding on land (previously or currently) classified as forest by communities.’ (p.13)

Community engagement with reforestation allows the widespread diffusion of programmes which are tailored to specific contexts and are based on the core principles of CBNRM; participatory democracy and incorporating multiple perspectives (Le et al. 2012). CBR is therefore intrinsically better placed than top-down projects to engage communities in a participatory manner. Projects primarily operate with social and environmental objectives, accelerating socio-economic development, restoration of local eco-systems and the mitigation of climate change through CO₂ sequestration. As table 2 indicates, community-based reforestation schemes have been deployed around the world with encouraging results. The diversity of cultural and environmental contexts of the projects is indicative of the approach’s flexibility. However, the approach is not insulated from some of the negative externalities of its broader framework CBFM (as discussed in table 1).

Table 2: Examples of CBR projects and outcomes.

<i>Project (Location)</i>	<i>Description</i>
Mangrove restoration (Philippines) Walton et al. (2006)	Restoration of a 76-ha mangrove forest on Panay Island, the Philippines. This has had considerable benefits for the surrounding communities. A positive correlation with fish productivity as natural hatching sites are restored and eco-tourism has led to quantifiable economic outcomes. The mangroves are perceived to act as a barrier against storm damage. Improved fish catches gave an estimated economic value of the mangroves of US\$463-2215 ha ⁻¹ year ⁻¹ .
Rainforest reforestation (Australia) (Vanclay, 2006)	From 1993 to 2000, a community reforestation project was run in eastern Australia. It aimed to establish a sustainable timber industry and promote the environmental services associated with rainforest in the area. However, the programme failed due to a number of oversights. A lack of forest specialist involvement, limited staff training, not enough local considerations and over-ambitious goals. The project's momentum stalled once support was withdrawn.
Reforestation and timber (Mexico) (Klooster and Masera, 2000)	In Michoacán state, Mexico, community-based reforestation efforts have led to the establishment of a sustainably managed forest which supports a thriving local timber industry. Training and expertise generation have allowed 1200 jobs to be sustained in the area, coinciding with an 814-ha area being reforested with native species from 1988 - 1997.
Rural development through reforestation (Uganda) (Natural Capital Partners, 2017)	Natural Capital Partners have funded community-reforestation initiatives in the southwest of Uganda. 8000 farmers have worked within the project to plant over six-million trees, with the aim of contributing to sustainable development through biodiversity protection, economic growth, food security, carbon sequestration and the empowerment of women.

So, reforestation is comprehensively acknowledged as a key strategy for mitigating climate change and restoring local eco-systems. However, top-down strategies can be exclusionary and socially damaging. Thus, reasons to explore the other end of the spectrum become increasingly persuasive, in particular integrating community-development. Using CBFM infrastructures as established vehicles through which CBR programmes can be launched helps to aid the approach's feasibility (Barazini et al., 2016).

The relative infancy of the approach means that further research to deepen understandings of CBR as a potential enhancement of CBFM comes at a critical point. To what extent CBR matches, exceeds or falls short of CBFM outcomes is of high contemporary significance for practitioners and academics (Le et al., 2012). Evaluating the potential for upscaling is another important element, and to what extent it can contribute on a global scale to reforestation efforts. The barriers and constraints which hinder the approach must also be clearly identified and evaluated in which ways they can be addressed (Thomas et al., 2010). Finally, how these programmes can relate to community resilience against climate change is also an area with limited academic attention. However, it is discussed by Locatelli et al. (2015) as an area that must be given greater appreciation as a potential synergistic crossover. If

CBR, as an element of CBNRM, can be approached in a manner to facilitate increasing resilience, it can be recognised as a local adaptation and global mitigation strategy.

1.4 Resilience

The resilience perspective forms the underlying theory upon which this research is based. While CBR is an inherently practical development-conservation approach, its immaturity warrants analysis from theoretical bases. The resilience perspective has been selected for this work due to its emerging potential and topical significance as an academic theory.

Resilience is a system's capability to withstand impacts from shock and stress challenges, allowing it to more confidently face increasingly uncertain futures (Mitchell & Harris, 2012). It features widely in both development and climate change studies, selected as the 2012 International Development Buzzword (Devex, 2012) and is used to describe targets in five of the SDGs (UNDP, 2018). The rise of the concept has been amplified by the need for development studies to better account for uncertain futures. Environmental, political, conflict and economic uncertainty can lead to a build-up of shock and stress challenges which can have catastrophic threats to development (Mitchell & Harris 2012). This is visualised in figure 3 below. *Shock* factors are short-term and unforeseeable while *stress* factors are long-term and cumulative. Figure 3 indicates three hypothetical responses, the most resilient response in both contexts is A, where function is restored fastest.

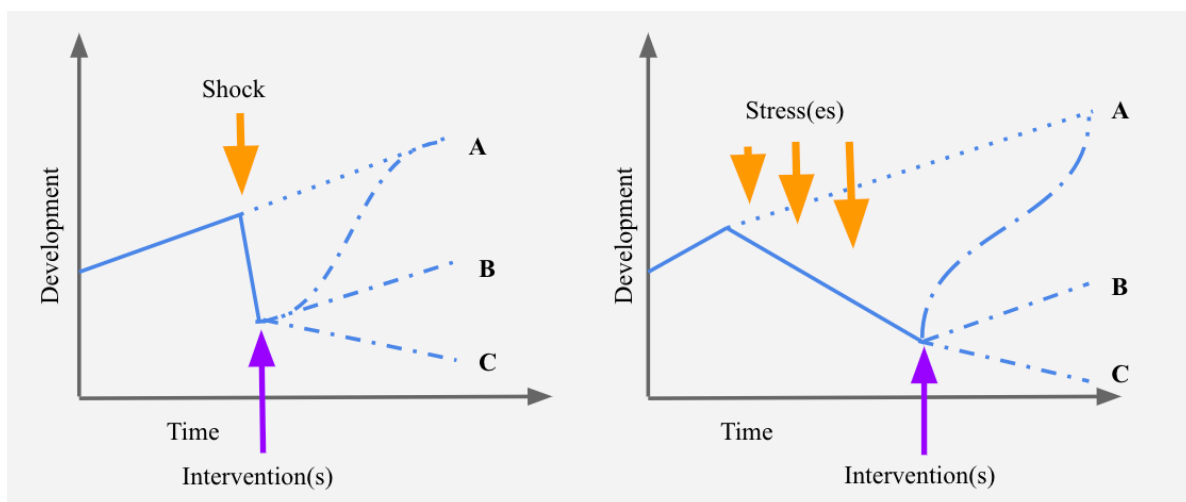


Figure 3: The impact of a shock (left) and the build up of stress (right) on development. Interventions A, B and C are indicative of counter-measures with differing effectiveness. Adapted from: Mitchell & Harris (2012).

However, the global use and prominence of resilience has drawn inevitable critical evaluations. For many scholars, the abstract and ill-defined nature of the resilience concept hinders its functionality. Described by Schipper & Langston (2015) as problematic due to its subjective and context-specific nature. Christopherson et al. (2010) suggest that a probable factor in resilience's popularity is its

malleability, meaning it has been used by different papers and fields without a consistent definition. MacKinnon & Derickson (2013) produce a three-tiered critique of the concept, suggesting it is undermined by its conservative approach to resilience, its western-orientated proceedings and the selection of scales for analysis. The optimum approach for assessing resilience remains contested.

‘Unsurprisingly, the identification of metrics and standards for measuring resilience remains a significant challenge. No consensus exists currently on how to measure resilience.’

(Winderl, 2014 p.5).

Despite concerns in some papers, there is considerable enthusiasm in others. Mitchell (2013) counters the above arguments with well-articulated enthusiasm, suggesting that the emergence of the resilience perspective allows scholars and practitioners insight into the ability of households and communities to cope with shocks and stresses, essential for uncertain futures. The resilience perspective attempts to transform the figurative strengths of resilience, namely its potential to assess vulnerable communities, into practically robust methods. Mitchell’s support for the approach is in relatively good academic company, with papers such as Berkes et al. (2008) and Folke (2006) also highlighting the potential of the perspective. This work sides with such views, supporting the resilience perspective as a valuable addition to the armoury of tools and approaches in development studies. This acceptance comes coupled with an appreciation of the relative immaturity of the approach. Despite its infancy, the legitimacy of the approach is improved due to its close ties with long established ones (Bours et al., 2014). Table 3 below provides a summary of definitions to support the clarity of this introduction to the resilience concept.

Table 3: Summary of definitions within the resilience concept.

<i>Concept</i>	<i>Definition</i>
Resilience	‘The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a shock or stress in a timely and efficient manner’ (Mitchell & Harris, 2012 p.2)
Community	‘...a community is an entity that has geographic boundaries and shared fate. Communities are composed of built, natural, social, and economic environments that influence one another in complex ways.’ (Norris et al., 2008 p.128)
Shock factor	‘Aversive circumstances that threaten the well-being or functioning of the individual, organization, neighborhood, community, or society’ (Norris et al., 2008 p.131), which are unpredictable and rapidly develop.
Stress factor	‘Aversive circumstances that threaten the well-being or functioning of the individual, organization, neighborhood, community, or society’ (Norris et al., 2008 p.131), which are long-term and cumulative challenges.
Vulnerability	‘The state of susceptibility to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt’ (Adger, 2006 p.1)

1.4.1 Resilience and social-ecological systems: the relationship

An important deployment of the resilience perspective is in regard to social-ecological systems (SES) (Folke, 2006). A key difference in using the resilience perspective, rather than more traditional concepts, is that attempts to *control* change are reduced. Instead value is given to the ability of SES to *respond* to change (Berkes et al., 2008). Importantly, the resilience perspective gives attention to a system's capacity for renewal and restoration of function (Folke, 2006). The approach has developed as a result of increasing appreciation of the heavily intertwined relationship between social and ecological systems. Simply put, due to their embedded nature the evaluation of systems in isolation compromises validity (Ostrom, 2009). Therefore, the resilience perspective appreciates that ecological or social changes in a system can be amplified to have wider consequences. This research builds on that recognition, focusing on community-level resilience. As rural Nepalese communities face a range of social and ecological shock and stress challenges, exploring how to bolster resilience will require an inter-disciplinary approach.

It is therefore well-established that community resilience is influenced by multiple ecological and social components (Folke, 2006; Tidball, 2012). However, research on the topic so far has been disproportionately focused on human systems within SES. As resilience holds potential to be a powerful tool for ensuring the long-term effectiveness of development interventions, it is important that understanding of *both* ecological and social components is gained. The relationship between ecological systems and community resilience has not been given sufficient attention in literature;

'Human interactions and feedback relationships between ecosystem development and social dynamics have not been adequately explored and analysed'
(Tidball et al., 2017 p.3)

Tidball et al. justify this proposition in an extensive discussion on feedback loops within SES that can be instigated by ecological interventions. Interventions in ecological systems that support positive feedbacks or restore dynamic equilibriums are well established and have given humanity unprecedented influence over its environment (Hobbs et al., 2011). However, the interaction that these interventions have within SES, particularly with regard to resilience, has been consistently overlooked. Tidball et al. (2017) conducted a study looking at how ecological systems in particular can relate to resilience, with a case-study of urban tree planting in New Orleans in the wake of Hurricane Katrina. The study found that community engagement in the project had multiple positive results. Ecologically, the establishment of an urban forest has helped to retain soils, improve air and water quality and provide future storm buffering. Socially, the project brought together community members in the wake of a disaster, which many found to be an important element of the healing process. Crime levels reduced in the neighbourhood, improved economic indicators, and increased social cohesion. These factors have all played in to improving the neighbourhood's function, and thus the resilience of the SES.

The study highlighted the broad literature gap relating to resilience, ecological systems, and positive feedbacks within SES. Although there is a wide acceptance between social-ecological system interplay, there is limited exploration into resilience impacts. The specificity of the study reduces direct transferability, being conducted to an urban context within a developed country following a disastrous environmental shock. Therefore, further research will contribute to a greater understanding of the field.

1.5 Community-based reforestation and community resilience

How does CBR relate to community resilience? First it is worth defining what is meant by community. As introduced in table 3, Norris et al. (2008) produce a concise definition;

‘...a community is an entity that has geographic boundaries and shared fate. Communities are composed of built, natural, social, and economic environments that influence one another in complex ways.’ (p.128)

The definition used in this work remains geographically routed, selected to best reflect the case-study communities, whose sense of community is entrenched in the land that has been worked by generations. With regard to resilience, the perspective of Schipper & Langston (2015) has been adopted, viewing community resilience as having three components, *learning, options* and *flexibility*, which exist within a context of challenges and vulnerabilities.

Challenges are explored as a means to assess a community’s vulnerability, and the severity of shock and stress hazards. Learning, relates to awareness of vulnerabilities and understanding how to respond to challenges. However, it must be acknowledged that although a community may have a good understanding of risk, it may lack the capabilities to act. Options are therefore the more practical elements that can facilitate or inhibit the bypassing of vulnerabilities. Flexibility refers first to a community being able to cope with shocks and stresses while retaining function and second an ability to recover to its previous state in a timely and efficient manner.

Figure 4 visualises these concepts. Crucially, it focuses on the interaction between CBR, community resilience and challenges and vulnerabilities. Challenges and vulnerabilities are directly related to the shocks and stresses that a community is exposed to. Exploring these helps to discern a more accurate picture of resilience. The barriers to CBR are also assessed, if CBR is found to have positive outcomes then what are the barriers to upscaling the approach?

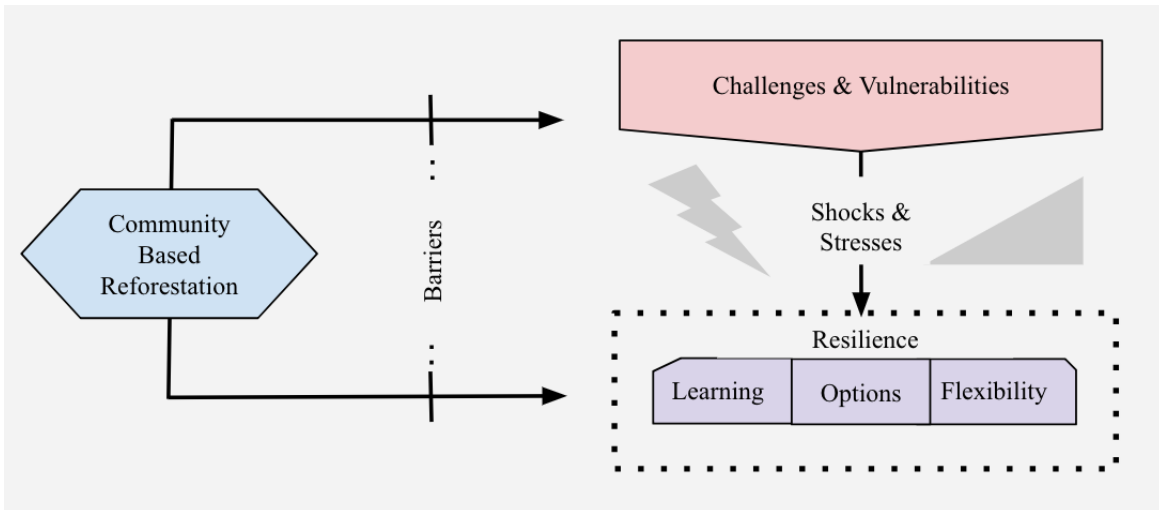


Figure 4: Conceptual framework showing the interaction between the key concepts of this work.

To explore the concepts as outlined in figure 4, a community-level perspective is adopted through which the wider regional and national variables and influences are acknowledged. By adopting this perspective, the resolution of the research is lower than if individual or household perspectives were used. However, intra-community dynamics are still appreciated and the assumption of a homogenous community-unit is not made. It is an important consideration that resilience is highly context specific, though geographically-distant influences can have considerable impacts through economic and political channels. The resilience perspective has been selected due to its practical orientation and ability to feed results, in a tangible form, back to practitioners and policy makers whilst informing the academic debate (Schipper & Langston, 2015). This practical emphasis holds particular value in the context of CBR, due to its relative immaturity and untapped potential for optimisation.

The components of resilience in figure 4 are based on the work of Schipper & Langston (2015), and are more comprehensively explained in table 4. These components have been integrated with the CoBRA approach (UNDP, 2014) which is a methodology through which contextual resilience can be analysed. Although methods to measure resilience can be disputed, this work attempts to take a middle-ground, using Schipper & Langston's analysis of literature through which the theoretical components were developed, and the UNDP's established methodology.

Table 4: Outlining resilience components and CBR outcomes.

<i>Resilience Components</i>	Influences
Challenges & vulnerabilities	Community socio-economic and ecological vulnerabilities Exposure to shock and stress challenges (severity and frequency) Preparedness for hazards
Learning	Awareness of risk Ability to share information with others Access to information (especially with regard to changing situations) Understanding of community strengths and weaknesses
Options	Knowledge and skills Land tenure Financial assets Non-financial physical assets
Flexibility	Self-regulation Community strength Low dependence on external factors Diversity of livelihoods Avoiding dependency on at-risk resources
<i>CBR Impact Domain</i>	Outcomes
Ecological	Environmental services Biodiversity Hazard exposure impact
Social	Poverty alleviation Economic opportunities Diversified livelihoods Intra-community relationships Gender equality

2. Research questions

2.1 Central research question

In what ways does engagement with community-based reforestation programmes affect community resilience in the Nepalese districts of Nawalparasi and Jhapa?

2.2 Sub-questions

The sub-questions should generate results that feed into a discussion which contrasts findings with the theories and positions outlined in the previous chapter. Therefore, they are structured in three sections.

The first sub-questions relate to CBR. First, a descriptive question is used to obtain an overview of CBR and other reforestation initiatives in Nepal to set the context. This primarily focuses on the model used by Eden. Second, an explorative question is posed to evaluate expectations and outcomes.

- **How are CBR programmes coordinated and deployed in Nepal?**
- **How do the communities' expectations for CBR engagement compare to the realised outcomes?**

The second set of sub-questions focus on the concept of resilience in the context of each community. First, perceptions of challenges are explored and where respondents feel that vulnerabilities for their households and community lie. Second, an evaluation of secondary data contrasts these findings to provide further input on vulnerabilities. Finally, adaptation strategies and their barriers are explored.

- **What are the key shock and stress challenges facing communities in the case-study districts?**
- **How do community perceptions of environmental change relate to available data sets and studies for the respective districts?**
- **In the context of the case-study districts, how can a community's resilience be influenced?**

Finally, one question is posed which transcends the district-level focus to explore the relevance of CBR on a broader level. This has been heavily informed by key informant interviews (KIIs).

- **What are the barriers to upscaling the CBR approach across Nepal?**

3. Regional framework

This section frames the context of the research. Overviews of Nepal’s social landscapes are provided before drawing into an environmental profile of the country. A brief history of the evolution of Nepal’s forest policy is given as an explanation for its contemporary standing as a world leader in CBFM policy. An introduction of key actors involved in CBR is provided before finally drawing into a district-level analysis of contexts and challenges for the two case-study districts of this work.

3.1 Nepal’s social landscapes

This section explores the social landscapes of Nepal, with political, economic and societal perspectives. Table 5 provides an overview of the country’s characteristics.

Table 5: Basic characteristics of Nepal.

Basic characteristics of Nepal

Total population	29-million ¹
Total area	147,181 km ²
Religions	Hindu (81%) Buddhist (9%) Muslim (4%) ²
Languages	Nepalese and 122 other native languages ²
Life expectancy	70.2 years ¹
Human Development Index (HDI)	0.490 ³
Gross Domestic Product (GDP) (GDP per capita)	US\$ 21.13-billion (US\$ 730) ¹
Literacy rate	65.7% ⁴
Corruption Index	31/100 (122 nd globally) ⁵
Gender Inequality Index	0.497 (115 th globally) ⁶

Sources: ¹World Bank (2016); ²Central Bureau of Statistics (2013); ³UNDP (2014); ⁴UNICEF (2012); Transparency International (2018); ⁶UNDP (2015)

3.1.1 Politics

Nepal’s transition towards a functioning democratic state has stuttered its way forwards and backwards since the first national elections of 1951, with the intervening decades until present being fraught with scandal and instability (Hatlebakk, 2017). From 1960 until 1980, the monarchy of Nepal lifted the powers of parliament and once again assumed control. A decade of civil disobedience and protests culminated in a new democratic constitution being introduced in 1990, and renewed hope for the pro-democracy movement of Nepal. The period of 1990 to 2000 failed to meet the national and global expectations for stability and prosperity, instead the decade held nine governments and the beginning of a civil war in 1996 (Malagodi, 2013).

Nepal's decade long civil war, more frequently termed as the Maoist insurgency, has played a pivotal role in the country's development. From 1996 until 2006, Nepal was subjected to bouts of horrific violence from both the government and insurgents, though it was the civilians of Nepal who paid the greatest price. There were an estimated 13-thousand deaths from the war (85% of which were in rural regions) and 200-thousand displaced persons (Gilligan et al., 2014). Towards the end of the civil war, dangerous and complex power-dynamics shifted between the government, Maoist rebels and the King. By 2006, the government and rebels formed an agreement on the need for democracy, uniting against the monarchy and signing the Comprehensive Peace Agreement (Singh et al., 2005). The Maoists were recognised as a formal political party, simultaneously bringing an end to the civil war and the powers of the monarchy. This ushered in what was hoped to be a new political and peaceful era for Nepal (Malagodi, 2013).

Since 2008 Nepal has officially been a republic, though political oscillations have hindered any sense of stability, and eight governments have been in place within the last decade. Chronic political instability has been a long-term issue for the country, and one which has begun to characterise Nepal (Hatlebakk, 2017). The complex leadership dynamics of Nepal are related to the nation's hugely diverse society.

3.1.2 *Society*

Traditionally, Nepalese society has been arranged with vertical and horizontal divisions, which still play relevant roles today despite efforts to reduce the weight of these arbitrary factors. Vertically, the caste system plays a dominant role in assigning pre-determined societal positions (Gellner, 2007). Although the system has been legally abolished, it remains observed across much of Nepal's society (Rao, 2010). Horizontally, the key differentiator is gender. As Nepal remains a highly patriarchal society, ranked 110th on the gender parity index (World Bank, 2016), inequality between genders remains apparent throughout the country (Nightingale, 2011). Other relevant horizontal factors include religion, education, and wealth (Gellner, 2007). The stratification of society is visualised in figure 5, though in present-day Nepal there have been concerted efforts to reduce the relevance of these factors. Crucially, the archaic and outdated social system stifles social mobility for many, with pre-determined social positions according to birth. Mandates for certain castes within political systems have helped to even representation within national institutions, though gender equity remains a far more distant target (Stash and Hannum, 2001; Nightingale, 2011). Local institutions remain heavily affected by the caste system (Gellner, 2007).

The caste system's ongoing relationship to poverty in Nepal is discussed by Rao (2010), who suggests that despite outlawing the system, ongoing discrimination based on caste is highly prevalent. In part, this is due to the identification of caste by second-name, which is not always the case in India, where the caste system is now less prominent (Gellner, 2007; Rao, 2010). The UNDP (2014) further highlight societal discrepancies, where Brahmins were found to have the highest HDI (human development index) across Nepal. This is reiterated by Rao (2010), who suggests that of Nepal, Sri Lanka and India,

Nepal is the most restrictive of opportunities for Dalits. It is even suggested that the caste system laid the groundwork for the decade long Maoist insurgency, as people pushed against generations of suppression (Nightingale, 2011).

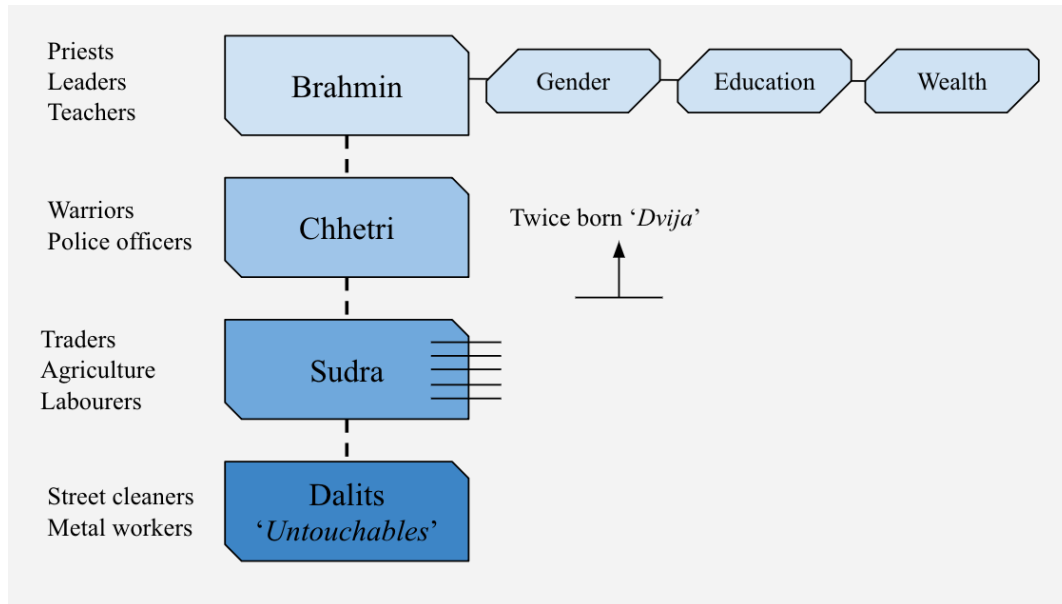


Figure 5: Overview of the vertical and horizontal divisions within Nepalese society. Horizontal lines within the Sudra caste represent the presence of sub-castes, relevant for all castes. Source: KIIs & field observations.

3.1.3 Economy

Despite political turbulence, Nepal has experienced steady per-capita increases in wealth of c.2-percent per annum since the mid-1980s. This has been coupled with relatively stable levels of inequality, indicative of real-terms increases in wealth for citizens (Hatebakk, 2017). However, Nepal remains the second poorest nation of Asia, surpassed only by Afghanistan in terms of lowest per-capita income. Despite this, Alkire et al. (2017) propose that when a multidimensional poverty index is applied (beyond the simplistic GDP indicator), Nepal shows strong progress in terms of poverty reduction. By achieving 5 – 9-percent reductions per annum, Nepal is a top-performer amongst the world's poorest nations.

Nepal's economic development has been accelerated through unprecedented levels of outmigration. Remittances have become an increasingly dominant support of the country's economy as Nepal exports its young, talented and hardworking population. The scale of the situation is made clear at Kathmandu's Tribhuvan airport, where everyday hundreds of young Nepalese go to catch their flights. The few arriving foreign tourists, in their shiny-new outdoor clothing, must first navigate their way through the throngs of departing Nepalese before they reach the city. Gartaula et al. (2012) suggest that four-million Nepalese are now working abroad, 90-percent of whom are men, and together send enough remittances to account for 30-percent of the economy. Whilst the trend has undoubtedly

supported Nepal economically, it has simultaneously formed a significant brain-drain which hinders long term development prospects (Beine et al., 2008). Therefore, generalising outmigration as positive or negative for Nepal would be too hasty, further research on the short and long-term impacts must be explored to gain a greater understanding (Gartuala et al., 2012).

Other than outmigration and remittances, agriculture (both commercial and subsistence) remains the economic heart of Nepal, where around 70-percent of the population are reliant on agriculture (UNDP, 2014). Within the last two decades, tourism has become a major industry in Nepal, supported by government policies as a means to acquire foreign currency and aid development (Arai & Goto, 2017). It accounts for 7.5-percent of the economy, and is forecast to rise considerably as infrastructure and marketing strategies are developed (Arai & Goto, 2017). The increasing role of tourism in the economy has renewed national commitments for the conservation of nature, a central attraction for many international tourists. This includes the national parks such as Chitwan, the conservation areas such as Annapurna and the strength of institutions to protect national forests (Nepal, 2000). It has been an important development that tourism provides a means through which communities across Nepal can profit from the conservation of their natural capital.

3.1.4 *Summary*

Although discussed independently above, the political, social and economic landscapes of Nepal are intrinsically intertwined and the interplay between each has developed the fascinating historical pathway of the country. It is important to note, however, that the unique history of Nepal has occurred within a physical environment of unparalleled richness and diversity, filled with both opportunity and risk.

3.2 Nepal's ecological landscapes

Nepal's 147,181 square-kilometres stretch from the world's highest peaks through glacier fields and inhospitable arid plateaus through to steamy sub-tropical jungle and fertile lowland plains. Although accounting for just 0.1-percent of the Earth's landmass, Nepal has the greatest altitudinal range of all nations on Earth. For a country that is roughly the size of Portugal, 118 biomes exist within its borders as a result of the topographical and climatic diversity (Chaudhary, 1998). This highly concentrated ecological hotspot holds an extraordinary level of biodiversity, containing 4-percent of the world's mammal species and 9-percent of the birds (Paudel et al., 2012). Particularly notable species of mega-fauna include Asian elephants, sloth-bears, snow leopards, one-horned rhinoceros, and royal Bengal tigers. This high level of biodiversity and varied assemblage of ecosystems makes it problematic to make generalised statements regarding Nepal's environment. A division of Nepal's environment on the basis of climate, topography, soils, flora and seasons was constructed by Hagen (1998, in Paudel et al., 2012). Hagen's physiographic classifications have served as a benchmark for mapping Nepal's multiple biomes. These classifications are summarised in table 6 and the locations are indicated in figure 6.

Table 6: Physiographic categorisation of Nepal's biomes.

<i>Physiographic Division</i>	Description
Tarai	Fertile lowland plain lands that stretch along the southern border of Nepal. The strip of land is 25-30 kilometres wide, and was previously dense jungle due to endemic malaria. It is now densely populated, with forest conserved mainly in national parks.
Siwaliks	The youngest mountains of the Himalayas, reaching 1500m in altitude. Situated to the north of the Tarai, the region experienced high deforestation rates from the 1950s.
Mahabharat	Reaching altitudes between 1500 and 2600m, the mountains have a climatic range from tropical to temperate. The topography of the zone includes steep valleys and seasonal meltwater rivers. Fertile soil has encouraged intensive agriculture in parts, leading to high rates of deforestation and terracing. Lies north of the Siwaliks.
Midlands	Lying between the Mahabharat and the Himalayas, the region is the most densely populated of Nepal. A favourable climate and soils and encouraged development
Himalayas	The region has a minimum altitude of 3000m, and is where eight out of ten of the world's highest mountains are situated. A key catchment zone for many of Asia's largest rivers. Population density is understandably low.
Inner Himalayas	Lying in the rain shadow of the Himalayas, the region consists of high-altitude valleys and plateau which are extremely arid. Barely populated due to these conditions.

Sources: Chaudhary (1998), Hagen (1998), Man Amatya (2013), Paudel et al. (2012).

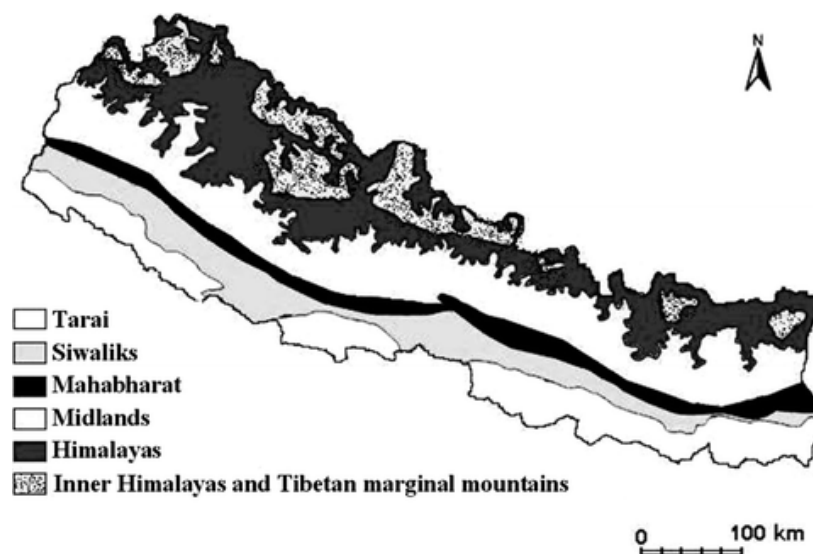


Figure 6: Nepal's six physiographic biome categories as identified by Hagen (1998). Source: Paudel et al. (2012).

3.2.1 Environmental risks and hazards

The physiographic differentiations of Nepal's environment are also related to respective environmental hazards, of which Nepal is in no short supply (Hagen, 1998). The *Himalayas* zone, as the world's largest ice-field outside of the poles, has a large number of glaciers and glacial lakes. The relatively rapid retreat of the majority of Himalayan glaciers means that melt water often accumulates in glacial lakes, burgeoning levels to threaten the strengths of moraines (Bolch et al., 2012). Glacial lake outburst floods (GLOFs), occurring when moraines are critically ruptured, are a potentially hugely destructive force, particularly relevant for Nepal's northern districts (Shrestha & Arval, 2011). The photo below is an example of the widespread glacial retreats across the country's mountains. Zones north of the Tarai are frequently exposed to landslides, exacerbated by high rates of deforestation, intensive agriculture and terracing (Dahal, 2012). More recent strategies to improve road infrastructures in Nepal have further aggravated the risk of landslides in rural areas (Dahal et al., 2006). The Asian Development Bank (2013) estimated that from 1983 until 2007, large-scale landslides resulted in the loss of 7341 lives and around US\$78-million in damages. The impacts of smaller-scale landslides remain unaccounted for, but are likely to be considerable. The mountainous regions of Nepal (north of the Tarai and Siwaliks) are also particularly vulnerable to earthquakes. This exposure was encapsulated in the tragic scenes of the 2015 earthquake, the dramatic footage of which circulated around the world and encouraged a strong international response (Sanderson & Ramalingam, 2015). Earthquakes are inherently difficult to predict, and as the seismic activity between the Indian and Tibetan plates is ongoing, Nepalese people are forced to live with the threat.



The Gangapurna glacier in northern central Nepal. The retreating glacier has left a large moraine, and a glacial lake with low-levels prior to the monsoon. Author's own.

In the southern regions of Nepal, most notably the Tarai, annual floods which coincide with the monsoon rains are a recurrent source of risk. The Himalayas, often referred to as the water towers of Asia, are the source of revered and culturally significant rivers. As the monsoon rains come down on Nepal, the rivers surge towards their respective deltas (Immerzeel et al., 2010). Floods can help to

bring nutrient-rich sediment to the low-lands. However, floods also have highly destructive potential as seen in 2017, when floods across Nepal and India were the highest in living memory. Uprety et al. (2017) analysed the drivers behind these floods, suggesting that 600mm of intense rainfall in just two days in mid-August caused a drastic rise in water levels that displaced c.14-thousand Nepalese families.

3.2.2 *Vulnerability to climate change*

Just as Nepal's natural capital is rich and diverse, it is immensely vulnerable to climate change. This pushed Nepal into conducting and publishing its National Adaptation Programme of Action (NAPA) (UNFCCC, 2010). The NAPA acts as a benchmark publication, conducted to UNFCCC standards to draw awareness to the country's situation, and to channel future efforts and resources to address the most pressing issues. Although published nearly a decade ago, collective pressures from over exploitation and climate change continue to push ecosystems towards increasingly threatened futures. The environmental hazards outlined above are equally as exposed to climate change, and it is the exacerbation of these which drives Nepal higher as a highly vulnerable nation (Gentle & Maraseni, 2012).

Despite its marginal contribution to climate change, Nepal is disproportionately affected with regard to both environmental change and its ability to adapt. Rapid annual temperature rises of 0.06°C, shifting seasons, increasingly erratic precipitation patterns and retreating glaciers at an average of 30m year⁻¹ are all contributing to an intensified portfolio of environmental hazards (Karki et al., 2009).

3.3 Nepal as a forestry policy forerunner

Forestry policy in Nepal today is considered as one of the most progressive and successful examples of widespread CBNRM globally (Agrawal & Ostrom, 2001). However, the route taken over the last century has been fraught with changes and U-turns that are indicative of the complex process of finding a balance between the use and protection of natural resources. This is summarised in figure 7 and elaborated upon in the subsequent section. The evolution of policy can be chronologically divided into three periods, the privatisation period, nationalisation, and community orientation (Chhetri, 2006).

Prior to 1957, forest cover in Nepal was heavily depleted. During the century long rule of the *Ranas* (ruling elites), which ended in 1951, many of the forests of Nepal were carved up as gifts and tributes to maintain favour with the aristocracy and dignitaries. This was often followed by deforestation in order to convert fertile plains and hills for agricultural production (Gautam et al., 2004). The profits of this paradigm of deforestation remained firmly in the pockets of ruling-elites and nobles, primarily from supplying the rapidly developing Indian railway network. From 1951 to 1957, following the fall of the *Ranas*, the succeeding democratic governments began to have their attention drawn to the degraded forests of Nepal and the environmental consequences. However, the turnover rate of governments in this period obstructed any meaningful policy changes (Baral, 1975).

From 1957 the nationalisation period began, characterised by the takeover of forests by the national government and an accompanying expansion of forest-related bureaucracy and institutions. Attempts to conserve forests in the period were numerous, with an increasing emphasis on scientific forestry measurement (Chhetri, 2006). However, as the accuracy of monitoring and evaluating forests increased, it became clearer that the centralised basis of management was failing. International support was considerable during this period, with afforestation and reforestation programmes forming the bulk of interventions (Gautam et al., 2004). However, the failure of international support programmes was widespread, coinciding with soaring rates of deforestation. The breakdown is attributed to failures to enforce penalties and failures to account for the input of communities (Gautam et al., 2004; Man Amatya, 2013). Hobley (1985) argues that the type of deforestation during this period arose from communities losing their attachment to the future vitality of forests, instead approaching them as open for exploitation. The inability of the government to reconcile forest conservation with a rapidly growing population, even with international support, gave rise to mounting internal and external pressures to overhaul national forest policy once again (Gautam et al., 2004).

The 1976 Forest Policy was the first to incorporate an emphasis on the role of communities in forest management and was a watershed moment in the evolution of forest policy (Chhetri, 2006; Gautam et al., 2004). Although initial policy in this period was comparatively tentative and cautious, early indications of CBFM's effectiveness were encouraging. These results facilitated the onset of evolving policies that have incrementally increased their allowance for independent management and geographical coverage of Nepal, characterising this period (Acharya, 2002). However, the policies are not without critique. In particular, underrepresentation in *Terai* regions, where CBFM has had minimal impact on forest conservation (Acharya, 2002), and the exclusion of women in decision making processes (Agrawal, 2002).

As CBFM reaches relative maturity in Nepal, the strength of CFIs as local democratic institutions becomes ever more apparent. CFIs consist of community members and leaders. The robustness of CFIs has been put through a number of stress tests in Nepal's recent history, including the decade long civil war, catastrophic earthquakes and a blockade of national gas supplies. However, the CFIs demonstrate remarkable resilience in the face of challenges, the majority maintaining operations, regulations and cooperation (Gilligan et al., 2014). CFIs are a key element in the deployment of the reforestation programmes as studied in this work.

Why is it that CBFM policy in Nepal is now considered to be progressive? Nepal was one of the first nations to adopt policy that formally recognised the value that communities play in conservation (Chhetri, 2006). This has encouraged the widespread diffusion of decentralised forest management, allowing 20-thousand rural communities to achieve land-tenure rights and associated forest rights (Thoms, 2008; DFRS, 2015). Forest cover has increased across the nation in line with CFIs, indicative of the popularity and effectiveness of CBFM (Man Amatya, 2013).

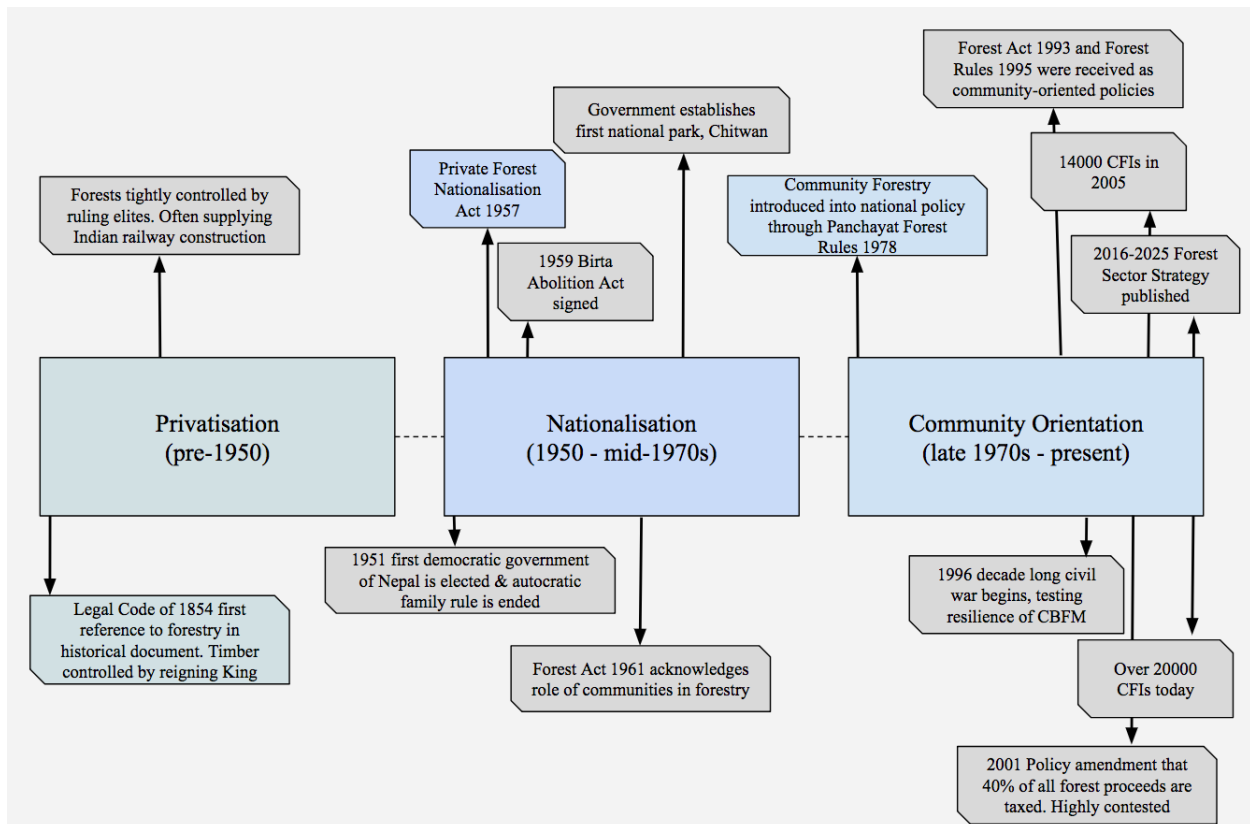


Figure 7: Evolution of Nepal's Forest Policy. Adapted from: Acharya (2002), Baral (1975), Chhetri (2006) DFRS (2015), Gautam et al. (2004).

The wide-spread uptake of CBFM has allowed natural regeneration of forests to take place across Nepal (Poudel et al., 2013). Active reforestation efforts are minimal, and consist of public land initiatives (small scale organised by authorities), government forestry projects (filling in large areas of under-utilised land), private sector forestry (commercial plantations) and community-based initiatives. Increasing efforts would have the potential to accelerate forest restoration across the nation.

4. Methodology

4.1 Introduction of key actors

4.1.1 *Eden reforestation projects*

Eden Reforestation Projects (Eden), head-quartered in California, is the world's largest specialist reforestation organisation. The organisation has grown rapidly since 2004 to its current capacity, planting four-million trees per month across in Indonesia, Madagascar, Haiti, Ethiopia and Nepal. The organisation has achieved a growth rate of around 70-percent per annum, and aims to be planting over eight-million trees per month by 2020. The model developed by the organisation plants a tree for an average of US\$0.10, including all national and international expenditures. Eden is funded through business partnerships, most notably with Ecosia and Ten Trees, and to a lesser extent private donations. The mission is to facilitate rural development through the planting of trees, using an operations model that has proven to be flexible and robust.

Eden began operations in Nepal in 2014, where a small national team of experts has since worked to develop Eden's presence into the largest non-governmental organisation working in reforestation. Today, Eden plants 300-thousand trees per month across 12 communities in Nepal. By working in a range of communities and environments, there is a wide portfolio of challenges and vulnerabilities. Therefore, a more insightful analysis of how CBR impacts resilience in different contexts can be achieved. Eden's operations in Nepal form a strong platform from which to explore the concepts of this research.

4.1.2 *Community-forest institutions*

CFIs, also known as community-forest user groups, play an integral role as local institutions. Generally, every household is represented in the CFI, the leaders of which help to plan and coordinate forest management activities (Gautam et al., 2004). Through CFIs the community gains land-tenure rights over forests, and can sustainably manage the forest for timber and NTFPs (Poudel et al., 2013). There are now over 20-thousand CFIs across Nepal (DFRS, 2015). CFIs operate locally, though are represented on a national level by the Federation of Community Forest Users in Nepal (FECOFUN). FECOFUN, established in 1995, provides a basis from which CFI views can be voiced at the national level (Gautam et al., 2004). In theory, CFI management structures should be participatory in nature. However, the degree of participation is a point of contention found in literature on the subject, reiterated by the findings of this work. Patriarchal management and the excessive role of local elites are both areas of critique (Agarwal 2001; Poudel et al., 2013). CFIs play an integral role in CBR, as established institutions with experience in managing forests. Once trees are planted, CFIs assume management of the forest in the long-term and improve the prospects of sustainable management.

4.1.3 Other actors

A third important actor is the Ministry of Forests and Soil Conservation (MoFSC), a government ministry which oversees the management of Nepal's forests that contains departments focusing on CBFM and REDD+ (reducing emissions from deforestation and forest degradation). It is the MoFSC which initially deployed CBFM policy, and has organised the formation of CFIs. Finally, The International Centre for Integrated Mountain Development (ICIMOD) is a key research institution, working to advise policy to improve sustainable development across the Himalayan region.

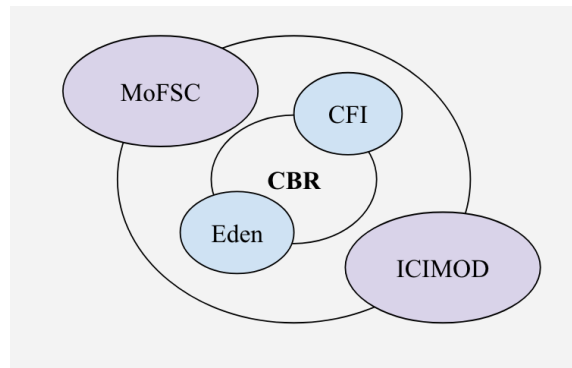


Figure 8: Actors involved with CBR in Nepal.

4.2 Study areas

The research was conducted in two of Nepal's districts, Nawalparasi and Jhapa. The location of these districts is shown in figure 9. Eden has been working in these districts since Nepal operations began in 2014 and are therefore two of the longest running projects in Nepal. The social-ecological contexts for each community are very different. As a result, the outcomes of CBR make for an interesting comparison. As with the majority of villages across Nepal, both communities have established CFIs.

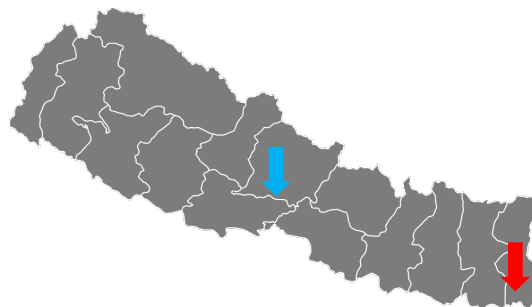


Figure 9: Nepal, with Nawalparasi indicated in blue and Jhapa indicated in red.

4.2.1 Nawalparasi



The terraced central mountains have been subjected to intense agriculture for generations. Looking north, the snow-capped Himalayas can be seen shrouded in cloud. Author's own.

Nawalparasi has an area of 2162-square kilometres and a population of c.640-thousand (DCEP, 2014). The HDI for the district is 0.493, closely situated to the national average. It extends primarily over *Tarai* and *Simaliks* zones, with a northern border to the *Mababharat* zone. This research focuses on a community between the *Simaliks* and *Mababharat* zones. Here, communities have forged existences into mountainsides through generations of work deforesting valleys and terracing steep slopes. As a result, the mountains and hills have a remarkably artificial appearance, as the forests have been scraped away. There are a number of problems and risks that have troubled these communities for generations and others that have emerged within the last decade, literature highlights the following areas as concerning; due to their geographical isolation, communities have developed a strong cultural independence, though this has hindered adoption of modern practices. Agricultural practices in this region have remained overwhelmingly static despite advances elsewhere in the country (Neupane & Thapa, 2001). This lack of adaptation is a partial explanation for falling agricultural productivity which is pushing communities towards food insecurity (Biggs and Watmough, 2012; Malla, 2009). The steep valleys of the region have hindered access and development for many communities, the majority of which are only accessible by dirt roads and paths which are vulnerable to seasonal rains and landslides (Dahal et al., 2006; Shrestha & Routray, 2001). Even when roads are open, the cost of using jeeps to access paved roads can be prohibitively expensive for small holder producers, hindering market access. The poor road network lessens the ability for communities to access the limited health and education facilities across the district. A study by Ahmed et al. (2010) found that women in Nawalparasi would favour home-births primarily due to the costs of transport to and the use of health facilities, a finding that is particularly concerning when coupled with overwhelming evidence that births attended by a professional significantly reduce child mortality rates (Rutstein, 2000).

With regard to climate change, the district is classified as moderately vulnerable by the NAPA (UNFCCC, 2010). However, the district does cross several physiographic zones, and thus internal vulnerability varies. A high-resolution district examination by Dangal & Gautam (2014) found that communities in the north (*Sivaliks* and *Mahabharat* zones) were highly vulnerable, and that their fellow compatriots in the south enjoyed a lower vulnerability. This differentiation is an important consideration to the NAPA's generalised classification. The exposure of communities in the north of the district is amplified due to the mountainous topography, which experiences some of the most drastic and rapid changes of all global environments (Parmesan & Yohe, 2003). Exacerbated risks of flooding and landslides are the primary concerns, with floods alone impacting an estimated 62-thousand lives and destroying 1700 houses in the last four decades (DCEP, 2014). Whilst the shock factors may incur catastrophic and immediate livelihood impacts, the subtler stress factors are tightening on communities and materialise in a multitude of direct and indirect impact pathways. Rainfall in the north of Nawalparasi has increased by 5-10mm per year from 1956 – 2006, though the variability has increased alongside this (Sharma, 2009). The result is a shorter and more intense monsoon season that is less predictable, followed by a longer and more pronounced dry season. Average temperatures in the district has also increased, by 0.02 – 0.03°C per year from 1956 – 2006 (Sharma, 2009). Sharma also notes that both trends experience an accelerating rate of change within the decade preceding 2009.

The intrinsic links between these issues are significant. Climate change is driving many of the problems first discussed. For instance, changing precipitation patterns are a driver behind decreasing agricultural productivity which in turn is limiting economic opportunities for community members, a key factor in outmigration which leaves communities lacking manpower for communal works (Gentle & Maraseni, 2012; Massey et al., 2010). Another example would be that the construction of a road network is hindered by seasonal landslides (Dahal et al., 2006), conditions for which are aggravated by oscillations between intense dry seasons followed by severe precipitation, a situation that is increasing in frequency (Sharma, 2009).

4.2.2 *Jhapa*



A farmer ploughs through the sunrise with his two water buffalo. The characteristically level fields of Jhapa spread to the horizon behind him. Author's own.

Jhapa is situated in the south-east of Nepal, with open borders to India's states West Bengal (eastern flank) and Bihar (southern flank). The district's 1606 square-kilometres consist of lower-tropical Tarai biomes, where summer temperatures frequently reach 35°C and drop to around 12°C in winter, with an average annual temperature of 24.25°C (1985 to 2015) (DCEP, 2017; Paudel et al., 2012). The landscape is strikingly comparable to the Netherlands, albeit the heat and humidity create a more tropical impression. The level ground consists of a patchwork of rectangular fields stretching out on all sides to the horizon, and the few trees visible from the main roads are planted in impressively straight lines. The people make up a population of 897-thousand and depend overwhelmingly on agriculture for their livelihoods, reflected by land-use in the district of which 94-percent is cultivated (CBS, 2011; DCEP, 2017). The HDI in the region is 0.500 – 0.549, which is above average for Nepal but falls short of the global average of 0.717 (UNDP, 2014). Alongside the low HDI, communities in the district face a number of other challenges. The rate of outmigration from the district is high, primarily attributed to limited opportunity outside of small-scale agriculture in many communities and further encouraged by the district's proximity to India (Gartaula et al., 2012). Whilst the remittances that often flow back to communities can support migrants' households, the ongoing depletion of the able-bodied and educated has an inevitable impact on the available labour force. However, Gartaula et al. (2010) suggest that the resultant impact on women has facilitated a rise in social empowerment, as many have become de facto household heads in the absence of their husbands.

Issues relating to outmigration coexist with those relating to a historic influx of Bhutanese refugees. In 1991 the deteriorating situation for refugees and local communities necessitated action from the United Nations High Commissioner for Refugees (UNHCR), where a number of camps were established across Jhapa (Ikram, 2005). The number of refugees peaked in 2007 with an estimated

108-thousand, followed by a gradual decrease through resettlement programmes, with c.35-thousand remaining in 2013 (Banki, 2013). Concerns regarding the health of refugees have been raised in the past, particularly with regard to human immunodeficiency virus (HIV) (Nepal, 2007) and tuberculosis (Bam et al., 2007). Whilst the situation at present is no longer as precarious as it was, it was a significant event in Jhapa's recent history.

Jhapa's climate has been changing in recent decades, with pronounced trends in increasing average annual temperatures, decreasing annual rainfall, and erratic season shifts (DCEP, 2017). The most apparent climate related hazards that the district is exposed to are floods, occurring during the monsoon season from June to September. The annual death toll from floods has been increasing for decades, in Jhapa and nationally (DCEP, 2014). This culminated in the most recent flood of 2017 where 148 lives were lost, 14-thousand families were displaced and crops worth an estimated US\$80-million were lost across the country (Rural Reconstruction Nepal, 2017). From 1956 to 2006, average precipitation has increased from 5 to 10 mm per year (Sharpa, 2009) The average temperature in the district has increased over a thirty-year observation period 1985 to 2015, while the average increase has been 0.04°C per year (DCEP, 2017). The rising temperature is a partial explanation for the shifting risk of climate-sensitive diseases in the district. A study exploring climate-disease relationships in Jhapa was conducted by Bhandari et al. (2010), focusing on the correlation between diarrhoea and climate change over a ten-year period. The relationship was found to be statistically significant. A second study by Bhandari et al. (2013) explored the linkages between climatic changes in Jhapa and the incidence of malaria, the conclusions suggesting that the increasing temperatures and altered precipitation patterns were correlated to an increased incidence of malaria. The shortfall of studies exploring the impacts of climate change is highlighted by DCEP (2017), which hinders compiling a more comprehensive evaluation of the district's exposure.

Again, the links between the climate, environmental and socio-economic challenges of the district are tied within a complex tapestry of historical and geographical factors. For instance, the district's proximity to India, population density and fertile ground have encouraged high rates of deforestation over the last two-centuries replacing primary forest with sprawling agricultural systems (Panta, 2009). In turn, this increases the district's vulnerability to extreme flooding events, as exacerbated by climate change (DCEP, 2017).

4.3 Data collection

The majority of the data was collected in Nepal during a ten-week fieldwork period from February to April 2018. The period was selected as accessibility to rural communities prior to the monsoon period is highest and it is prior to the busy harvest season. The data was analysed and the thesis was written from May to July 2018. The research has consisted of approaches to collect emic and etic perspectives through qualitative primary data and qualitative and quantitative secondary data.

The emic perspective was gained from studying communities in the districts of Nawalparasi, situated in the central mid-mountains of Nepal, and Jhapa, in the south-east flat lands. This period included two ten-day community stays, throughout which semi-structured household interviews and focus group discussions (FGDs) were conducted. The methodology is based on the UNDP's CoBRA approach. This approach was selected due to its highly participatory nature, rural focus, qualitative orientation and appropriateness for this research's scope (Bours et al., 2014). The CoBRA methodology uses semi-structured interviews and FGDs. The key strength of the CoBRA is its recognition that there is no universal threshold of resilience, thus a community-level evaluation of contextual factors is adopted (Quinlan et al., 2016). The methodology has been adapted to widen the scope of the assessment beyond resilience and challenges. Additional sections have been integrated into the interview to include participation in CFIs and CBR, environmental change, views on coordination of CBR and upscaling potential. The semi-structured interview guide, outlining the topics covered, can be found in appendix 1. FGDs have also been used to gain community input for the research, using the same structure as the semi-structured interviews.

The two case-study communities were Ruchang (Nawalparasi) and Manakamana (Jhapa). They were selected as two of the longest running CBR examples in Nepal and their differing physiographic biomes and cultures. Respondents were selected through snowball sampling, which was chosen as a replacement for the transact walk proposed in the CoBRA methodology. Communities were so highly fragmented, that an accurate transact walk was deemed unfeasible, thus snowball sampling was utilised. In both communities, saturation points were reached as interview answers were eventually repetitive, and further interviews would not have added new perspectives. Interviews were conducted in Nepalese or local languages, through the use of one or two research assistants.

Table 7 provides a summary of respondents from within communities and the gender division. Field and participatory observations of agricultural practices, forest management and community characteristics were conducted throughout the fieldwork. These observations were recorded in a field journal, which has provided valuable insights and material for reflection on the research's limitations.

Table 7: Summary of community respondents

<i>Method</i>	Nawalparasi	Jhapa
Household interviews	46 respondents (28 males and 18 females)	31 respondents (15 males and 16 females)
Focus group discussions	2 discussions (3 males and 2 females, 6 females)	2 discussions (4 males, 5 females)
Total respondents	57 (31 males and 26 females)	40 (19 males and 21 females)

The etic perspective has been explored through KIIs in political, academic and practitioner spheres alongside reviewing datasets and literature relevant for both districts. This has allowed a triangulation of the communities' perspectives with scientific data. Key informants were selected on the basis of their expertise and experience with CBR and (or) forestry in Nepal. They were approached throughout the fieldwork period in Nepal and upon returning to the Netherlands. Follow-up interviews have been conducted where appropriate. Table 8 provides a summary of KIIs, their institutions, positions and topics covered in discussions. This research was also presented at the International Agroforestry Conference (Kathmandu) in April 2018, the poster from which can be found in appendix 2. The conference was a useful platform to discuss findings with other researchers in the field and contribute to the formation of a policy proposal for the Nepalese government on integrating forestry to aid development.

Table 8: Summary of key informant interviews.

<i>Respondent</i>	Institution and position	Summary
Dr Ian Nuberg	University of Adelaide. Senior lecturer.	Overview of forest policy over time, potential of reforestation and agroforestry to improve livelihoods.
Professor Ram Chhetri	Resources Himalaya Foundation & Tribhuvan University. Chairperson & Head of Department.	Evolution of CBFM and resilience of CFIs. Current threats to CFIs.
Dr Rajendra K.C	MoFSC. Deputy General.	Overview of reforestation efforts in Nepal and the government's approach. Discussion of REDD+ in Nepal.
Prakash Lamsal	MoFSC. Community Forest Development Official.	How CBFM was initiated in Nepal, barriers and opportunities. Reasons for success and current challenges.
Dr Bhaskhar Karky	ICIMOD. REDD+ Initiative Coordinator.	Current situation of REDD+ in Nepal, and future prospects. Opportunities and barriers.
Laxmi Bsatta	ICIMOD. Senior Specialist for Environmental Services.	ICIMOD's involvement with reforestation and its relationship to resilience.
Dr Steve Fitch	Eden Reforestation. Founder and CEO.	Overview of Eden's work, development of the CBR model, international deployments, barriers, threats and opportunities.
Rachhya Kayastha	Eden Reforestation. International Director Nepal.	Multiple discussions covering CBR approaches, barriers and outcomes.
Ram Khadka	Eden Reforestation. National Consultant Nepal.	Multiple discussions on the practicalities of CBR, lessons learned and future directions.
Paspha Ghale	Eden Reforestation. Jhapa District Coordinator.	Discussion on local authorities involvement in CBR, community objections, processes and experiences.
Derrick Emsley	Ten Trees. Founder and CEO.	Driving forces for supporting reforestation initiatives from a commercial perspective.
Man Bahadur Sharu	Local Community Leader Nawalparasi.	Community engagement in CBR, challenges, trends, environmental change and CBR impacts.
Kasilal Rajbanshi	Local Community Leader Jhapa.	Community engagement in CBR, challenges, trends, environmental change and CBR impacts.

4.4 Data analysis

Following the collection of data, NVivo software has been used to code the community interviews and FGDs, helping to order considerable quantities of qualitative data into succinct categories for analysis. The KIIs have not been coded, instead full transcripts are used to bolster (and contrast) findings from the community-based research and wider literature.

4.5 Limitations

This research acknowledges itself as being far from the final judgement on CBR and its relationship to resilience. Rather it positions itself as an encouraging indicator of CBR's potential to foster climate and social resilience and invites further work to explore the following limitations.

The central restriction of this work has been its cross-sectional nature, examining a snapshot of time. Although respondents' perceptions of changes over time have been sought, it is accepted that a longitudinal study would produce more robust conclusions. A complementary follow-up study to explore how resilience is impacted as the forest matures would be of interest, examining how today's expectations are mapped out over time. Tying into to this cross-sectional issue is that Eden has only been operating in Nepal for four years, thus even when working within the longest running communities, outcomes are in their relative infancy. As highlighted by Le et al. (2012), any reforestation initiative must be considered a multi-generational project. Therefore, it is difficult to draw long-term conclusions from the study, as lapses in commitment can have catastrophic consequences for forests.

Second, the resilience perspective has a range of definitions and methodologies from which it can be explored, introducing the risk that conclusions depend on the analysis selected. As highlighted by Bours et al. (2014) the variety of approaches is significant. As methodologies and definitions are still being established, the CoBRA approach was selected to embed results in a credible institution (UNDP). However, limited examples of CoBRA deployments introduced uncertainty. Future evaluations of CBR through a different resilience perspective methodology would be of value in contextualising findings.

Third, the examination of communities as a unit instead of households inherently brings a number of assumptions. Admittedly, it reduces the resolution of the study and may overlook the heterogeneous nature of communities. In a social landscape such as Nepal's, these intra-community differences have potential to become highly pronounced, with variations in religion, caste and ethnicities. However, the rural nature of the case-study communities means that their relative differences are not overly pronounced and they remain traditionally homogenous. Despite communities consisting of one primary caste, the dynamics of sub-castes can be highly influential. A household level analysis would have allowed for an exploration of relevance. While this is an important point of consideration, results

of the study did reaffirm that the two selected communities were generally in internal agreement on challenges faced and environmental changes.

Fourth, the research is based on households' perceptions of CBR impacts and the most pressing challenges. Although the challenges (in particular environmental change) have been contrasted and verified with available datasets, the perceptions of CBR remain untested. Contrasting perceptions of impacts with environmental assessments and more concrete indicators may be of interest for future studies, though lie outside of the scope of this work. In particular, longitudinal studies of CBR on hazards such as floods and landslides would be of practical use. Providing an assessment over time would allow practitioners to equip themselves with knowledge of timescales, an important consideration when assessing intervention options.

Finally, there were a number of practical issues regarding the research. Due to the isolated nature of both communities, some respondents did not speak Nepalese, rather only local languages. It was a privilege to be able to spend time with people who spoke such ancient languages, which are vulnerable as the languages of Nepal are increasingly unified. However, it was at times challenging for the research. The research assistants helping in both communities only spoke Nepalese, requiring a second translator during interviews (English to Nepalese to dialect). This inevitably generates some concerns with regard to accuracy and completeness. While the interviews were designed with input from research assistants and Eden staff to ensure contextual appropriateness, there were also some new concepts for respondents. These new concepts were most at risk of being lost in (double) translation. Another consideration during the interviews was the tendency for respondents to limit their responses to '*ramro cha*' ('it is good'). Delving deeper into answers required further probing and the framing of questions in certain ways to avoid these positive yet limited answers.

4.6 Ethical considerations

The ethical dimensions of this research have been given careful consideration, and conducted in accordance with guiding principles as outlined by Hennink et al. (2011). The research must be conducted in a respectful manner at all times. Respondents must not be negatively impacted from participating, and where possible should benefit. The research must be non-exploitative. These guiding principles aided the general design, though the following contextual factors required additional attention.

An area of recurring difficulty in the research was with regard to achieving a gender balance from respondents. Women in rural communities would frequently struggle with the confidence to participate in interviews, all too often deferring questions to male household members. At the beginning of the research it soon became apparent that interviews conducted in public spaces would often be embraced by male respondents, whilst being difficult for female respondents. The approach was tailored to recognise that female respondents would often appear more comfortable in private and interviews could run without interference when male household members were absent. This was

found as an important intervention to ensure the voices of women were integrated more equally into the research. There were some notable exceptions when female respondents were more likely to answer questions confidently and freely. First, women working in nursery sites were clearly more confident and second, women who were interviewed with other women around them answered more freely. FGDs were then used where possible for female respondents. For the second case, one example helps to emphasise the point. In Ruchang (Nawalparasi), once an interview had been completed and an informal conversation was taking place, the female respondent began to explain that she had found the questions difficult. She believed the men were able to spend the days chatting and discussing such things while women were not free to do so, meaning she did not know how to answer the interview questions. This informative and insightful comment was suggestive of not only how some female respondents could be uncomfortable, but importantly that they felt there were correct and incorrect answers. In subsequent interviews, with male and female respondents, it was emphasised further that there were no incorrect answers and that the research was simply based upon their experiences and insights.

A second important area of consideration is the primary stratification of Nepalese society, based on the caste system. Although the communities primarily consisted of a single caste, the influence of sub-castes can also be significant (Gellner, 2007). As the community research involved living with families in each community, areas where lower sub-castes lived were identified and interview sites were selected to give a more balanced representation of sub-castes. Having a good geographical coverage in each community allowed for more representative sampling of respondents and avoiding a caste-bias.

5. Results I: Community-based reforestation in Nawalparasi and Jhapa

5.1 CBR coordination

How are CBR programmes coordinated and deployed in Nepal?

There are four categories of reforestation in Nepal, which are outlined in table 9 below. As explored in chapter 3 (context on Nepal's forest policy), Nepal's turbulent forest policy has had inevitable implications for reforestation efforts, and the initiatives of today are the result of several decades' policy development.

Table 9: Summary of reforestation initiatives in Nepal.

<i>Reforestation initiative</i>	Description
Public Land Reforestation	Primarily in the Tarai by authorities, they are small-scale in nature, filling in areas of under-utilised land. Projects are therefore highly fragmented.
Government Forestry Projects	Large-scale and top-down initiatives using public land for commercial forestry. Generally favouring mono-cultures of pine or eucalyptus.
Private Sector Forestry	Smaller-scale than government projects, though similar methods of quick-rotation forestry
Community-based Initiatives	Primarily operating through CFIs with aims to re-establish naturally functioning forests or forests with a commercial orientation. Limited government support through district forest offices.

Community-based initiatives, the focus of this research, involve a number of approaches. Some are well supported by district forest offices, which may support CFIs with saplings from central nurseries. However, the level of support varies on a district by district basis and lacks the level of coordination necessary to unlock its full potential. Other CFIs are conducting reforestation initiatives independently, though it has not been possible to obtain official figures on how nationally relevant this approach has become. Finally, CFIs reforest under-utilised areas with the assistance of organisations such as Eden. This approach is in its relative infancy in Nepal, though the potential is vast.

Eden began operations in Nepal four-years ago, growing to be active in twelve communities across four districts, planting over one-million trees per year. The initial step in the process is to find candidate communities with sufficient under-utilised community land. This can be assisted by district forest offices or through professional forestry networks. The community leader is then contacted by

Eden staff, which is the beginning on the second step, assessing a community's willingness to engage with the project. If communities are sufficiently engaged in the potential of the project and can commit sufficient land for long-term reforestation, the third step can begin. This involves a site evaluation (soils, water and climate), the selection of trees (community select from suitable native species), and the establishment of a nursery. The nursery site is coordinated by a manager, who has responsibility for ensuring the timing and effectiveness of growing seeds into saplings. Saplings are planted after a year of growing in the nursery, just prior to the monsoon season (May). The planted areas must be weeded and cleared throughout the year, whilst the trees establish themselves. All stages involve multiple community members. The recruitment of workers and the division of labour is conducted by the nursery manager. CFIs are an essential element of the process, providing local institutions with strong leadership that are generally appreciative of forest benefits.



A woman plants seed in filled poly-pots on a steep hillside of Nawalparasi. Author's own.

It is also worth discussing here, that knowledge in the community regarding the project coordination was low. It is highlighted by Le et al. (2012) that transparency and availability of information should be championed by reforestation projects, as understanding perpetuates engagement. However, in both communities the vast majority of respondents were unaware who was coordinating the project and why it was happening. Understanding of the trees' full ecological impact was also limited (discussed further below). Even local nursery managers would struggle to explain who Eden were, and why they were assisting the community. This is discussed further in subsequent chapters, with a key recommendation being to utilise nursery managers as points through which information can be diffused on the purpose and mission of CBR engagement for the community.

5.2 Expectations and outcomes

How do the communities' expectations for CBR engagement compare to the realised outcomes?

As highlighted by Le et al. (2012), it is essential that communities remain engaged in the reforestation project and it is recognised as a long-term initiative. Ensuring that communities have a thorough understanding of the commitment and *likely* outcomes of the project at the beginning. Lapses in commitment can have catastrophic consequences as forests remain highly vulnerable while they establish themselves. This section explores how communities have experienced the outcomes of CBR so far, and the expectations they hold for the future. Figure 10 provides a summary of impacts, as perceived by respondents. This does not include expectations of future impacts.

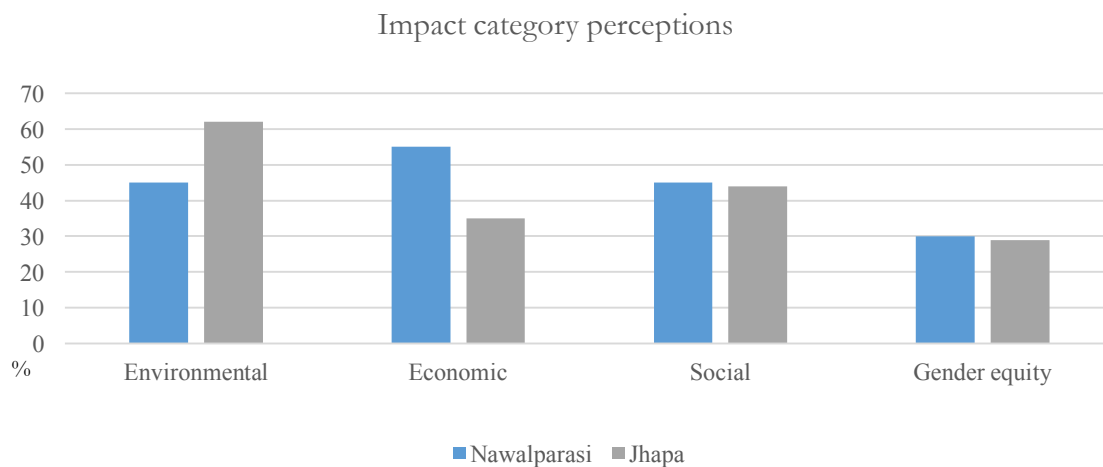


Figure 10: Percentage of respondents that perceive CBR impact areas.

5.2.1 Environmental

Environmental expectations and outcomes of reforestation were considered the most important by respondents, holding more value than economic or social outcomes. In Nawalparasi, expectations for reforestation included the restoration of precipitation cycles, climatic improvements, reduced pollution, cessation of soil erosion and above all reduced the risk of landslides. For respondents in Jhapa, there were similar hopes that the re-establishment would help to restore rains to their previously favourable timings and quantities, and help to reduce temperatures in the area. The realised environmental outcomes for reforestation efforts in Nawalparasi were limited, with respondents primarily focusing on barren land having a better purpose. There was widespread appreciation that the environment appears healthier, greener and fresher, which was appreciated by respondents. In Jhapa, environmental conditions have allowed the forest to establish itself far faster, so outcomes were

found to be more varied. Trees have been planted to flank river sides around the community, and several respondents noted that soil loss during floods had decreased, retaining valuable topsoil throughout the area and preventing the erosion of river banks. A second impact was with regard to wind and dust; tree plantations were said to have had a notable impact decreasing wind and dust levels in the area, which was worsened by the land's previously barren state. References were also made to improved precipitation as a result of the plantation, with some respondents believing that the trees had led to an increase in rainfall in the area. Finally, the presence of wild elephants was of high concern for respondents in Jhapa, and primarily attributed to the plantation. While from the comfort of a university desk, the return of elephants may seem a somewhat romanticised notion, from the perspective of respondents it is an incredibly serious development which threatens homes, crops and lives. Human-wildlife conflict is a highly contentious issue around the world, where solutions are both context-specific and expensive (Dickman, 2010). Therefore, solutions for both the short and long term must be explored with government support to prevent unfavourable outcomes for the community, animals and trees themselves.

While expectations were high and the outcomes positive (though differing in scale) for both districts, understanding of ecological impacts of forests was low. Many respondents referred to environmental impacts as being 'green and fresh'. Although they were enthusiastic about this, there may be potential to strengthen engagement if understanding of wider ecological outcomes is greater. With trees playing an integral part in the development and maintenance of water tables and soil fertility, two points which are of major value to agricultural communities, methods to diffuse this information through communities could reinforce commitments.

5.2.2 Economic

In the process of partnering with a community for CBR, the economic benefits of participation are given particular emphasis. This raised expectations of employment opportunities in both communities. The economic impact is made as participants are paid a nationally determined fair wage for CBR work, the funds for which are released by Eden. Workers are paid at all stages of the project, from nursery work to weeding plantation sites. The nursery manager organises workers, having been provided with a budget for achieving each stage. They then divide work between many community members each doing a little bit, or a few workers each doing a lot.

The economic outcomes of participation in CBR have been good in Nawalparasi, where respondents felt that community engagement was high. This was matched with well distributed employment opportunities during clearing, planting and weeding. While payment for working on the plantation was considered fair by respondents, some pointed to the project as being a long-term economic investment, and that future generations may be able to manage the forest for timber and NTFPs. Respondents felt that the work had bolstered household incomes and that it provided opportunities for employment, something that is novel for many small-holders. The fodder that is grown in the area alongside trees allows households to provide livestock with higher quality feed, which several noted

as increasing milk production. In Jhapa, there was not such a consensus that opportunities were well distributed. Respondents' perceptions were divided regarding how accessible employment opportunities were. There was a general view that respondents were not aware of how to get involved in the project, and although people were supportive of it, did not feel there were opportunities to engage with. This has limited the distribution of direct economic benefits for respondents. Those who were working for the project found that employment gave opportunities to support their livelihoods, in the payment of school fees and agricultural investments. In both districts, the community wide impacts were recognised as reducing unemployment and providing new opportunities. However, respondents felt that the seasonal nature of employment opportunities was difficult to manage with agricultural commitments and would have a greater impact if work was more consistent.

'With the salary from planting trees I can send my children to a new school, where they speak in English. I am very proud.'

(42-year-old Male agricultural worker, Jhapa)

Figure 11 provides a summary of the economic impact pathways for CBR participation described above. Payment for work is the most immediate and direct economic impact, though only relevant for participating households. Broader and indirect pathways evolve over time, and hold relevance for the wider community. The prevention of free-grazing from CBR participation may incur an initially negative economic impact, as pastoralists adopt new agricultural practices. Respondents found that this was countered over time by increasing productivity.

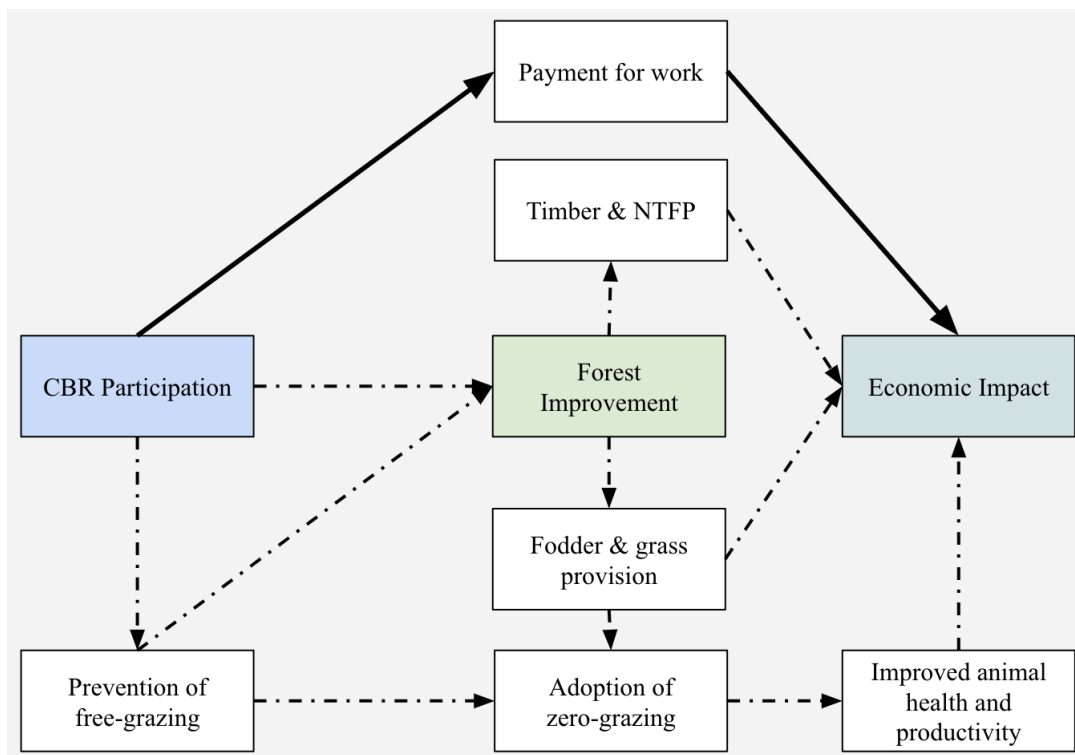


Figure 11: Economic impact pathways of CBR participation.

The long-term nature of realising outcomes from the forest was apparent to most respondents, though there were consistent recommendations that the project could have a greater economic impact through the use of fruit trees and faster growing species. Integration of fruit-species into CBR was seen by respondents as a clear route to enhancing community income in Nawalparasi. In Jhapa there was a greater emphasis that faster growing timber species could be of value for the community when managed through the CFI.

5.2.3 Social

While the economic and environmental impacts may be easily understood results of CBR engagement, the social impacts are subtler and less tangible. However, this should not detract from their significance to community development. Social outcomes from the projects in both communities were found to be diverse. Participation in CBR was said to have raised awareness of the importance of forests. This is likely to have strengthened CFIs in both areas, an important social outcome. In Nawalparasi, the high level of community involvement meant that respondents felt participation was a positive force on the community's union. Working together on a project, for which the community holds high environmental expectations, was perceived to strengthen bonds between households. Respondents were also highly considerate of the intergenerational nature of the work, with references being made to how children and grandchildren could benefit from their work today. A number of respondents mentioned how new opportunities could help encourage people to stay in the community, helping to counter outmigration. In Jhapa, the social impacts of CBR engagement were not so well concentrated as in Nawalparasi. Respondents felt that it was a positive force, though primarily for those who were employed. References were made to the elephants, and how those with employment benefited from the project but they must all cope with the externalities and elephant impacts. There were fewer references regarding how the project has brought the community closer together. Instead, the emphasis was very much placed on how the land now serves a purpose for the community, where people can gather fodder, grasses and firewood. One respondent made reference to how some call it the 'love-area', as couples will go there to enjoy the relative privacy of a fast-growing forest.

'All people contribute in different ways, some bring manure, others bring tea.'
(26-year-old male agricultural worker, Nawalparasi)

One of the central social outcomes for both communities was the impact on women in the community, the impacts of which are comparable. The projects are perceived to empower women three-fold. First, the collection of firewood and fodder from forests is a responsibility placed on women in both communities, and one that takes a significant proportion of each day. In Jhapa, the establishment of the forest means that many NTFPs can already be sourced sustainably in close proximity to the community, which respondents found had been an important outcome. Second, incomes provide a new dimension to gender power dynamics within communities and households. For female respondents with employment, especially younger ones, incomes are a new opportunity. Young men form the majority of outmigration from the communities, while women take responsibility

for agriculture and form a dependency on remittances. Therefore, through the work they are able to support their households. Third, through participation in both nursery and planting activities, women are brought together to work on a project that they feel is doing good. This has forged and strengthened bonds between women within the communities, bringing them out of households and uniting them with a purpose. Throughout the course of interviews, it was noted that there was a marked difference in the confidence and demeanour of women who were working in nurseries and those who were not. Nursery workers generally appeared more comfortable to answer questions, reinforcing their points that the project had instilled a feeling of empowerment in them.

5.3 Chapter summary

CBR is a rapidly developing form of reforestation in Nepal, though easy integration with CFIs helps embed interventions in more established infrastructures. There are some significant discrepancies between expectations and outcomes, however, which if left unchecked have potential to develop further. This knowledge gap between Eden and communities could be addressed to better align expectations. Actions to further enhance outcomes, in particular social and economic impacts, are seen as valuable by respondents.

6. Results II: Community resilience in Nawalparasi and Jhapa

6.1 Challenges and vulnerabilities

What are the key shock and stress challenges facing communities in the case-study districts?

As previously highlighted, Nepal's varied environment and social landscapes result in a heterogeneous mix of communities, facing different challenges. Gaining an understanding of these challenges and deriving their root causes is the critical first step for further discussions on resilience. The research indicated that whilst both communities shared a number of stress challenges, often tying into Nepal's prevailing socio-economic state and environmental change, the stress challenges were distinct for each district.

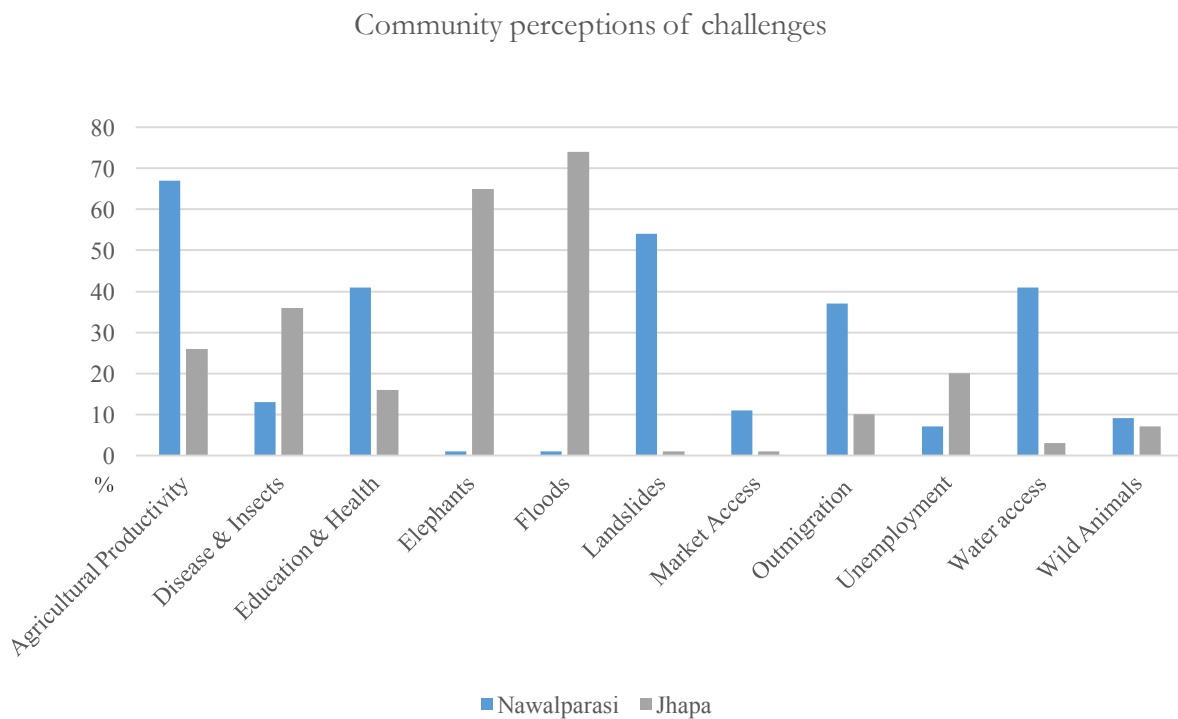


Figure 12: Percentage of respondents in each community highlighting key challenges. The graph does not cover environmental changes, which are explored in subsequent sections. 'Wild animals' refers primarily to deer, monkeys and boar. Elephants are separately categorised.

6.1.1 Nawalparasi

Situated in the intensely-terraced mountains of central Nepal, the community of Ruchang in the north of Nawalparasi is exposed to a range of challenges that have hindered its socio-economic development. The most frequently highlighted challenges were falling agricultural productivity,

landslides, decreasing rainfall and outmigration. However, concern was also raised regarding water access, seasonal shifts, health and education facilities, road infrastructure and market access. It is important to note that the majority of respondents indicated that many challenges are becoming increasingly pronounced, particularly in the last five to ten years.

As an agrarian based economy, falling agricultural productivity was of high concern amongst respondents. When asked about the causes of such issues, the majority of respondents found it difficult to answer. Some suggested that since the earthquake (2015) productivity has fallen, though could not elaborate on why this may be. Others suggested that changes in the environment were most likely to blame, as increasingly erratic rainfall was said to be disrupting traditional agricultural cycles. Older respondents made a number of references to their youth, and the quality of soil from many years ago. The link to outmigration was obvious to many respondents, who highlighted labour shortages as also decreasing production. This creates a ‘double-edged sword’ effect, where not only production per ha is decreasing but the area of serviced arable land is too.

‘Production has dropped because the soil has changed. Before I used to dig in the fields and it was just mud, now I dig and there are many stones and so much dust.’

(50-year-old male agricultural worker, Nawalparasi)

When falling agricultural productivity was highlighted by a respondent, a follow-up question was asked regarding adaptations that have been made to agriculture strategies. Whilst there have been some changes to agriculture in Ruchang, the agricultural systems that remain today are basic, strikingly unchanged over generations with minimal, if any, mechanical input. The crops are primarily locally available varieties of maize, millet and wheat. Within the last ten-years, ginger has become a cash crop grown by many households. The second cash crop grown in Ruchang is communally managed broom-grass (*Thysanolaena maxima*), used in the production of brooms. The introduction of cash crops has provided new income opportunities in Ruchang, though disruptions to accessing markets and price volatility were highlighted as important challenges. Other than cash crops, agricultural systems have remained static. A small number of farmers have begun to use chemical fertilisers and pesticides to combat falling productivity and the incursion of insects, though the majority cannot access or afford such inputs.



A woman prepares ginger to be roasted. The crop has become an important source of income for the community. Author's own.

'I haven't changed my style of agriculture at all, just doing what my forefathers have done. I would like to change if possible, but I don't know any other techniques...'

(36-year-old-male agricultural worker, Nawalparasi)

Respondents in Nawalparasi have spent most of their lives exposed to unpredictable and potentially catastrophic landslides and earthquakes, which undermines faith in the ground's stability. The risk of this is reflected in the recurrence of landslides being highlighted as a key challenge. The photo below indicates a large landslide from 2010, where a neighbouring village to Ruchang was engulfed by the steep valley sides above it. However, smaller scale landslides are far more frequent and play a more persistently challenging role in respondents' lives. Many have lost fields and homes, and collectively the community is hit by frequent road closures.

'I worry for my livelihood if a landslide were to happen near my house'

(38-year-old female farmer, Nawalparasi)



The exposed cliff on the far side of the valley is from a large landslide that engulfed a village lying in the bottom of the valley. Author's own.

A lack of access to health and education facilities was considered a problem for multiple respondents. Although Ruchang has a primary school within the village, the closest secondary school is two hours' walk away. This was thought to be a significant deterrent for many to attend school. Those who wished to attend require significant tenacity and support from parents. At a time when there is a labour shortage within the community, education has become a luxury that some cannot afford. There was a government health post in the village, though with limited function. For more serious ailments, community members had to walk for up to several hours to larger settlements. An issue that was repeatedly raised was with regard to women's health. The closest facility for assisting with giving birth was five hours' walk, which many were required to do while in labour.

6.1.2 *Jhapa*

In contrast to Nawalparasi's cool climate, Jhapa lies in the heat of the Indo-Gangetic plain, southern Nepal. Respondents in the community of Manakamana highlighted two central challenges; floods are an increasingly destructive annual force and wild elephants have returned. Other highlighted issues were increasing temperatures, seasonal shifts, decreasing precipitation, insects and diseases, increasingly intense monsoon periods, unemployment and outmigration.

Floods play an integral role within the agricultural cycles in the Indo-Gangetic plains, which have allowed generations of farmers to utilise productive wheat-rice cropping rotations (Abrol, 1999). However, respondents repeatedly highlighted that decreasing predictability and increasing severity were leading to high levels of destruction on an annual basis. The floods of summer 2017 were the highest of a lifetime, though the preceding five years have been abnormally high. When floods have come early, they swamp the pre-rice crop (most often wheat), and stop rice being planted. Prior to the introduction of boreholes this destroyed the year's two crops. The destruction of property, including houses and livestock, is widespread. The loss of life can be high, with a number of respondents

knowing people who had died in floods. The photo below indicates how some respondents believe that recent floods have nearly doubled in height.

‘Floods are the biggest challenge in this area. Last year, it was the highest level I have ever seen. The level is increasing year on year.’

(46-year-old female nursery worker, Jhapa)



A mother and son indicate ‘normal’ floods levels (left) and recent floods levels (right). Author’s own.

The impact of wild elephants was a new issue for respondents, even the older generations had no previous experience. The emergence of elephants began within the last five-years, coinciding with CBR efforts, which many believe has worsened the situation. Respondents suggested that elephants have a highly destructive potential, destroying crops and homes. The effectiveness of the compensation scheme was disputed, with some claiming that they had been reimbursed for damages while others have been left with the costs on their own. As elephants have raided the community multiple times a year, often just prior to harvests, respondents were highly concerned about this. A recently erected electric fence was seen by many as inadequate, and only a temporary solution to this human-wildlife conflict.

‘Now the forest is back, the elephants have been encouraged, and even my house was destroyed one night by an elephant.’
(65-year-old female, Jhapa)

Jhapa’s flat landscape has allowed good road access across the district, allowing communities reliable market access. Manakamana’s economy remains agrarian based, though market access has facilitated the development of agricultural practices. Within the last two decades, farms in the community have been adapting their agriculture to bolster productivity despite decreasing precipitation. Boreholes have become widespread, allowing for three annual crop cycles independently of rainfall, thus insulating

the community from unfavourable changes. The use of agricultural chemicals is becoming widespread, countering decreasing soil fertility and the insect activity. Those who did not use chemicals (for personal or economic reasons) were struggling to maintain productivity levels. The mechanisation of agriculture was also high, with generators pumping boreholes and tractors in many fields. The community has mostly been able to counter issues of falling soil fertility and environmental change. However, issues regarding outmigration remain somewhat prevalent. While many respondents acknowledged the benefits of remittances and opportunities gained through outmigration, others felt that it was undermining local development due to labour shortages.

‘Twenty years ago, every farmer here was dependent on rainfall. Now people have boreholes and irrigation so rainfall isn’t so important... They use tractors, new seed types, new crops, and many chemicals, without which things don’t grow enough.’

(37-year-old male agricultural worker, Jhapa)

Environmental changes are primarily seen as problematic in the community. Issues were highlighted regarding increasing summer temperatures, erratic monsoon rains and decreasing rainfall outside of the monsoon period. The impact pathways of these changes included an inability to predict planting periods, reduced ability to work during the day and increased levels of insects and diseases. The increased levels of insects in the area was primarily attributed to the environmental changes. Mosquitos are posing a particular challenge to humans, while grass hoppers and other insects target crops at an escalating rate. Amongst respondents there was general agreement that these environmental changes have been most pronounced in the last ten-years.

6.2 Perceptions of environmental change

How do community perceptions of environmental change relate to available data sets and studies for the respective districts?

This sub-question aims to discern how accurately respondents perceive environmental changes, and the degree to which these are considered threats. The communities involved in this research were both confident that their environments have been changing. As previously highlighted, the country is immensely vulnerable due to twin challenges of high exposure and limited adaptive capacity. This has been emphasised in the course of this research. Contrasting the community perspective with scientific data gives an insight into the accuracy and reliability of the results, though admittedly the available data sets are generally sparse and of low resolution. Table 10 provides a summary of data on changes, contrasted with community perceptions.

Table 10: Reality and perceptions of environmental change.

<i>Environmental changes</i>	Nawalparasi	Jhapa
Temperature change	0.02 – 0.03°C increase per year from 1956 to 2006 ¹ 0.056°C per year in more recent decades ³	0.04°C increase per year from 1985 to 2015 ²
Perceptions of temperature change	56-percent noted increasing temperatures Majority noted changes within the last ten-years	61-percent noted increasing temperatures Majority noted changes within the last ten-years
Precipitation Changes	5-10 mm increase per year from 1956 – 2006 ¹	5-10 mm increase per year from 1956 – 2006 ¹
Perceptions of precipitation change	64-percent noted decreasing rainfall 52-percent noted more erratic rainfall Most noted changes within five to ten-years	16-percent noted decreasing rainfall 61-percent noted more erratic rainfall Most noted changes within five to ten-years

Sources: ¹Sharma (2009); ²DCEP (2017); ³Shrestha et al. (2012).

In Nawalparasi, increasing temperatures were acknowledged by respondents. Summer temperatures were said to be too high to work for the day. The changes in temperature were said to have occurred within the last ten years, prior to which they were primarily considered stable. Changes to precipitation were stressed as a more pressing challenge, in particular a perception of decreasing precipitation. The majority of respondents highlighted that it had not rained for six-months, a highly unusual occurrence. Previously, rain would be fairly consistent over the year allowing for crops to be sown and rice to be sown prior to the monsoon. Within the last five to ten-years, rains were said to nearly exclusively come in the monsoon period. These would be heavy enough to damage crops, cause flash floods near the river (destroying rice paddies) and trigger landslides in the area. As a result of precipitation changes, respondents felt that water access had dropped, and local springs that previously supplied the village with water had dried up. The village now relies on a piped supply from 4-km away. Seasonal shifts are noted as becoming less predictable, especially when the monsoon is more suddenly occurring. When asked about some of the causes of the changes, speculation was wide. Most respondents believed that historic deforestation was too blame, some of the older respondents would even express regret at having been involved. Others believed pollution was causing changes, from overpopulation and too many vehicles. There were also suggestions that since the earthquake (2015) things had got much worse.

In Jhapa, respondents also highlighted temperatures as a major environmental change and point of concern, suggesting that within the last ten years they have been increasing. Changes in precipitation

were noted as being problematic for multiple respondents, particularly the lack of rainfall outside of the monsoon season and the unpredictability of the monsoon. These were both said to have changed within the last five to ten years, and were having disastrous implications for flooding. Only a minority of respondents suggested that rainfall had decreased, whereas the majority were concerned regarding its increasingly erratic nature. Annual floods were perceived as becoming higher and less predictable, and respondents were primarily attributing this to changes in precipitation. References to erratic and odd-types of rain were also made. However, the floods were the key challenge resulting from environmental changes, as discussed before, various adaptation strategies are used to minimise other impacts.

Both communities are clearly able to describe environmental changes, with a greater emphasis on the last decade or so. Perceptions support the available data on temperature increases, though with discrepancies regarding precipitation. Respondents in Nawalparasi stress that less rainfall is generating drought-like conditions, though data suggests that precipitation is increasing. This is explained as rainfall is increasingly concentrated in the monsoon season, so the dry seasons are longer and more intense despite a net annual increase. Although the communities share a recognition of changes, they hold distinct capabilities to respond. In Jhapa adaptation has been extensive and effective, while in Nawalparasi respondents remain highly exposed to future unfavourable changes.

6.3 Resilience and adaptation strategies

In the context of the case-study districts, how can a community's resilience against climate change be influenced?

Having explored the key challenges for each community and their respective environmental changes, a discussion on each community's resilience can be more accurately framed. Both communities are facing pressures from environmental changes, many of which are partly or entirely influenced by climate change. The key discussion now is regarding how resilience to these changes can be instilled into the communities.

As both communities maintain agrarian-based economies, agriculture is one of the most important starting points to consolidate resilience. In Nawalparasi, where agricultural adaptations were minimal and productivity was falling, respondents felt that the key limitation in adapting their practices was a lack of knowledge and skills regarding alternatives. It is difficult for farmers to access markets to sell produce, and it is difficult for information on modern practices to reach the community. As environmental change increasingly disrupts equilibriums that have held precedent for generations, it is essential that agricultural practices are adapted as traditional approaches lose relevance and begin to fail. This is well demonstrated in Jhapa, where changes to agriculture (primarily conducted for economic reasons) such as boreholes, mechanisation and use of chemicals have improved productivity in the face of environmental changes. This has required access to information and equipment, both of which will hold increasing value in maintaining productivity for agricultural communities in the future.

A second key area of resilience is the community's ability to recover independently after a shock event, without necessitating assistance from external support systems (Mitchell, 2013). Following discussions with respondents about recoveries from previous events, a number of factors were suggested as particularly important. Intra-community support is of high value. Receiving help from extended families and neighbours in times of need, whether it is financial, physical or emotional, buffers the worst impacts of shock challenges. Second, the sourcing of materials for recovery locally was highlighted as important. Respondents in both communities noted the importance of access to natural resources as a central element of post-shock recovery. In the case of the 2015 earthquake, 2017 floods in Jhapa and landslides in Nawalparasi this was primarily timber for reconstruction. Finally, the financial cost of recovery is high. It was highlighted by Professor Ram Chhetri (Tribhuvan University) that communities with greater financial assets are able to recover faster. Impoverished communities will be restricted in the speed and effectiveness of their recovery.

Preparedness is a key component of resilience, and can lessen the immediate impact of an event and hasten the recovery of a community (Folke, 2006, Schipper & Langston, 2015). In Jhapa, respondents were able to better prepare for flooding events as the timing of floods coincides with monsoon rains. Therefore, adaptations such as storing animals in raised sheds and temporarily moving away from their homes were both possible to lessen impacts. In Nawalparasi, the risk of landslides was higher in the monsoon period, though discerning where and when they could occur is inherently difficult. Therefore, the community is limited in its ability to prepare, rather focusing on the response.

6.4 Chapter summary

Both communities are exposed to shifting portfolios of challenges, exacerbated by environmental changes and social developments. The differing contexts of each community result in different challenges and vulnerabilities, reflecting Nepal's diversity. Respondents were aware of environmental changes in both communities, perceptions of which are supported by data for each region. Discrepancies between adaptation strategy options were significant. Jhapa has been able to modernise its agriculture through chemicals, mechanisation and irrigation. Respondents in Nawalparasi highlighted how a lack of access to information and technology constrains agricultural adaptations. As a result, productivity has fallen at an alarming rate. CBR participation has a number of outcomes that directly influence these challenges and vulnerabilities. While this is beneficial for the engaged communities, exploring the broader relevance of CBR helps to assess the extent to which CBR can be a nationally significant intervention.

7. Results III: Broader relevance of the CBR approach

What are the barriers to upscaling the CBR approach across Nepal?

7.1 Local barriers and bypasses

Resistance from within the community can be a significant obstruction to CBR programmes. Working to resolve resistance has become an essential initial step in the model. Resistance has been found to most generally be rooted in misunderstandings, and the spread of misinformation within the community. Community suspicions over Eden's motives, land-tenure rights, community investment requirements and access to timber were all recurrent issues highlighted by Jhapa's district officer. Community respondents also shared experiences highlighting their initial misunderstandings on the project and who was coordinating it. The potential for misinformation to have detrimental impacts on a project was highlighted in an anecdote from Professor Ram Chhetri;

'In the early-nineties I went to visit a site where there was supposed to be an 80-ha pine forest. Having arrived at the site, there was nothing there. (...) The project was one of the old international reforestation initiatives. The community were paid to plant hectares and hectares of pine trees. Then at night, while the international staff went to bed, the community would go out and kill the saplings. The community had never been consulted on this project, it was land they used for grazing. Some thought pine would stop other plants and trees growing, and others that people would come back and take the timber. This is what happens when communities are not consulted. It's an example that has been repeated all over Nepal.'

(Professor Ram Chhetri, Tribhuvan University)

The example encapsulates a number of issues which feed into community resistance. Instead of directly opposing the plantation, the community opted to accept the employment from the project though not the trees.

One of the most important elements for countering community resistance is the involvement of strong local leadership. This has been apparent throughout the community-based research, and is reiterated in literature reviews such as Le et al. (2012). As leaders are first approached by Eden, their reaction is critical. If the leader is able to see the opportunities from engaging with CBR, they act as a pivotal component helping to facilitate subsequent steps in the project. By holding influence in the community and being better informed on the project, leaders are able to effectively counter the spread of misinformation and act as catalysts and shore up support. Strong local leadership helps to legitimise Eden for communities in which it is a new organisation and concept. In particular, by creating a shared vision through consultation meetings, helping to gauge commitment and potential outcomes. Many respondents in both communities highlighted how leaders had made the first introduction to the project by pitching the opportunities that could come from this. It is important to note here, that the expectations of community members were primarily influenced by local leaders. Therefore, there is a risk that these could be unrealistically raised, and a failure for projects to meet expectations endangers

their longevity. While local leadership was highly important in both contexts, there was a contrast between the two communities in terms of a feeling of participation. While in Nawalparasi the community was highly engaged, respondents in Jhapa more frequently felt excluded from the project. As highlighted by Le et al. (2012), processes with lower participation have greater potential for community resistance as there is a failure to create a sense of shared ownership.

A second area highlighted as a significant local barrier is that of local governments and authorities. This was highlighted as an area of concern by Eden's national and district staff. As CBR projects in Nepal are highly integrated into CBFM and CFIs, local forest authorities are involved as they work closely with CFIs to ensure forests are managed in the previously co-agreed manner. Forest officials have held arbitrary responses to projects in both research districts, described as either inhibitive and facilitative. In Jhapa and Nawalparasi, the MoFSC and local officers have helped to locate potential communities. This has accelerated the roll-out of projects across Nepal. Working with local authorities also helps to legitimise Eden, and CBR as an approach. However, in Jhapa, officials have also taken control of projects at certain sites and reassigned planting areas. This interference undermines Eden's planning efforts, as well as consultations with communities on pre-determined planting strategies. It was highlighted during an interview with Dr. Ian Nuberg, that corruption throughout the forest sector of Nepal is high.

'The forest sector is riddled with joints at local and national levels. These joints could be monitoring processes, harvesting checks or report writing. It is in these joints that the rot sets in, corruption. The overly complex system stops the benefits of forestry from being realised.'

(Dr. Ian Nuberg, University of Adelaide)

At a local level, corruption is well-established as an inhibitive factor on development efforts and incurs a significant economic burden (Gray and Kaufmann, 1998). In this context, resisting corruption increases a project's complexity and feasibility, while bowing to corruption incurs an economic cost and is morally questionable. Dr. Steve Fitch, the CEO and founder of Eden, reiterated Dr. Nuberg's point that corruption is an issue for Eden's operations. However, it is worth noting that neither of Eden's national staff noted corruption as an issue. Discussion on whether this was as a result of no exposure to corruption, or as a result of its absolute embeddedness (and thus accepted as an inevitability), would be un-grounded.

7.2 National barriers and bypasses

Aside from the local-level barriers, there are some influential national-level factors that hold influence over CBR in Nepal, and thus its future prospects as an approach with wider relevance. The influence of policy on CBR programmes is significant. As the approach is in its infancy, there are no policies or guidelines to direct government and ministerial responses. The lack of policy is the primary cause for the arbitrary local-level response. During the course of this research, Nepal's first international agro-forestry conference was held, with the aim of bringing together practitioners, academics and

government representatives to form policy guidance for agro-forestry. This collaboration paves the way for Nepal to be the second country globally to have agro-forestry integrated into national policy, and thus actively promote the approach to support rural development. A comparison can be made between agro-forestry and CBR as rural development approaches with strong environmental credentials. If CBR were to gain further recognition, as agro-forestry has done, there is potential for future policy-integration to facilitate further deployments. The extensive CBFM infrastructure across Nepal provides a network of established local institutions and support government departments, through which CBR policy could be deployed. An extensive interview with the MoFSC's Deputy General did not indicate that this was being investigated. In fact, neither of the MoFSC respondents were aware of such an approach in Nepal. The current low-profile nature of Eden's work in Nepal should not deter enthusiasm though, rather focusing on the growth rate on the projects and future potential.

A second key barrier for the approach is the cost associated with supporting each project for years. Eden's approach to funding has allowed it to access business networks to secure long-term stable funding commitments. This reduces reliance on unpredictable private donations. The national staff felt well-supported by the international organisation, and that funds were available to expand into new projects and communities when required. However, funding for the international organisation was a concern for the founder, Dr. Steve Fitch. Exploring new avenues of funding is therefore of high importance. Nepal's efforts to engage with the REDD+ programme are therefore of significance, as a potential new financial support. Several interviews were conducted to assess the relevance of REDD+ to CBR in Nepal, including Dr. Bhaskar Kharky (ICIMOD REDD+ Economic Consultant), Dr. Rajendra K.C (MoFSC Deputy General) and Mr. Prakash Lamsal (MoFSC Community Forestry Development Official). Despite optimistic trial results, for both ecological and economic outcomes, the complexity of REDD+ was highlighted by all respondents as a key hindrance on its future in Nepal. Monitoring and evaluation requirements have potential to undermine feasibility, a concern echoed by Dr. Steve Fitch (Eden). However, Eden has recently ramped up funding to reinforce its monitoring capabilities to support partner requirements. As processes are refined, there is potential it could support communities in ratifying ecological impacts to access other PES forms. The international carbon market, for instance, has been speculated on as an area of growth. If Eden can diversify income streams and access further financial support for the work it is already conducting, national expansion would be heavily facilitated.

Finally, there are barriers associated with the approach's relative immaturity. Following discussions with MoFSC officials and presenting this research at an agro-forestry conference, an interesting comparison can be made with agro-forestry and CBFM as more well-established approaches, and CBR has potential to learn from the development of each. CBFM was an alien concept across much of Nepal just some decades before, and as Prakash Lamsal worked closely with the development of the programme to its current highly integrated and normalised form he provided some valuable reflection points for CBR. Building the capacity of local institutions was extremely difficult, until CBFM began to integrate with existing traditional management structures. Resistance to the programme was high

due to low awareness, communities were hesitant to engage with CBFM when they were unsure of requirements and outcomes. Programmes to raise national awareness were highly effective, including demonstration sites, discussion meetings and leaflet distribution. Momentum gathered behind the movement as legitimacy was gained and benefits realised. It is a lack of awareness and low understanding which is the major source of resistance from within communities.

'Communities always want to know exactly what they're doing, understanding everything and know who is doing what.'

(Prakash Lamsal, Community Forestry Development Official)

Agro-forestry is an example of how the assembly of evidence for an approach's impact coupled with academic lobbying can lead to the formation of complimentary policy. Similar to CBR, agro-forestry in Nepal links with the well-established CBFM infrastructure, providing a network of local institutions for deployment. Formalising the relationship has the potential to streamline the process, which could equally be achieved for CBR as the approach gains further recognition.

There are a number of other significant factors facilitating CBR deployment in Nepal that have been touched upon in the course of this research. First, as previously arable land is under-utilised, an opportunity forms for widespread land-use change. Second, Professor Ram Chhetri (Tribhuvan University) suggested that changes in agricultural practices also decreased the utilisation of community lands. In particular, a reduction in livestock per household was suggested as a major driving force. It was also suggested that households now favour tethered and zero-grazing pastoral agriculture, reducing the burden that livestock exert on forests. Community members will then selectively harvest grasses for livestock, a skill that a goat is unable (or unwilling) to develop. The development of roads across Nepal has also been relevant, as incursions into previously isolated and inaccessible areas were feared to open up forests to exploitation. However, the road network has instead relieved pressures on forests, opening up routes for communities to access cooking gas. As gas becomes an increasingly accessible fuel-source, forests are can be managed with a reduction in demand for wood, facilitating restoration.

8. Discussion

When stripped back to basics, this work aims to examine how CBR programmes have impacted the resilience of two case-study communities in Nepal. It is accepted that resilience is highly contextual, thus exploring the social-ecological landscape of each community was the point of departure. This was followed by an approach to discern the human and ecological impacts of CBR within each community. Thus far, stages have been presented in succinct chapters with limited discussion on their relationships. This chapter explores to greater depth how the practically-orientated CBR approach relates to the resilience perspective. The chapter is structured based on the components of resilience (*challenges, learning, options and flexibility*), with discussion on how results feed into the resilience perspective. The final part of the chapter comprises of a reflection on the resilience perspective.

Before proceeding with this chapter, it may be beneficial to quickly review the indicators for resilience in table 4. These components of resilience feed into the definition of the concept as used in this work,

‘The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a shock or stress in a timely and efficient manner.’

(Mitchell & Harris, 2012 p.2)

8.1 Challenges and vulnerabilities

Respondents in both communities perceived that forest restoration had impacted challenges they faced, though not always positively. In Jhapa, trees have helped in the retention of top-soil and river banks, which has been a significant support to the community. Conversely, the forest provides cover for wild elephants, which have proved to be an extremely destructive force for the community. Conflict between humans and elephants is rising across Nepal, as elephants are drawn to the arable agriculture surrounding communities (Pradhan et al., 2011). As with much human-wildlife conflict, solutions are beyond the adaptive capacities of local communities, necessitating external financial and technical assistance (Dickman, 2010). Therefore, if CBR introduces challenges to a community that exceed their adaptive capacities, this is a significant trade-off with the beneficial impacts in other areas of resilience.

Another important area of discussion is the role in which CBR plays in mitigating climate change, and thus reduces exposure to challenges arising from environmental change. While this link is tenuous, it is relevant. This work has not attempted to discern the contribution CBR makes to mitigating climate change, as accurate methods to measure carbon sequestration are notoriously expensive and complex. Eden has planted over four-million trees in Nepal, with a self-determined survival rate of 70-percent. Table 11 gives a rough calculation of carbon sequestered by the projects. If these were to be up-scaled nationally and globally, the cumulative impact of CBR is significant, though the translation to reducing localised climate change impacts remains inherently problematic to discern.

Recognition of carbon sequestration, despite remaining hypothetical, does have potential for opening up REDD+ integration. Importantly, this has potential of opening up new revenue streams to overcome barriers. REDD+ in Nepal has not progressed further than trial deployments, and discussion with experts did not inspire confidence that programmes would significantly develop before 2020. Equally, any potential outcomes from REDD+ engagement should be considered with the trade-off of the possible recentralisation of forest governance (Phelps et al., 2010). Therefore, other PES programmes could be preferable if autonomy of governance is maintained. A key outcome from the Paris Climate Summit in 2015 was the carbon-pricing leadership coalition, forming a unified platform to stabilise carbon prices and encourage participation (World Bank, 2017). Therefore, the future potential of the private carbon market is precise to sequestration projects. Table 11 is meant purely as an indicative example of future potential rather than a stringent calculation, the reality of accessing the carbon market for projects remains shrouded in costs and complexities (Paul et al., 2013).

Table 11: Indicating the carbon sequestration of CBR in Nepal.

Annual plantation	Annual CO ₂ uptake	CO ₂ price per tonne	Estimated annual value
(1-million at 70-percent survival rate) 700-thousand	(2-kg per tree) 1400 CO ₂ tonnes total ¹	US\$16.2 ²	US\$22,680

Sources: ¹Forestry Commission (2014) estimating 2-kg per tree CO₂ sequestration and ²Evans (2012) accounting for the average carbon price across 41 nations.

The extent to which CBR programmes can be deployed to mitigate challenges remains an area of limited academic understanding. This work has found that CBR will generally positively reduce exposure to challenges, though as the above example indicates, careful management is required to minimise externalities.

8.2 Learning

This component of resilience relates to the understanding and awareness of risk and ability to learn from events. *Learning* consists of an awareness of risk, access to information, sharing information with others, and understanding the community's strengths and weaknesses.

While communities recognise that their respective environments are changing, the understanding of why this is remains fragile. Equally as tenuous was community knowledge on the impacts of restoring forests. The CBR approach has potential as an educative platform, to disseminate knowledge on the ecological impacts of trees and broader issues such as climate change. As highlighted by Le et al. (2012), a greater understanding of the process that communities are participating in reaffirms commitment. Eden utilises community leadership structures to initially engage support, though these

structures could be further utilised to improve access to information. The employment benefits of CBR are the primary point to attract interest, yet in Nawalparasi respondents consistently referred to environmental outcomes as the most important. Research indicates that improved soil fertility, restored local water tables and soil retention are key outcomes for forest restorations (Agrawal, 2001; Eckholm, 1976; Sunderlin et al., 2005). While stressing these points to communities is important, avoiding the formation of unrealistic expectations is also necessary. This is where knowledge of climate change becomes important for communities. Studies of community disaster-preparedness by van Aalst et al. (2008), suggest that knowledge was an essential component, for both understanding the issues faced and how to adapt to them. The authors acknowledge that while local knowledge is of significant value, external assistance remains valuable for communities.

Finally, an understanding of the community's relative strengths and weaknesses is an important aspect of *learning* (Schipper & Langston, 2015). This component appeared to be heavily influenced by CBR, primarily through the empowerment of women in each community. As women are brought together with a purpose and paid what is accepted as a fair wage, there was a strong feeling of connection and shared empowerment amongst respondents. The work of Acharya et al. (2005) highlights how such processes can strengthen intra-community networks, and increase self-reliance. As the women work together, an appreciation of their collective strength forms, acting as a foundation for facilitating economic growth and development (Duflo, 2012). Alongside the empowerment of women, CBR projects have brought together the community as a whole uniting them through positive action. This strengthens bonds and a more general understanding for respondents of the communities they live within.

The impact of CBR on gender equality is an exciting area for further research. CBFM was highlighted by Agarwal (2001) as having potential to empower women, though in reality the CFIs were often male-dominated. Discerning the equality of decision making with CBR would deepen understandings, and make an interesting contrast with CBFM in general.

8.3 Options

Options can be broadly considered as the more practical and tangible elements of a community's resilience. Options can facilitate a community in bypassing vulnerabilities, and when exposed to a challenge, allow a broader range of reactions. The components to be discussed are knowledge and skills, financial assets, land tenure and non-financial assets.

As highlighted in the preceding section, despite the community's recognition of environmental changes, a limited understanding of potential future scenarios can limit the capacity to prepare. It is knowledge and education that plays a pivotal role in allowing a community to prepare against challenges (Mathbor, 2007). The contribution that CBR has made for enhancing this appears to be an area of untapped potential. A more thorough understanding of the ecological impacts of trees would better engage communities, and allow them to use trees to buffer certain environmental changes

(Sunderlin et al., 2005; Le et al., 2012). As multiple respondents from both communities suggested that training and skill development programmes would be a valuable addition to CBR, there is a clear desire for participation. Eden's purist approach to reforestation is a barrier to this, perhaps hindering it from broadening its focus, to explore options for further enhancing resilience. It may be an area of future development to partner with organisations whose work is complementary. Acharya et al. (2005) examine multiple rural development programmes in Nepal, several of which are complimentary in nature to CBR. Collaborating with other organisations in the region could encourage knowledge sharing, and allow programmes which bolster knowledge and skills to further community development. However, collaboration between organisations can incur complexities, and must be appropriately managed to avoid undermining outcomes (Pfeiffer, 2003).

Although not directly related to CBR, respondents in Jhapa demonstrated a relatively high level of knowledge on adapting to environmental stresses. The introduction and widespread use of boreholes and agricultural chemicals has had a transformative effect on the community's agriculture. However, despite the increasing use of chemicals, there is a lack of knowledge on their correct use. Respondents had rarely received training, and on occasions when they had, it was provided by the delivery drivers. A number of respondents who opted for organic agriculture raised concerns regarding the excessive use of chemicals, suggesting they were applied with the understanding that more chemicals would equal higher yields. These concerns are echoed widely in literature of the topic. A lack of training means that residues on crops are damaging to consumers, dependencies are formed on externally priced resources, traditional practices are forgotten and there is a risk of localised ecological damage (Ecobichon, 2001; Konradsen et al., 2003). Although this is perhaps unrelated to CBR, it is meant as an indicative case-study of how limited skills and knowledge can have unforeseen impacts, and that poorly managed adaptive strategies can have externalities. While the initial impact on resilience is easily framed as positive, cumulative impacts can have adverse effects.

CBR was found to have a significant impact on households' financial assets. A lack of employment was an issue for both communities, and access to markets hindered economic development more so in Nawalparasi. Both communities were found to benefit from the employment opportunities generated from CBR. Employment forms an essential component of community resilience, aiding financial security which allows an increased range of options in coping with vulnerabilities (Cutter et al., 2008). The scope for CBR to further increase its positive economic impact is significant, though yet again is hindered by Eden's purist reforestation approach. By focusing on native species, forests are restored to a closer natural function. However, as discussed by Chazdon (2008), forest restoration programmes can be managed to optimise outcomes for communities and the environment. NTFPs can help to bolster community income opportunities. While Eden takes pride in restoring native forests, the quantity of under-utilised private land may be an opportunity to better support household livelihoods on a long-term basis. Using CBR infrastructure to grow appropriate fruit saplings, and allowing these to be distributed within the community could capitalise on reductions in cultivated land, while aiding development and planting trees.

With regard to land tenure, CBR has not had an impact. This is due to the integration with local CBFM institutions, through which land tenure agreements have been long established (Agarwal, 2001). The reforested land is most commonly community land, previously used for grazing. Participation in CBR does require community agreement on changing land-use, and initial resistance in both communities was overcome through the pivotal role of local leadership structures. With regard to non-financial assets, there is a differing story dependent on perspective. While the majority of households have not experienced changes, when a community perspective is adopted, there have been considerable changes in assets. The restoration of forests helps to provide access to timber and non-timber forest products. The timber in particular is of significant value for community resilience, as a means for independently reconstructing in the wake of a disaster. The most frequent examples were floods and landslides, where timber is the most important resource during the rebuild. Access to this resource makes a considerable contribution to a community's flexibility.

8.4 Flexibility

Flexibility is the extent to which a community can withstand shocks and stresses, while retaining its function (Schipper & Langston, 2015). The greater the flexibility of a community, the greater their ability to deal with challenges. If the capacity is exceeded, the second element of flexibility is to be able to restore function, quickly and independently (Cutter et al., 2008). As the environmental changes and social developments of the future are uncertain, predictions and preparations are disputed. This is well encapsulated by Lewis & Gallant (2013), *'The only certainty is uncertainty'* (p. 1). Flexibility is therefore an important element for facing future uncertainty. The component consists of: self-regulation, low dependence on external factors, diversity of livelihoods and avoiding dependency on at-risk resources.

Self-regulation and low dependency on external factors hold areas of crossover and can therefore be discussed together. As CBR has been conducted on large tracts of under-utilised land, the land's function has been improved. With improved function comes the provision of timber and NTFPs. The local provision of such resources is highly valuable for communities, with respondents in both districts being able to source fodder closer to their community. In the wake of destructive shocks, including floods, elephants and landslides, locally sourced timber allows a more rapid and cost-effective reconstruction. While all extraction of timber from the community forest is meticulously managed by CFIs through multiyear plans, forests with higher coverage can of course achieve a higher sustainable extraction rate (Molnar et al., 2011). The work of Cutter et al. (2008) stresses how communities with access to greater environmental resources are able to achieve greater interdependence during the recovery from a disaster, by avoiding a reliance on intermittent external support. Conversely, communities with heavily depleted natural environments can struggle to buffer and recover from disasters.



The early construction of a home in Jhapa using locally sourced timber. Author's own.

The strength of a community is an integral element of flexibility (Schipper & Langston, 2015). The measurement of this component is a contested point in literature, and despite developments, optimal approaches remain contested (Western et al., 2005). This work gauged CBR's contribution on the basis of how respondents felt participation had brought the community closer. Respondents were confident that the project had brought people together and united them with a purpose. Tidball et al. (2017) provide a strong argument for how community projects can bolster resilience; as people are brought together and work on something for the common-good, relations are improved and the community's strength is improved. It is worth noting, however, that this was much more obviously the case for Nawalparasi than Jhapa. Respondents in Jhapa were unable to engage in concerted efforts for reforestation, rather participation was more limited. Therefore, it would appear that even for the two communities, that the same model can generate divergent outcomes.

Livelihood diversity in both communities is limited, with the vast majority of livelihoods depending directly on agriculture. Increased out-migration and the inflow of remittances has been significant for many households, with impacts on land-use and agricultural practices (Jaquet et al., 2015). However, whilst increasing opportunities for primarily young and able males (through outmigration), women are increasingly finding themselves with greater responsibilities and thus restricted livelihood opportunities (Gartaula et al., 2010). Thus, diversifying livelihoods for those who remain in communities is extremely important. CBR provides a contribution to broadening economic opportunities through employment (Sunderlin et al., 2005). Realising this potential requires well distributed opportunities for participation, arguably achieved in Nawalparasi, though conducted on a more restrictive basis in Jhapa. The extent to which CBR could mitigate rural outmigration would be an exciting area of future study. In theory there should be a connection, if CBR not only provides short-term employment but long-term environmental improvement, this could incentivise staying for some young people.

This leads in to the final component of *flexibility*; avoiding dependencies on at-risk resources. During an age of unprecedented globalisation, the somewhat romanticised images of subsistence orientated communities high in the Nepalese mountains has begun to end. Respondents in Nawalparasi, the more isolated community, would wear imported Chinese clothes, eat rice grown in India and play on smart-phones manufactured in South Korea. Many would have relatives working in the Gulf States or Malaysia. While links to the wider-world have never been greater for such communities, determining the strength and resilience of connections or ‘development corridors’ (Zoomers & van Westen, 2011) is an important area of discussion. Locally, such connections are susceptible to annual periods of disruption. In Jhapa, floods can isolate communities for extended periods, while in Nawalparasi landslides cause temporary yet frequent blockages. These factors have the potential to put all goods, that are not locally produced, at risk. With regard to localised dependencies on at risk-resources, the high concern over water access for respondents in Nawalparasi is a point of contention. In theory CBR has potential to protect and restore water tables within an area, thus improving the situation (Sunderlin et al., 2005). However, these long-term effects will sit in direct opposition to the impacts of over-extraction and climate change. It would therefore be advisable for alternative management approaches to support the community in more effectively managing water resources. Finally, in Nawalparasi falling agricultural productivity is suggestive of compromised soils, a point which is also supported by Massey et al. (2010). The authors go so far as to link falling productivity to encouraging out-migration, indicative of the complex tapestry of factors and their relationships covered in this chapter. The soils can therefore be considered, to some extent an at-risk resource.

For both districts, a more comprehensive assessment of the dependencies on at-risk resources would provide a more thorough understanding of vulnerabilities and thus inform actions to mitigate such risks. Such an assessment is beyond the scope of this research, although advisable for future studies.

8.5 Resilience beyond Eden

What happens to a community’s resilience, beyond Eden? Once under-utilised lands have been reforested, Eden’s activities in the community cease. This work has solely examined communities in which CBR remains active, and there are no longer-term examples in Nepal where Eden’s support has been withdrawn. However, as stressed by Le et al. (2012) CBR is ultimately a long-term endeavour. The base that it is launched from must be strong, but it is the following decades in which value can truly flourish. If these results are not realised, CBR is limited as a complex and costly intervention to provide short-term employment and little else. Therefore, detaching from CBR must be managed in a way to ensure continuation of forest development. First, the CFIs will be required to play an integral role in the management of forests, thus ensuring Eden secures strong collaborations with CFIs prior to departure is important. Integrating the plantation areas into CFI management plans could formalise this process. Second, community appreciation of the long-term benefits of forests must be fostered. Eden’s potential for dispersing information is not sufficiently utilised, and a better informed community will more accurately value forests. Third, at present, Eden does not incentivise particular

post-plantation management strategies, though there is scope to improve this. Forest management science suggests that interventions should continue to optimise survival and growth rates (Hunter, 1990). Therefore, perhaps continuing employment opportunities for plantation management on a less regular basis could encourage continued engagement from the community. This could go some way to covering the limbo-period, that exists between the initial of the plantation period and realising benefits from timber and NTFPs.

This work has focused on short-term CBR resilience impacts, and longitudinal studies would be a valuable endeavour for gauging changes over time. While economic and social impacts arise from plantation activities, the continuation of impacts is supported by the forest's establishment over decades. Ongoing monitoring and support is therefore paramount.

8.6 Reflections on CBR and the resilience perspective

The resilience perspective, as introduced in chapter 1, can be critiqued due to its ill-defined and abstract nature (MacKinnon & Derickson, 2013). However, as deployed in this study, the perspective has demonstrated flexibility and relevance. The perspective has given an overview of each community, and insight into the impacts of a conservation-development intervention.

While this allows for a general conclusion to be formed on whether the contribution has been positive or negative, it is limited in its ability to compare CBR with other interventions (agro-forestry for instance). This restricts the scope of discussions, and the transferability of results. If a more conventional means of analysis was adopted, then results could be contrasted with interventions that are capable of making the most significant impact on resilience. The second area of limitation is that the impact on community development has not been quantified, rather commented upon. This does not allow CBR to be contrasted with development approaches in regard to effectiveness and value. Future studies which contrast costs of development amongst different approaches would allow CBR to have its value discerned amongst other interventions, which would be of value for policy and decision-makers. Both of these stages will arise as the approach matures, and further verification is needed. At its present stage CBR remains in a relative niche, it has not been subjected to rigorous reviews of impact, though as recognition is gained critiques will follow. Adopting the resilience perspective has explored the topic from a new angle, with encouraging results.

As discussed in chapter 1, CBR is inherently linked to the participatory development theory where communities are equipped for taking the reins of their development. However, the second component of participatory development is with regard to equity of participation. The extent to which CBR management structures counter the stratifications of Nepalese society (based on caste and gender) was not explored in this work. Such issues deserve attention, especially with consideration that some CFIs have been previously highlighted as patriarchal and dominated by local elites (Agarwal, 2001; Thoms 2008). Findings from this work suggest that the involvement of women in CBR projects was

empowering, exploring the effects of involving women in the management structures gives further insight into optimising impacts.

8.7 Chapter summary

The concept of resilience can be explored in multiple ways. The lens selected in this work has suggested that participation in CBR leads to positive outcomes for communities, thus bolstering resilience. This positive indication supports the limited amount of literature on the topic. However, it is important to reiterate that understanding of the relationship remains limited and that this work echoes the findings of Tidball et al. (2017); further research is required to shed light onto this exciting area of potential. CBR has showcased itself as full of potential, but it is not a single intervention approach. The long-term nature of the projects and external support network requirements are complex and incur significant costs. Deployments must be carefully monitored, necessitating ongoing assistance. The construction and maintenance of these infrastructures could be a limiting factor on future deployments of the approach. Greater understanding of how to optimise deployments to maximise positive impacts and minimise costs will be of value in the future.

9. Conclusion

This thesis opened by emphasising the global impacts of forest degradation, and the widespread lack of effort and power from governments to tackle the issue. However, meaningful action cannot be indefinitely deferred. As the world's leaders begin to cement their commitments on restoring forest reserves, there are numerous options which can be considered. While centralised and top-down projects may incur significant externalities, community-based alternatives are growing in feasibility. CBR acts as an enhancement of CBFM, where communities not only take responsibility for the management of their forests, they receive financial and technical assistance in actively restoring them. While the short-term economic impacts of the approach are of benefit, it is essential to recognise that the long-term benefits are realised over generations (Le et al., 2012). These long-term benefits are also not exclusively for the community. As forests re-establish, their impact is valuable for the global community, a contribution that should be acknowledged to encourage support. CBR is a contextually appropriate intervention which has indicated sufficient potential for aiding development and supporting resilience, warranting further research and greater attention. This concluding chapter will summarise the three sub-question areas (CBR, resilience and barriers) before concluding on the central research question.

Gaining an understanding of CBR has been the initial part of the research, results from which also stand on their own in furthering knowledge in an emerging approach. Practically exploring how such methods are deployed in Nepal gives a basis for contrasting findings with the limited literature on best practices. Uncovering widespread acknowledgements of social, economic and environmental outcomes was highly encouraging. Community consultation and participation are the cornerstones of successful projects, facilitating the necessary long-term engagement. However, contrasting results with regard to perceptions of participation highlight an area to be focused on to improve the long-term outlook of the projects. A second important area for attention is a widespread limited understanding in communities of what can be expected from CBR engagement. While low expectations lead to under-appreciation, unrealistically high expectations can result in eventual disappointments. Both outcomes can limit concerted long-term efforts for the conservation of the forest, where lapses in the communities' commitment can have irreversible impacts. Facilitating a better understanding of the ecological impacts of trees is a countermeasure to this, while also aligning expectations and outcomes and preventing the spread of misinformation.

Resilience assessment has been the adjacent strand of research. While the desk-based regional framework research discerned national and regional vulnerabilities, in-situ participatory research has delved into new avenues and highlighted the value of the emic-perspective. The nature of shock challenges, many of which were escalating in frequency and severity, raised concerns in communities. The impact of stress challenges also took its toll, with pressures being exerted on communities primarily from environmental changes. Findings on the translation of environmental changes into SES impacts have been varied and contextually relevant. Adaptation strategies are of course a highly important response to such circumstances, though discrepancies in the deployment of these were

significant. Multiple examples of independent and effective adaptations were uncovered. However, external assistance can facilitate further adaptations, a point reiterated by many respondents. Therefore, how best to influence community resilience remains a contested point. Gaining an understanding of contextual resilience through an adapted CoBRA framework has provided the foundation for this research, while demonstrating the flexibility of the approach through a new deployment. This work has opted to use the resilience perspective of *learning, options* and *flexibility* to focus only on elements which are directly related to resilience as defined by Schipper & Langston (2015).

While this model has worked well in the case-study communities, discussions which transcend the community-level focus help to gauge wider feasibility. This research has therefore explored inhibitive and facilitative factors for CBR. A number of barriers and bypasses were uncovered at local and national levels, revolving around governance issues such as corruption and practical issues such as funding and suitable communities. Some significant trends in Nepal, in particular rural-outmigration and well-established CBFM infrastructures, have been extremely valuable in the deployment of CBR. However, this should not detract from the model's flexibility which has been demonstrated through other international deployments. Diversifying revenue streams remains a point of difficulty. The potential to tap into the carbon market remains unfulfilled, currently inhibited by complexity and costs. As monitoring and evaluation methods are refined, this is an area of future potential which could enable widespread deployment. Further evaluations of the model should broaden recognition of the wide-ranging constructive impacts and encourage greater levels of attention.

The research questions which have guided the preceding paragraphs have been organised to answer the central question of this work:

In what ways does engagement with community-based reforestation programmes affect community resilience in the Nepalese districts of Nawalparasi and Jhapa?

Having first discerned what resilience is for the local contexts and then evaluated outcomes from CBR engagement, the findings of this research suggest that CBR programmes have a significant impact on community-level resilience. This carries an appreciation that SES have equally weighted ecological and social elements, and that occurrences have ripple effects for both components. The impacts from CBR strengthen multiple areas of a community's resilience, reinforcing it to better cope with shocks and stresses. Simultaneously, there is evidence that CBR plays an active role in influencing challenges which communities face, reducing exposure by stabilising local environments. However, the potential to exacerbate issues is encapsulated in Jhapa (elephant encroachment), acting as a case-study to encourage comprehensive evaluations to reduce the potential for externalities. While the short-term impacts are centred on economic stimulation and community empowerment, the long-term impacts will be realised by successive generations as environmental functions are restored.

Today's world needs more trees. The optimal means for achieving this, however, remain contested. This work has evaluated an emerging approach through the resilience perspective, and indicated that it has further potential to be realised. Subsequent research from different perspectives, in particular longitudinal studies, will be of significant value in deepening understanding of the issue. As communities across the planet face uncertain futures, approaches to bolster resilience are required with increasing urgency. CBR does appear to offer compensation to a small number of communities. The damage from a changing climate is apparent as a global problem, with rural and developing communities all too frequently bearing the brunt of impacts. Through CBR, communities can play an active role in mitigating climate change while simultaneously reinforcing their resilience through an adaptation strategy.

Community-based reforestation and the resilience perspective are innovative approaches, relevant to today's multifaceted world. The concepts are far from refined, though both hold significant potential at local and global scales for the environment and development in the coming years. Action is required today to defend the forests of tomorrow.

'We have become great in a material sense because of the lavish use of our resources [...] But the time has come to inquire seriously, what will happen when our forests are gone[?]'.

(Roosevelt, 1908)

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Appendix 1: Semi-structured community member interview and FGD

Background Information	
Location of interview / FGD	
Gender	
Age	
Highest level of education	
Occupation	
Household size	
Community-based reforestation participation	
Questions	Follow-up points (where applicable)
What do you understand about the community's reforestation project?	Organisation's structure Project objectives Level of community participation
To what extent have you been consulted on the project?	First heard about the project How concerns were dealt with Feeling of understanding
Have you had the opportunity for involvement and/or to provide feedback for the project?	
<i>If yes:</i> Do you feel it was sufficient? How was your participation and feedback acted on? Do you think community participation is sufficient? Are there any improvements that you would suggest for more community involvement?	<i>If no:</i> Would you like to be able to be more involved? How could participation opportunities be improved? Do you think community participation is sufficient? How could community involvement be encouraged?
To what extent do you believe that community-reforestation has been beneficial for this community?	
Should the programme be changed in any way to increase benefits for the community?	
Contextual resilience	
In your opinion, what are the greatest hazards facing this community?	What do you think is causing this hazard? How has the hazard changed over time? How does the community respond to this hazard? How do you think the hazard could be better dealt with?
How has the environment changed over time?	What does a 'normal' year look like here? Temperature changes? Precipitation patterns? Seasonal shifts? Have there been any other environmental changes? When did these changes begin, and how have they developed over time?

Have changes led to any impacts on your livelihood?	What are the key impact areas of changes? Environmental hazards? Diseases and insects? Agricultural productivity?
How has the community dealt with environmental hazards in the past?	
How well prepared is the community to deal with environmental hazard now?	
How has outmigration impacted the community?	Why are young people moving away? Could environmental degradation push people away from villages? Do people want to stay in the community if there are better employment opportunities?
Community-based reforestation impacts	
How was the land used for reforestation chosen?	What was the land used for before the plantation? Is this a positive or negative change? How will the land be managed in the future?
Have you noticed any changes to the environment since the plantation began?	
How has the risk of environmental hazards changed since the project began?	Why do you think this is the case? Do you believe this will change over time? Has the project influenced the community's ability to deal with hazards?
How has the project impacted employment opportunities in the community?	Are the opportunities fairly distributed? What are the results of these opportunities? Is the community benefitting from these opportunities? Has your household been effected by new economic opportunities?
To what extent has the project been beneficial for the community's strength?	Does the community work together on the project? Has the project impacted your relationships with other community members? Has this been a positive or negative impact?
(for women only) To what extent has the project provided you with new opportunities?	How have you found working with other women from the community? Has the income supported your household? Has the project influenced how women are perceived in the community? How could the project further support women in the community?
Final questions for the interviewer & close	

Appendix 2: CBR poster presented at the 2018 Kathmandu agro-forestry conference

Community Based Reforestation: An Innovative Approach for Accelerating Rural Development and Building Climate Change Resilience?

An exploration into how community reforestation programmes in Nepal can aid local development and simultaneously strengthen resilience against climate change for some of the world's most vulnerable populations

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The Eden Projects

1. Setting the Context

This research focuses on the role community-based reforestation (CBR) can play in aiding community-level development and resilience to climate change in Nepal. CBR aims to bring employment and ecosystem-provisioning services to participating communities, though numerous other potential impact pathways are yet to be explored.

This work has begun to analyse other impact dimensions, in particular focusing on resilience against climate change. The resilience perspective has numerous components, both ecological and socio-economic, the cumulative impact of which can enhance or undermine a community's future prospects.

2. Methodology

An adapted version of the UNDP's community-based resilience analysis (CoBRA) approach has been utilised to gain an insight into community-resilience through qualitative household interviews. These explore the three components of resilience, as discussed by Schipper (2015):

Learning Options Flexibility

Learning relates to the understanding of risks and recovery, while *options* allow for the circumnavigation of risks, and *flexibility* refers to absorbing disruption without collapse. The CoBRA method discerns the key challenges facing a community and impacts of interventions through:

- Semi-structured household interviews
 - Community focus group discussions (FGDs)
- Additional key informant interviews (KIs) help to broaden the perspective.

4. Furthering the Research

An analysis of the barriers to upscaling will be conducted. Eden Projects has planted nearly four-million trees in Nepal, across twelve communities in five years. As the community-perspective has been highly encouraging, the barriers to further upscaling will be explored. These will fall into the following categories, institutional, social, and environmental. A greater number of KIs will be utilised to gain insight on the topic.

5. Conclusions

- Community-based reforestation appears to have the ability for amplifying the positive impacts of CBFM in Nepal
- The approach has potential to be framed as an adaptation strategy to climate change which simultaneously mitigates, though further research must validate
- The barriers to upscaling this approach remain unclear at present, and unless they are clearly identified and addressed then cumulative national and international impacts of the approach will remain unfulfilled

3. Preliminary Results

The community perspective has been explored through 100 household interviews and four FGDs, with four communities across Nawalparasi and Jhapa. Several KIs have been conducted in the research districts, Kathmandu and Pokhara with political and academic interviewees.

Community-level Challenges

Community-engagement with the programmes is high, along with an appreciation of the inter-generational nature of such projects. Initial benefits are apparent, namely employment and provision of forest products. There is also a high recognition in communities on the importance of forests in balancing the local ecosystem. All communities are facing increasing rates of environmental change, and the majority of respondents acknowledge that trees can act as a partial-buffer to future changes.

- Jhapa
- Wild elephants. Risk likely introduced from reforestation project. Widespread damage to crops and homes.
 - Monsoon floods. Communities perceive the risk is increasing as floods become more severe and less predictable.

- Nawalparasi
- Decreasing availability of water (precipitation, surface and ground water). Impacting agricultural productivity due to rain fed systems.
 - Landslides. The risk has been increasing in recent years, thought to be driven by deforestation and road construction.

Project Impacts

Forest ecosystem services



- Retention of top soil and river bank reinforcement during floods in Jhapa
- Improving hillside stability in Nawalparasi
- Reduction of wind and dust levels in Jhapa
- Aesthetic improvements in both districts

Agricultural adaptations



- Planting on previously grazed land has encouraged a move to zero-grazing agriculture, improving milk production & animal health
- Partially offset decreasing agricultural productivity in Nawalparasi

Social outcomes



- The involvement of women in all stages of the projects has facilitated a widespread feeling of empowerment
- Income opportunities have had multiple impacts for households, such as school fee provision and purchasing fuel-efficient stoves

References

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- UNDP. (2014). Community Based Resilience Analysis (CoBRA). Available from: http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/sustainable%20land%20management/CoBRA/CoBRA_Conceptual_Framework.pdf
- All photos are credited to Ten Trees (www.tentree.com)