Melting Nzururu: Glacier-Related Loss and Damage in Uganda's Rwenzori Mountains

A Plural Values Approach to Loss and Damage and Implications for Transformative Governance

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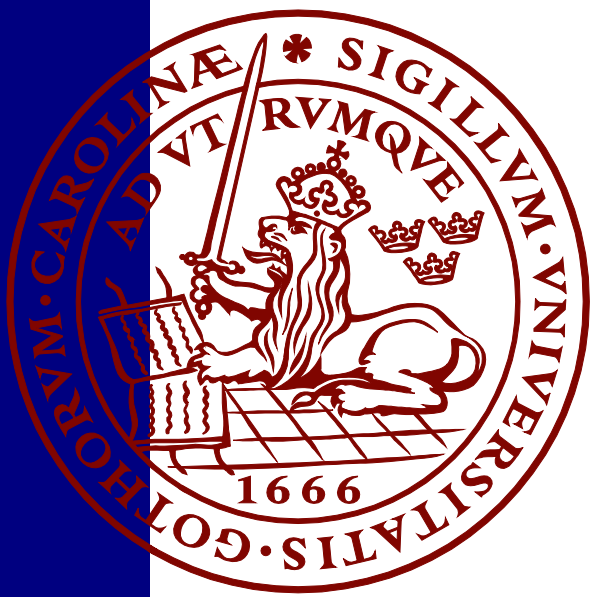

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Abstract:

Glacier retreat has cascading effects for mountain communities whose livelihoods and cultural-cosmological beliefs are deeply intertwined with glacier-fed ecosystems. Loss and damage research and governance overly emphasize economic framings rendering intangible losses invisible. This thesis adopts a Plural Values approach to surface lived experiences of glacier-related loss and damage in the Ugandan Rwenzori Mountains. Drawing on semi-structured interviews and focus group discussions, findings reveal 25 diverse relational, instrumental, and intrinsic values at risk, highlighting complex human-glacier interactions such as place-based identities or livelihood dependencies. Considerable variation across socio-economic axes underlines the need for context-sensitive responses, which currently centre on ecosystem restoration, livelihood diversification, and cultural agency, but also reveal an overemphasis on adaptation and mismatches between community and governance perspectives. Discussing implications for transformative governance, the study concludes that responses should address structural drivers of vulnerability such as the region's colonial legacy, centering strategies around cultural recognition and community ownership.

Keywords: Loss and Damage, Plural Values, Glacier, Non-economic Loss and Damage, Rwenzori Mountains, Transformative Governance

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Abbreviations

Abbreviation	Full term
AOSIS	Alliance of Small Island States
CCFU	Cross-Cultural Foundation of Uganda
CRM	Comprehensive Risk Management
FGD(s)	Focus group discussion(s)
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
KDLG	Kasese District Local Government
L&D	Loss and Damage (Policy Dimension)
NELD(s)	Non-economic loss(es) and damage(s)
OBR	Obusinga bwa Rwenzururu (Kingdom)
PV	Plural Values / Plural Valuation
RMNP	Rwenzori Mountains National Park
SES	Socio-ecological system(s)
TK	Traditional Knowledge
UBOS	Uganda Bureau of Statistics
UNFCCC	United Nations Framework Convention on Climate Change
WIM	Warsaw International Mechanism

1 Introduction

Anthropogenic climate change is severely impacting socio-ecological systems (SES) around the world (IPCC, 2022), yet its negative effects fall disproportionately on those least responsible (Boyd et al., 2021; Dorkenoo et al., 2022): communities whose vulnerability has been historically and spatially produced by colonial legacies, unequal development pathways, and the enduring power asymmetries of the global political economy. Those adverse effects of climate change materializing despite mitigation and adaptation efforts are now commonly referred to as losses and damages (Boyd et al., 2017), which contentious policy conceptualization as 'Loss and Damage' (L&D)[1] took the international community more than two decades, resulting in Article 8 of the Paris Agreement which emphasizes the need "to minimise, avert, and address loss and damage from climate change" (UNFCCC, 2015).

As a relatively recent addition to the global climate policy arena, research and governance on loss and damage remain contested and evolving, indicating a persistent dominance of economic impacts (Tschakert et al., 2019), technocratic risk management, and a focus on coastal and island states (Jackson et al., 2023; McNamara & Jackson, 2019). Despite being one of the most climate-sensitive earth systems (IPCC, 2023b), mountainous regions and impacts from glacier retreat have been severely underrepresented in loss and damage assessments (Huggel et al., 2019). Cryosphere changes in mountains are mostly studied using a single-disciplined lens, but little is known about the cascading effects glacier retreat has on the life of Indigenous Mountain communities whose livelihoods, culture, and spiritual identities are often deeply interwoven with the glacier-fed ecosystems (Drenkhan et al., 2023; Palomo, 2017).

The Rwenzori Mountains in Uganda's Kasese district form such a unique SES. Home to some of Africa's last remaining tropical glaciers, the Rwenzoris are projected to lose their ice entirely within the next decade (Dieckman, 2025), potentially posing complex challenges for downstream communities (Knight, 2023). This slow-onset loss unfolds in one of Uganda's poorest regions, where most peoples' livelihoods depend almost entirely on subsistence agriculture (Kule et al., 2023). For the Indigenous Bakonzo people, the loss extends far beyond the hydrological: their cosmology, rooted in the sacred presence of the mountain deity Kithasamba residing in the glaciers, makes the Rwenzori ice inseparable from their socio-cultural and spiritual life (CCFU, 2022). As a former British colony, the

[1] I follow the common distinction between the concepts global policy and governance dimension as 'Loss and Damage' (L&D, capitalized letters), and climate-related impacts as 'loss and damage' (lowercase letters) (Dorkenoo et al., 2022).

region's vulnerability is historically produced as Indigenous groups have been facing complex forms of marginalisation (Pennacini, 2008). The Rwenzoris offer a uniquely urgent and underexplored context for understanding what glacier-related loss and damage truly means for those who experience it.

However, three interrelated gaps currently prevent frontline experiences of loss and damage from being meaningfully addressed: First, debates around loss and damage have been shaped by Western-dominant epistemologies focusing on quantifiable economic dimensions, struggling to incorporate intangible effects which are particularly pronounced in slow-onset events such as glacier retreat (Tschakert et al., 2019; UNFCCC, 2024). Second, L&D governance deals with an issue of scale by remaining overwhelmingly concentrated around international-level debates, with locally lived experiences rarely informing the technocratic frameworks that shape responses on the ground (Scown et al., 2025; Vanhala et al., 2021). Third, loss and damage inevitably raise ethical questions of justice on whose losses count, whose knowledge shapes governance, and how structural drivers of vulnerability are addressed, which remains inadequately operationalised in research practice (Boyd et al., 2021).

Drawing on Islar et al.'s (2025) socio-glaciology framework, this thesis explores the socially differentiated impacts and place-based complexities of human-glacier relations, with the explicit goal of contributing to genuinely just L&D governance. Conducting a qualitative case study of glacier-related loss and damage in Uganda's Kasese District, I aim to understand how glacier-related loss and damage is experienced and addressed in the Rwenzori Mountains from both community and governance perspectives, translating these local insights into implications for L&D governance. My thesis is guided by the following overarching research question, operationalised through its three sub-questions:

How is loss and damage from glacier retreat experienced and addressed in the Rwenzori Mountains, and what are the implications for transformative Loss and Damage governance?

1. *What values associated with the Rwenzori glaciers do local stakeholders perceive to be at risk of loss and damage from glacier retreat?*
2. *How can glacier-related loss and damage in the Rwenzori Mountains be addressed, comparing community perspectives and local governance framings?*
3. *How should glacier-related loss & damage be addressed to reflect principles of transformative governance?*

As proposed by Islar et al (2025), my thesis is informed by political ecology and applies the Plural Values (PV) of Nature framework. Through this approach, I aim to contribute to sustainability science in two major ways: (1) Thus far, PV has not been widely used for loss and damage assessments, yet it may

solve some of L&D's central gaps. I will connect the two concepts in theory, then testing its applicability in praxis to understand the complex place-based value losses behind human-glacier relations – core features of sustainability science (Spangenberg, 2011). (2) Being particularly informed by feminist-decolonial strands of political ecology, my epistemological commitment centres marginalised voices while accounting for socially differentiated experiences of loss to unveil power asymmetries between those who govern and those who are governed. Discussing what these context-sensitive findings imply for a transformative approach of L&D governance directly contributes to sustainability science's explicit normative commitment (Wiek et al., 2011).

2 Conceptual Background

2.1 What is Loss and Damage?

35 years after the term ‘loss and damage’ was brought up by the Alliance of Small Island States (AOSIS) in 1991, the concept still lacks any formally agreed definition. As a practical approximation, loss and damage can be described as the “adverse effects of climate-related stressors that have not been or cannot be avoided through mitigation and adaptation efforts” (Van der Geest & Warner, 2015, p. 135), stemming from both sudden-onset events such as floodings, and/or slow-onset events such as glacier retreat. Particularly L&D governance is contentious, leading to differing understandings for responses (Boyd et al., 2017).

After AOSIS’s call for an insurance pool for sea-level-affected countries, loss and damage was long treated as a supplementary issue of disaster risk management rather than compensation (Roberts & Huq, 2015). Finally institutionalized in 2013 through the establishment of the Warsaw International Mechanism (WIM), L&D policy was crucially reframed toward impacts exceeding "that which can be reduced by adaptation" (UNFCCC, 2013), shifting from risk management to acknowledging the ‘limits to adaptation’ (McNamara & Jackson, 2019). Under Article 8 of the Paris Agreement, L&D was anchored as the third pillar of international climate policy, though incorporating a caveat that excludes any liability and compensation, now focusing on *comprehensive* risk management (CRM) (UNFCCC, 2015). More recently, the Santiago Network for technical assistance and implementing L&D approaches at (sub-)national level was established, finally followed by an international compensation mechanism, the Fund for Responding to Loss and Damage. However, pledges only amount to 0.2% of the annual L&D finance need (Richards et al., 2023; UNFCCC, 2025). L&D’s three strands of financial compensation, risk management, and limits to adaptation continue to coexist in tension (Mechler et al., 2019).

While ambiguity may be helpful for international policy, research needs a more stringent understanding but even here a universally agreed definition is missing (Van der Geest & Warner, 2015). Loss and damage is primarily understood in reference to the ‘limits of adaptation’ (Boyd et al., 2021), the point at which "an actor's objectives cannot be secured from intolerable risks through adaptive actions" (IPCC, 2023a, p. 2898). *Intolerable risk* becomes central: Whereas the goal of adaptation is to keep risk of occurrence of losses and damages within tolerable limits (Dow et al., 2013), L&D measures aim to minimise *the risk of negative effects* of such occurring impacts, enabling society to deal with the consequences (Van der Geest & Warner, 2015).

Hence, both adaptation and L&D measures deal with risks and can be retro- and prospective (Wallimann-Helmer, 2015), leading to two different ways of distinguishing: Following Verheyen and Roderick (2008), loss and damage refers to impacts that have not been avoided or cannot be avoided. Unavoidable impacts correspond to hard adaptation limits, while unavoided ones include soft limits where impacts may have been able to be avoided but currently no respective adaptive actions are available (Dow et al., 2013), with losses and damages occurring as residual impacts due to socio-economic constraints (Huq et al., 2013). A second perspective defines loss and damage more narrowly as impacts exceeding tolerable risk (Wallimann-Helmer et al., 2019), staying closer to the IPCC definition of 'limits of adaptation'. Both carry implications for governance: the former focuses simply on impacts beyond adaptation's reach, the latter on what society considers intolerable, leaving room for normative debates about what must be sustained.

2.2 Non-economic loss and damage

The WIM (2013) recognizes that not all climate impacts have direct economic effects, leading to the widely used distinction between economic and non-economic loss and damage (NELD). Defined ex-negativo as "items not commonly traded in markets" (Fankhauser et al., 2014, p. 3), NELD encompasses impacts that are difficult to quantify and monetize but still adversely experienced by those affected (Serdeczny et al., 2018). NELDs are always influenced by social and cultural factors, and can arise as direct effects, such as loss of territory, or indirectly as cascading/compounding effects, for example when migration after flooding erodes social cohesion (Serdeczny, 2019).

There is an ongoing debate on what constitutes a NELD (UNEP, 2024). NELDs were often described in rigid categories, with the UNFCCC proposing eight types such as health, cultural heritage, or biodiversity (Fankhauser et al., 2014)[2]. Recently, the WIM's expert group highlighted biodiversity, territory, and cultural heritage as particularly important NELDs given their cascading effects on SES, while acknowledging that no comprehensive understanding of NELDs yet exists (UNFCCC, 2024). What makes the concept so difficult to grasp are its two main characteristics: *Incommensurability* describes that some values resist a common unit of measurement (Serdeczny et al., 2016), hence expressing NELDs in monetary terms is not just imprecise but could erase them entirely (McShane, 2017). Importantly, incommensurability does not imply incomparability, as comparing NELDs in terms of their perceived importance for affected communities can be a crucial to understand value trade-offs and inform governance (Tschakert et al., 2017). NELDs are also characterized by high *context-dependency*

[2] The paper by Frankhauser et al. (2014) is the extended version of UNFCCC's technical report on NELDs. It is used whenever I refer to the UNFCCC's conceptualisation on NELD.

as they often arise from specific interactions between people and their environment (Serdeczny et al., 2016).

These properties expose crucial gaps in research and policy which can be attributed to the dominance of Western epistemologies in NELD assessments: Valuation frameworks proposed by the UNFCCC (2014) have been criticized for treating all NELDs as "a diminished psychological state or a preference dissatisfied [...] allow[ing] even non-economic goods to become quasi-economic" (Preston, 2017, p. 146), metricizing incommensurable items for the sake of universal comparability. NELD categorizations statically generalized a concept that is inherently place-based, leading to research and policy that fails to account for intangible effects and the 'one thousand ways' people perceive loss (Tschakert et al., 2019). Dominant assessment frameworks do not ask the central question on *whose* losses count, *what* losses are perceived as intolerable, and *how* these should be addressed (Van Schie, McNamara, et al., 2024). Additionally, Van Schie et al. (2024) argue that a strict separation between economic and non-economic impacts may itself be a harmful dichotomy. In non-Western contexts, with sometimes pluricentric worldviews and the meaning of 'place' extending far beyond the merely physical (Pascual et al., 2023), values behind items might be both instrumentally-economic or relational-non-economic (Himes et al., 2024).

Assessments must be contextually sensitive without following rigid frameworks, not falling into the dichotomy-trap, and aimed at capturing lived experiences (Preston, 2017). Literature indicates that a value-based approach appears particularly promising, as qualitative expressions from frontline communities better account for complex non-Western expressions of loss (Van Schie, McNamara, et al., 2024). Tschakert et al. (2019) systematically captured NELDs in the form of values, concluding that starting from people's self-expressions rather than pre-defined categories offers a more nuanced view, where values implicitly carry both tangible and intangible, quantifiable and non-quantifiable dimensions of loss.

2.3 Socio-glaciology

Glacier-retreat has cascading and compounding effects: it affects the physical-hydrological dimension of providing basic needs (Cook et al., 2021), biodiversity of glacier-fed SES (Brown et al., 2007), and the socio-cultural dimension of mountain communities (Jurt et al., 2015), making L&D's gaps particularly visible in such glacier-near contexts (UNFCCC, 2024). Huggel et al. (2019) found that only very limited loss and damage research has addressed the mountain cryosphere, none of the reviewed studies focused on Africa, and that NELDs seem to be of particular importance as five of their seven identified impact-categories reflect intangible effects. However, assessing NELDs in their true variety might be

particularly difficult in the case of slow-onset events, as their long time frames, complex and cascading implications, and great contextual sensitivity make valuation difficult (UNDRR, 2024).

Islar et al. (2025) provide a socio-glaciology framework that integrates qualitative-social sciences with quantitative modelling to inform inclusive L&D governance: Drawing on political ecology, the approach aims to uncover local experiences regarding glacier loss that typically remain invisible to top-down assessment tools. On its qualitative side, it grounds the assessment of glaciers' contributions to people in plural valuation (IPBES, 2022), capturing instrumental, relational, and intrinsic values people hold toward the glacier, while integrating future-thinking so that the visions of affected communities can inform governance. Since this thesis does not provide quantitative insights on glacier dynamics, it applies the framework's qualitative dimension to construct a bottom-up knowledge base of glacier-related loss and damage in the Rwenzoris, a context whose remote location and small glacier size make low-resource qualitative assessment both practically fitting and particularly urgent.

2.4 Governing loss and damage

Debates around liability and financial compensation have attracted most research attention to the international level focusing on L&D's legal perspectives (Calliari et al., 2020; McNamara & Jackson, 2019). However, impacts are experienced locally and must be addressed at (sub-)national level which the current top-down frameworks struggle to reach (Scown et al., 2025). Vanhala et al. (2021) argue that the deliberate ambiguity of L&D at international level acts as a barrier to create a unified understanding at (sub-)national level. To meaningfully address losses and damages, research must undergo a 'national turn' (Calliari & Vanhala, 2022).

Local decision-maker seem to draw on familiar approaches of climate governance (Vanhala et al., 2021), resulting in a dominance of technocratic, risk-management-focused governance (Boyd et al., 2021). Jackson et al. (2023) identify a resulting governmentality in which climate change is framed as the singular root cause of loss and damage, focusing on attribution science rather than acknowledging that vulnerability is mediated by historical, political-economic, and other socio-ecological developments (Raju et al., 2022). This leads to governance responses focusing on CRM (Mechler et al., 2019). Boyd et al.'s (2017) typology of four different L&D conceptualisations reflects this, with 'risk management' and 'limits to adaptation' as the dominant framings in literature (McNamara & Jackson, 2019). While 'risk management' focuses incremental technical fixes that neglect the root causes of vulnerability (Jackson et al., 2023), the latter tries to extend the adaptation limits but tend to benefit those better off (Roberts & Pelling, 2020). Both struggle to answer the essential normative question of

what to sustain (Boda et al., 2021), and neither adequately addresses governance's inherent justice dimensions of *how* to respond to loss (Boyd et al., 2021).

2.4.1 Conceptualizations of justice

L&D governance is inherently normative, dealing with disproportionate harm by both unequal emissions and structural socio-economic inequalities (Dorkenoo et al., 2022), resulting in the ultimate governance goal of achieving climate justice (Boyd et al., 2021). There are two dominant justice framings within L&D debates: *Compensatory justice,* a backward-looking approach, requires those responsible for losses to compensate those harmed which is prominently operationalized through the polluter-pays principle (Wallimann-Helmer et al., 2019). This approach aims to restore the well-being of affected communities to the level it would have been without the impact, making them 'whole again' (Goodin, 1989). In practice, compensation demands clear liability (Wallimann-Helmer, 2015), which is often impossible to reach due to the complexity of disentangling losses from climate variability or other socio-economic vulnerabilities (Wallimann-Helmer et al., 2019). Since NELDs typically concern non-substitutable ends rather than replaceable means, meaningful compensation is inherently limited (Page & Heyward, 2017). *Distributive justice* broadens the frame by shifting from liability to an understanding of undeserved harm*,* acknowledging that every deviation from a fair baseline demands a redistribution (Wallimann-Helmer et al., 2019). Responsibilities are shared through principles such as ability-to-pay, allowing a more forward-looking approach that supports even where attribution is uncertain (Wallimann-Helmer, 2015). Though being more comprehensive, distributive justice still leaves underlying power relations and development pathways largely unchanged. Both framings fall short of addressing all forms of loss and damage effectively and pose ethical concerns regarding their feasibility to address complex socio-ecological realities underlying climate losses and damages. Roberts and Pelling (2020) therefore argue that L&D governance must become truly *transformative,* an approach which I will outline in the theoretical framework.

3 Theoretical Framework

Studying loss and damage in the context of socio-glaciology requires a theoretical approach capable of eliciting diverse values of glacier-near communities while offering a critical lense to start a process towards transformative L&D governance. As proposed by Islar et al. (2025), my thesis is informed by Political Ecology, particularly its feminist-decolonial strands (Rocheleau, 2015; Sultana, 2021), which have shaped the epistemological sensibilities and analytical choices running throughout the study: political ecology aims to understand environmental change under explicit consideration of power, thereby openly embracing a normative angle to improve the conditions of those marginalised by existing governance structures (Benjaminsen & Svarstad, 2021; Sultana, 2023). The values people hold toward the Rwenzori glaciers, and the losses they experience as they retreat, are considered socially constructed and therefore not uniformly distributed across intersecting axes of power (e.g. gender, residency etc.), determining who is most exposed and whose losses are least likely to reach governance arenas. To reveal these nuances, I apply 'Plural Valuation' of nature (IPBES, 2022), a framework building on political ecology's critical and normative commitments (Raymond et al., 2023). Informed by a feminist-decolonial lense, I will account for value nuances across social axes and the differentiated vulnerabilities they produce (Elmhirst, 2015), while comparing these situated experiences with local governance framings should help to identify implications for transformative governance (Newell et al., 2021; Roberts & Pelling, 2020).

3.1 Plural Valuation

Dominant valuation frameworks prioritize a narrow set of values regarding nature's contributions to people – a 'value crisis' resulting in governance approaches failing to account for the diverse ways nature matters for SES (Pascual et al., 2023). PV tries to counteract as a process of "eliciting the diverse values of nature articulated by different stakeholders in order to inform decision making and thus achieve more equitable and sustainable outcomes." (Zafra-Calvo et al., 2020, p. 1). Going beyond Western conceptualizations typically dichotomizing human-nature interactions into instrumental-economic and intrinsic-conservational utility of nature, PV explicitly includes marginalized voices holding a more reciprocal relationship to nature (Raymond et al., 2023).

The value typology (Figure 4) describes how nature's contributions and human well-being are interconnected within dynamic SES shaped by institutions, governance, and diverse knowledge systems (Díaz et al., 2015; Raymond et al., 2023). Losses and damages are not natural and universally experienced, neither are the values behind them, but experienced through context-dependent worldviews, norms, and life frames (S. Jacobs et al., 2020). The typology reflects what many NELD

scholars argue: one cannot identify what people experience as loss without acknowledging the broader socio-historical context in which the underlying values emerged.

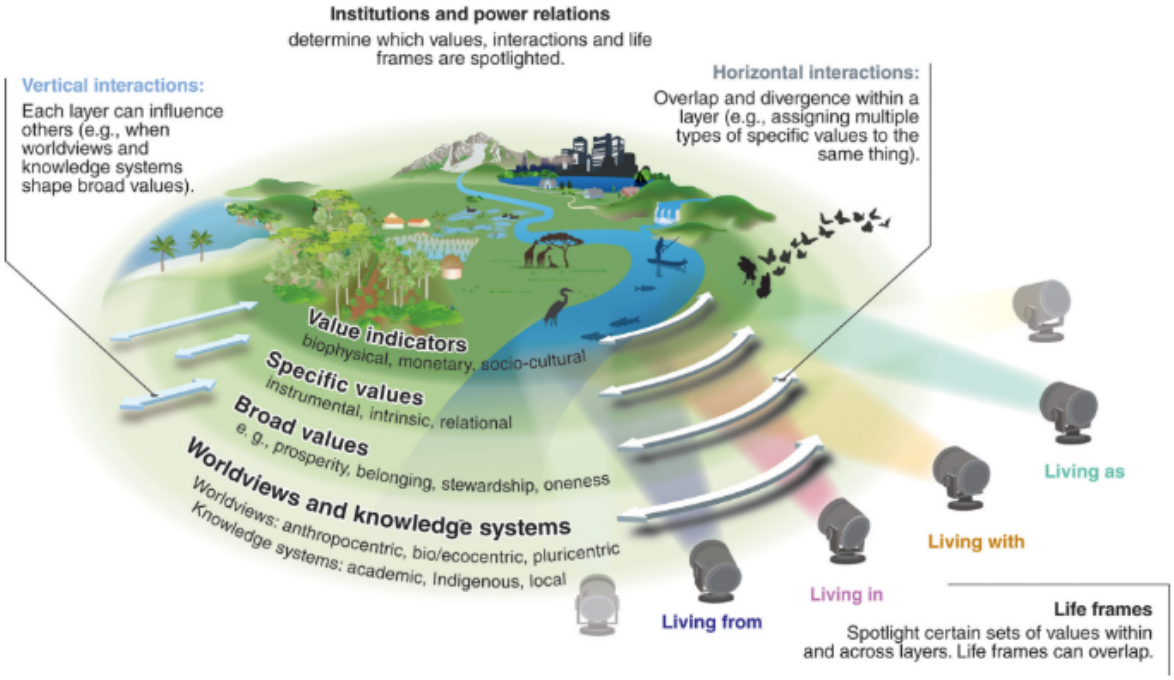

Figure 1: The typology behind the plural valuation framework of nature. Different value types and dimensions can be found in the four value layers: i) worldviews and knowledge systems, ii) broad values, iii) specific values, and iv) value indicators. Four non-mutually inclusive life-frames show how individuals or groups can hold multiple frames, representing vertical and horizontal integration within the typology. (Figure by Raymond et al, 2023, adopted from IPBES, 2022b)

Worldviews are lenses through which people perceive and interact with the world and build their knowledge systems, while *broad values* refer to moral guiding principles and life goals (Anderson et al., 2022). By including value systems other than the hegemonic monetized-utilitarian one, Indigenous and local community voices are made visible for environmental governance (Pascual et al., 2023). *Specific values* are people's judgment regarding the importance of nature in a specific context, justified through three different value categories of instrumental, relational and intrinsic values, with *indicators* as their quantitative or qualitative descriptors (Anderson et al., 2022). The higher up in the value typology, the more anchored are certain characteristics, though they are never binary but context-depending and evolving (Raymond et al., 2023). This is captured through four *life frames* describing different conceptions of being in the world, allowing that the same person can foreground different aspects of the typology in different decision-making contexts. By paying attention to the interactions within the typology, meaning what spectrum of *specific values* emerged out of what worldviews, institutions or power relations (Raymond et al., 2023), offers a framework to understand the dynamics through which people perceive, prioritize, and contest losses and damages.

3.2 Specific values

Specific value expressions form the foundation for negotiating governance approaches to loss and damage. Himes et al. (2024) synthesize scholars' various 'salient articulations' of these values into single core meanings, serving as the definitions for this study. *Instrumental* values are described as "values of other-than-human entities, as means to achieve human ends or satisfy human preferences" (Himes et al., 2024, p. 30). Put simply, nature is valued for its utility or economic well-being for humans, be it through direct extraction of resources or indirect ecosystem-services (Anderson et al., 2022). As means to an end, these values are considered substitutable, therefore often expressed in monetary terms (Chan et al., 2016).

Intrinsic values are described as "values of other-than-human beings expressed independently of any reference to humans as valuers, including values associated with entities worth protecting as ends in and of themselves", often described as the non-substitutable opposite of instrumental value (Himes et al., 2024, p. 29). This definition allows humans to recognize nature's inherent values while bridging objective value with subjective moral expressions, viewing natural entities as ends in themselves worthy of protection (Himes & Muraca, 2018).

As a relatively recent addition, *relational values* remain contested (Pratson et al., 2023), with ongoing debates whether they can be considered a separate value type (Maier & Feest, 2016). Himes et al. (2024, p. 31) define them as "values of meaningful, and often reciprocal human relationships beyond means to an end – with nature and among people through nature, where nature is often specified as a particular landscape, place, species, forest, etc.".

While intrinsic values exclude a justification of nature's importance in reference to human-nature relationships by definition, a distinction from instrumental values is more difficult: Whereas instrumental values follow a means-to-an-end relationship, relational values follow a 'reciprocal' logic that cannot be reduced to substitutability and commensurability (Himes & Muraca, 2018). They are not only about relationships with nature, but also among people through nature (Chan et al., 2016). For example, considering only nutritional contributions of a traditional crop could undermine its importance for social cohesion built by harvest ceremonies (McNamara et al., 2023). Relational values also carry normative guidance as "essential components of a meaningful, dignified, and flourishing life" (Anderson et al., 2022) – a conceptualization connected to *eudaimonia*, where value derives from contribution to a collectively fulfilling 'good life' (Chan et al., 2016). Their place-based understanding makes room for pluricentric worldviews that deem nature important because of the unique relationships and histories that can be found with and through it (Himes & Muraca, 2018).

3.3 Plural values for loss and damage

Being interested in the losses and damages resulting from changes of the specific natural entity of a glacier allows using PV as a targeted valuation approach, aiming to reveal both the tangible and intangible dimensions of the Rwenzori glaciers importance, ultimately uncovering Tschakert et al.'s (2019) 'one-thousand ways' to perceive losses and damages.

In its most basic conceptualizations, the connection between PV and loss and damage can be drawn in reference to substitutability, with instrumental values corresponding to economic loss and damage, while relational and intrinsic values, both difficult to measure and substitute (Anderson et al., 2022), correspond to NELDs (Figure 2a). However, this discrete understanding is too simplistic: As Himes et al. (2024) outline, some values sit at the overlaps of specific value types (Figure 2b), they can be expressed in multiple ways depending on the valuer and decision-making context. A single physical impact, such as reduced meltwater, could potentially materialize instrumentally, relationally, or intrinsically depending on worldview and life frame (Figure 2c). In theory, both substitutability and losses and damages captured through PV should be understood as a scale; while for some people the value behind a certain loss might be substitutable, for others the same value loss cannot be easily replaced. A PV approach to loss and damage potentially solves two of the fields central issues: It directly challenges the harmful economic/non-economic dichotomy (Van Schie et al., 2024), and it is context-sensitive enough to account for crucial value trade-offs to ask *whose* losses count and *what* losses are perceived as intolerable (Tschakert et al., 2017).

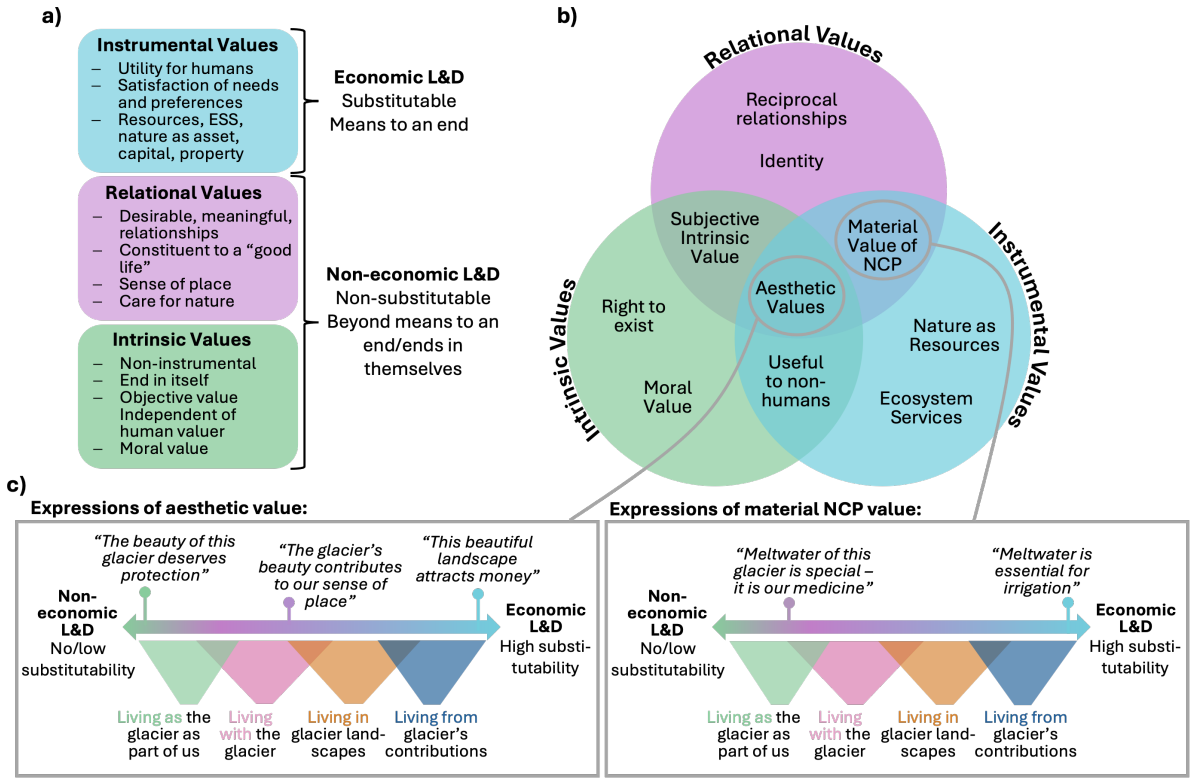

Figure 2: Theoretical connection of PV and loss and damage. a) Ideal-typical representation of value types and their characterizations. Discrete categories with binary understanding of substitutability. (Authors own work, PV characteristics based on Himes & Muraca; 2018); b) Overlapping representation of specific value types with some specific values spanning through all three value types. Examples of specific values within the figure are not exhaustive. (Authors own work, based on Himes et al., 2024); c) Exemplary, theoretical expressions of 'boundary values' in reference to glaciers. Illustrative expressions aim to show that specific value types may not always be mutually exclusive but must rather be understood on a scale of substitutability. For example, some expressions of relational aesthetic value could theoretically be expressed as preferences and become monetarized. Life frames of the valuer influence which value type becomes dominant in their expression. (Author's own work).

What becomes key is the chosen valuation method: Statement-based valuation is the most promising PV method for capturing the full range of substitutability as it allows for qualitative expressions of economic loss while simultaneously providing deeper understandings of underlying worldviews and life frames (Termansen et al., 2022). This makes it not merely a methodological choice but a political one: by centering first-voice narratives of those most affected, it highlights structural drivers of vulnerability and the power relations that determine whose losses reach governance (S. Jacobs et al., 2020). Statement-based PV offers the critical lense Zafra-Calvo et al. (2020) demand when highlighting that PV is not about mere value documentation but rather a process of transformative change that guides decisions for equity and sustainability, both crucially missing components in current L&D governance.

3.4 Transformative Governance

Governance can be defined as "a social function centered on steering human groups toward desired outcomes", with a governance system including "cognitive, cultural, and technological" institutions (Young, 2013, p. 88). As outlined in chapter two, L&D is suffering from an overly technocratic, risk-management focused governance, struggling to deal with lived experiences at the local level. Roberts and Pelling (2020) therefor argue for *transformative* L&D, governance that addresses the root causes making a society vulnerable for loss and damage. Vulnerability includes diverse elements, at its core meaning the "predisposition to be adversely affected" including the "lack of capacity to cope and adapt" (IPCC, 2023a, p. 2927).

Chaffin et al. (2016, p. 399) outline transformative governance: It builds on broad theories of change ultimately aiming at "actively shift[ing] degraded SES to alternative, more desirable, or more functional regimes". Transformation becomes necessary when a system approaches or crosses critical thresholds that lead to persistent social injustices, leaving adaptive measures unable to achieve a sustainable state. As loss and damage occurs after the 'limits of adaptation' (Boyd et al., 2021), one could argue that transformative governance is by definition the key approach to L&D. However, when aiming for profound changes in SES, there will be value-conflicts and power asymmetries. To address these normative issues of L&D governance, Boda et al. (2021) argue that it must be understood through the normative lens of sustainable development[3], carrying an imperative for climate justice.

3.4.1 Transformative climate justice

L&D's compensatory and distributive justice remain technocratic international-level debates, while a transformative understanding of climate justice must open up wider discussion on vulnerability and unequal exposure to loss (Roberts & Pelling, 2020). There are many angles to climate justice (intergenerational, epistemological etc.), but for transformative L&D the following seem particularly critical (Newell et al., 2021; See et al., 2025): Governance must become more inclusive, i.e. as a form of *recognition justice,* different worldviews and cultures must be acknowledged, using postcolonial approaches that inform place-based interventions with local knowledge. As *procedural justice,* decision-making must become more inclusive, moving from top-down technocratic to community-led, bottom-up processes. *Restorative justice* can serve as context-sensitive middle-ground between compensatory and distributive justice, as it builds on acknowledgment of disproportionate harm and

[3] Boda et al. (2021, p. 677) define Sustainable Development through the Brundtland Commission's understanding as "the strategy for prioritizing options when faced with tensions between economic development and environmental conservation in the pursuit of meeting human needs, now and in the future".

forward-looking rectification, not only for losses themselves but for historically and spatially produced vulnerabilities (See et al., 2025).

As a critical praxis investigating how and why different people experience loss and damage differently (Sultana, 2022), transformative justice helps overcoming two of L&Ds central gaps: First, it addresses the scale mismatch of overemphasising international-level legal debates by informing responses from peoples' lived experiences at the frontline (Nightingale et al., 2020). Crucially, climate impacts magnify pre-existing patterns of intersectional inequalities (race, gender, etc.), hence any L&D approach must be informed by feminist perspectives to account for heterogeneities among those experiencing it (Sultana, 2022). Second, transformative L&D addresses the root causes of climate injustices, inevitably resulting in a contestation of current power dynamics (Newell et al., 2021). Transformative climate justice provides the implementation frame for L&D governance that seeks to sustainably address the structural vulnerabilities driving losses and damages.

4 Case background

Tropical glaciers are melting at unprecedented rates, now at their smallest state since beginning of the Holocene (Gorin et al., 2024). Due to their remote location and small size making on-ground as well as satellite monitoring difficult, the Rwenzori glaciers lack a comprehensive understanding on their wider socio-ecological importance (Posite et al., 2025). This lack of data is particularly concerning considering that households in the rural Rwenzori region mostly live from subsistence agriculture heavily sensitive to climatic changes (UBOS, 2025). When the region was not yet divided by colonial borders, the Indigenous Bayira people – now commonly known as 'Bakonzo' on the Ugandan and 'Banande' on the DRC side of the Rwenzoris but still sharing the same language, Lhukonzo – settled on the steep slopes of the mountains and developed livelihoods, a cosmology, and spiritual beliefs centering around the mountains and their glaciers (CCFU, 2022). Uganda's rich cultural realm is governed by traditional kingdoms that exist alongside administrative districts and hold cultural autonomy (Bird & Michuda, 2025); in the Rwenzori region, this is the 'Obusinga bwa Rwenzururu' (OBR) kingdom.

4.1 Physiographic and climatic context

Including Africa's third highest peak Margherita (5,109 m asl), located only 45km north of the equator, the tropical Rwenzori Mountains lie on the southern border between Uganda and the D.R. Congo (Figure 3). On the Ugandan side, Kasese forms the mountain's largest administrative district and directly covers the Rwenzori Mountain National Park (RMNP), recognized as a UNESCO World Heritage site for Africa's most extensive glacier and Afro-alpine ecosystem (UNESCO, n.d.). After its establishment in 1992, people had to relocate outside the park boundaries so that settlements can only be found at elevations of up to ~2,200 meters (Steinicke & Kabananukye, 2014). The climate is tropical, with precipitation patterns heavily influenced by the twice-yearly movement of the Inter-Tropical Convergence Zone resulting in two rainy seasons (Taylor et al., 2007). A steep elevation gain of ~4190m over only ~37km, from the lowland savannas east of Kasese to the Rwenzori peaks in the west, produces a pronounced orographic effect with increasing precipitation at higher elevations (Posite et al., 2025).

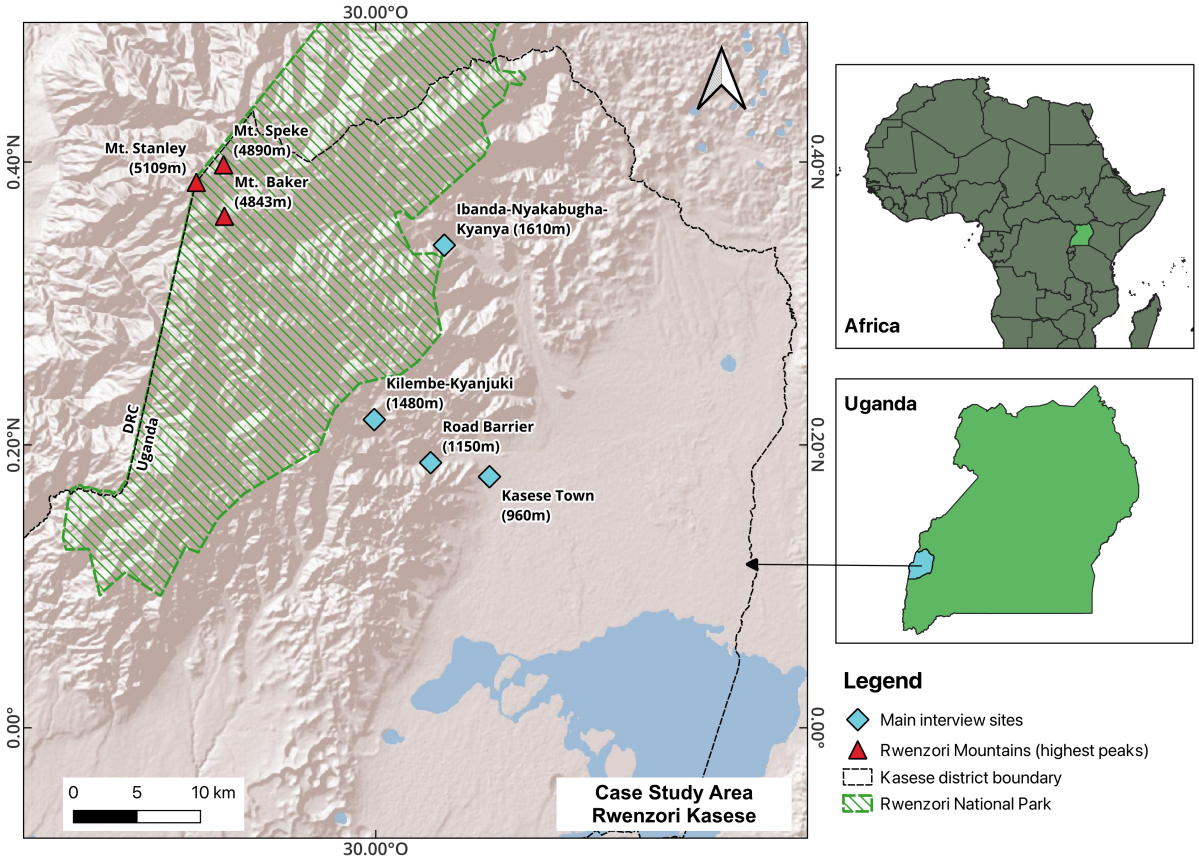

Figure 3: Study area map in Kasese district, Uganda. Interviews were conducted in three main locations: Kasese town, and the two valleys of Kilembe and Ibanda as human settlements closest to the main Rwenzori peaks for impressions of local residents. Altitudes of peaks and interview sites are given in meters above mean sea level. The enlarged map shows the altitudinal difference between the savanna landscape east of Kasese town and the Rwenzori mountains in the west. The equator crosses Kasese district only below the Rwenzori Mountain range.

Glacierized peaks were once found on all three main mountains in the Rwenzoris – Stanley (5,109 m), Speke (4,890 m), and Baker (4,843 metres), but on-ground data regarding their cryosphere dynamics is limited. Taylor et al. (2006) reported that due to increased air temperature total glacial cover has decreased by 52% from 2.01 km^2 in 1987 to 0.96 km^2 in 2003, concluding that the Rwenzori glaciers will disappear within two decades. Recent expeditions by the science-art spanning 'Project Pressure' support this claim (Dieckman, 2025; Project Pressure, 2025): Only Mount Stanley now holds permanent glaciers (Figure 4), but its main plateau ice field decreased by 29.5% since 2020. Mt. Speke only holds static ice; Mt. Baker is practically ice free with only seasonal coverage.

The Rwenzoris are considered Uganda's largest water catchment (CCFU, 2022). Glacier meltwater appear to contribute only little to alpine river flows so that their decline should not have a major impact on downstream water supplies (Taylor et al., 2008). However, Posite et al. (2025) caution that cryospheric and hydrological dynamics in the Rwenzoris are difficult to predict given the complex interplay of equatorial climate systems and local topography, concluding that the cryosphere can still play a critical role for seasonal water availability. Natural hazards in Kasese are closely tied to this

hydroclimate as increasingly frequent floods have claimed hundreds of lives (L. Jacobs et al., 2016). Although meltwaters seem to play subordinate role for peak water levels (Taylor et al., 2009), media often connects glacier melting with flooding (Baluku, 2023), potentially shaping public opinion.

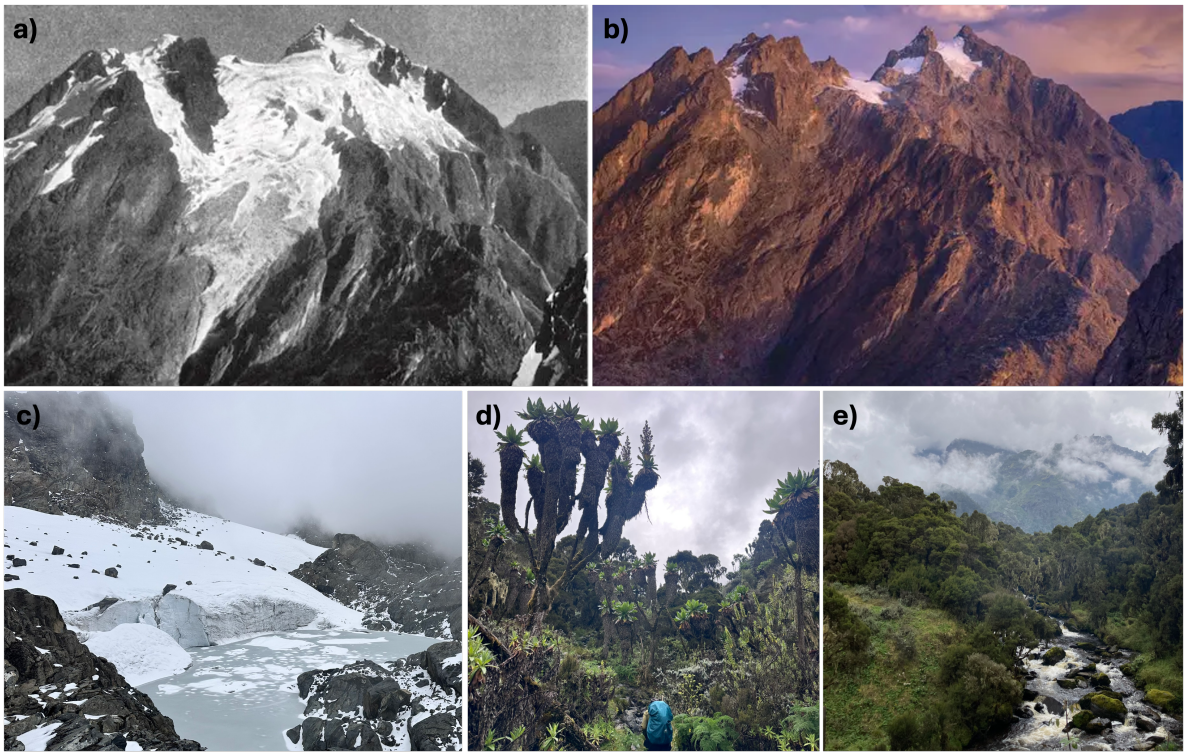

Figure 4: Figure a and b show the difference in glacier extent on Mt. Stanley between 1906 (a) and 2022 (b) viewed from Mt. Baker (Project Pressure, 2025). Figure c shows the current state of the Stanley plateau glacier (4,900m; March 2026). Remaining pictures show impressions of the Rwenzori Mountains National Park with its giant groundsels (d) and the wet afroalpine landscapes (e). (Figures c, d, e own photos by the author).

4.2 Socio-economic and cultural context

The Rwenzoris are one of Uganda's socio-economically least developed regions, facing one of the country's highest poverty rates of 55.2% (Kule et al., 2023). Population increased by almost 2.5 times compared to 1991, with every second person experiencing moderate or severe food insecurity, access to clean water and sanitation is far below a level of basic wellbeing, and only 55% of people have access to electricity. (KDLG, n.d.; UBOS, 2025). Livelihoods are tied to subsistence agriculture, and access to land has become a key factor for survival, further exacerbated by the fact that only one-third of Kasese's land is habitable while the rest is designated as protected areas (Harris, 2008). Settlement dynamics are driven by expansion of smallholder agriculture, resulting in widespread deforestation which is undermining ecosystem functioning, exacerbating the effects from floods and landslides (Bechau et al., 2024) (Figure 5). Land disputes have become a central driver of inter-ethnic and state-society conflicts (Reuss & Titeca, 2017).

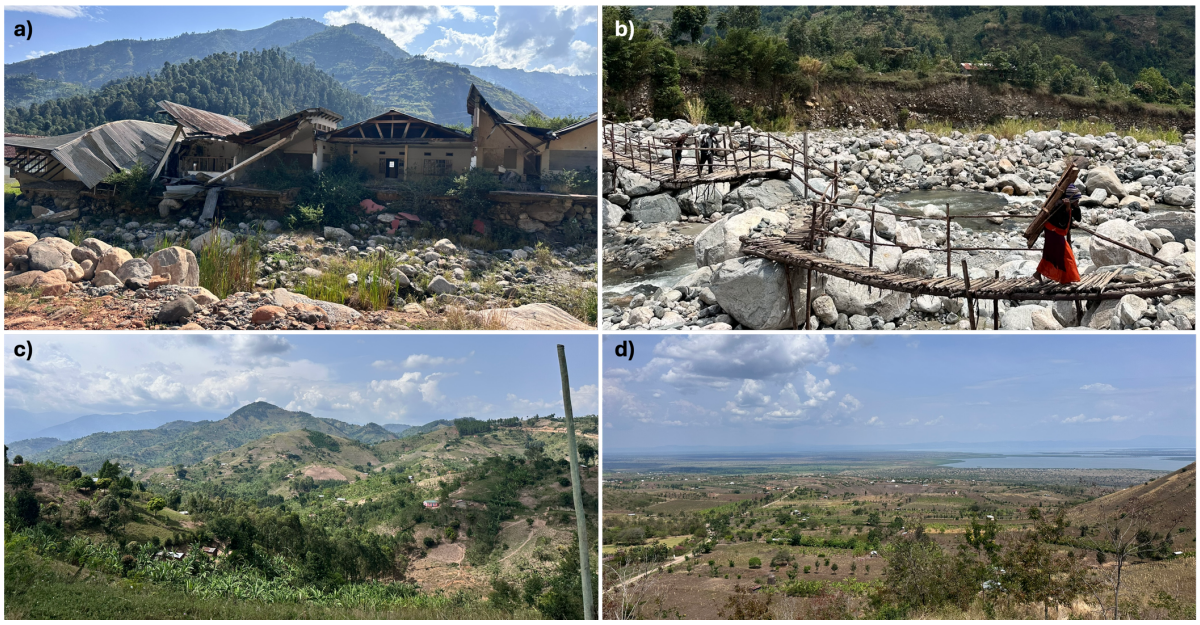

Figure 5: River Nyamwamba in Kilembe valley has been flooding more frequently in recent years, leaving many houses destroyed (a) and a strongly widened channel with coarse boulders and steep eroded banks (b). Figure c shows the fragmented land patches typical for smallholder agriculture in hills of Kasese, while d gives an impression of the flatland savannas of Queen Elizabeth National Park, viewed from the Rwenzori hills.

Present-day Kasese district is primarily inhabited by three ethnic groups: the minority groups of the Basongora and Banyabindi, and the majority group of the Bakonzo (CCFU, 2014). Under British colonial rule, the distant Toro kingdom excluded other ethnic groups from public institutions and forced them into the colonial monetary economy, sparking the violent 'Rwenzururu rebellion' in the early 1960s which led to the creation of Kasese district in 1972 and recognition of the OBR as a distinct Bakonzo cultural institution in 2009 (CCFU, 2014; Pennacini, 2008). Today, the Bakonzo are in turn accused of marginalizing minority groups through their newly institutionalized cultural power (Kule et al., 2023). This contested sociocultural context demonstrates that experiences of cultural loss in Kasese are not universal but mediated by historically embedded inequalities.

Nevertheless, the Bakonzo developed the strongest cultural attachment to the mountains, presumably due to their mountain upward migration responding to demographic pressures at the end of the 17th century (Pennacini, 2008). In their cosmology, the lives of Bakonzo people and the mountain environment are inextricably intertwined through the presence of local nature spirits and sacred landscapes, with the glaciers as core elements (CCFU, 2022): Nyamuhanga, the highest deity, created the 'nzururu' (Lhukonzo for snows or glacier) at the mountain peaks where the highest spirit Kithasamba resides. Kithasamba controls all life around the Rwenzoris, as the snow is interpreted as his frozen sperm that fertilises the earth through seasonal snowmelt. Environmental changes and natural hazards are often attributed to displeased spirits, underscoring the importance of traditional rituals in maintaining the socio-ecological integrity of the Rwenzori Mountains (Bwambale et al., 2022).

5 Methodology

Using a qualitative single case study design (Baxter & Jack, 2008), my research approach is threefold: PV uncovers glacier-related values at risk (RQ1), responses to losses and damages are identified remaining sensitive to power asymmetries between those who govern and those who are governed (RQ2), and perceived drivers of vulnerabilities and notions of justice serve as the basis to discuss transformative governance implications (RQ3). Common for PV and to capture subjective experiences (IPBES, 2022), statement-based methods were the singular data collection method. Two similar yet practically distinct methods were employed (Bryman, 2012): Non-governance community perceptions were explored through group interview methods, particularly focus group discussions (FGD)[4]. The choice was based on the recommendation of my local facilitator, feminist traditions seeking to mitigate participant-researcher power asymmetries (Wilkinson, 1998), and the dual interest of PV and loss and damage research in both the *why* (e.g., worldviews, life frames) and the *how widespread* behind values, which FGD's larger participant samples can offer (Bryman, 2012). To gain deeper qualitative insights (Knott et al., 2022), semi-structured interviews serve as the primary method to explore Kasese's governance landscape, while occasionally used for non-governance key informants.

5.1 Sampling

Generic purposive sampling was applied to identify an a-priori list of governance interviewees with the help of my local facilitator, occasionally complemented by snowball sampling (Bryman, 2012), always following predetermined criteria (Knott et al., 2022): The sample was split between non-governing and governing actors following Youngs (2013) definition of a governance system, with the latter divided into political-administrative (Kasese District Local Government), cultural (OBR), and civil society actors (NGOs). Focus areas included climate change related informants, e.g. District's environmental head officer, and key affected sectors like agriculture and tourism, represented by respective district officers and kingdom ministers. Non-governance community participants were selected based on location and demographic considerations, occasionally incorporating convenience sampling (Etikan, 2016). I focused on the valleys of Kilembe and Ibanda due to their proximity to the main peaks and their role as entry points to RMNP. Efforts were made to ensure diversity in gender and age, while including key livelihood groups such as mountain guides and farmers. Key informant interviews include caretakers

[4] Distinguishing between group interviews and FGDs can be hard in practice, often done by determining the researcher's role – whether active-investigative or passive-facilitating (Parker & Tritter, 2006). In my group settings, a clear-cut distinction was hardly possible; Some groups were characterized by lengthy discussions in which I merely acted as a moderator, others took on more of an interview-like character. For the sake of simplicity, all group interviews will be abbreviated as FGD.

of heritage sites or community workers. Although not an intentional criterion, most participants identified as Bakonzo, reflecting their demographic predominance in Kasese.

5.2 Data collection

Three semi-structured guides (Appendix A-C) were used for data collection, varying slightly in wording to account for the different perspectives but following the same structure; *demographics and introduction*, *value assessment*, *coping mechanisms and just responses*, *concluding questions.* Interview design drew on other PV literature, particularly Johannson et al. (2025) and Himes et al. (2024). My local facilitator was briefed extensively on the research aim and helped readjust the guide to the local context.

The sample consists in total of 14 interviews and 8 FGDs, lasting 50 min on average and reaching a total of 61 respondents (Appendix E). Most community FGDs took place in the valleys of Ibanda and Kilembe, while almost all interviews were conducted in Kasese town. Since FGD often took place in public settings, groups sizes vary depending on community size and daytime. Women were more strongly represented in community FGDs than in governance (Table 1 and 2). The total sample shows a relatively even distribution for age, gender distribution skews toward men (Figure 6).

Table 1: Details of Community FGD (non-governance).

Locations	Number (total participants)	Average size	Average age	Gender ratio (% female)
Ibanda Valley	3 (25)	8.3	40	38%
Kilembe Valley	3 (12)	4	46	41%
Kasese City	2 (9)	4.5	39	67%
Total	8 (46)	5.8	42	43%

Table 2: Details of Interviews.

Sub-sample	Number of interviews	Location	Gender ratio (f|m)
Non-governance	4	Kasese City	1|3
Governance			
Political-administrative	4	Kasese City	1|3
Cultural	3	Kasese City	1|3
Civil Society	3	Kasese City, Kilembe Valley	1|2
Total	14		4|11

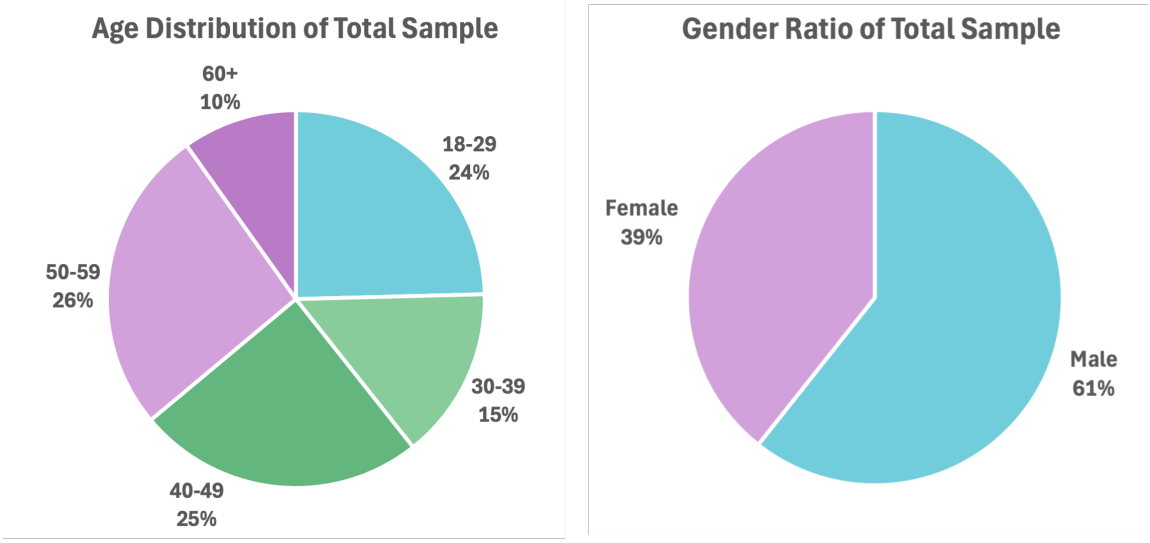

Figure 6: Age Distribution and Gender Ratio of the total study sample n=61.

Based on participants preferences, spoken language was English or Lhukonzo, with most non-governance conversations held in Lhukonzo with translation by my local facilitator. Translation was done by meaning rather than word (Temple & Young, 2004), as structural and semantic differences between Lhukonzo and English make direct translation difficult. For better readability of direct quotes used in-text, the third-person translation was changed to first-person. All 22 conversations were audio-recorded and transcribed, with my local facilitator occasionally consulted to refine translations where the on-site interpretation and original response differed substantially in length.

5.3 Data analysis

Data was analyzed using Brown and Clarke's (2006) six step approach for reflexive thematic analysis. Johansson et al.'s (2025) definitions of plural values for glaciers were further nuanced using Himes et al (2024) salient articulations (Table 3), serving as the foundation to create an a-priori coding framework inspired by existing PV literature such as Pratson et al. (2023). However, as values are highly context-sensitive, thereafter I used an inductive approach to provide enough space for case-specific codes. A fully inductive approach was used to identify patterns on how to address glacier-related loss and damage in the Rwenzoris, and to identify vulnerability drivers and justice notions which serve as the foundation to discuss transformative governance implications (coding frameworks in Appendix D). I used Nvivo for analysis and data processing.

Table 3: Plural values of glaciers. Based on Johansson et al. (2025) and Himes et al. (2024)

Plural values of glaciers	Definition
Instrumental	Value expressions referring to the importance of glaciers as a means to achieve human ends or satisfy needs and preferences, in principle substitutable, though not always in practice. This includes any direct or indirect material contribution of glaciers or their meltwater to human well-being, such as water provision, agricultural productivity, hazard regulation, or income generation.
Relational	Value expressions deriving from meaningful, reciprocal relationships between people and glaciers, and among people through glaciers, i.e. beyond any means-to-an-end logic. This includes values from relationships that are constituent elements for living a "good life", such as identity, care, social cohesions, or a cultural/sacred sense of place.
Intrinsic	Value expressions referring to the inherent worth of glaciers as ends in themselves, expressed independently of any reference to human interests or needs. This includes any expression of glaciers as part of a wider ecosystem worth to protect in its own right, or as a natural entity whose existence has value regardless of what it provides to people.

While RQ2 and RQ3 are addressed qualitatively, value expressions allow for a more quantitative data exploration. Following Tschakert et al.'s (2017) call for NELD assessments to identify trade-offs regarding their importance within affected communities, assessing their prevalence is essential. Although contested in qualitative research due to potential biases, quantitative indicators can still signal important thematic salience (Maxwell, 2010). To mitigate biases, I used three complementary metrics: The share of references captures the *discursive weight* of a value but may be influenced by talkative participants or conversation length. The share of participants mentioning a value indicates its *distribution* across the sample but potentially underestimates prevalence in FGDs when not all participants verbally articulated agreement/disagreement with certain values, thereby making a sub-sample comparison difficult. References per speaker/file provides an indication of *discussion intensity* but can be affected by unequal participation levels. Interpreting these metrics jointly allows for a triangulated assessment of value prevalence, reducing biases associated with any single measure.

5.4 Positionality

As a white, male student from Europe conducting fieldwork in a region with Indigenous cultures, marked by socio-economic and political struggle and shaped by colonial history, being reflective about my positionality was central throughout the research process (Sultana, 2007). My privileges inevitably influenced how I accessed, interpreted, and represented the knowledge shared with me, particularly considering abstract concepts such as loss, value, and justice which meanings may differ between my westernized and local conceptualizations (Sultana, 2021). This research was inevitably shaped by unequal power relations between me as a researcher, the participants, and the translator. In a context

where participants described how “foreigners changed our mind” (IV9) and imposed Western worldviews, my presence risks reproducing similar dynamics of knowledge extraction. Particularly gender dynamics shaped my access: female community members were much more sceptical and cautious toward me and my male translator, likely influencing whose voices and values I was able to capture most fully.

Close collaboration with my local facilitator from the Cross-Cultural Foundation of Uganda (CCFU) helped navigate some of these limitations – their deep knowledge of cultural sensitivities in the Rwenzoris was essential for building trust. Of course, some degree of sampling influence cannot be entirely ruled out, but CCFU's regional standing primarily facilitated access to the diverse governance landscape, while community participants were selected independently, keeping sampling broadly neutral. Collaboration alone cannot dissolve the structural asymmetries inherent in my positionality, and I cannot claim neutrality or full reciprocity. While analysing, I tried to let participants' own framings guide interpretation, but ultimately accepting that the knowledge produced here is always partial, situated, and shaped by who I am and where I come from (Haraway, 1988).

6 Results

6.1 Plural Values of the Rwenzori Glaciers

Coding for RQ1 resulted in 14 relational, 4 intrinsic, and 7 instrumental values connected to the Rwenzori glaciers, identified through 556 value expressions (Table 3). Relational values (47%) were slightly more dominant than instrumental values (43%), with intrinsic values (10%) falling far behind (Figure 7). Both instrumental and relational values were expressed by 46 participants (85% of total sample), with relational values discussed slightly more intensely (5.7 vs. 5.1 ref/sp.). Water provision and hydrological regulation was the most referenced (15%), widely distributed (36 participants; 67%), and most intensely discussed (2.28 ref/sp.) value, followed by Sacredness & Religion which was discussed with similar intensity (2.24 ref/sp.). Most locals emphasized the glaciers' role for seasonal water supply, ensuring stable supply during dry season but also contributing to flooding during rainy season. Many interviewees described the glacier's importance for attracting rainfall, evident in the linguistic ambiguity of the word 'nzururu': "Those snows, in our local language, 'nzururu' means rain maker. So, it has to be there! If it recedes, we may not have rain in future and this place will be very dry forever." (FGD1-P1).

Although hard to show by reference number, collective identity stands out as a relational value across the whole sample. When asked what the glacier personally means to them, participants often referred first to the origin of the Bakonzo kingdom and how it is named after the glaciers: "For us, the snows are called nzururu. And we call ourselves Rwenzururu, […] we are part of the snow, and it is part of us. So, when you talk of snow, […] we are talking about our identity." (IV4). The relational implications of losing the glaciers are captured by one community member: "If you lose that glacier, that snows, our name will be useless! We would no longer be called Rwenzururu. We have gone away." (FGD2-P1).

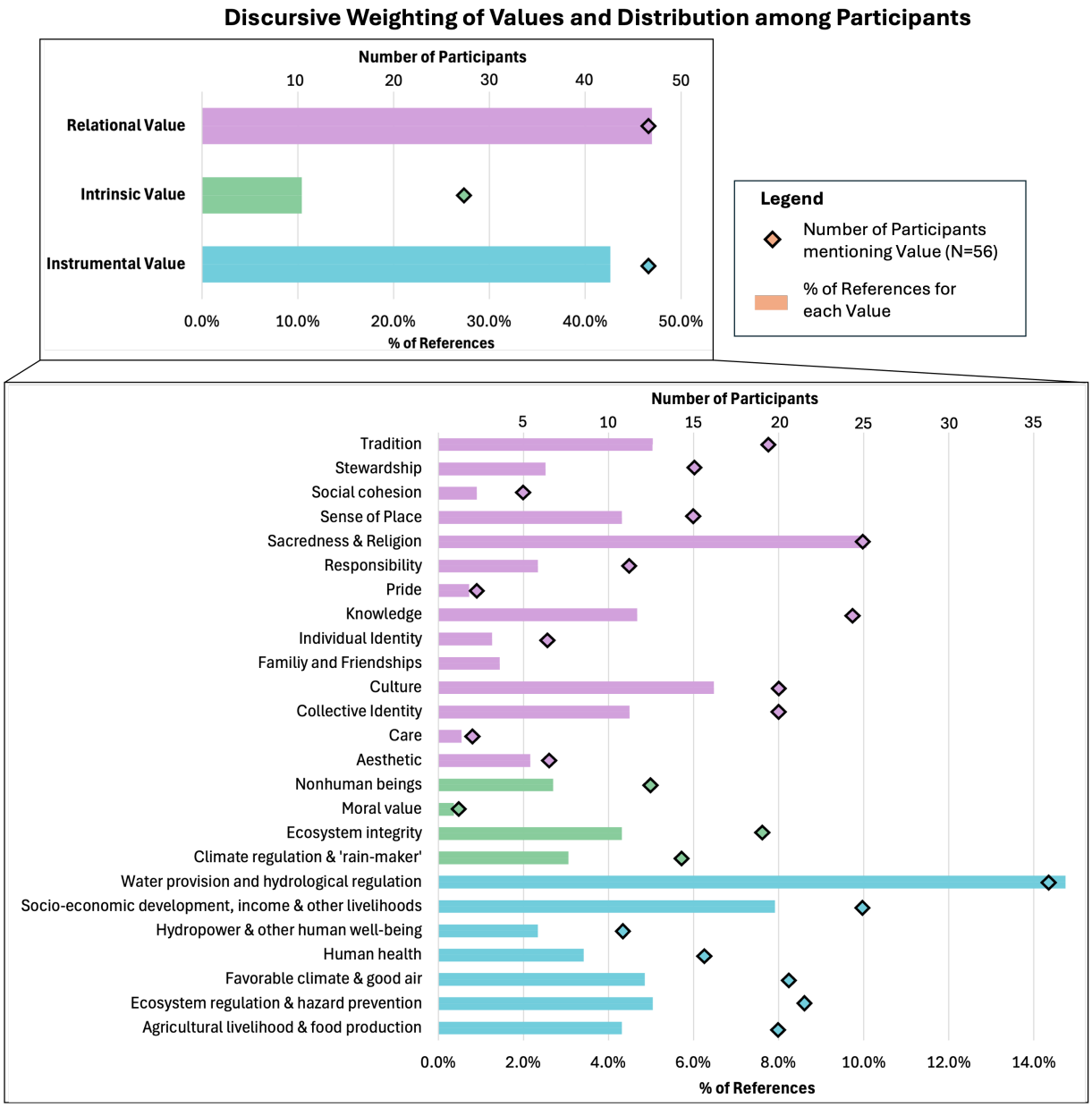

Figure 7: Total sample value expressions and distribution, with bars indication the share of a certain value (lower horizontal axis) and diamonds indicating the number of participants mentioning that value (upper horizontal axis) (Author's own work).

Table 4: List of all 25 values resulting from qualitative coding, including number and share of references and participants, as well as exemplary quotes from the interviews/FGDs.

	Refs.	Refs. %	Partic.	Partic %	Example
Instrumental Value	237	43%	46	85%	
Agricultural livelihood & food production	24	4%	20	37%	"We were predicting certain seasons in the community. When the snows are seen, that means now it's rainy season. You see that very easily." (IV11)
Ecosystem regulation & hazard prevention	28	5%	22	41%	"This water comes directly from the snows! Like when they melt, the water will be too much." (FGD1-P2)
Favorable climate & good air	27	5%	21	39%	"Fresh air, cool condition around here. It [regulates] all the zones on the mountain. So, if it disappears this place will be very hot." (IV4)
Human health	19	3%	16	30%	"[…] at times we are allowed to pick medication, the herbals, which is supported by the snow." (FGD6)
Hydropower & other human well-being	13	2%	12	22%	"[…] if the glacier disappears and water volume reduces, even the power plants will be affected, so they will not have electricity around." (FGD3-P2)
Socio-economic development, income & other livelihoods	44	8%	25	46%	"So, when tourists come, then we earn money to take our children to school." (FGD2-P2)
Water provision and hydrological regulation	82	15%	36	67%	"Those rivers were huge rivers, but because of the reduction in the glaciers that would produce the water, the waters in those rivers are also reducing" (IV13)
Intrinsic Value	58	10%	27	50%	
Climate regulation & 'rain-maker'	17	3%	14	26%	"Nzururu is what we call the rain maker. Those snows, in our local language, nzururu means rain maker." (FGD1-P1)
Ecosystem integrity	24	4%	19	35%	"When they [the glaciers] are changing, it means the rest of the environment is also being changed." (IV12)
Moral value	2	0%	2	4%	"Actually like we said that Kithasamba is found in those glacier parts […]. So, we feel like the glacier has a right to exist on its own." (FGD3-P5)
Nonhuman beings	15	3%	13	24%	"Yes, they [the glaciers] are important to the animals and trees that are up there. There are some animals that stay there." (FGD8-P2)
Relational Value	261	47%	46	85%	
Aesthetic	12	2%	7	13%	"And every morning or evening we would be appreciating looking at the snows." (IV13)

Care	3	1%	3	6%	“And that's why we are saying we should all work hand in hand to ensure that we protect it. […] When there is no more glaciers, what will be the Rwenzururu for?” (IV14)
Collective Identity	25	4%	20	37%	“We are called the Bakonzo, the Rwenzruru. And Rwenzururu means ‘the snows’. If you lose that glacier, that snows, then our name will be useless!” (FGD2-P1)
Culture	36	6%	20	37%	“[…] according to the Bayira culture, there are things we have tampered with, that have contributed to the reduction of the glacier, meaning there is some - that close connection with the culture and glacier.” (IV10)
Family and Friendships	8	1%	8	15%	“So, this guy got a chance to have friends who are now supporting him. […] he used to help them move up the mountains as he was studying. So, most of the youth will get friendship that can help them for the rest of their future.” (IV6)
Individual Identity	7	1%	7	13%	“I took long without performing the rituals, the ridge cleansing. 43 years without going to the mountains, without performing these rituals, so they reduced.” (IV9)
Knowledge	26	5%	24	44%	“Even when rivers would start flooding, they would go to appease the gods and the flooding stops.” (IV14)
Pride	4	1%	3	6%	“So, all these [stories connected to the glaciers] are in our attachments, in our pride” (IV4)
Responsibility	13	2%	12	22%	“We don't want to lose it [the glaciers]. It is our responsibility as a cultural institution.” (IV5)
Sacredness & Religion	56	10%	25	46%	“That’s the seat of god, the throne of god. Our god here is called Kithasamba. The one who has not climbed. He lives up. So, we are related to this future in that, you know, that is where our god sits, it is sacred” (IV4)
Sense of Place	24	4%	15	28%	“Even if I go to America, I don’t mind, I leave my mountain, I shall come back to my mountain. You are here as a visitor, you will take me there, but I want to see my snow!” (FGD1-P3)
Social cohesion	5	1%	5	9%	“[…] we are tied because the glacier is there. So, it's very important to the locals.” (FGD2-P9)
Stewardship	14	3%	15	28%	“And we feel as beneficiaries, we should take the lead in protecting and maintain them [the glaciers].” (FGD6)
Tradition	28	5%	19	35%	“So, she is saying the rituals used to be performed at the glacier are supposed to continue. Because it was a good idea, they were important to them, they should be important to the current generation too.” (FGD7-P4)

6.1.1 Non-governance vs. governance actors

Differences between non-governance and governance voices are only marginal considering overall value categories. Non-governance participants slightly prioritized relational over instrumental values, also evident in discussion intensity (4.7 vs. 4.1 ref/file), while governance actors mentioned both with similar frequency (Figure 8).

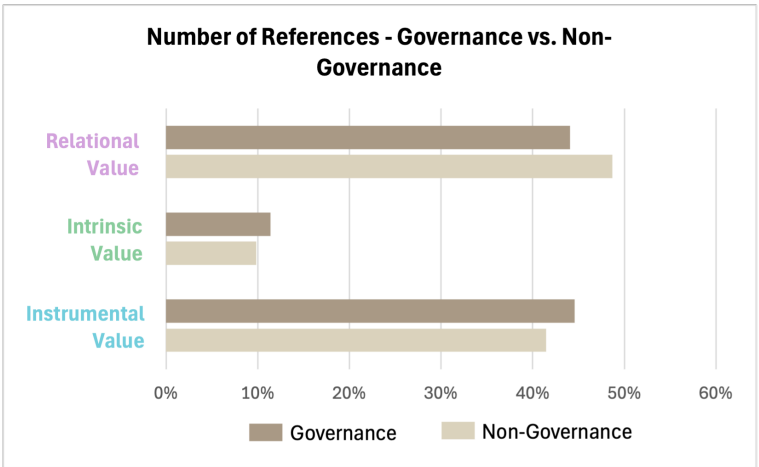

Figure 8: Comparison of the share of references for the three value categories between the governance and non-governance sub-sample. (Author's own work)

Differences become more pronounced when looking at each group's top values (Figure 9): While governance participants favored instrumental ones, particularly water provision and hydrological regulation, non-governance conversations focused on relational ones, particularly Sacredness & Religion which they expressed in far greater intensity (3.4 vs. 1.5 ref/f). Governance actors (excluding kingdom representatives) tend to describe the traditional beliefs more passively, almost as historical artefacts: "they used to tell us that our gods live on that mountain" (IV12), or "that god used to be called Kithasamba" (IV13). Community voices expressed a more active, reciprocal connection in which they "really belong to the Kithasamba" (FGD1-P3) and worrying of losing this connection: "The snow is the habitat of Kithasamba. Now, if the snow is no more, we will not be able to communicate to Kithasamba." (FGD3-P2).

The closely related relational values of tradition, sense of place, and collective identity are only found among the top values of non-governance actors. Participants expressed the importance of traditional practices connected to glaciers to appease mountain spirits who prevent natural calamities, exemplifying a pluricentric worldview of Bakonzo communities: "We made sacrifices in the past, […] ceremonies for the gods. The people and the spirits join together so that it can continue." (IV4).

Governance actors also value these traditions but tend to frame them as responsibility of the cultural institution.

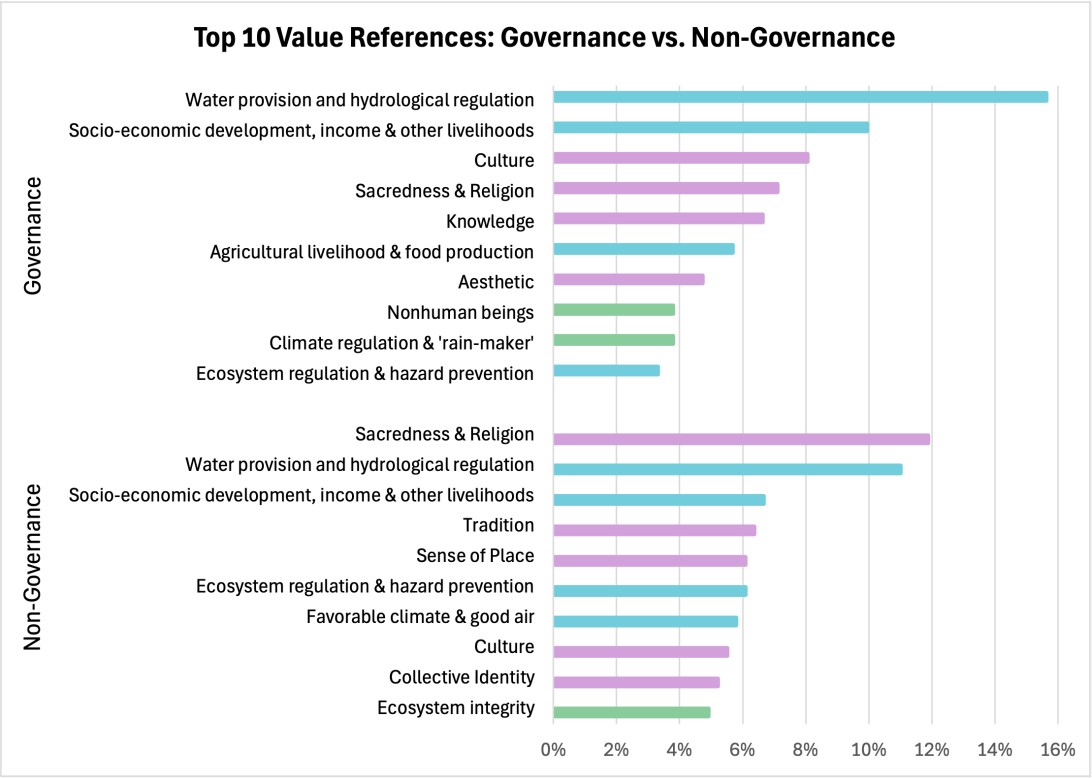

Figure 9: The top 10 values according to the share of value expressions across the governance and non-governance sub-sample. (Author's own work)

6.1.2 Gender differences

While relational and instrumental values are balanced for men, female participants expressed more instrumental values (Figure 10), particularly evident since men discuss both categories equally intense (both 4.3 ref/sp.), while women clearly favour instrumental values (4.1 vs. 3.3 ref/sp.).

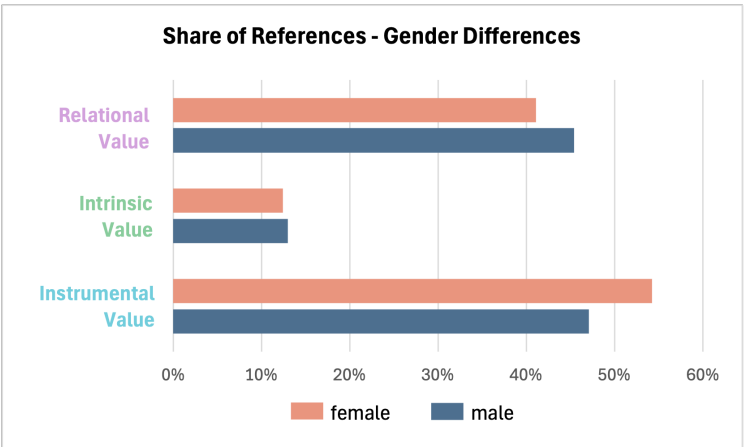

Figure 10: Comparison of the share of references for the three value categories between the female and non-male participants. (Author's own work)

This pattern continues for each group's top values (Figure 11), particularly pronounced in socioeconomic development, income & other livelihoods. Both groups agree that the tourism sector is heavily affected, with major implications for people's livelihoods: "When glaciers are there, then tourists are coming in big numbers. But because of global warming, the numbers of tourists who are coming here, they have reduced." (FGD2-P8-m), with a female participant stating: "If they [tourists] stop coming, because the glacier is no more, we are also going to face a financial crisis" (FGD3-P4-f). While men tended to express the direct benefits of income-generation, many women pointed to the glacier's indirect contributions for broader socio-economic development. Regarding relational values, men explained their cultural connection to the Rwenzoris in greater detail, often describing Bakonzo cultural "taboos" and sometimes attributing glacier retreat to their disregard, while women referred to cultural values more briefly, often linking them to knowledge passed down from 'grandfathers'.

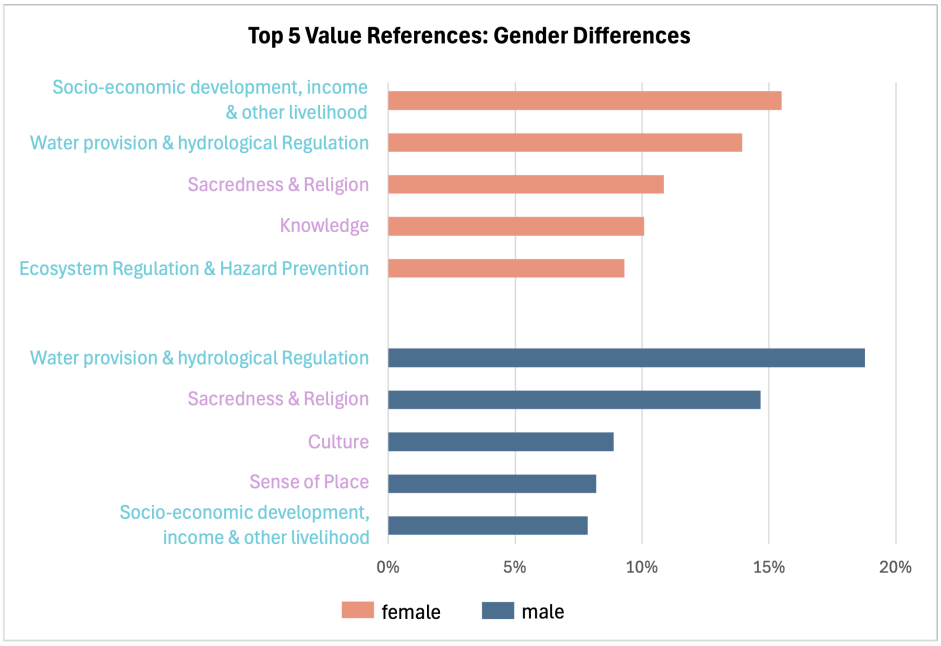

Figure 11: The top 5 values according to the share of value expressions across female and male participants. (Author's own work)

6.1.3 Location Differences

Rural mountain participants most often expressed instrumental values (55%) and in greatest detail (instrumental 3.4 vs. relational 2.1 ref/speaker), but relational values (94%) showed a wider distribution than instrumental (77%) within the group. Interestingly, this pattern is mostly driven by the flooding affected Kilembe Valley where participants expressed more instrumental (64%) than relational (35%) values, while in Ibanda the two categories were more balanced. Urban participants showed a more even split between categories but discussed relational values in considerably greater detail (7.4 vs. 5.7 ref/sp.).

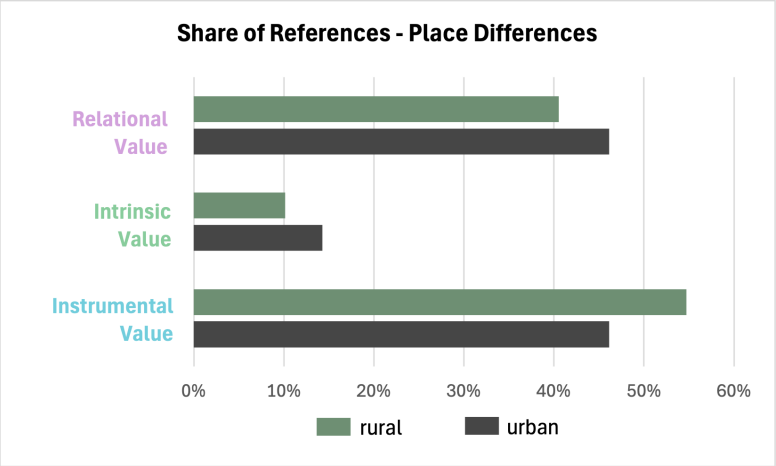

Figure 12: Comparison of the share of references for the three value categories between the rural and urban participants. (Author's own work)

Considering the top values (Figure 13), rural participants tended to favour instrumental values while urban residents focused on relational values. A value particularly worth mentioning is Favorable Climate & good Air, frequently expressed among rural participants but receiving little attention from urban residents. Rural mountain participants considered the glacier as key entity for a good and healthy life, providing fresh and cold air in an otherwise hot climate: "The snows bring us comfort!" (FGD3-P3). Participants often linked glaciers to human health and traditional medicinal knowledge, either through their cooling effects for the mountain climate, meltwater to treat chronic cough, or medicinal plants thriving in cold high-altitude environments.

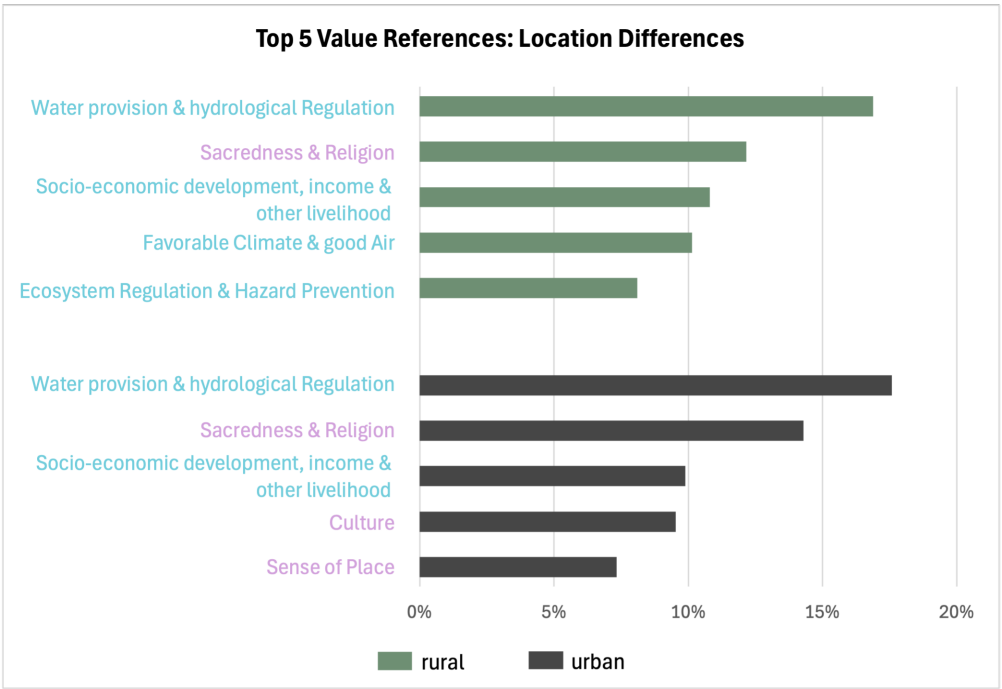

Figure 13: The top 5 values according to the share of value expressions across rural and urban participants. (Author's own work)

6.2 Addressing glacier-related loss and damage

To answer RQ2, responses to the effects of glacier retreat were grouped into three main themes, while 'knowledge and capacity building' and 'institutional and policy mechanisms' were identified as cross-cutting issues to capture *how* measures should be implemented. For each main theme, perspectives of non-governance and governance actors are compared, with responses differentiated between existing and desired measures.

6.2.1 Ecosystem Restoration

Being mentioned in every conversation, 'ecosystem restoration' was the most frequently cited response to glacier retreat. Particularly among community members, deforestation was perceived as the primary driver of glacier melting, with several participants describing how locals practicing bush-burning are mainly responsible since "the fumes hit uphill and reduce the glacier" (FGD3-P1), often translating into an overly optimistic local stewardship: "we should plant more trees so that the glaciers don't go away" (FGD1-P1).

This local belief reflects campaigns by governance actors in which tree-planting initiatives dominate sensitization, mentioned in every governance interview and framed in two-fold terms: as a mitigation measure to prevent glacier loss, but also as an adaptation strategy, with agroforestry often presented as most sustainable. However, restoration efforts appear constrained in two major ways: insufficient funding for tree seedlings, with the international community portrayed as the only viable source of finance. Second, interviews revealed an institutional mismatch between national policy formulation and local implementation, pointing either to 'top-down' nature, or implementation failures: "if you go to the Ministry of Environment, they will show so many books of good policies, but they are not implemented on the ground." (IV11-P2).

This gap was mirrored in many non-governance conversations: people expressed a need for greater law enforcement of tree cutting. Regarding knowledge and capacity building, many non-governance participants expressed a desire for technical support and hands-on advice, with some indicating international voices were more credible than those of government institutions: "I would be wishing that we get a connection to the organizations that send volunteers to Africa or Uganda, […] more specialized conservationists, they might train our local people here." (FGD2-P9).

6.2.2 Livelihood & community-based strategies

Mentioned in every conversation, governance and non-governance actors agree that alternative livelihoods and income-generating activities will be key to cope with glacier-induced changes. However, the degree to which alternatives are taken up by communities differs across sectors. For the tourism sector, mountain guides perceive a decline in tourist numbers as traversing the Stanley Glacier to summit Margherita is becoming increasingly seasonal and unpredictable. Tourism was described as the only source of income for most rural households, alongside calls for alternatives and criticism of some international projects whose "mind is in the gem inside the ground, […] not on making sure people have better livelihoods" (IV4). Governance actors articulated more concrete strategies than community voices, proposing diversification toward community-based, cultural, and agri-tourism rather than relying predominantly on mountaineering. Sensitization and capacity building would be key but constrained by financial capabilities and culturally unsensitive interventions, undermining crucial community ownership without which "we fight the problem. We don't fight the cause." (IV5).

In agriculture, many participants perceive changing temperatures and rain patterns as a direct consequence of melting glaciers. Farmers adapt intuitively by changing crop varieties: the yam, once the "most stable fruit on this mountain, […] is now disappearing" (IV4), with crops like cassava now replacing it at higher altitudes. Most FGDs revealed a desire for training in alternative practices, such as "crops which are more commercial, they bring us some money, like cocoa and avocado" (FGD4-P10).

Governance measures centre around 'Climate Smart Agriculture', combining the dominant tree planting narrative with adaptive measures like drought-resistant varieties and diversified irrigation schemes. TK for seasonal prediction is increasingly perceived as unreliable, hence sensitization and capacity building is now based on research and meteorological information delivered through sub-county extension services. However, this decentralised approach remains constrained by funding and staff training, as described by an agriculture district officer: "I'm supposed to have 88 [extension workers] but at least I have 48 now. If we would have the resources. […] That would be – not even effective, but at least somewhere" (IV13).

6.2.3 Cultural Agency

Greater cultural agency was the second-most named response to glacier loss, either to directly address the loss of certain relational values or as a mean to drive environmental conservation. Particularly non-governance actors emphasize the role of culture, mentioned in 11 of 12 conversations. Here, 'culture'

elusively describes norms, practices, or beliefs of the Bakonzo, with most people drawing a direct link between cultural approaches and environmental governance. Again, people described great local responsibility, connecting conservation to cultural 'taboos', for example in reference to flood prevention: "If I can look at riverbanks, one was never allowed to cut trees, to cut grass, to cast any vegetation along the river. [...] there were taboos that when you cut the vegetation along the rivers, then you were cutting the habitat of specific gods" (IV7). Ritual practices sustaining spiritual ties were described as essential to address natural hazards and further prevent glacier retreat. Most community voices expressed frustration regarding a declining cultural value system and emphasised the need to preserve culture through documentation and youth education.

Governance actors described culture as the key vehicle for successful environmental governance interventions, which should always include the OBR. In most interviews, the cultural approach to conservation was mentioned as a form of governance in itself: "taboos worked as policies to manage communities, to do the right thing" (IV11-P2). OBR representatives mentioned ongoing initiatives to institutionalise TK in the formal education system, while highlighting the challenge of reaching youth in a technocratic, modern society.

Both community and governance actors stressed the need for greater intercultural exchange and knowledge transfer at international level on how other Indigenous Mountain communities deal with climate change. They agreed that sensitization is only possible through culturally sensitive approaches and greater institutional collaboration between the kingdom, government, and private organizations, naming the RMNP as a contested example of collaboration: While in most conversation its importance for the environment and socio-economic development was acknowledged, rural participants in particular perceived state control as limiting cultural significance and access: "This mountain has [been] taken by the government" (FGD2-P3). OBR representatives took a more nuanced perspective, emphasizing the role of formal permission procedures rather than outright exclusion.

6.3 Transformative Governance

To later discuss implications for transformative governance of glacier-related loss and damage in the Rwenzoris (RQ3), it is essential to outline *what* vulnerabilities needs to be addressed by governance interested in more fundamental change, and *how* justice can be achieved.

6.3.1 Drivers of vulnerability

Across most conversations *socio-economic hardship & demographic pressure* were perceived as the most crucial constraints for mitigating local climatic change and adapting to the adverse effects of glacier retreat. Participants described how high levels of poverty coincide with high population growth in a region with land scarcity, making people search for arable land everywhere. People settle near rivers and become vulnerable to floods, while driving widespread deforestation as a matter of survival: "You find people cutting down the trees because of charcoal. They don't have what you call economic kind of earning […] they are forced to grow there." (IV5).

A theme coming up occasionally was the region's *capitalist-colonial legacy,* driving the loss of specific instrumental values but most notably the loss of relational values through *cultural marginalization & erosion of TKS.* Kingdom representatives explained how the British colonizers worked closely with the Batoro who excluded Bakonzo from the formal education system, which consequences are still evident in their high illiteracy rates. Many participants described how Europeans brought Christianity and western worldviews, making people abandon their traditional beliefs: "the foreigners changed our mind and then they stopped preaching the Kithasamba. They divided us to rule over us, now we think that our culture is satanic" (IV9). Participants from Kilembe valley expressed frustration over Canadian copper mining operations until the 1980s, whose abrupt departure increased flood vulnerability through river modification and health impacts from residual tailings.

6.3.2 Notions of Justice

Considering different notions of justice, many people expressed the need for greater cultural *recognition:* "We need to come back. […] if the West can allow the Africans to also document what they know about their worship, […] you'd find we are almost doing the same things. Then eventually, that would solve so many problems in Africa than to be solved using the Western methods." (IV7). Governance interventions were described as effective only when applied context-sensitively and through established cultural institutions, with a recurring desire to better document Bakonzo culture, integrating TK into the formal education system and every possible governance intervention. Community ownership and bottom-up governance were often named as key enablers, with inclusiveness and accountability in decision-making as forms of *procedural justice* appearing to be of high importance in a region where trust in governance interventions is low: "Even if programs come here, they don't have full community support. Community ownership. They look at it as if it is theirs." (IV4).

Participants more often expressed *distributive*, forward-looking approaches to share the burdens of climate change than *compensatory*, backward-looking ones. Both were discussed primarily in monetary rather than non-economic terms. Compensatory measures were occasionally raised by non-governance actors in connection to flooding as desired long-term resettlement for internally displaced people. Governance actors repeatedly stated that justice is only possible when funds actually reach the local level, with concerns about mistreatment of funds at higher governance levels evident across both groups.

7 Discussion

For RQ1, PV revealed a diverse set of 25 values, confirming the cascading nature of glacier loss extending far beyond quantifiable-economic impacts, with relational values being particularly pronounced in the non-governance sample. Participants emphasized glaciers' values connected to the traditional Bakonzo way-of-life, confirming the Rwenzoris as a deep entangled socio-glaciological system. Glaciers are not only a mean to achieve human ends but also key cultural-cosmological entities. Within-sample differences highlight that value loss is never universal, making trade-offs important to develop effective responses (RQ2): Ecosystem restoration, livelihood-based strategies, and greater cultural agency were expressed as key responses, but governance actors seem to overly prioritise climate adaptation measures instead of L&D measures helping people to cope with value loss. Differences between community and governance perspective are particularly pronounced for cultural agency, with communities describing it in a far more active way. As a basis for discussing transformative governance, results for RQ3 unveiled that L&D should ultimately address the region's instrumental vulnerability of socio-economic hardship, and the capitalist-colonial legacy to better cope with relational value loss. Governance interventions should be context-sensitive with greater cultural recognition, emphasising forward-looking approaches beyond monetary compensation.

7.1 PV for loss and damage in the Rwenzoris

While findings of the PV deserve some nuanced interpretations, I integrate these into a broader discussion on how PV proved to overcome two central challenges in loss and damages assessments: (1) statement-based PV addressed NELDs key characteristic of context-sensitivity (Serdeczny et al., 2016) while simultaneously overcoming Van Schie et al.'s (2024) 'harmful dichotomy' of economic and non-economic loss. (2) By capturing different situated value expressions and employing a threefold metrization, PV made NELDs comparable across groups despite their inherent incommensurability, allowing to account for crucial value trade-offs for potential response prioritization (Tschakert et al., 2017).

The ambiguity behind the word *nzururu* captures the importance behind both arguments: simultaneously used for glaciers, snows, rainmaker, and as the kingdom's name, it's value spans across instrumental, intrinsic, and relational categories, proving PVs ability to account for ontological embeddedness and subjective realities of the valuer (Anderson et al., 2022). The fact that non-western glacier-near communities do not differentiate between snows and glacier was also found by Johansson et al. (2025), serving as a potential explanation why locals perceived the Rwenzori glaciers of greater

hydrological importance than scientific evidence allows (Taylor et al., 2009). Neither static NELD frameworks (UNFCCC, 2013), nor economic valuation methods would have captured these nuances.

Under the UNFCCC (2024) the economic/non-economic dichotomy continues – but could be challenged by a PV approach. As theorized in chapter 3 and illustrated in figure 14, a single physical impact can materialize instrumentally, relationally, and intrinsically, depending on the valuer's worldview and life-frame (Raymond et al., 2023). The loss of ritual spaces illustrates this: some participants linked it to cascading instrumental effects, attributing increasing natural hazards to displeased gods as a form of local spiritual sense-making, also documented for mountain communities in Nepal (Allison, 2015). Others emphasized its compounding relational effects like social cohesion or TK, an inseparable co-occurrence also highlighted by Pearson et al. (2023). Himes et al.'s (2024) concept of fuzzy boundaries may be particularly characteristic for glacier-near SES: Johansson et al. (2025) found comparable entanglements of glaciers' material contributions and relational values in Himalayan glacier communities, while Jurt et al. (2015), comparing cultural glacier values across three mountain communities, confirm the non-dichotomous character of economic and cultural values and add an important temporal nuance that glaciers are sites of memory. This was evident in Kasese through participants' storytelling-like childhood recollections, and statement-based PV was well suited to capture glacier loss as a rupture of the historically grown socio-cultural fabric.

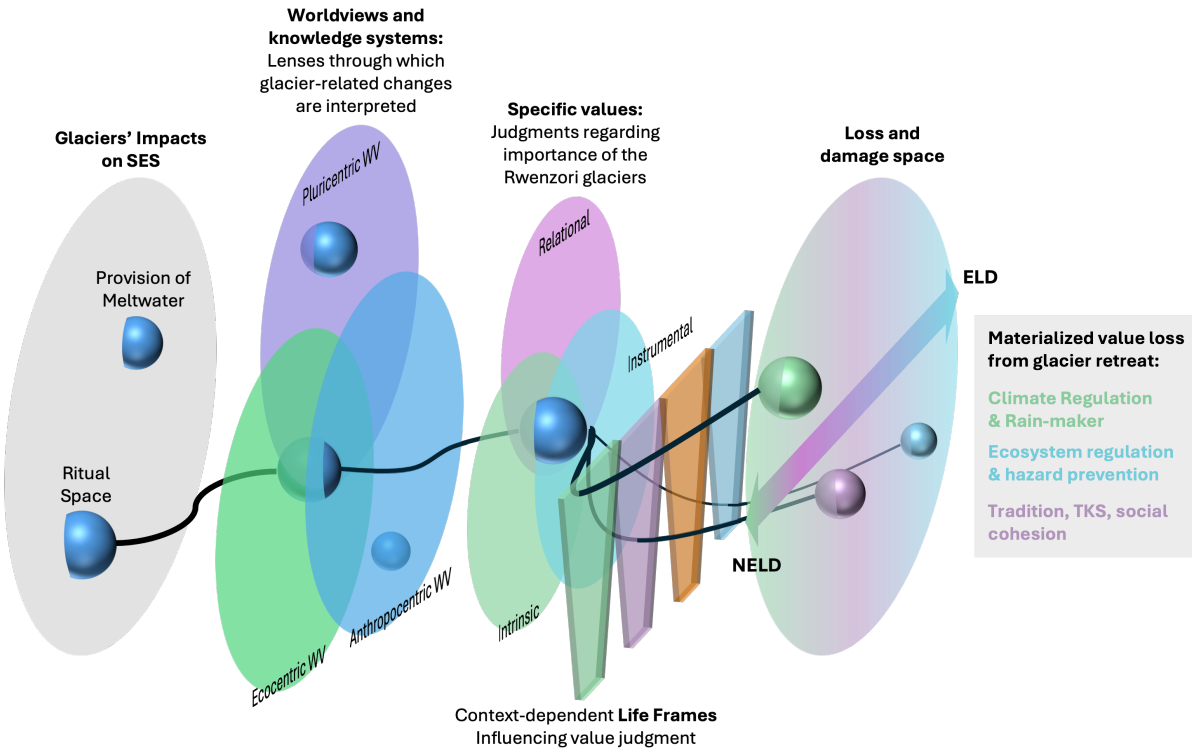

Figure 14: Cascading value interpretation as loss and damage. Glacier's impacts on the Rwenzori SES are interpreted through worldviews and subjectively judged influenced by the valuer's context-dependent life frame

(living *from*, *in*, *with*, or *as* the glacier). 'Ritual space' serves as an example for a boundary object whose subjective value is interpreted instrumentally, relationally, or intrinsically, materializing somewhere on the substitutability scale between economic and non-economic loss and damage. (Authors own work, PV part based on Raymond et al., 2023)

NELD's context-sensitivity demands a situated analysis of people at risk; the question on whose losses matter is "subject to complex and contested power relations" (Tschakert et al., 2017, p. 10): Using their heuristic of a relational loss space, it becomes evident that power-sensitive governance must account for differences among peoples' tolerability of losing certain values, based on the likelihood of loss and their perceived importance (Figure 15). Gender differences illustrate how PV revealed such trade-offs: In the Rwenzoris, relational values were primarily mediated through the elusive notion of 'culture', shaped by a longstanding dualism that associates women with nature and men with culture (Ortner, 1972). In Uganda, culture is often synonymous with the customary realm, reproducing ethnic patriarchy in which women, under the guise of "tradition", are frequently confined to passive roles (Sseremba, 2024), while patriarchal structures in rural areas reinforce women's responsibility for household subsistence through agricultural production and water provision (Asaba et al., 2013; FAO, 2022). Women's prioritization of instrumental values might indicate a slightly enhanced tolerability for some relational value loss, though this may also reflect reluctance to discuss such values with a male interviewer. Nevertheless, such nuanced findings highlight the importance of acknowledging these trade-offs when developing governance responses.

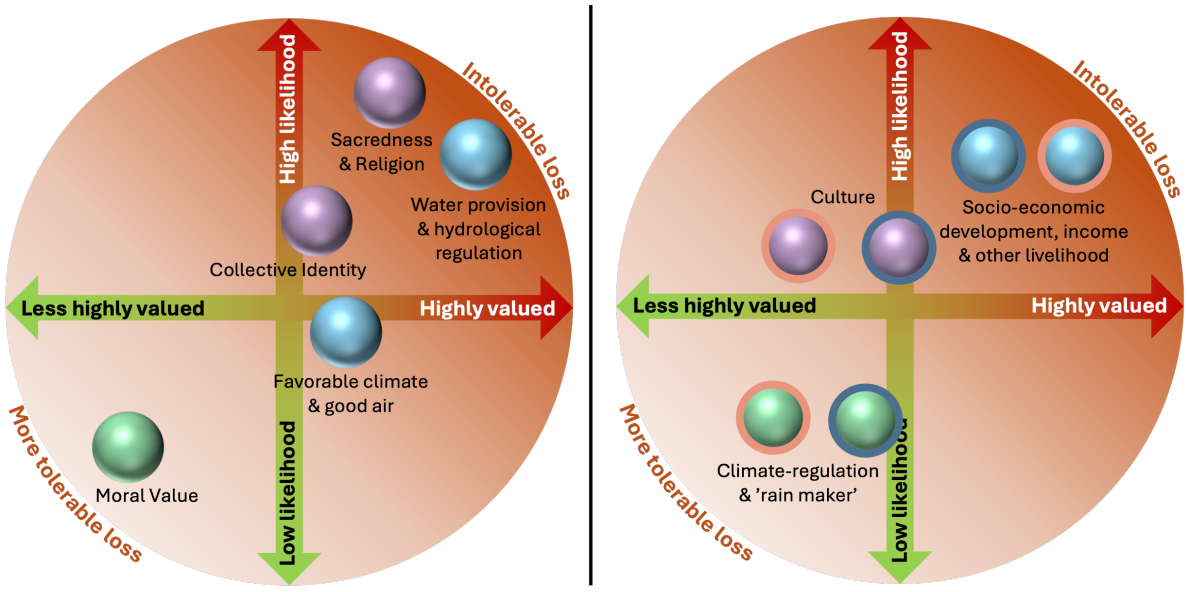

Figure 15: Heuristic of a relational value loss space with trade-offs, here illustratively adapted for certain values based on PV results (horizontal-axis) and structural vulnerabilities (vertical-axis). Left: Example values based on total sample data; right: example values based on gender differences for women (orange circle) and men (blue circle). Tschakert et al. (2017) equate 'likelihood of loss' with the risk that a value is affected by climate change. For glacier-related values, this risk would be almost uniformly high given the Rwenzori glaciers' high recession probability. However, as argued throughout the thesis, likelihood of value loss is not determined by climate change alone; it is mediated by structural vulnerabilities, which produce varying loss likelihoods even for glacier-

related values. As an indicative heuristic, likelihood of value loss is not based on quantitative measurement but reflects an ordinal ordering derived from participants' expressions of structural vulnerability and background literature. For instance, 'Sacredness & Religion' is positioned at higher likelihood of loss than 'Water provision & hydrological regulation' since cultural marginalization operates as a persistently erosive force, whereas glacial meltwater plays only a subordinate role in local water provision (Author's own work, based on Tschakert et al., 2017).

7.2 Addressing glacier loss: overcoming adaptation

Strategies to address glacier-related loss and damage in the Rwenzoris face two pitfalls: (1) Clearly differentiating between climate adaptation and loss and damage measures appears crucial for cascading slow-onset events but proves difficult on the ground. Finding effective responses requires knowing how avoidable and how tolerable certain losses are for affected people. In Kasese, there is a misalignment between futile efforts to still avert glacier loss, and true strategies to enable society to deal with cascading value loss (Van der Geest & Warner, 2015). (2) Such latter strategies, here livelihood adaptation and cultural agency, face crucial socio-economic constraints, revealing a disconnect between the level at which loss is experienced and the level at which responses are discussed.

Findings follow the theorising by Wallimann-Helmer et al. (2019): lines between adaptation and loss and damage are inherently blurry. Ecosystem restoration to avert glacier loss dominates for both governance and non-governance actors, yet operating against a hard adaptation limit given the Rwenzori glaciers' full retreat is effectively unavoidable (Dieckman, 2025; Taylor et al., 2006). Several dynamics explain this misalignment: deforestation is framed as the primary environmental threat and tree planting promoted as a near-panacea (Bechau et al., 2024). Secondly, Orlove et al. (2019) found that glacier-near communities tend to perceive glacier recession through a local rather than global climate change frame, potentially explaining locals' internalized responsibility. Thirdly, even governance actors seemed not to perceive L&D as structurally distinct from adaptation, a pattern Vanhala et al. (2021) attribute to L&D's international ambiguity filtering down to constrain local governance. Together, these dynamics fuel false hopes among communities that glacier retreat can be halted while producing a governance response overly emphasizing technocratic risk management (Boyd et al., 2017); tree-planting should mitigate the risk of glacier loss and other natural disasters, yet simultaneously suppressing responses to deeper value loss.

Strategies better capable of addressing value loss are livelihood diversification and cultural agency. While the former include well-documented responses to altered instrumental conditions from glacier retreat (Johansson et al., 2025), the latter deserves greater attention: Bakonzo's cultural-cosmological ties with the glaciers developed through long-lasting multi-ethnic dynamics and colonial histories

(Pennacini, 2008), further enhanced by physical separation from the glaciers after the establishment of the RMNP. Following Motschmann et al. (2020), conceptualizing relational value erosion must consider that culture is never static, with participants desire for greater cultural agency being a response to diverse erosive drivers. While this unique context may limit cross-case comparisons, there is agreement that culture and TKS play a key role in local adaptive measures (Adger et al., 2013). Allison (2015) reviewed cultural-unique responses to glacier retreat, revealing adapted ritual practices, reversed society-deity relationships creating new forms of stewardship, or calls for greater cultural respect. Interestingly, such *active* cultural agency is mostly found in my community sample, while governance actors tend to treat it passively as a sensitization tool or moral guidance.

This mismatch points to a structural scale disconnect, potentially illustrating the governmentality Jackson et al. (2023) warn against: ecosystem restoration in the Rwenzoris frames local climate change as the main root cause of vulnerability to glacier-retreat, obscuring deeper drivers of value loss. Strategies better capable of addressing value loss face structural barriers exceeding local capacities and appear to remain outside the scope of L&D governance. It requires more than better-funded adaptation measures but a fundamental reorientation of whose knowledge shapes governance and whose losses count.

7.3 Transformative governance

Having shown which and whose values are a at risk, and what responses are feasible to address value loss, these results now form the base to outline implications for transformative L&D governance. This should address the root causes of vulnerability (Roberts & Pelling, 2020), while accounting for power asymmetries driving injustices even within vulnerable communities themselves (Sultana, 2022). Before turning to both identified drivers of vulnerability, I want to highlight *procedural* justice as the enabling condition for all interventions. Community ownership in decision-making was frequently mentioned and serves as a key tool for transformative governance (See et al., 2025), with Newell et al. (2021) highlighting the potential of local democratic practices, potentially counteracting Uganda's corrupt electoral politics (Reuss & Titeca, 2017).

Addressing socio-economic hardship & demographic pressure requires a holistic development strategy beyond the scope of this thesis. However, livelihood adaptation strategies expressed across all conversations are commonly discussed in similar contexts (Pandey et al., 2017), offering transformative potential: community voices highlighted a desire for capacity-building, while governance participants pointed to funding constraints as the central barrier for livelihood diversification – a gap that L&Ds technocratic *distributive* mechanisms such as insurance schemes

cannot address (Schinko et al., 2019). Conversely, a *compensatory* approach requires disentangling glacier retreat from other socio-economic vulnerabilities (Wallimann-Helmer, 2015), but seems impossible given its cascading nature: “if we have a situation where we have crop failure for two years in a row, what happens? The daughter will drop out of school, should become pregnant. The son will run away to go ride a boda boda somewhere, will end up in slums in Kampala.” (IV8). *Restorative* justice could serve as a middle ground, acknowledging disproportionate harm as result of multifactorial vulnerabilities and rectifying these through both monetary and non-monetary forms like capacity-building (Robinson & Carlson, 2021; See et al., 2025), pointing directly to the Santiago Network’s mandate. Crucially, technical assistance must account for place-based differences: rural mountain communities showed far greater reliance on subsistence agriculture and tourism than urban dwellers, Kilembe valley residents seem more vulnerable to flooding than those in Ibanda. Such nuances create distinct thresholds of tolerability that any restorative intervention must reflect.

Meaningfully responding to relational values loss requires empowering cultural agency guided by *recognition* justice while accounting for gendered realities. The Bakonzo experiencing a recurring disruption in their socio-cultural fabric: Participants described how Bakonzo were excluded from formal education, how expert-led interventions overlooked TK, and how western worldviews eroded Bakonzo cosmology – forms of recognition injustice only addressable through decolonial approaches (See et al., 2025). As Allison (2015) puts it, western rationalism is not capable of comprehending what the disappearance of a god may mean for mountain culture, a blind spot transformative governance must actively correct. Governance interventions must be challenged by questions on “whose knowledge counts, who participates in agenda-setting” (Newell et al., 2021, p. 10).

Translating this into praxis, participants constantly expressed a desire for collective efforts in which culture serves as a bridge between the siloed nature of politics, research, and religion. Using its mediating power for local communities, culture becomes more than merely a sensitization tool but a direct challenge to the current distribution of epistemic power (Sultana, 2022). Crucially, this shall not imply an uncritical romanticization of culture. Traditional governance in Uganda often reproduce patriarchal structure (Sseremba, 2024), though African feminist scholars emphasise that many such hierarchies were consolidated under colonial rule (Amadiume, 1997). To counter, governance should be informed by a substantial body of African Feminist literature like the work of Ifi Amadiume or

Obioma Nnaemeka's (2004) *nego-feminism*, offering culturally sensitive interventions without reinforcing male-dominated power relations[5].

7.4 Limitations

Using PV for loss and damage has several pitfalls: No single valuation method captures the true plurality of values connected to the Rwenzori glaciers. Statement-based valuation is prone to a participant selection bias (Termansen et al., 2022), further compounded by the mixed use of purposive and convenience sampling (Etikan, 2016). While my approach aimed to follow affirmative valuation by highlighting values from a group not yet represented in the loss and damage debate, valuation choices were mainly developed by myself rather than in true participatory fashion (S. Jacobs et al., 2020). Female participants are underrepresented in my sample, so gender differences should be viewed with caution. As loss and damage is mostly governed at international level, future research on glacier-related loss and damage should focus on higher governance levels to fully leverage transformative change.

The quantitative presentation of value frequencies risks overstating the generality of my findings (Maxwell, 2010). Contributing meaningfully to L&D's dichotomization is a balancing act: intangible losses are incommensurable making statement-based valuation important, but effective governance requires some degree of quantitative comparability. The three metrics-approach shall mitigate some biases my PV-findings include, but numbers emerging from qualitative coding risk creating a spurious validity. Differences in value frequencies between sub-groups are meaningful for identifying patterns but cannot support definitive claims given the sample size and qualitative nature.

Several limitations concern data collection and interpretation. Concepts central to this research are difficult to translate from Lhukonzo, carrying meanings deeply embedded in non-western worldviews that may not have direct equivalents in English, risking that nuance was flattened. This is further compounded by my positionality as an outsider, which shaped access and interpretation: Trust is central to a valuation process (Zafra-Calvo et al., 2020), and power relations between me and participants may have led to withheld information. Finally, the design of interview questions itself may have influenced which values were expressed and to what extent (Pratson et al., 2023).

[5] Amadiume (1997) examines gendered realities in African institutions, arguing that matriarchy is fundamental to traditional African kinship ideals yet long overlooked and misinterpreted by many modern theorists. Nnaemeka's (2004) nego-feminism centres negotiation as feminist practice, arguing that African feminism must work *with* rather than against cultural values, rejecting western feminism's confrontational approaches.

8 Conclusion

Loss and damage from glacier retreat in the Rwenzoris extends far beyond the instrumental-hydrological, encompassing the erosion of sacred relationships, cultural identity, or TK that current frameworks are structurally ill-equipped to see, let alone address. Though transferability of such place-based findings is limited, informed by Islar et al.'s (2025) wider socio-glaciology framework, my findings can inform a holistic knowledge base of socio-glaciological change to inform L&D in glacier-near SES.

PV proved to be of high analytical value for capturing cascading losses and damages in their full diversity and overcoming the economic/non-economic dichotomy while accounting for crucial trade-offs among affected people. At local level, loss and damage was predominantly addressed through adaptation measures, struggling to meaningfully address vulnerabilities behind both relational and instrumental human-environment interactions. Transformative L&D governance should address socio-economic hardship through restorative justice mechanisms, while responding to cultural marginalization with greater recognition of place-based cultures through decolonial approaches, overcoming technocratic and western-rationalist interventions. L&D of glacier retreat must acknowledge multifactorial vulnerabilities rather than isolating it as a physical climate impact. However, local governance alone cannot address such structural challenges, underlining that L&D must overcome its ambiguous international-level focus and leverage its transformative potential at local level.

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10 Appendices

Appendix A – Local Authorities and Organizations Interview Guide

I: Introduction and informant's relation to Rwenzori mountains and glaciers

Q1: Please tell me a little bit about yourself and your institution.

What does your institution do, what role does it have in this area?

What position do you hold and what are your main responsibilities?

Age: Sex: Institution/Department:

Place of residence:

Q2: How familiar are you with the Rwenzori Mountains and their glaciers?

- Probing questions:
  - Have you ever visited and/or seen the glaciers yourself?
    - If yes, when and how many times?
  - How do you learn about changes related to the glacier? (e.g. own observations, stories, newspaper articles, etc.)
  - Are glacier-related changes discussed in your institution or department?

II: The effects of glacier retreat on the communities.

Climate change is causing glaciers to melt all over the world, which is affecting communities living in these mountain regions. I am interested in how these changes are understood and addressed from your professional perspective.

Q3: In what ways, if any, are the Rwenzori glaciers important for people and communities in this region?

Q4: In what ways are the glaciers useful for people to meet their everyday needs and to support their livelihoods?

How is glacier retreat affecting the people's everyday life and livelihood?

- Probing questions:
  - Which impacts are most recognized or discussed?
- Keywords:
  - Changes in water supply
  - Changes in work (e.g. agricultural practices, cattle farming etc.)

Q5: What does the glacier mean for people's way of life? How would you describe the relationship between local people and the Rwenzori glaciers?

Have these relationships or meanings changed as the glaciers have been retreating?

- Probing questions:
  - In what ways are these meanings considered in your work and discussed in your institution?
  - Do you think you/your organization have a responsibility towards the glaciers?
- Keywords:
  - Spiritual significance & sense of place
  - Emotional meaning & identity shaping

Some people say certain parts of nature are valuable simply because they exist. They have value independent of any human interests or activities.

Q6: Do you think the Rwenzori glaciers are considered valuable in themselves, for example for ecosystems or environmental balance?

How do you think are these values affected by glacier retreat?

- Probing questions:
  - How is glacier retreat discussed in relation to ecosystems and the broader environment in your institution/department?
- Keywords:
  - Wildlife (plants & animals)
  - Climate regulation (e.g. monsoons)
  - Landslides and environmental changes

III: Coping mechanisms and climate just responses to glacier retreat.

Q7: What responses or measures exist to address the impacts of glacier retreat and related changes in this region?

- Probing questions:
  - Do you think these responses are effective? Why or why not?
  - At what level are these responses implemented? (local, district, national)
  - Does your institution have the ability and resources to respond to these changes?
  - What makes it difficult to respond to these changes?

Q8: What additional measures would be needed to better address the effects of glacier retreat and support affected communities?

- Probing questions:
  - Who should play what role in addressing these effects?
- Keywords:
  - Offering alternative livelihoods
  - Preserving traditions and culture
  - Community actions

Q9: From your perspective, how would you describe the most just and fair responses to the effects from glacier retreat? Elaborate.

- Probing questions:
  - What is necessary to make the people in the region feel a sense of justice regarding the effects of glacier retreat?
  - Who should be responsible for addressing these impacts, and at which scale?
  - Who should be involved in shaping the responses?
- Keywords:
  - Local knowledge and experiences
  - Repair (Material and Non-material)

IV: Concluding questions

Q10: Do you have any additional information and observations you would like to add? (e.g. anything you would like to express that was not covered)

Q11: Is there anything else you think we should consider to better understand this topic, and are there other people you would recommend speaking to? If so, can we mention that you suggested contacting them?

Appendix B – Community Interview Guide

I: Introduction and informant's relation to Rwenzori mountains and glaciers

Q1: Please tell me a little bit about yourself.

Where do you live? What do you do for living? Can you tell me a little bit about your community, in what way are you engaged?

Age: Sex:

Place of residence & since when do you live here:

Place of origin:

Q2: How familiar are you with the Rwenzori Mountains and their glaciers?

- Probing questions:
  - Have you ever visited and/or seen the glaciers yourself?
    - If yes, when and how many times?
  - Do you think the glaciers are changing? If yes, how do you learn about these changes? (e.g. own observations, stories, newspaper articles, etc.)

II: Values tied to the glaciers and impacts on values from glacier retreat.

Climate change is causing glaciers to melt all over the world, which is affecting communities living in these mountain regions. I am interested in how you personally experience these changes (from glacier retreat), how they manifest in your daily life and how you cope with them.

Q3: In what ways, if any, are the Rwenzori glaciers important for you? Why?

Q4: In what ways, if any, are the glaciers useful to meet your everyday needs and to support your livelihood?

How is glacier retreat affecting these values of your everyday life?

- Probing questions:
  - In what ways do the glaciers support/hinder you to secure income, food, or other basic needs? How does glacier retreat affect this?
- Keywords:
  - Changes in water supply (Ecosystem services)
  - Changes in work (e.g. agricultural practices, cattle farming etc.)

Q5: What does the glaciers personally mean to you and your way of life? How would you describe your relationship with the Rwenzori glaciers?

Have these relationships/meanings changed as the glaciers have been retreating? How?

- Probing questions:
  - Can you tell me any stories about the glaciers?
  - How is the glacier connected to your traditions or cultural practices?
  - Do you feel responsible for the glaciers?
- Keywords:
  - Spiritual significance & sense of place
  - Emotional meaning & identity shaping

Some people say certain parts of nature are valuable simply because they exist. They have value independent of any human interests or activities.

Q6: Do you think the Rwenzori glaciers have value in themselves, for example as part of the Rwenzori ecosystems? Why do you think so?

How do you think are these values affected by glacier retreat?

- Probing questions:
    - How do you think is the ecosystem and environment affected by glacier retreat?
- Keywords:
    - Wildlife (plants & animals)
    - Climate regulation (e.g. monsoons)
    - Morality, right-to-exist

III: Coping mechanisms and climate just responses to glacier retreat.

Q7: What are you doing to cope with or respond to these changes?

- Probing questions:
    - Do you think these responses are effective? Why or why not?
    - Have you been offered any external help to respond to changes?
    - Do you have the ability and resources to respond to these changes?
    - What makes it difficult to respond to these changes?

Q8: What additional ways or support would help you to address the effects from glacier retreat?

- Probing questions:
    - What actions would help to preserve your way of life/ preserve for a better life?
- Keywords:
    - Offering alternative livelihoods
    - Preserving traditions and culture
    - Community actions

Q9: From your perspective, how would you describe the most just and fair responses to the effects from glacier retreat? Elaborate.

- Probing questions:
    - Do you think justice is achievable in this context?
    - Who do you think is responsible to follow up on these effects? (Ask on different scales)
    - Who should be involved in shaping the responses?
- Keywords:
    - Local knowledge and experiences
    - Repair (Material and Non-material)

IV: Concluding questions

Q10: Do you have any additional information and observations you would like to add? (e.g. anything you would like to express that was not covered)

Q11: Is there anything else you think we should consider to better understand this topic, and are there other people you would recommend speaking to? If so, can we mention that you suggested contacting them?

Appendix C – Focus Group Discussion Guide

I: Introduction: Sociodemographics and relation to Rwenzori mountains and glaciers.

Q1: Let's start with an introduction of ourselves. Please tell me a little bit about yourself.

Where do you live? What do you do for living?

Ask every participant for…

Age: Sex: Profession:

Place of residence & since when do you live here:

Place of origin:

Q2: What comes to your mind when you think about the Glaciers in the Rwenzori Mountains?

- Probing questions:
  - Have you ever visited and/or seen the glaciers yourself?
    - If yes, when and how many times?
  - Do you think the glaciers are changing? If yes, how do you learn about these changes? (e.g. own observations, stories, newspaper articles, etc.)

II: Values tied to the glaciers and impacts on values from glacier retreat.

Climate change is causing glaciers to melt all over the world, which is affecting communities living in these mountain regions. I am interested in how you personally experience these changes (from glacier retreat), how they manifest in your daily life and how you cope with them.

Q3: In what ways, if any, are the glaciers useful to meet your everyday needs and to support your livelihood?

How is glacier retreat affecting these values of your everyday life?

- Probing questions:
  - In what ways do the glaciers support/hinder you to secure income, food, or other basic needs? How does glacier retreat affect this?
- Keywords:
  - Changes in water supply (Ecosystem services)
  - Changes in work (e.g. agricultural practices, cattle farming etc.)

Q4: What does the glaciers personally mean to you and your way of life? How would you describe your relationship with the Rwenzori glaciers?

Have these relationships/meanings changed as the glaciers have been retreating? How?

- Probing questions:
  - Can you tell me any stories about the glaciers?
  - How is the glacier connected to your traditions or cultural practices?
  - Do you feel responsible for the glaciers?
- Keywords:
  - Spiritual significance
  - Emotional meaning

Some people say certain parts of nature are valuable simply because they exist. They have value independent of any human interests or activities.

Q5: Do you think the Rwenzori glaciers have value in themselves, for example as part of the Rwenzori ecosystems? Why do you think so? Elaborate

How do you think are these values affected by glacier retreat?

- Probing questions:
    - How do you think is the ecosystem and environment affected by glacier retreat?
- Keywords:
    - Wildlife (plants & animals)
    - Climate regulation (e.g. monsoons)
    - Morality, right-to-exist

III: Coping mechanisms and climate just responses to glacier retreat.

Q7: Is there anything you are currently doing to respond to changes by glacier retreat?

- Probing questions:
    - Do you think these responses are effective? Why or why not?
    - Have you been offered any external help to respond to changes?
    - Do you have the ability and resources to respond to these changes?
    - What makes it difficult to respond to these changes?

Q8: Do you think there are other ways or support that could help you to address the effects from glacier retreat? Elaborate

- Probing questions:
    - What actions would help to preserve your way of life, or even offer opportunities for a better way of life?
- Keywords:
    - Alternative livelihoods
    - Preserving traditions and culture
    - Community actions

Q9: How would you describe the most just and fair responses to the effects from glacier retreat? Elaborate.

- Probing questions:
    - What is the most important action?
    - Do you think justice is achievable in this context?
    - Who do you think is responsible to follow up on these effects? (Ask on different scales)
    - Who should be involved in shaping the responses?
- Keywords:
    - Local knowledge and experiences
    - Repair (Material and Non-material)

IV: Concluding questions.

Q10: Do you have any additional information and observations you would like to add? (e.g. anything you would like to express that was not covered)

Q11: Is there anything else you think we should consider to better understand this topic, and are there other people you would recommend speaking to? If so, can we mention that you suggested contacting them?

Appendix D – Coding Framework

Research question 1:

Topic	Theme/Code	Description
Instrumental Value	Agricultural livelihood & food production	Expressions where the glaciers of the Rwenzori Mountains are described as supporting agricultural production by contributing to a favorable cultivation environment, securing reliable seasons and being an indicator for growing seasons. This includes both subsistence food production and agriculture as a livelihood source.
Instrumental Value	Other human well-being & hydropower	Expressions that describe glaciers as necessary for human survival or essential living conditions without specifying a particular mechanism (e.g., water supply, agriculture, health). This category captures general statements that the loss of glaciers would threaten people's ability to live, sustain, or maintain basic living standards, with emphasis on hydropower generation as a dominant contribution.
Instrumental Value	Ecosystem regulation & hazard prevention	Expressions describing the role of glaciers in maintaining environmental stability in the Rwenzori Mountains with clear reference to preventing natural hazards (e.g., floods, landslides, drought) that threaten people, livelihoods, or infrastructure.
Instrumental Value	Favorable climate & good air	Expressions describing the role of glaciers in maintaining cool and healthy atmospheric conditions in the Rwenzori Mountains, such as references to good air, temperature regulation, a pleasant climate for living.
Instrumental Value	Human health	Expression referring to the role of glaciers in supporting and/or protecting human health through favorable environmental conditions (fresh air, climate), medicinal water, or plants sustained by glacier ecosystems, and the prevention of disease, as well as health impacts resulting from glacier loss and its related environmental changes.
Instrumental Value	Socio-economic development, income & other livelihoods	Expressions describing the glaciers as supporting income generation, economic opportunities, and broader socio-economic development, focusing on monetary benefits. This includes livelihoods directly or indirectly linked to the mountain system (e.g., guiding for tourists, agriculture-based income, or development opportunities).
Instrumental Value	Water provision and hydrological regulation	Expressions describing the glaciers as a source and regulator of water, emphasizing their role in supplying and sustaining water for agriculture (particularly through rain formation and source of irrigation), domestic use, as well as general references of downstream water availability. This also includes expressions of their hydrological importance beyond Uganda.
Intrinsic Value	Climate regulation & 'rainmaker'	Expressions where the glaciers are understood as active environmental entities that regulate weather systems, especially rainfall, temperature, and local microclimates, including beliefs that glaciers attract, generate, sustain, or control rain and climate stability. It captures both biophysical explanations (microclimate, evaporation, condensation

		cycles) and local ecological knowledge and beliefs (rainmaker, cloud attraction, climate control) that link glacier presence directly to rainfall patterns and climatic balance.
Intrinsic Value	Ecosystem integrity	Expressions where the glaciers are understood as key parts of a connected ecological system, where glaciers, forests, water bodies, soils, climate, and biodiversity are perceived as an interdependent whole that must remain intact to sustain ecological balance. Glacier loss leads to cascading failures across the mentioned ecological components.
Intrinsic Value	Non-human beings	Expression of the glaciers as critical ecological foundations for the survival, habitat, and well-being of animals, plants, fish, insects, and other non-human organisms, which are directly dependent on glacier-linked environmental conditions.
Intrinsic Value	Moral value	Expressions that attribute an inherent moral right for the glacier to exist and be protected.
Relational Value	Aesthetic	Expressions where the glaciers of the Rwenzori Mountains are experienced through visual appreciation, including perceptions of beauty, brightness, visual presence, and wonder, where the glaciers are valued for its appearance in the landscape or its contribution to scenic beauty.
Relational Value	Care	Expressions of emotional concern, attentiveness, and affective attachment toward the glaciers and the surrounding community, where speakers convey feelings of worry, empathy, appreciation, or emotional responsiveness to their condition or change. It captures how people feel about the glacier and its wellbeing.
Relational Value	Collective Identity & Community	Expressions in which the glaciers are constructed as a core marker of group identity, origin, and collective self-definition of the Bakonzo/Bayira, where the communities are named after, defined through, or symbolically constituted by the glacier, including beliefs that their existence, naming, or cultural continuity is inseparable from the Nzururu.
Relational Value	Culture	Shared social norms, practices, meanings, and institutional structures through which the Bakonzo/Bayira relate to the glaciers as an integral part of everyday life. It includes culturally embedded rules and guidelines governing appropriate behaviour toward the mountain environment, collective understandings of the Bayira/Bakonzo as the primary community associated with the landscape, and the perceived connection between the people and the glacier as part of their lived social world.
Relational Value	Family and Friendships	Expressions where the glaciers of the Rwenzori Mountains are embedded in kinship relations, ancestral lineage, intergenerational transmission, and close interpersonal bonds, where family ties (parents, grandparents, ancestors) or friendship networks emerge from the glaciers or shape how people relate to them.
Relational Value	Individual Identity	Expressions where individuals define themselves in relation to the glaciers, including when the glaciers is described as part of the self or when personal roles (e.g., guide, ritual/spiritual practitioner) are shaped by direct engagement with it.
Relational Value	Knowledge	Expressions of traditional, locally embedded ways of understanding and using the glaciers – knowledge passed through elders and historical experience, and expressed in practices such as seasonal prediction, environmental interpretation, ritual responses to calamities, and herbal or medicinal uses of glacier-supported ecosystems.

Relational Value	Responsibility	Expressions of moral duty, obligation, or accountability toward the glaciers, where speakers explicitly state or imply that they should, must, or are expected to protect, respect, or preserve the glaciers and associated environment.
Relational Value	Sacredness & Religion	Expressions that frame the glaciers as spiritually significant, divinely governed, or inhabited by supernatural beings. The mountain environment is understood as sacred space linked to God(s), spirits, or ancestors, and where human–glacier interactions are mediated through worship, rituals, taboos, or beliefs in spiritual agency.
Relational Value	Sense of Place	Expressions of deep emotional, spatial, and existential attachment to the glacier and mountain landscape, where people feel they belong to, originate from, or are inseparable from the place, often describing them as part of home, motherland, or a landscape they must see, return to, or live with in daily life.
Relational Value	Social cohesion	Expressions showing that the glaciers contribute to strengthen unity, solidarity, and cooperation within the community, reinforcing shared belonging, mutual support, and collective social ties among the Bakonzo/Bayira people.
Relational Value	Stewardship	Expressions of active custodianship, or protecting/managing the glaciers, focusing on practical responsibility-in-action, often framed through beneficiary relationships.
Relational Value	Tradition	Expressions of long-standing practices and customs related to the glaciers that are passed down across generations and maintained as part of Bakonzo/Bayira life. These include inherited rituals performed to fight calamaties, or general practices that people continue because they were established by ancestors.

Research question 2:

Theme	**Codes**
Cultural Agency	Preserve Culture
Cultural Agency	Strentghening the role of Rwenzururu kingdom
Cultural Agency	Use Culture for Environmental Conservation
Cultural Agency	Use Culture to fight Calamties
Ecosystem Restoration & Environmental Stewardship	Conservation & stopping environmental degradation
Ecosystem Restoration & Environmental Stewardship	Restoring Nature
Ecosystem Restoration & Environmental Stewardship	Tree Planting to Cope & Adapt
Ecosystem Restoration & Environmental Stewardship	Tree Planting to Preserve & Restore Glacier
Institutional & Policy Responses	Disaster Risk Management & Policy
Institutional & Policy Responses	Environment & CC Policy

Institutional & Policy Responses	External Technical Support
Institutional & Policy Responses	Government Agency & Law Enforcement
Knowledge & Capacity Building	Research & Development
Knowledge & Capacity Building	Sensitization & Mindset Change
Knowledge & Capacity Building	Social Learning & TK
Knowledge & Capacity Building	Training & Formal Education
Livelihood & Local Adaptation Strategies	Alternative Agriculture & Crops
Livelihood & Local Adaptation Strategies	Alternative Electiricty & WASH
Livelihood & Local Adaptation Strategies	Alternative Livelihoods
Livelihood & Local Adaptation Strategies	Alternative Tourism
Livelihood & Local Adaptation Strategies	Use TK

Research question 3:

Topic	Theme	Definition/Description
Justice	Compensatory Justice	Backward-looking approach, those responsible for losses and damages compensate those harmed with the aim of making affected people ‚whole again', often operationalised through polluter-pays-principle.
Justice	Distributive Justice	Forward-looking approach aimed at fair distribution of burdens and resources related to environmental change and climate impacts, shared responsibilties often operationalized through ability-to-pay principle.
Justice	Recogniiton Justice	Acknowledgment and respect of different identities, knowledge systems, cultures, and experiences.
Justice	Procedural Justice	Fairness and inclusiveness of decision-making processes, including participation, transparency, and accountability.
Drivers of Vulnerability	Socio-economic hardship & demographic pressure	Vulnerabilities arising from poverty, limited education, and rapid population growth that intensify dependence on natural resources for livelihoods, leading to environmental degradation and reduced capacity to cope with long-term environmental change.
Drivers of Vulnerability	Capitalist-colonial legacy	Structural vulnerabilities rooted in colonial and capitalist systems that reorganized land ownership, governance, and resource extraction in ways that marginalized local communities, enabled external exploitation of resources, and produced enduring socio-economic inequalities, environmental degradation, and cultural disruption.

Drivers of Vulnerability	Cultural marginalisation & eorsion of TKS	Processes through which Indigenous cultural practices, spiritual beliefs, and traditional knowledge systems are marginalized, restricted, or devalued by (post-) colonial policies, religious influence, modernization, and generational change, weakening cultural institutions and reducing communities' ability to maintain and transmit place-based knowledge.

Appendix E – Participant Information

ID	Sample	Gender	Age group	Primary Occupation	Place of Residence	Geographical ID	Affiliation/Institution
FGD1-P1	NG	Male	60-69	Business	Kasese City	Urban	none
FGD1-P2	NG	Male	60-69	Farmer	Kasese City	Urban	OBR
FGD1-P3	NG	Male	50-59	Farmer	Kasese City	Urban	OBR
FGD2-P1	NG	Male	50-59	Mountain Guide	Ibanda Valley	Rural	none
FGD2-P2	NG	Male	40-49	Mountain Guide	Ibanda Valley	Rural	none
FGD2-P3	NG	Male	40-49	Mountain Guide	Ibanda Valley	Rural	none
FGD2-P4	NG	Male	50-59	Mountain Guide	Ibanda Valley	Rural	none
FGD2-P5	NG	Male	30-39	Mountain Guide	Ibanda Valley	Rural	none
FGD2-P6	NG	Male	30-39	Mountain Guide	Ibanda Valley	Rural	none
FGD2-P7	NG	Male	70-79	Mountain Guide	Ibanda Valley	Rural	none
FGD2-P8	NG	Male	40-49	Mountain Guide	Ibanda Valley	Rural	none
FGD2-P9	NG	Male	30-39	Mountain Guide	Ibanda Valley	Rural	none
FGD3-P1	NG	Female	50-59	Farmer	Ibanda Valley	Rural	none
FGD3-P2	NG	Female	70-79	Farmer	Ibanda Valley	Rural	none
FGD3-P3	NG	Female	18-29	Student	Ibanda Valley	Rural	none
FGD3-P4	NG	Female	18-29	Farmer	Ibanda Valley	Rural	none
FGD3-P5	NG	Male	18-29	Student	Ibanda Valley	Rural	none
FGD3-P6	NG	Female	40-49	Farmer	Ibanda Valley	Rural	none
FGD4-P1	NG	Male	18-29	Farmer	Ibanda Valley	Rural	none
FGD4-P2	NG	Male	40-49	Farmer	Ibanda Valley	Rural	none
FGD4-P3	NG	Male	40-49	Farmer	Ibanda Valley	Rural	none
FGD4-P4	NG	Male	18-29	Farmer	Ibanda Valley	Rural	none

FGD4-P5	NG	Male	50-59	Farmer	Ibanda Valley	Rural	none
FGD4-P6	NG	Female	30-39	Farmer	Ibanda Valley	Rural	none
FGD4-P7	NG	Female	30-39	Farmer	Ibanda Valley	Rural	none
FGD4-P8	NG	Female	18-29	Farmer	Ibanda Valley	Rural	none
FGD4-P9	NG	Female	18-29	Farmer	Ibanda Valley	Rural	none
FGD4-P10	NG	Male	18-29	Farmer	Ibanda Valley	Rural	none
FGD5-P1	NG	Male	50-59	Farmer	Kasese City	Urban	none
FGD5-P2	NG	Female	40-49	Farmer	Kasese City	Urban	none
FGD5-P3	NG	Female	40-49	Market Vendor	Kasese City	Urban	none
FGD5-P4	NG	Male	30-39	Farmer	Kasese City	Urban	none
FGD5-P5	NG	Male	50-59	Farmer	Kasese City	Urban	none
FGD6-P1	NG	Male	40-49	Mountain Guide	Kilembe Valley	Rural	none
FGD6-P2	NG	Male	40-49	Farmer	Kilembe Valley	Rural	none
FGD6-P3	NG	Male	40-49	Mountain Guide	Kilembe Valley	Rural	none
FGD6-P4	NG	Male	60-69	Farmer	Kilembe Valley	Rural	none
FGD7-P1	NG	Female	30-39	Market Vendor	Kilembe Valley	Rural	none
FGD7-P2	NG	Female	30-39	Market Vendor	Kilembe Valley	Rural	none
FGD7-P3	NG	Female	18-29	Market Vendor	Kilembe Valley	Rural	none
FGD7-P4	NG	Female	50-59	Market Vendor	Kilembe Valley	Rural	none
FGD7-P5	NG	Female	18-29	Student	Kilembe Valley	Rural	none
FGD8-P1	NG	Female	18-29	Handicraft maker	Kasese City	Urban	none
FGD8-P2	NG	Female	30-39	Market vendor	Kasese City	Urban	none
FGD8-P3	NG	Female	40-49	Market vendor	Kasese City	Urban	none
FGD8-P4	NG	Female	18-29	Handicraft maker	Kasese City	Urban	none
IV1-P1	NG	Female	40-49	Administration	Kasese City	Urban	none

IV2-P1	G	Male	30-39	NGO representative	Kasese City	Urban	Centre for Citizens Conserving Environment and Managemnt (CCCEM)
IV3-P1	G	Male	50-59	Forestry Officer	Kasese City	Urban	Kasese District Local Government
IV4-P1	NG	Male	50-59	Caretaker Heritage Site	Kasese City	Urban	none
IV5-P1	G	Female	40-49	OBR representative	Kasese City	Urban	OBR Ministry of Tourism
IV6-P1	G	Female	18-29	NGO representative	Kasese City	Urban	Youth Action for Culture and Environmental Conservation
IV7-P1	NG	Male	60-69	College Director	Kasese City	Urban	none
IV8-P1	G	Male	50-59	King of Busongora Kingdom	Kasese City	Urban	Busongora Kingdom
IV9-P1	NG	Male	50-59	Carpenter	Kilembe Valley	Rural	none
IV10-P1	G	Male	50-59	Community Worker	Kilembe Valley	Rural	none
IV11-P1	G	Male	50-59	OBR representative	Kasese City	Urban	OBR Ministry of Culture
IV12-P1	G	Female	40-49	Tourism Officer	Kasese City	Urban	Kasese District Local Government
IV13-P1	G	Male	50-59	Agriculture Officer	Kasese City	Urban	Kasese District Local Government
IV14-P1	G	Male	50-59	Environmental Officer	Kasese City	Urban	Kasese District Local Government

Appendix F – Consent Form

Interview and Focus Group Discussion Consent Form

Information about participation in Master's thesis research from Julian Baum, Lund University, Master in Environmental Studies and Sustainability Science (LUMES).

Introduction to the research

My name is Julian Baum, I am master's student at the Lund University Centre for Sustainability Science (LUCSUS), Sweden. For my thesis, I am researching what values local communities ascribe to the glaciers' of the Rwenzori Mountains, and how these values are affected by glacier retreat. I am interested in learning how local communities are currently dealing with changes related to shrinking glaciers and how they would like to address changes in the future.

I would like to invite you to participate in an interview/focus group discussion and share your experience on this topic. Because you live in the Rwenzori Region and due to your local knowledge, your insights as a participant are deemed of high relevance for the research.

Who is responsible for the research?

I am conducting this research independently for my master thesis. The Cross-Cultural Foundation of Uganda (CCFU) is supporting me with practical issues on site. The results will be shared with CCFU in an appropriate format.

Participation is voluntary

Participation in this project is entirely voluntary. You may choose not to participate or to withdraw your consent at any time, during or after the interview, without giving a reason and without any negative consequences. You are also free to skip any questions you do not wish to answer. If you withdraw, all information relating to you will then not be used.

Data usage and storage

1. **All information will be anonymized, your name and other identifying information will be removed during transcription and analysis.** Data will be processed confidentially and in accordance with data protection legislation (General Data Protection Regulation and Personal Data Act). Only the researcher and academic supervisors will have access to the data. The data will not be shared with third parties.
2. **Interviews and focus group discussions will be audio-recorded**. Audio recordings will be stored securely and locally on my hardware. Recordings will be deleted once analysis is completed. Anonymized transcripts may be stored securely for a limited period after the completion of the project in case of academic publication or examination requirements.
3. The data collected will be used **solely for academic purposes** in the form of a written Master's thesis at Lund University. The thesis will be published electronically through the Lund University Library (https://lup.lub.lu.se/student-papers/search/). Anonymized excerpts from interviews/focus group discussions may be quoted in the thesis.

4. If you participate as a representative of a public/private institution, your organisation may be mentioned by name only with your consent. Your personal identity and affiliation will remain confidential.
5. A summary of the research findings can be made available to participants.

Your rights

For as long as you can be identified in the collected data, you have the right to:

- access the personal data collected about you,
- request correction of inaccurate personal data,
- request deletion of your personal data,
- request that your data be excluded from the study

Consent form

I confirm that I have read and understood the information provided about this master's thesis research on community experiences of glacier retreat. I have been given the opportunity to ask questions and have received satisfactory answers. I give consent:

☐ to participate in this interview/focus group discussion, including being recorded.

☐ to the use of anonymized quotations from my responses in the thesis.

☐ to the use of my personal data as described in this document.

If applicable, I give consent

☐ to the mention of my organisation's name.

If you have any questions, please don't hesitate to contact me directly:

Julian Baum: julian.baum00@gmx.de

THANK YOU!

Place and Date

Participant's signature and name

Researcher: Julian Baum