Stakeholder preferences for ecosystem services provided by wetlands in Eswatini

by

Linda Siphiwo Mahlalela

Submitted in partial fulfilment of the requirements for the degree of
Doctor of Philosophy (Environmental Economics)

in the

Department of Agricultural Economics, Extension and Rural Development
Faculty of Natural and Agricultural Sciences
University of Pretoria
South Africa

January 2024

Dedication

I dedicate this thesis to my mother, Celiwe ‘Cece’ Mahlalela, who is now with the Lord, for teaching me the principles and core values of life, rooting, building, and strengthening me in the faith. To my wife, Sithabile Nombulelo ‘Peace’ Mathunjwa, for the unending support and love and for walking with me side by side.

Declaration of originality

I declare that this thesis I submit for the degree of Ph.D. Environmental Economics at the University of Pretoria is my work and I have not previously submitted it for a degree at this or any other institution of higher learning.

The fourth chapter of this thesis has been published in a journal (Ecological Economics) and I take responsibility for any omissions or inaccuracies.

Signature .....
Linda Siphiwo Mahlalela
Date .....

Approved by:
Signature .....
Prof. Eric Dada Mungatana
Date .....

Approved by:
Signature .....
Prof. Damien Jourdain
Date .....

Approved by:
Signature .....
Prof. Thomas Hedemark Lundhede
Date .....

Acknowledgements

Firstly, I thank the Lord God Almighty, our gracious Father, for the gift of life, the Lord Jesus Christ for His Grace that has always been sufficient for me, and the Holy Spirit for His fellowship.

My profound gratitude goes out to my supervisors, Prof. Eric Mungatana, Prof. Damien Jourdain, and Prof. Thomas Lundhede, for their scholarly direction, advice, and support, all of which significantly raised the calibre of the thesis. I thank the Bill and Melinda Gates Foundation for covering the cost of my Ph.D. tuition for the first three years of my studies. I thank Prof. Johan Kirsten for the support. I must thank Prof Sherly Hendriks and Prof. Edilegnaw Wale Zegeye for supporting me and making it possible to complete my studies. I also thank Dr. Selma Karuaihe for the encouragement, advice, and support. In addition, I extend my thanks to Yvonne Samuels, Rose Ngwenya and Daleen Fouche for their unlimited support.

A special thanks to Eswatini National Trust Commission, particularly Mr. Sandile Gumedze, for the exceptional support. I also extend my thanks to all the participants who spent the time filling out the survey questionnaires. I am indebted to Sithabile Mathunjwa, Mcebo Nxumalo, Lungile Mahlalela, Bafana Vilakati, Londiwe Shabalala, Lungelo Mahlalela, Autarky Shiba, Londiwe Mahlalela, Vumile Masuku, and Muzi Mkhonta for assisting with data collection. I also appreciate the assistance with transport and accommodation we received from various local residents.

I thank Rev. Simon Mathunjwa, Ps. Thandiwe Mathunjwa, Prof. (Ps.) Mandla Msibi, Ps. Nonhlanhla Msibi, and Ps. Mbuso Mbukwane for the spiritual support and thanks to Prof Gregory Hicks (late), Dr. Manfred Molomo and Melodie Wheeler for the emotional support.

Most importantly, I thank my wife, Nombulelo Mathunjwa, and our wonderful children, Tephillah Mahlalela, Gracie Mahlalela and Simelokuhle Mahlalela for their understanding, patience, and love. I also thank my two sisters, brother, and father, who have always been there for me.

Stakeholder preferences for ecosystem services provided by wetlands in Eswatini

By

Linda Siphiwo Mahlalela

Degree: PhD Environmental Economics
Supervisor: Prof. E.D. Mungatana
Supervisor: Prof. D. Jourdain
Supervisor: Prof. T.H. Lundhede
Department: Agricultural Economics, Extension and Rural Development

Abstract

Wetlands sustainability and their capacity to provide ecosystem services is threatened by increasing land pressure and climate change effects. Wetlands are also complex ecosystems that present several challenges to public agencies charged with their sustainable use and management. This thesis explores three aspects of wetlands management that are relatively less explored in the environmental economics literature.

First, there is little empirical evidence on the associations between wetland interventions, ecosystem services, and threats to wetlands. The first essay systematically reviewed literature to assess the potential associations between wetland interventions, ecosystem services, and threats to wetlands.

Second, research on the economic valuation of environmental goods and services has paid less attention to their cultural services relative to provisioning, regulating, and supporting services, yet the former are important for cultural continuity. The second essay addresses this gap and is an attempt to measure the economic value of cultural services.

Third, a major constraint to sustainable wetlands management is that users and public decision-makers often have different perceptions about how they function and often disagree on the relative importance of their different ecosystem services. The different perceptions and disagreements have led to wetland management issues being identified as “wicked problems”,

i.e., intractable problems embedded in complex systems, difficult to define, and without clear solutions. “Wicked problems” are evident in the lack of consensus among stakeholders on the definition and solutions to wetland management challenges. Complex wetland management challenges are often created by the variety of stakeholders with conflicting interests. Conflicts often arise from the different perceptions on the relative importance of ecosystem services and disagreements. The wetland management challenges are evident in disputes between public authorities and households as well as between public authorities themselves. Following the wicked problems literature, stakeholder involvement is imperative in designing long-term solutions to wetland management challenges and a better understanding of the different stakeholder perspectives should contribute to reducing ecosystem management’s wickedness. The main objective of the third essay was to identify the different worldviews[1] about the ecosystem services provided by a wetland.

The first essay reports on the systematic review of studies in southern Africa and the potential associations between wetland interventions, ecosystem services, and threats to wetlands. Three main wetland interventions were identified i.e., wetland management, wetland rehabilitation, and wetland restoration. Interventions such as wetland policies, wetland preservation, and wetland conservation were reported in combination with the three main interventions. Cultural services were one of the least reported ecosystem services (n = 3, 8%). The results show that wetland degradation is mostly caused by population growth, which leads to an increase in agriculture and the construction of infrastructure to accommodate the rising demands of people for shelter, food, and water. Wetland management interventions were associated with threats such as invasive alien plants, grazing, canalisation, unregulated wetland use, and urban developments. Likewise, wetland rehabilitation interventions were associated with grazing and canalisation while wetland restoration was only associated with invasive alien plants. Moreover, wetland management and wetland rehabilitation interventions were associated with wetland agriculture and fibre (reeds and sedge) production.

The second essay reports on a discrete choice experiment that was designed to elicit preferences for cultural services using the special case of reed dance and wetlands in Eswatini. The reed dance is traditional ceremony where young maidens honour the Queen Mother by cutting reeds

[1] In this thesis, the term ‘worldviews’ refers to perspectives, viewpoints, or views consistent with the terminology used in multidisciplinary research using Q methodology. The term is used interchangeably.

from wetlands which are then presented to her and eventually used for repairing the windbreaks around the royal residence, in Eswatini. Three split samples were used with respective payment vehicle types, i.e., household tax, contribution, and reduced subsidy. The results suggested that respondents had positive attitudes and perceptions towards wetland management. Surprisingly however, the price attribute had a positive sign indicating that respondents experienced positive utility from paying higher taxes. Several explanations could lead to this theoretically inconsistent result. First, cultural services may not be as important for stakeholders as conceptualised in the research. Second, stakeholders may have experienced difficulties trading-off cultural services with price (incommensurability), as confirmed by attribute non-attendance on the price attribute. Finally, while best-practice non-market valuation surveys are designed to be incentive compatible, asking respondents about a cultural experience with delicate links to a political system might have prevented them from truthfully revealing their preferences. Results on knowledge about the reed dance and wetland management suggested that the respondents were familiar with the reed dance.

The third essay used a semi-qualitative approach, the Q methodology to investigate how stakeholders rank ecosystem services provided by Hawane Dam and Nature Reserve. The Q methodology did not require respondents to make trade-offs between services and price but allowed them to rank the importance of different ecosystem services in a transparent and systematic way. We chose the Q methodology among other potential qualitative approaches. Results suggested three contrasting views which were labelled: “water users”, “conservationists”, and “the traditional users”. Stakeholders uniformly recognised two regulatory functions as important: water purification and water flows regulation. The results imply that the consensus views can initiate discussions among stakeholders on ecosystem services to be prioritised and given visibility when designing strategies in incentivising behavioural change. The distinct views could help initiate and facilitate further fruitful discussions, commitment, and future collaborations across stakeholders. Overall, stakeholders ranked cultural services lower relative to other ecosystem services categories suggesting that the Q methodology should have logically come before essay 2 which attempted to elicit preferences for cultural services.

Both essays 1 and 3 focused on all ecosystem services while essay 2 was dedicated to cultural services. However, essay 1 broadly assessed ecosystem services in southern Africa while essay 3 focused on ecosystem services in Eswatini and essay 2 focused on preferences for cultural

services in Eswatini. In both essay 1 and 3, cultural services were the least reported and ranked relatively lower than other ecosystem services, respectively. The study contributes to reducing the "wickedness" of wetland management challenges and generally to conservation management i.e., it identifies three main viewpoints and consensus views which help initiate discussions. However, the power dynamics should be uncovered and managed for mutually beneficial discussions to take place, especially for local communities with no power to influence decision outcomes. Overall, our results underline the importance of understanding how individuals look at and understand the services being valued and suggest the use of Q methodology as a possible means to prepare a choice experiment. Stakeholder engagements and local community participation are key in both incentives and regulatory legislation discussions to encourage sustainable management of wetlands without adversely affecting local livelihoods.

Keywords: Discrete choice experiments, ecosystem services, payment vehicle, Q-methodology, wetland interventions, wetland degradation, sustainable wetland management

Table of contents

List of tables

List of figures

List of acronyms and abbreviations

ANA	Attribute Non-Attendance
ANOVA	Analysis of Variance
ASC	Alternative Specific Constant
CES	Cultural Ecosystem Services
CL	Conditional Logit Model
DCE	Discrete Choice Experiment
EBA	Elimination By Aspects
ENTC	Eswatini National Trust Commission
ESS	Ecosystem Services
HDNR	Hawane Dam and Nature Reserve
IIA	Independence of Irrelevant Alternatives
LC	Latent Class Model
MA	Millennium Ecosystem Assessment
ML	Mixed Logit Model
MNL	Multinomial Logit Model
NGO	Non Governmental Organisation
PCA	Principal Component Analysis
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
RPL	Random Parameters Model
RUM	Random Utility Maximisation
SZL	Swazi Lilangeni
TEEB	The Economics of Ecosystems and Biodiversity
UNESCO	United Nations Educational, Scientific and Cultural Organization
WTP	Willingness to Pay

Chapter 1: General introduction

1.1. Background

Multiple stakeholders' conflicting demands and interests on wetland ecosystem services (ESS) hampers sustainable wetland management. Stakeholders depend on wetlands for multiple economic, ecological, cultural, and social benefits, which often leads to competition among several stakeholders for limited ESS, i.e., ecosystems' intangible and tangible benefits, generally classified into cultural and recreational, regulatory and maintenance, and provisioning services (Haines-Young & Potschin, 2010; Millennium Ecosystem Assessment, 2005). A stakeholder refers to an individual or group of individuals who benefits directly or indirectly from a wetland including those involved or have an interest in the management of the wetland. The diversity of stakeholders with conflicting interests creates management issues that defining and resolving is difficult and may even lead to disputes between public authorities and wetland users and even between public authorities. These complex management challenges are often referred to as "wicked problems" (Rittel & Webber, 1973). Another layer of complexity is that the stakeholders usually prioritize tangible ESS, i.e., water, food, and fiber, among others, while often ignoring the intangible benefits like cultural and recreational services. Research has focused mainly on provisioning services and recently on regulating and maintenance services compared to cultural services (Hirons, Comberti & Dunford, 2016).

Cultural services often arise from human-nature interactions as ecosystems contributions (flows or benefits) to human well-being, i.e., capabilities and experiences (Chan, Guerry, Balvanera, Klain, Satterfield, Basurto, Bostrom, Chuenpagdee, Gould, Halpern, Hannahs, Levine, Norton, Ruckelshaus, Russel, Tam & Woodside, 2012a). The interaction of humans with ecosystems co-produces cultural services (Onofri & Boatto, 2020). The MA (2005) defines cultural services as the nonmaterial or intangible benefits people obtain from ecosystems through aesthetic experiences, spiritual enrichment, recreation, reflection, and cognitive development. Compared to other ESS, cultural services are challenging to measure. Apart from being non-market goods with no established market to trade, cultural services have other challenges, such as intangibility and being intertwined with other ESS, among other factors, making them even more challenging to measure (Costanza, D'arge, Groot, Farber, Grasso, Hannon, Limburg, Naeem, O'neill, Paruelo, Raskin, Sutton & Belt, 1997). The process of eliciting preferences and assigning monetary values to non-market goods such as cultural services, founded in the welfare

economics theory, is referred to as economic valuation. The information from economic valuation is useful to stakeholders such as policymakers, among others, in conservation management, planning, decision-making, and policy frameworks. For example, wetland degradation has threatened the continuation of the reed dance in Eswatini which warrants an economic valuation of cultural services. The reed dance is a traditional ceremony where young maidens honour the Queen Mother by cutting and presenting reeds to her and repair the windbreak around the royal residence. Wetlands produce reeds while the young maidens' interaction with the wetlands coproduces the reed dance. The Ramsar Convention on Wetlands defines wetlands as areas of peatland, marsh, water, or fen, whether temporary or permanent, artificial or natural, with water that is flowing or static, fresh, salt, or brackish which includes areas of marine water with low tide depths below six metres (Matthews, 1993; Ramsar, 1971). If the neglect of wetlands continues unabated the production of cultural services will continue to decline posing a threat to cultural continuity.

Discrete choice experiments (DCEs), rooted in random utility theory (McFadden, 1974) and new consumer theory (Lancaster, 1966), have been considered the most appropriate method for eliciting preferences for non-market attribute-based goods like cultural services. Previous studies have used DCEs in the valuation of landscape aesthetics (Baumgart, 2005; Hasund, Kataria & Lagerkvist, 2011; Hatan, Fleischer & Tchetchik, 2021; Huber, Hunziker & Lehmann, 2011; Rewitzer, Huber, Grêt-Regamey & Barkmann, 2017), bequest values (Oleson, Barnes, Brander, Oliver, Beek, Zafindrasilivonona & Beukering, 2015), heritage values and identity (Tengberg, Fredholm, Eliasson, Knez, Saltzman & Wetterberg, 2012), ecotourism, and recreation (Jobstvogt, Watson & Kenter, 2014). However, the existing literature is limited to landscape aesthetics, ecotourism, and recreation aspects of cultural services with a geographical bias toward Europe and America (McElwee, He & Hsu, 2022). In Africa, some studies focused on wildlife conservation (Ntuli, Muchapondwa & Okumu, 2020) and urban parks recreation (Tibesigwa, Ntuli & Lokina, 2020). In addition, there is a dearth of research on the economic valuation of cultural services in developing countries, generally in Africa and specifically in southern Africa, where the socio-political context, perceptions, and beliefs are different from those in the global North (Rosenberger, Peterson, Clarke & Brown, 2003; Tilliger, Rodríguez-Labajos, Bustamante & Settele, 2015).

The lack of specific wetland policies and their implementation exacerbates wetland management challenges i.e., a Draft National Wetlands Policy was only made recently, in 2020

while uncoordinated policies from other sectors were applied to wetlands use and management in Eswatini such as Environmental Management Act of 2002, Natural Resources Regulations of 1951, Water Act of 2003, and the Wild Bird Protection Act of 1914 (see Masarirambi, Manyatsi & Mhazo, 2010). Despite cultural services not been explicitly mentioned in the wetlands policy, the Swaziland National Arts and Culture Policy of 2016 emphasises the importance of cultural continuity and environmental protection. However, there are relatively few studies on the valuation of cultural services in the environmental economics literature.

Individuals do not always make trade-offs between ESS and money, i.e., economic valuation but preferences can also be obtained through ranking ESS without the price attribute. Other semi-qualitative approaches help to unravel different stakeholder preferences between ESS, such as the Q methodology, among others. The Q methodology is considered to be transparent and appropriate for assessing stakeholder preferences (perceptions) between ESS, i.e., trade-offs between different ESS (Sy, Rey-Valette, Simier, Pasqualini, Figuières & De Wit, 2018). Perceptions are known to influence and impact wetland use patterns and policies (Vélez, García & Tenorio, 2018). Unsustainable wetland use patterns are one of the leading causes of wetland degradation and ESS loss. Understanding the main perspectives and consensus views can help initiate fruitful discussions among stakeholders including discussions on the (re-)formulations of wetland policies. The multiplicity of stakeholders with different perceptions, interests, and power relations at various levels of decision-making warrants an investigation on the full suite of ESS.

1.2. Statement of the problem

Eswatini's wetland ecosystem stocks continue to deteriorate, posing a threat to the production of associated cultural services (GOS-SEA, 2016). Wetland management challenges range from poor public participation to lack of institutional coordination, in addition to policy or programme intervention failures and poor tenure systems (Manyatsi & Singwane, 2019; Masarirambi, Manyatsi & Mhazo, 2010). Unsustainable wetland use patterns are evident and manifest in the conversion of wetlands into human settlements and agricultural fields, generally peculiar to adjacent stakeholders (Ramsar, 2016). For example, the number of human settlements has been increasing adjacent to the Hawane Dam and Nature Reserve (HDNR) over the past 20 years (Ramsar, 2016). Over-exploitation of wetlands resources is common, especially in communal areas (Ramsar National Working Group, 2015), while fertilizer use in

adjacent cultivated areas continues unabated (Chonguiça & Brett, 2003; Ramsar, 2016). This warrants an investigation of the potential associations between wetland interventions, ecosystem services, and threats to wetlands at a broader scale i.e., southern Africa.

Previous literature has been limited to valuing other ESS, while few studies have valued cultural services but focused on landscape aesthetics, recreation, and ecotourism (e.g., see Baumgart, 2005; Hasund *et al.*, 2011; Hatan *et al.*, 2021; Huber *et al.*, 2011; Jobstvogt *et al.*, 2014; Oleson *et al.*, 2015; Rewitzer *et al.*, 2017; Tengberg *et al.*, 2012). Evidence of the preferences and value of cultural services is often needed by policymakers to inform public budget allocations, conservation of wetlands, preservation of culture, and policy formulations. This study attempted to address this gap by valuing cultural services beyond landscape aesthetics, recreation and ecotourism in a unique socio-political context using the case of the reed dance (locally known as *Umhlanga*). The degradation of wetlands threatens the continuation of ceremonial and traditional events such as the reed dance, which calls for the elicitation of public preferences for cultural services. Empirical evidence of public preferences for cultural services and related willingness to pay is necessary for requesting public funding in conservation management.

Literature suggests that payment vehicles must be incentive compatible. Incentive compatibility can be defined as the process in which it is in the best interest for respondents to answer questions truthfully (Carson and Groves, 2007; Mariel, Hoyos, Meyerhoff, Czajkowski, Dekker, Glenk, Jacobsen, Liebe, Olsen, Sagebiel & Thiene, 2021). Central to stated preferences and payment vehicles is the issue of incentive compatibility. Payment vehicles vary in coerciveness and population coverage i.e., donations or contributions are less coercive than income taxes. Some scholars argue that incentive compatibility depends on the choice of payment vehicle, i.e., household tax, contributions, and subsidy reductions (Hassan, Olsen & Thorsen, 2017). The current literature points to both directions, with some evidence showing effects on welfare estimates (e.g., see Vossler, Doyon & Rondeau, 2012; Vossler & Watson, 2013), while others find no effects (e.g., see Alexander, Allen & Bindoff, 2013). Since some of the aspects of incentive compatibility are that the respondents must care about the outcomes and the payment must be coercive (see Vossler et al., 2012), the study used three payment vehicles to account for the potential biases on payment vehicles.

Disagreements among stakeholders on the ESS's relative importance culminate in unstainable wetland use patterns. A better understanding of the perceptions of the relative importance of ESS, in particular cultural services, can be achieved by using a qualitative trade-off approach. One of the advantages of semi-qualitative methods such as the Q methodology is that they are not prone to incentive compatibility challenges as trade-offs are between ESS. However, there is limited evidence on the full suite of ESS, in particular, stakeholder preferences for cultural services (e.g., see Armatas, Venn & Watson, 2017).

In addressing the above research gaps, the thesis was guided by the following research questions: What are the potential associations between ecosystem services, threats to wetlands, and wetland interventions in southern Africa? Do Swazi people have positive preferences for cultural services? What are the main latent distinct and consensus views on the relative importance of ESS?

1.3. Objectives of the study

The general objective of this study was to investigate stakeholder preferences for cultural services and stakeholder perspectives in Eswatini. The specific objectives were:

i. To investigate the associations between ecosystem services, threats to wetlands and wetland interventions.
ii. To elicit public preferences for cultural services using the case of the reed dance and wetlands.
iii. To investigate how different types of stakeholders rank the ESS provided by HDNR and evaluate if there are diverging and converging views about the importance of these different services.

1.4. Approaches and methods of the study

In response to wetland management challenges defined as 'wicked', the study first conducted a systematic review to assess the potential associations between wetland interventions, ecosystem services, and threats to wetlands. Chi-square tests were used to assess the associations in objective 1. The study then used a discrete choice experiment (DCE) to elicit preferences for cultural services using the reed dance and wetlands case. The study chose a DCE, one of the most preferred economic valuation techniques used to elicit preferences and

assign a monetary value to non-market goods like cultural services (Adamowicz, Louviere & Williams, 1994; Mazzanti, 2003). DCEs use attributes of a good to make hypothetical scenarios that model real-life decision-making, presented in choice sets made of two or more alternatives on which respondents choose their most preferred alternative (Train, 2009). The DCE survey utilised three payment vehicles to assess the potential bias due to payment vehicles i.e., household tax, reduced subsidy, and voluntary contributions. The random utility model was used to analyse the DCE data. In the analysis, the study employed the conditional logit (CL) model, mixed logit (ML), and latent class (LC) models in objective 2. In addition, the study used the LC and ML models to test the internal validity of the DCE, i.e., attribute dominance, preference heterogeneity, and attribute non-attendance (ANA). The ML and LC models assessed the heterogeneity of preferences while the LC also assessed ANA. Further, the study employed the Chi-square and F-tests to investigate the robustness of the qualitative results by assessing the associations.

Lastly, the study used the Q methodology to identify stakeholders' perspectives through ESS ranking. The Q method used factor analysis to correlate all the statements, corresponding to 40 wetland ESS of stakeholders who participated in the survey. Factor analysis analysed the correlated sorting of the statements in objective 3. It grouped the perspectives of all the stakeholders who obtained benefits from the HDNR with similar views on the wetland ESS ranking. The conceptual framework shown in Figure 1.1 served as a guide for the investigation. The respondents used past experience with the ESS, information provided by the survey instrument given limited time and budget to make an economic choice on an alternative with the highest utility. The decision process was influenced by the respondent's memory, motivations, attitudes, underlying preferences, and perceptions or beliefs. In addition to the DCE data, information of the attitudes, knowledge and perceptions on the reed dance and wetland management was collected using Likert scales. The presence of different stakeholders with competing interests adds complexity to wetland management challenges, referred as 'wicked'. However, public authorities through various institutions respond to wetland management challenges including threats to wetlands through wetland interventions with an aim of improving human wellbeing. In objective 1, the study sought to assess the associations between wetland interventions, ESS, and threats to wetlands while in objective 2 the study attempted to elicit preferences for cultural services, and in objective 3, the study sought to investigate the main latent distinct and consensus views on the relative importance of ESS.

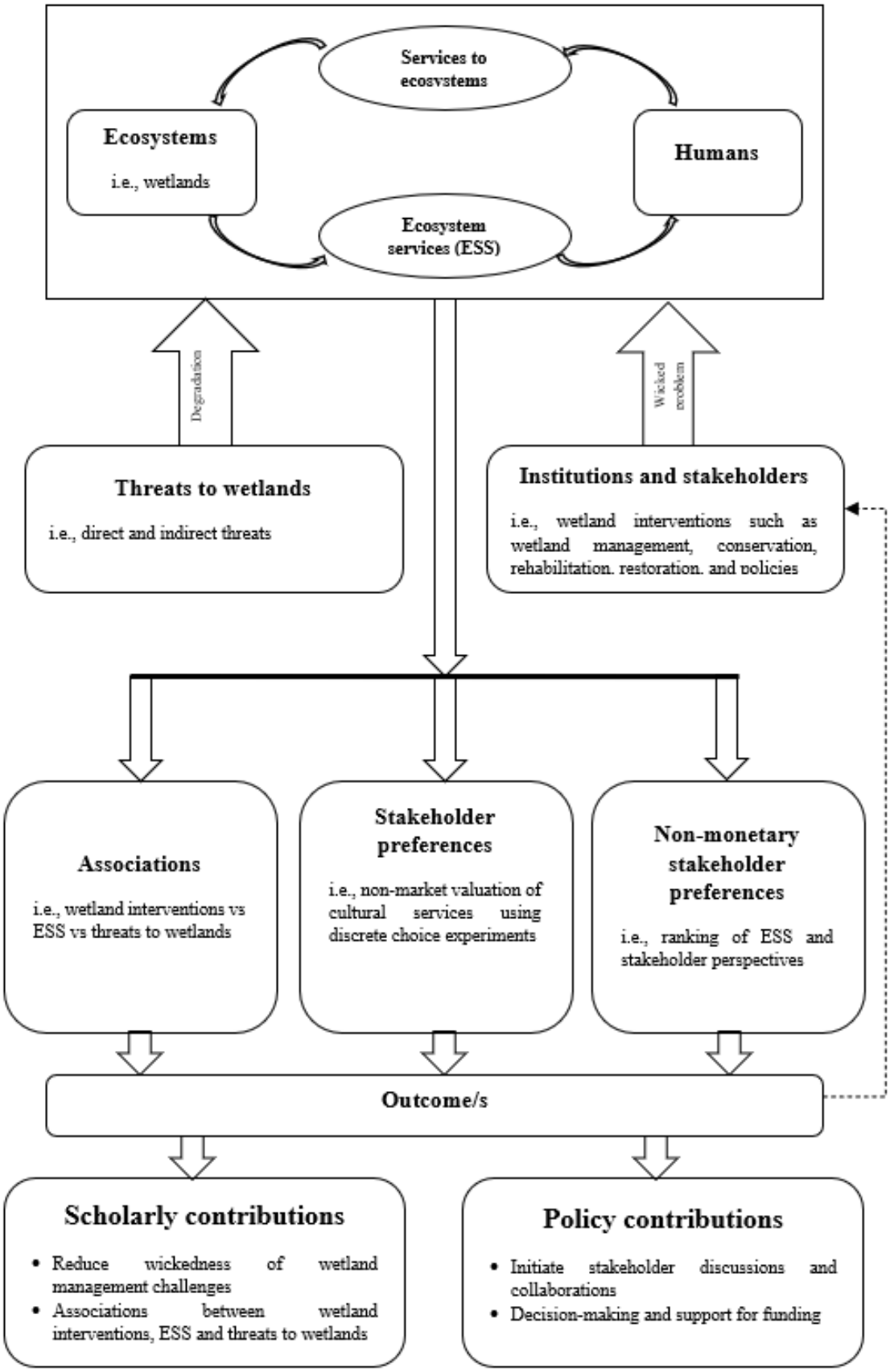

Figure 1.1: Conceptual framework

Source: Adapted from the Millennium Ecosystem Assessment (2005)

The study tested the following hypotheses: 1) There are no potential associations between ecosystem services, threats to wetlands, and wetland interventions in southern Africa, 2) Swazi people do not have positive preferences for cultural services, and 3) There are no main latent distinct and consensus views on the relative importance of ESS. Solid lines or arrows represent the relationships from the input perspective of the framework, while the dotted represent the anticipated impact of the research study on academia and policy.

1.5. Thesis outline

The rest of the thesis is structured as follows. The second chapter presents a systematic review of ecosystem services, threats to wetlands, and wetland interventions in southern Africa. Potential associations between ecosystem services, threats to wetlands, and wetland interventions are presented and discussed. In the third chapter, public preferences for cultural services are elicited using the case of the reed dance in Eswatini. Results from three payment vehicle split samples were presented. The chapter then draws lessons learned from the unexpected findings. Chapter 4 presents the information on the stakeholder perspectives on the ranking of ESS. Three main distinct views are discussed followed by the consensus views. The final chapter of this thesis then presents the summary, conclusions and recommendations derived from the study's findings.

Chapter 2: Interventions, ecosystem services and degradation of wetlands in southern Africa: A systematic review

Abstract

Background: The purpose of this study was to investigate the associations between ecosystem services, threats to wetlands and wetland interventions.

Methods: A systematic review was conducted guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). Search terms were used in the Scopus database to identify potential studies between June and August 2023. Out of the identified 1,416 publications, 36 studies met the predefined inclusion criteria. Potential associations between ecosystem services, threats to wetlands and wetland interventions were assessed using Chi-square test.

Results: The results show evidence of wetland degradation mainly driven by population growth resulting in agricultural expansion and infrastructure development to meet the growing demand for food, water, and shelter. Wetland management interventions were associated with threats such as invasive alien plants, grazing, canalization, unregulated wetland use, and urban developments. Similarly, wetland rehabilitation interventions were associated with grazing and canalization while wetland restoration was only associated with invasive alien plants. We found that wetland management and wetland rehabilitation interventions were associated with wetland agriculture and fibre (reeds and sedge) production. Studies used several solutions to address the socio-political and economic aspects of wetland degradation. The multi-sectoral approach was associated with politics and had a likelihood of improving flood control function while the bottom-up approach was associated with politics, low income, and limited implementation of wetland policies. Some studies used solutions to address environmental aspects of wetland degradation. The livelihood diversification approach is a potential promising solution to help relief the pressure on wetlands and address climate change issues especially droughts. This approach is likely to improve fishing, fibre (reeds and sedge) production, wood collection, and cultural experiences i.e., the reed dance. Another environmental targeted solution used mainly in wetland rehabilitation interventions were weirs. Weirs were associated with canalization (which leads erosion), and they are likely to improve wetland agriculture.

Conclusions: Understanding the associations between wetland interventions and threats to wetlands, ecosystem services, and solutions can help contribute to sustainable wetland management.

Keywords: Ecosystem services, wetland interventions, wetland degradation, sustainable wetland management

2.1 Introduction

Throughout the ages humans have been intricately linked to wetlands (Chan, Timmermann, Baldi, Moore, Lyons, Lee, Kalsbeek, Petersen, Rautenbach & Förtsch, 2019; Hook, 1993). Agricultural activities on wetlands can be traced back to about 6000 years ago (Verhoeven & Setter, 2010). Over the years wetlands have been gradually converted to agricultural land coupled with infrastructure development. As a result, more than 50% of the world's wetlands have been lost (Millennium Ecosystem Assessment, 2005; Davidson, 2014; Verhoeven & Setter, 2010). The increasing population growth and climate change coupled with poverty, unemployment, and food insecurity exacerbates the degradation and loss of wetlands especially in Africa. However, humans continue to depend on wetlands for their benefits to human wellbeing i.e., provisioning services like fibre, food and water, regulatory and maintenance services such as natural water regulation and flood control, and cultural and recreational services such as culture experiences, tourism, and recreation. Wetlands are being degraded and lost more than three times faster in the 21st century (Davidson, 2014). It is apparent that humans are the instigators of wetland degradation (Mermet, 1991).

Governments authorities, policymakers, wetlands users and other stakeholders have responded to the continuing degradation and loss of wetlands through various interventions i.e., wetland management, wetland conservation, wetland preservation, wetland policies, wetland rehabilitation, and wetland restoration. Interventions often seek to address causes of degradation i.e., the ultimate or indirect threats such as politics, population growth, poverty, and climate change, and proximate or direct threats such as agricultural cultivation, irrigation, and overharvesting wetland resources like fibre among others. As explained by Elliott (2014), environmental management generally aims *"to protect and enhance the natural structure and functioning of the ecosystem while at the same time ensuring that we obtain societal goods and benefits"*. The success of wetland management lies on the involvement and participation on all the relevant stakeholders. Managing a wetland include activities and priorities of various stakeholders with diverging views (Mermet, 1991).

Wetland rehabilitation and restoration interventions are based on two main concepts, namely, ecohydrology and ecoengineering also referred to ecological engineering. These two interventions are often a necessity when a wetland is at an advanced stage of degradation i.e., erosion, with an aim of attempting to achieve a win-win state between ecology and economy. Ecohydrology refers to the key physical processes behind the maintenance, recovery and restoration of the wetland while ecoengineering refers to engineering the physical-chemical process with an objective of improving the ecology but also refers to directly engineer the ecology such as restocking and replanting (Elliott, Mander, Mazik, Simenstad, Valesini, Whitfield & Wolanski, 2016). It is important to note that some of effects of degradation are irreversible and ultimately lead to the loss or extinction of wetlands.

Previous studies including systematic reviews have looked at the drivers of wetland conversion at a global level (Asselen, Verburg, Vermaat & Janse, 2013), economic consequences of wetland degradation in Africa (Schuyt, 2005), remote sensing of wetlands in sub-Saharan Africa (Thamaga, Dube & Shoko, 2022a), developing wetland inventories in southern Africa (Taylor, Howard & Begg, 1995) and threats to wetlands in South Africa (Adeeyo, Ndlovu, Ngwagwe, Mudau, Alabi & Edokpayi, 2022). There is little empirical evidence on the associations of wetland interventions and ecosystem services and threats to wetlands. To understand how wetland interventions are linked to ecosystem services and threats to wetlands, we conducted a systematic review following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) 2020 guidelines in conducting a systematic literature review (Page, McKenzie, Bossuyt, Boutron, Hoffmann, Mulrow, Shamseer, Tetzlaff, Akl & Brennan, 2021). This review assesses the associations between wetland interventions and ecosystem services, and threats to wetlands in southern Africa. We also present an overview of the threats to wetlands, ecosystem services, solutions, and recommended management strategies reported by studies in the region.

The chapter comprises seven sections. The rest of the chapter is structured as follows: section 2 presents the methodology which includes the search strategy, eligibility criteria, and data analysis. Section 3 presents the results on the wetland interventions, ecosystem services, wetland degradation, solutions, and potential associations. Section 4 provides the discussion and lastly section 6 provides the conclusion and recommendations.

2.2 Methods

The study used the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) 2020 guidelines in conducting a systematic literature review (Page *et al.*, 2021). We followed a three-step procedure consisting of the search strategy, eligibility screening, and data analysis.

2.2.1 Search strategy

A search was first performed on the Scopus database in June 2023 and again in August 2023. Scopus is one of the largest citations and abstracts database of peer reviewed scientific research outputs especially journal articles (Baas, Schotten, Plume, Côté & Karimi, 2020; Burnham, 2006; Chadegani, Salehi, Yunus, Farhadi, Fooladi, Farhadi & Ebrahim, 2013). Compared to other databases like Web of Science, Scopus is helpful in literature search using keywords and has a wider range of journals but to some extent it is limited to articles published after 1995 (Falagas, Pitsouni, Malietzis & Pappas, 2008). No date limits were set. The database was screened using the following key words and Boolean operators: "ecosystem service*" OR "ecosystem function*" OR "ecosystem good*" OR "ecosystem benefit*" OR "environmental service*" OR "environmental function*" OR "environmental good*" OR "environmental benefit*" OR "natures contribution* to people" OR "nature benefit*" OR "provisioning service*" OR "provisioning ecosystem service*" OR "cultural service*" OR "cultural ecosystem service*" OR "regulating service*" OR "regulating ecosystem service*" OR "supporting service*" OR "supporting ecosystem service*" OR "wetland degradation" OR "wetland loss" OR "wetland conversion" OR "threat* to wetland*" AND "wetland management" OR "conservation management" OR "wetland conservation" OR "wetland preservation" OR "wetland restoration" OR "wetland rehabilitation" AND "wetland*". The initial search yielded 1,416 publications. Another search term AND "Africa" was then added in order to narrow down the literature search and we obtained 78 publications. We also conducted another search using the same terms and instead of filtering by “Africa” we specified the countries in southern Africa as follows AND "Lesotho" OR "Swaziland" OR "Eswatini" OR "Botswana" OR "Namibia" OR "South Africa" OR "Zimbabwe" OR "Mozambique" OR "Malawi" OR "Zambia" OR "Angola". We considered countries that fall in the subregion southern Africa (African Union, 2022). In other listings the countries fall under southern and eastern Africa (see United Nations, 2023). The search yielded 48 publications. A total of 87

publications were identified from the two complementary database searches after accounting for the 39 duplicates from the combined 126 publications.

2.2.2 Eligibility criteria

The review included studies reporting on original case studies on wetlands in southern Africa that assessed (1) wetland management, rehabilitation, restoration, conservation, preservation, or policies in association with (2) either ecosystem services or wetland degradation or both. As the review intended to explore the association between these criteria, we further assessed the eligibility of the publications by reviewing the keywords, abstracts, and titles using a set of exclusion criteria. In this review, original case studies not done in southern Africa were excluded as the target was on empirical findings from case studies in southern Africa (Exclusion criteria 1). Theoretical, conceptual, book chapters, reviews and non-peer reviewed publications were also excluded (Exclusion criteria 2). The studies had to include broadly wetland management as well as ecosystem services or wetland degradation and jointly assess them so that we can draw conclusions on impact of wetland (mis)-management or related interventions on ecosystem services or wetland degradation status. Studies that did not show the association but only focused on one aspect were excluded (Exclusion criteria 3). Finally, publications that were not available for the full-text screening were also excluded (Exclusion criteria 4).

First, subsequent to retrieving the publications, the first screening was conducted by reviewing titles, abstracts and keywords of all the 87 publications identified from the literature search. Two independent reviewers conducted the screening. The following information was collected: title, year of publication, abstract, keywords, citation, language, type of publication and publication stage. Following the inclusion and exclusion criteria, 44 publications were excluded after screening the keywords, titles and abstracts. Exclusion reasons included publications not done in southern Africa (35 publications), theoretical, conceptual, book chapters, reviews and non-peer reviewed publications (9 publications). We then retrieved the 43 publications that met the first screening inclusion and exclusion criteria. One publication out of the remaining 43 publications was not available for the second screening, a full-text screening.

Second, a full-text screening was conducted, and studies were selected using the inclusion and exclusion criteria. A total of 42 publications underwent the full-text screening. Seven publications were excluded because they did not show the association between wetland

management and ecosystem services or wetland degradation but only focused on one aspect. A total of 35 publications met the inclusion and exclusion criteria from the full-text screening (see Figure 2.1).

Third, more information was extracted from the selected case studies after the full-text screening for complete analysis which included wetland management or specific related intervention (i.e., wetland conservation, preservation, rehabilitation, restoration, and policies), ecosystem services, wetland threats (proximate and underlying threats), solutions to wetland management challenges, and wetland management strategies.

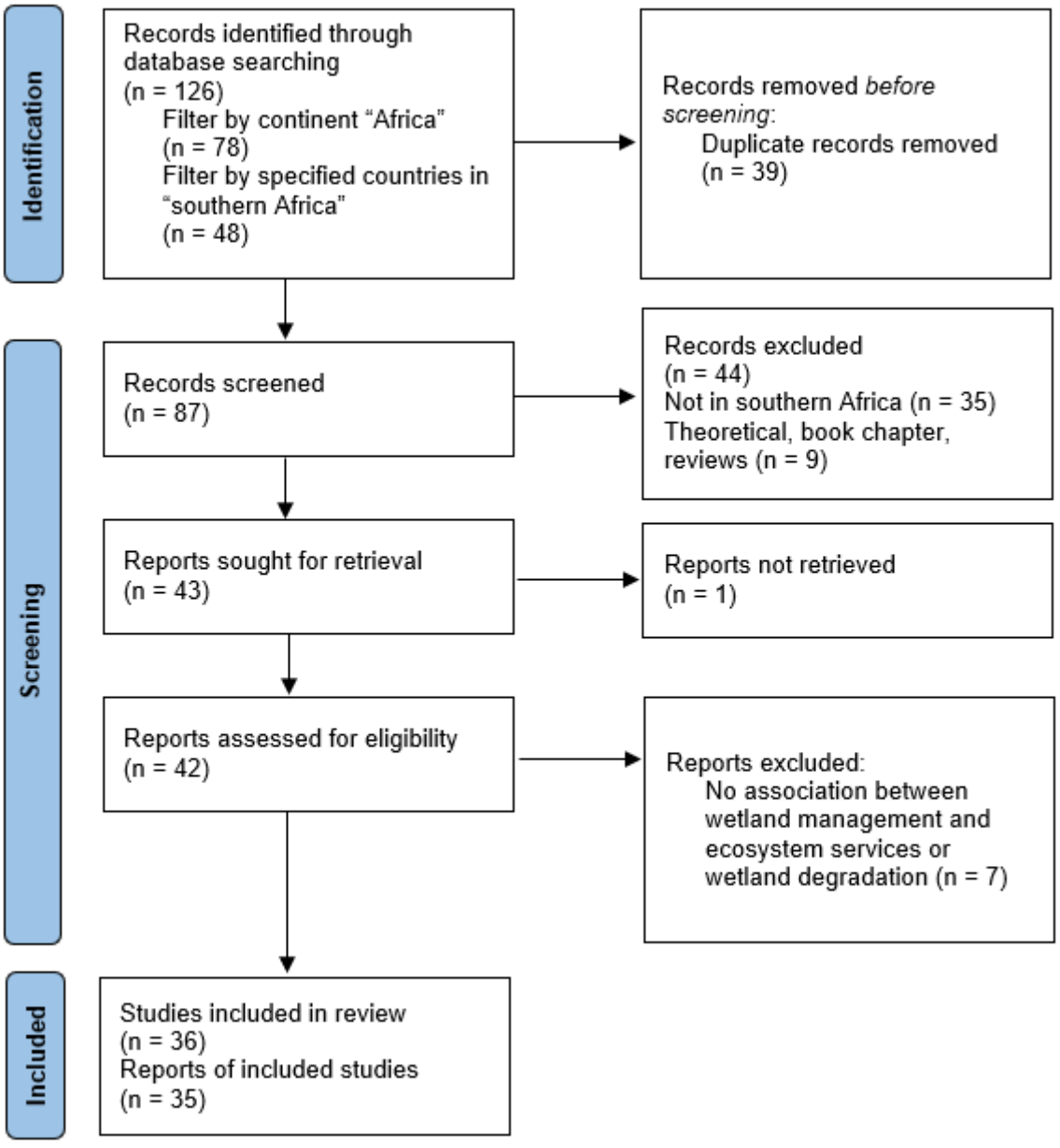

Figure 2.1: PRISMA flow chart of the study selection process

2.2.3 Data analysis

We used qualitative synthesis method to combine the findings from the studies and evaluate them. Moreover, we used the Chi-square test to assess the potential associations between ecosystem services, threats to wetland, reported solutions, and wetland interventions.

2.3 Results

2.3.1 General trends in wetland interventions

In the review we used 36 country case studies in the qualitative synthesis from the 35 publications. One of the 35 publications had two country case studies in southern Africa. Most of the studies were from South Africa (n = 25, 69%) and the rest were from other parts of southern Africa, Zimbabwe (n = 5, 14%), Lesotho (n = 2, 6%), Zambia (n = 2, 6%), Botswana (n = 1, 3%), and Eswatini (n = 1, 3%). Most of the studies mentioned the intervention as wetland management only (n = 21, 58%) followed by wetland rehabilitation only (n = 5, 14%), and wetland restoration only (n = 4, 11%). Wetland policies (n = 4, 11%) and wetland conservation (n = 1, 3%) were only mentioned in combination with wetland management. Few of the studies mentioned wetland restoration (n = 1, 3%) in combination with wetland management (see Figure 2.2).

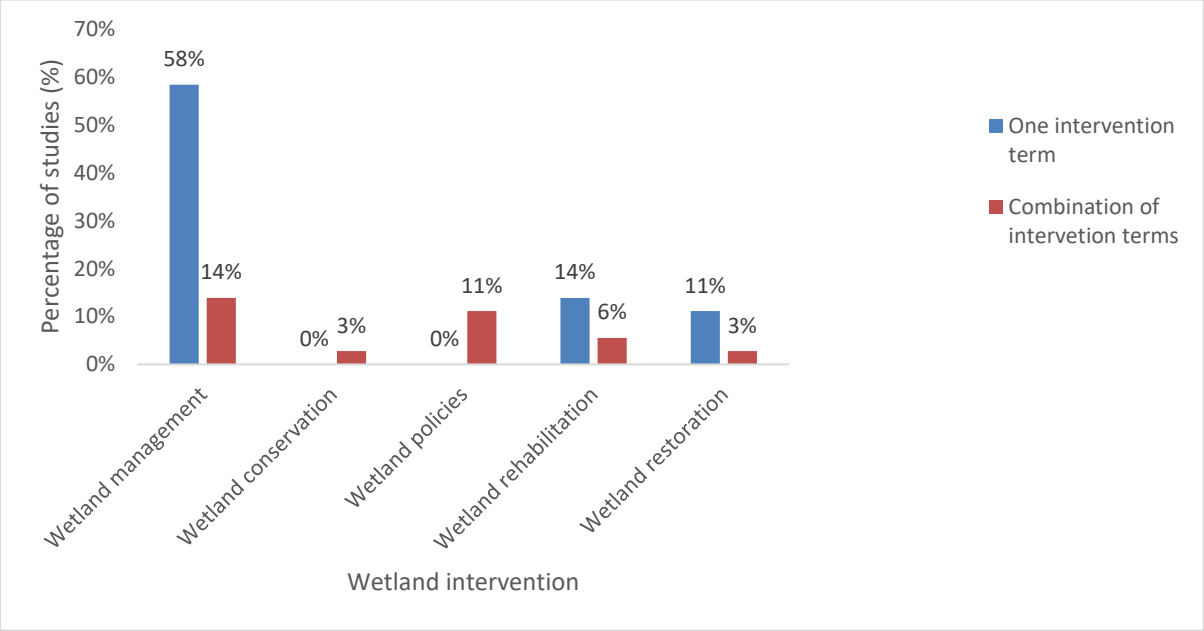

Figure 2.2: Wetland interventions in studies

The first publication with evidence of wetland intervention and ecosystem services or wetland degradation was published in 2007 from South Africa. In 2009, there was one publication with case studies from Eswatini and Zimbabwe. South Africa had at least one study published from 2010 with a maximum of four publications in 2019. Overall, the publications have been increasing since 2011 despite the fluctuations (see Figure 2.3). The most recent publications were published in 2023 and they are from Zambia and Zimbabwe.

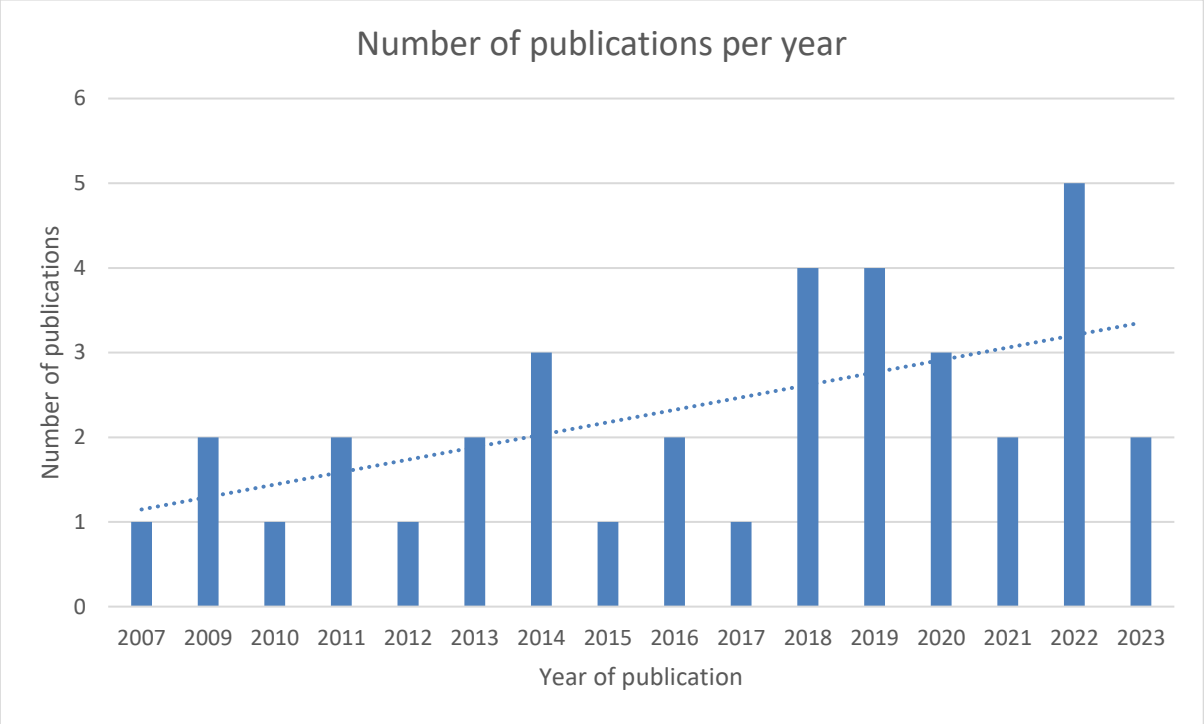

Figure 2.3: Number of publications per year

2.3.2 Ecosystem services

We identified 22 ecosystem services provided by wetlands from the 36 case studies and grouped them into three main ecosystem services categories, 43% (n = 10) provisioning services, 33% (n = 7) regulating and maintenance services, and 24% (n = 5) cultural and recreational services. Among the provisioning services, the prominent ecosystem services reported in the studies included agricultural use for cultivation (n = 25, 69%), followed by water uses for irrigation (n = 20, 59%), agricultural use for livestock grazing (n = 20, 56%), supporting local livelihoods through income generation (n = 17, 47%), household water supply (n = 15, 42%), reed and sedge harvesting (n = 11, 31%). It is not surprising that these extractive uses were also reported as the causes of wetland degradation (see Figure 2.5).

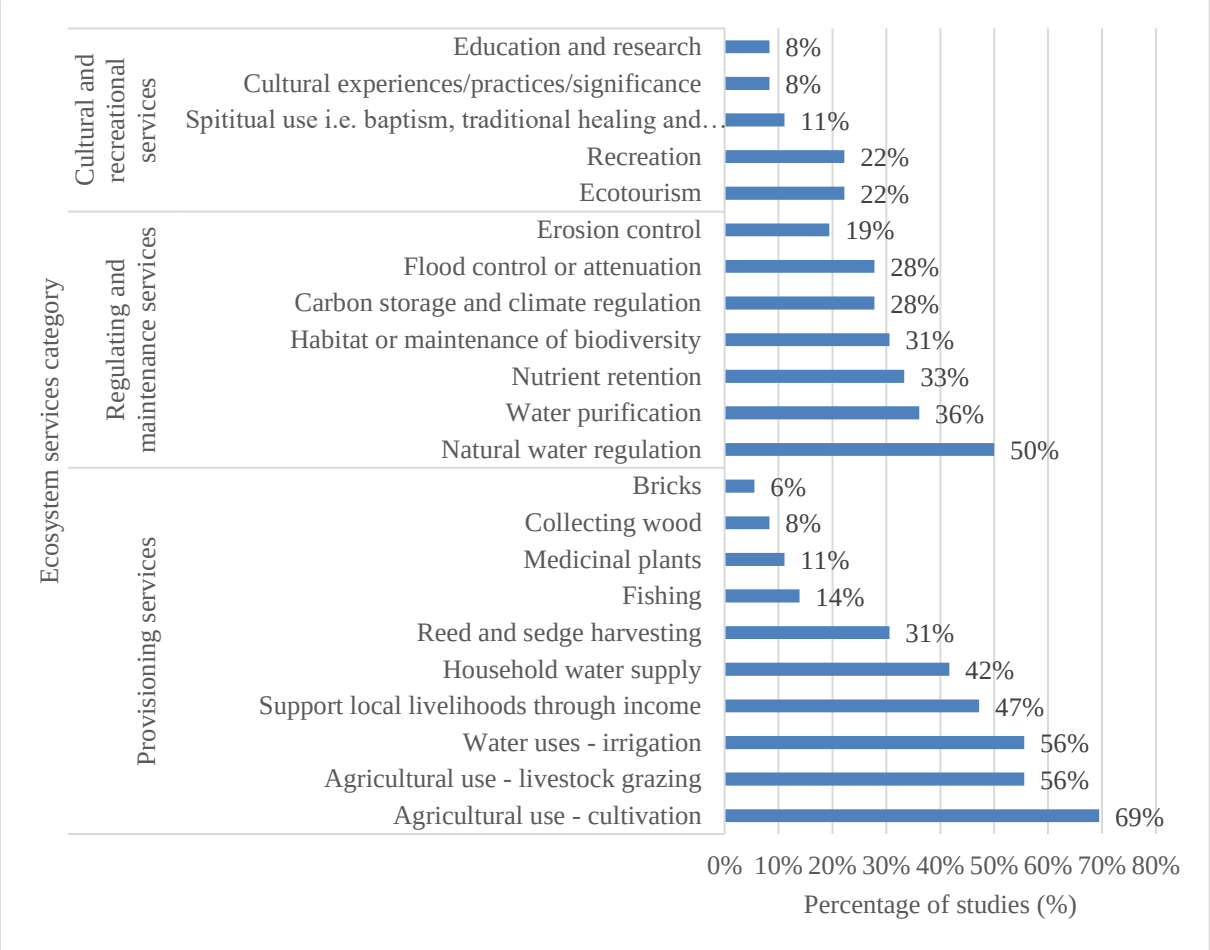

Figure 2.4: Ecosystem services provided by wetlands

In the regulating and maintenance services, the prominent ecosystem services reported in the studies were natural water regulation (n = 18, 50%), water purification (n = 13, 36%), nutrient retention (n = 12, 33%), habitat/biodiversity maintenance (n = 11, 31%), carbon storage/climate regulation (n = 10, 28%), flood control/attenuation (n = 10, 28%), and erosion control (n = 7, 19%). Understanding the trade-offs and potential synergies between the ecosystem services can help in addressing wetland degradation and inform wetland planning, use, monitoring, and management i.e., provisioning services and regulating and maintenance services (Lee & Lautenbach, 2016; Sil, Rodrigues, Carvalho-Santos, Nunes, Honrado, Alonso, Marta-Pedroso & Azevedo, 2016).

Cultural and recreational services had only two prominent ecosystem services reported in the studies, ecotourism (n = 8, 22%), recreation (n = 8, 22%). Education and research (n = 4, 10%), cultural experiences/practices/significance (n = 3, 8%), and spiritual use i.e., baptism, traditional healing, and cleansing (n = 3, 8%) were reported by few studies (see Figure 2.4).

There is a need for more studies that report on and assess cultural and recreational services especially wetland-based cultural experiences i.e., the reed dance in Eswatini and South Africa. Compared to the other ecosystem services categories, cultural and recreational services were the least reported in the studies. Enu, Zingraff-Hamed, Rahman, Stringer and Pauleit (2023) also found that cultural and recreational services were the least reported ecosystem services in a recent review of nature-based solutions in sub-Saharan Africa.

2.3.3 Wetland degradation

The proximate threats to wetlands leading wetland degradation identified include extensive agricultural practices related to cultivation (n = 23, 64%), high wetland dependency (n = 21, 58%), extensive agricultural practises related to livestock grazing (n = 19, 53%), over-utilization of wetland resources (n = 17, 47%), anthropogenic draining (n = 13, 36%), erosion (n = 13, 36%), unregulated wetland use (n = 12, 33%), and pesticide use (n = 7, 19%). It is evident that wetlands in southern Africa are mainly used for agricultural purposes to sustain local livelihoods. The agricultural-related threats seem to trigger other threats i.e., introduction of invasive alien plants (n = 10, 28%), and infrastructure developments such as road crossings (n = 10, 28%), urban development (n = 9, 25%), incised channel/canalisation i.e., ridge and furrow cultivation (n = 7, 19%), rural development (n = 7, 19%). While wetland agriculture improves local livelihoods and human wellbeing, it can lead to devastating effects if there is poor wetland co-management/collaboration (n = 6, 17%), often resulting to pollution (n = 5, 14%), unplanned fires (n = 5, 14%), extinction of endangered plants and animals' species (n = 4, 11%). It is surprising that few studies reported on wetland policies and power dynamics i.e., limited implementation of wetland policies/laws (n = 3, 8%), lack of transparent open platform to discuss wetland issues (n = 3, 8%), centralized top-down approach (n = 2, 6%) were the least mentioned immediate threats.

Among the threats which may be classified as the ultimate causes of wetland degradation, climate change (n = 10, 28%), followed by population growth/pressure (n = 9, 25%) and drought (n = 5, 14%) were prominent. The results show that emphasis is placed on the proximate threats (i.e., symptoms) instead of the root causes of wetland degradation or ultimate threats (see Figure 2.5). Understanding the root causes of wetland degradation and their relationship with proximate threats (i.e., symptoms) can help inform planning and management to ensure food security, local livelihoods, and sustainable wetland management. Corruption often hampers

efforts towards curbing wetland degradation especially in southern Africa (see Ganda, 2020; Mwonzora, 2022; Sundström, 2013). Assessing the political environment is key in addressing wetland management challenges yet few studies reported on politics (n = 2, 6%). Understanding the socio-economic conditions of the communities is equally important for sustainable wetland management yet few studies reported on poverty (n = 4, 11%), low income (n = 3, 8%), and unemployment (n = 2, 6%).

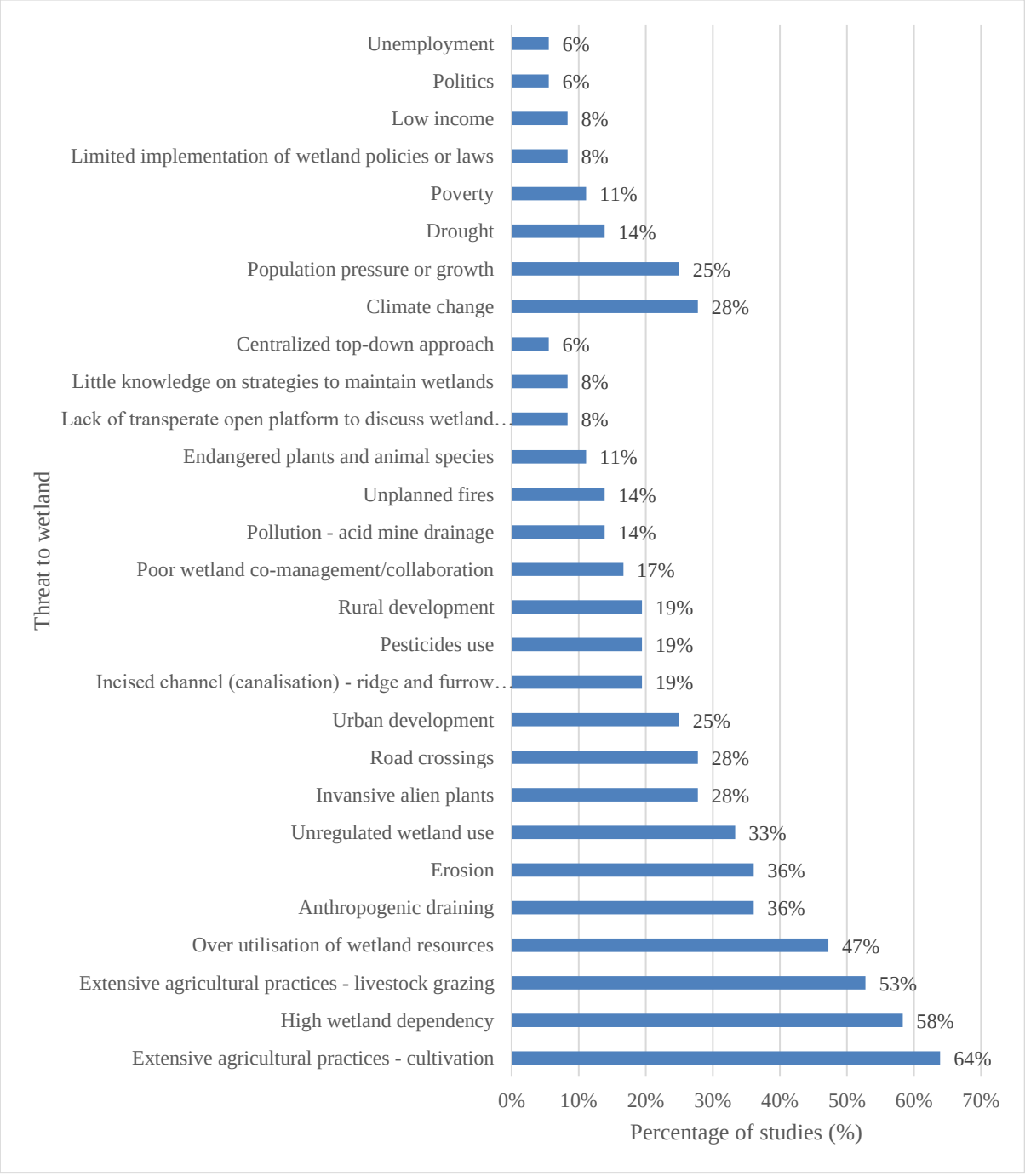

Figure 2.5: Threats to wetlands

2.3.4 Solutions to wetland degradation

A total of 9 solutions for reducing wetland degradation were reported. In terms of wetland management, most studies reported wetland management multi-sectoral approach (n = 6, 17%) followed by bottom-up approach (n = 5, 14%), using wetland assessment methods to inform planning (n = 5, 14%), and livelihood diversification (n = 5, 14%). The results emphasise the importance of stakeholder engagements from wetland planning through to monitoring and to management. The reporting of solutions in wetland management intervention studies such as weirs (n = 3, 8%) and integrated wetland restoration and invasive alien plants control programmes (n = 2, 6%) can be explained by the presence two or more interventions mentioned in the studies i.e., wetland management and wetland rehabilitation.

In contrast to wetland management, weirs (n = 5, 14%) were the most reported solutions in wetland rehabilitation intervention studies followed by earth berms (n = 2, 6%), and chute-drop inlets to address big erosion head-cuts (n = 1, 3%). All these solutions seem to be practical and aimed at slowing down and/or halting erosion. It is interesting to see wetland management solutions being reported in the rehabilitation interventions studies i.e., wetland offsetting (n = 2, 6%), wetland management multi-sectoral approach (n = 1, 3%), and using wetland assessment methods to inform planning (n = 1, 3%). The results highlight the importance of continuous monitoring and management after rehabilitating a wetland.

Similar to wetland rehabilitation, weirs (n = 2, 6%) and integrated wetland restoration and invasive alien plants control programmes (n = 2, 6%), were relatively the most reported solutions in wetland restoration intervention studies followed by chute-drop inlets to address big erosion head-cuts (n = 1, 3%). The results are like those from wetland rehabilitation intervention studies. Interestingly, wetland management solutions were also reported even though to a less extent i.e., wetland management multi-sectoral approach (n = 1, 3%), using wetland assessment methods to inform planning (n = 1, 3%), and wetland management multi-sectoral approach (n = 1, 3%) were the least reported (see Figure 2.6).

Overall, the reported solutions in both wetland rehabilitation and wetland restoration intervention studies seem to be mainly addressing erosion and invasive alien plants. Wetland agriculture contributes to erosion and introduction of invasive alien plants. Therefore, erosion

and invasive alien plants may be perceived as indicators of the severity of wetland degradation that require urgent attention.

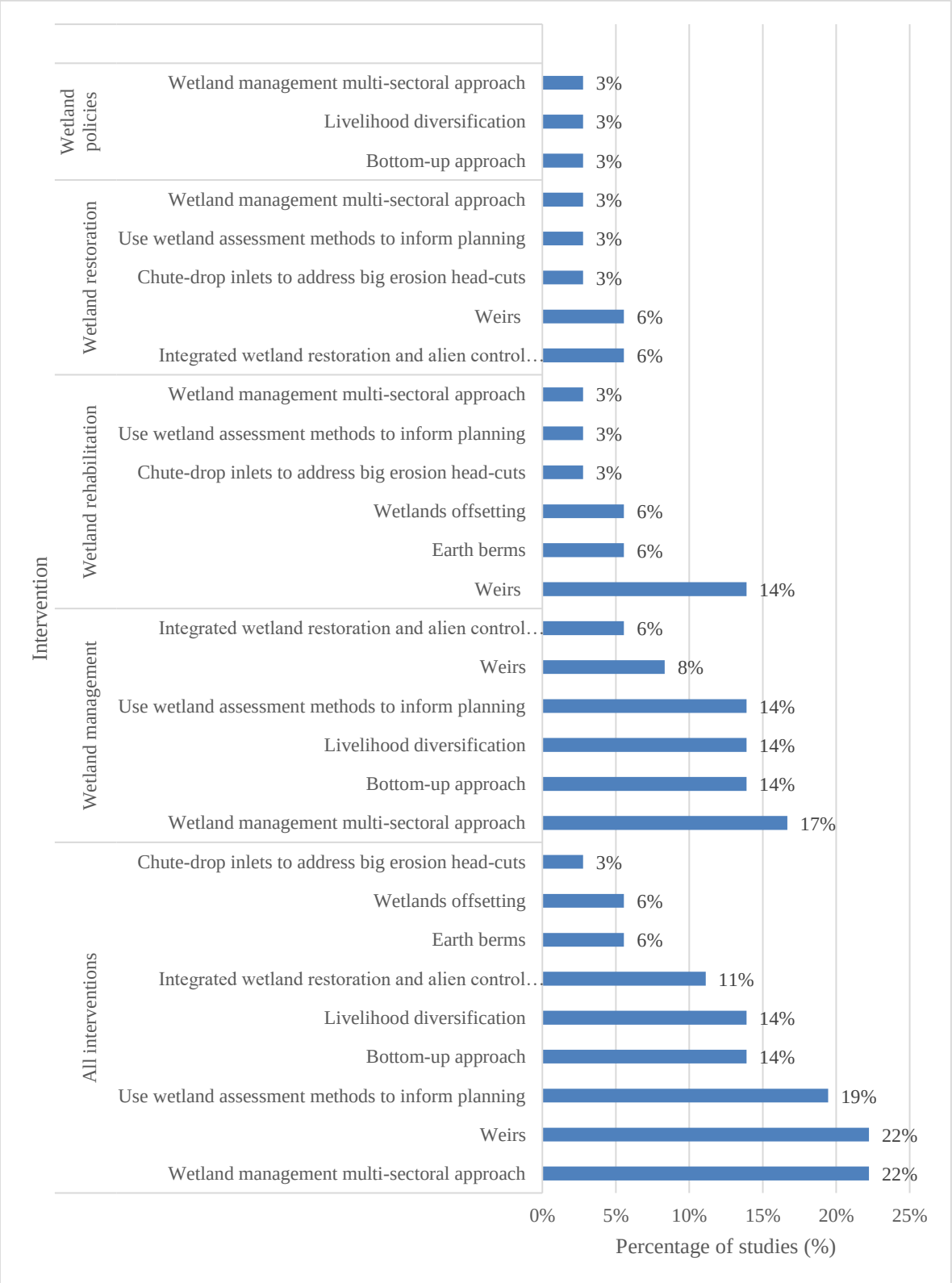

Figure 2.6: The link between wetland intervention type and solutions to wetland degradation

2.3.5 Recommended wetland management strategies

About 26 wetland management strategies were recommended in the case studies for consideration by wetland practitioners, policymakers, and researchers in addressing wetland degradation. In the wetland management intervention case studies, community participation including creating committees (n = 9, 25%), monitoring use of wetland resources (n = 6, 17%), and educating communities on the importance of wetland management (n = 4, 11%), conservation programmes (n= 4, 11%), fencing around the wetlands (n = 3, 8%), economic incentives (n = 2, 6%), raising awareness (n = 2, 6%), seasonal grazing resting system (n = 2, 6%) were relatively the most reported. Weirs (n = 3, 8%) were relatively the only most reported strategy recommended in the wetland rehabilitation case studies while the others were 3% or less. In wetland policies, community participation including creating committees (n = 2, 6%) was the most reported. In contrast, wetland restoration case studies had the least reported strategies which were all 3% or less (see Figure 2.7).

2.3.6 Linking wetland interventions with ecosystem services

We examined the relationship between ecosystem services and wetland interventions. The Chi-square test of association was used to test the relationship between two categorical variables i.e., wetland management intervention and ecosystem services. One of the assumptions of the Chi-square test is that none of the expected cell counts should be less than 5 (McHugh, 2013). In cases where this assumption was violated, we relied on the Fisher's Exact test results (McHugh, 2013). The null hypothesis was that there is no relationship between the two variables.

We found a significant association between wetland management and provisioning services which included agricultural use for cultivation ($p < 0.01$), agricultural use for livestock grazing ($p < 0.05$), and reed and sedge harvesting ($p < 0.05$). Interestingly, we found similar results in the wetland rehabilitation intervention except for reed and sedge harvesting ($p < 0.1$) which has a weak association (see Table 2.1). This suggests that probably both wetland management and wetland rehabilitation interventions have the potential to improve wetland agriculture. It would be prudent to use wetland management interventions to ensure the continuous supply of reeds and sedge. For example, livelihood diversification (solution to wetland degradation) was

significantly associated with reed and sedge harvesting ($p < 0.05$) suggesting that having more livelihoods options can reduce the high dependency on wetlands (see Table 2.3).

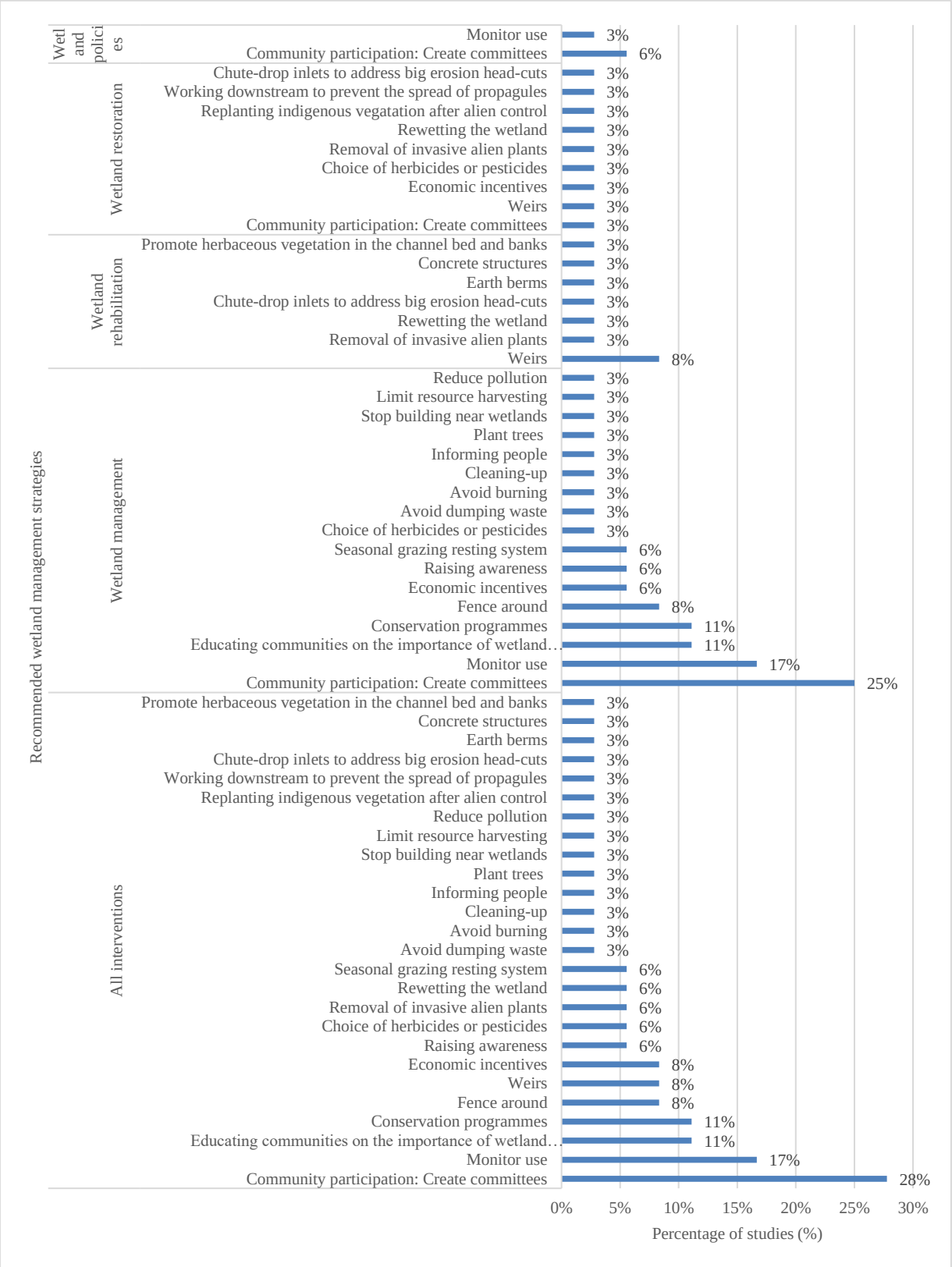

Figure 2.7: Wetland management strategies recommended by studies

Table 2.1: Association between ecosystem services and wetland interventions

Ecosystem services category	Ecosystem services	Wetland management (% of studies and p-value in parenthesis)	Wetland rehabilitation (% of studies and p-value in parenthesis)	Wetland restoration (% of studies and p-value in parenthesis)
Provisioning services	Agricultural use for cultivation	61% (0.003)***	6% (0.018)**	6% (0.154)
	Agricultural use for livestock grazing	50% (0.011)**	3% (0.030)**	3% (0.149)
	Water uses for irrigation	44% (0.285)	6% (0.204)	6% (0.637)
	Household water supply	33% (0.468)	6% (0.674)	3% (0.376)
	Supporting local livelihoods through income generation	39% (0.274)	6% (0.408)	6% (1.000)
	Reed and sedge harvesting	31% (0.016)**	0% (0.076)*	0% (0.295)
	Medicinal plants	11% (0.559)	0% (0.566)	0% (1.000)
	Fishing	14% (0.293)	0% (0.559)	0% (1.000)
	Collecting wood	8% (0.545)	0% (1.000)	0% (1.000)
	Bricks	6% (1.000)	0% (1.000)	0% (1.000)
Regulating and maintenance services	Natural water regulation	33% (0.711)	11% (1.000)	11% (0.338)
	Carbon storage and climate regulation	14% (0.100)	8% (0.370)	8% (0.119)
	Habitat and maintenance of biodiversity	17% (0.224)	8% (0.650)	8% (0.154)
	Water purification	19% (0.119)	11% (0.225)	6% (1.000)
	Nutrient retention	22% (0.700)	6% (1.000)	6% (1.000)
	Flood control or attenuation	22% (0.689)	0% (0.155)	6% (0.603)
	Erosion control	14% (0.947)	3% (1.000)	3% (1.000)
Cultural and recreational services	Ecotourism	14% (0.658)	6% (0.639)	6% (0.305)
	Recreation	17% (1.000)	3% (1.000)	3% (1.000)
	Education and research	6% (1.000)	3% (0.488)	0% (1.000)

Spiritual use i.e., baptism, traditional healing and cleansing	11% (0.559)	0% (0.566)	0% (1.000)
Cultural experiences/practices/significance	8% (0.545)	0% (1.000)	0% (1.000)

2.3.7 Linking wetland interventions with wetland degradation

Similar to section 2.3.6, we employed the Chi-square test to assess the relationship between wetland interventions and threats to wetlands. Immediate threats to wetlands significantly associated with wetland management included incised channel/canalization like ridge and furrow cultivation ($p < 0.05$), invasive alien plants ($p < 0.05$), unregulated wetland use ($p < 0.05$), extensive agricultural practices for livestock grazing ($p < 0.05$), and urban development ($p < 0.05$). Population growth or pressure ($p < 0.05$) was the only underlying/ultimate threat significantly associated with wetland management. The results imply that wetland degradation is mainly driven by population growth and usually manifest in agricultural expansion, wetland conversion and infrastructure development to meet the growing demand for food, water, and shelter. This implies that policymakers, local wetland users and relevant stakeholders need to plan for future population increases for effective wetland planning and management to minimize high wetland dependency ($p < 0.1$) and over-utilization of wetland resources ($p < 0.1$).

In wetland rehabilitation interventions, we found significant associations with the following proximate threats, incised channel/canalization like ridge and furrow cultivation ($p < 0.05$), extensive agricultural practices for livestock grazing ($p < 0.05$), and unregulated wetland use ($p < 0.05$). Despite the weak significant association, there is ample evidence of erosion ($p < 0.1$) as expected and continuing over-utilization of wetland resources ($p < 0.1$). This may imply that wetlands at the rehabilitation stage continue to be used for agriculture which often results into physical damage i.e., erosion.

As expected, proximate threats significantly associated with wetland restoration included only invasive alien plants ($p < 0.05$). Wetlands requiring restoration are often at an advanced stage of degradation. Invasive alien plants species are known of drying up wetlands, altering habitats, reducing quantity of species, compromising water quality, and altering nutrient recycling, among others (see Le Maitre, Blignaut, Clulow, Dzikiti, Everson, Görgens & Gush, 2020;

Pathak, Bhuju, Shrestha & Ranjitkar, 2021; Rai & Singh, 2020). Table 2.2 shows the threats to wetlands' potential associations with wetland interventions.

Table 2.2: Association between threats to wetlands and wetland interventions

	Threats to wetlands	Wetland management (% of studies and p-value in parenthesis)	Wetland rehabilitation (% of studies and p-value in parenthesis)	Wetland restoration (% of studies and p-value in parenthesis)
Proximate/immediate threats	High wetland dependency	50% (0.058)*	6% (0.103)	6% (0.630)
	Extensive agricultural practices for cultivation	53% (0.119)	8% (0.225)	6% (0.328)
	Extensive agricultural practices for livestock grazing	47% (0.025)**	3% (0.037)**	3% (0.167)
	Over-utilization of wetland resources	42% (0.065)*	3% (0.092)*	3% (0.342)
	Anthropogenic draining	19% (0.119)	11% (0.225)	8% (0.328)
	Erosion	19% (0.119)	14% (0.073)*	8% (0.328)
	Invasive alien plants	11% (0.014)**	3% (0.370)	11% (0.015)**
	Unregulated wetland use	33% (0.015)**	0% (0.070)*	0% (0.146)
	Road crossings	22% (0.689)	8% (0.370)	3% (1.000)
	Urban development	25% (0.036)**	0% (0.153)	0% (0.297)
	Incised channel/canalization i.e., ridge and furrow cultivation	6% (0.010)**	11% (0.016)**	6% (0.244)
	Rural development	19% (0.155)	0% (0.303)	0% (0.559)
	Pesticides use	19% (0.155)	0% (0.303)	0% (0.559)
	Pollution i.e. acid mine drainage	11% (1.000)	3% (1.000)	0% (1.000)
	Unplanned fires	14% (0.293)	0% (0.559)	0% (1.000)
	Poor wetland co-management/collaboration	17% (0.157)	0% (0.317)	0% (0.564)
	Limited implementation of wetland policies/laws	8% (0.545)	0% (1.000)	0% (1.000)

	Endangered plants and animals' species	8% (1.000)	3% (1.000)	3% (0.466)
	Centralized top-down approach	6% (1.000)	0% (1.000)	0% (1.000)
	Lack of transparent open platform to discuss wetland issues	8% (0.545)	0% (1.000)	0% (1.000)
	Little knowledge on strategies to maintain wetlands	8% (0.545)	0% (1.000)	0% (1.000)
Ultimate/underlying threats	Population growth/pressure	25% (0.039)*	0% (0.156)	0% (0.302)
	Drought	14% (0.293)	0% (0.559)	0% (1.000)
	Climate change	25% (0.223)	0% (0.155)	3% (1.000)
	Low income	8% (0.545)	0% (1.000)	0% (1.000)
	Poverty	11% (0.559)	0% (0.566)	0% (1.000)
	Unemployment	6% (1.000)	0% (1.000)	0% (1.000)
	Politics	6% (1.000)	0% (1.000)	0% (1.000)

2.3.8 Linking ecosystem services and solutions

The Chi-square test, like in the previous sections, was used to assess the associations between ecosystem services and solutions that sought to address wetland degradation. We found significant associations between ecosystem services and solutions (see Table 2.3). Among the provisioning services, for example, weirs were significantly associated agricultural use for cultivation ($p < 0.05$) while livelihood diversification was associated with collecting wood ($p < 0.01$), fishing ($p < 0.05$), reed and sedge harvesting ($p < 0.05$), and water uses for irrigation ($p < 0.05$). In the regulating and maintenance services, only multi-sectoral approach was associated with flood control or attenuation ($p < 0.05$). Despite the fact the cultural and recreation services are often overlooked and under-reported with a bias to ecotourism and recreation, we found a significant association between livelihood diversification and cultural experiences/practices/significance ($p < 0.05$). It appears that livelihood diversification is relatively a promising solution in sustainable wetland management given the projected population increases in southern Africa.

Table 2.3: Association between ecosystems services and solutions

	Ecosystem services	Multi-sectoral approach (% of studies and p-value in parenthesis)	Weirs (% of studies and p-value in parenthesis)	Wetland assessment methods (% of studies and p-value in parenthesis)	Bottom-up approach (% of studies and p-value in parenthesis)	Livelihood diversification (% of studies and p-value in parenthesis)	Alien control programs (% of studies and p-value in parenthesis)	Earth berms (% of studies and p-value in parenthesis)	Wetlands offsetting (% of studies and p-value in parenthesis)	Chute-drop (% of studies and p-value in parenthesis)
Provisioning services	Agricultural use for cultivation	19% (0.388)	8% (0.040) **	17% (0.400)	14% (0.295)	14% (0.295)	6% (0.570)	0% (0.087) *	0% (0.087) *	0% (0.306)
	Agricultural use for livestock grazing	14% (0.709)	8% (0.422)	11% (1.000)	8% (1.000)	11% (0.355)	6% (1.000)	0% (0.190)	0% (0.190)	0% (0.444)
	Water uses for irrigation	17% (0.257)	6% (0.103)	14% (0.426)	14% (0.053)*	14% (0.053) *	6% (1.000)	0% (0.190)	0% (0.190)	0% (0.444)
	Household water supply	8% (1.000)	6% (0.424)	11% (0.103)	6% (1.000)	11% (0.138)	3% (0.626)	0% (0.500)	0% (0.500)	0% (1.000)
	Supporting local livelihoods through income generation	11% (1.000)	8% (0.695)	14% (0.219)	6% (1.000)	6% (1.000)	6% (1.000)	0% (0.487)	0% (0.487)	3% (0.472)
	Reed and sedge harvesting	8% (0.678)	3% (0.388)	6% (1.000)	6% (0.631)	11% (0.023) *	3% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
	Medicinal plants	6% (0.207)	0% (0.555)	0% (0.566)	6% (0.084)*	6% (0.084) *	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
	Fishing	3% (1.000)	0% (0.566)	3% (1.000)	3% (0.549)	8% (0.013) **	3% (0.466)	0% (1.000)	0% (1.000)	0% (1.000)
	Collecting wood	3% (0.541)	0% (1.000)	0% (1.000)	3% (0.370)	8% (0.001) ***	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
	Bricks	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)	3% (0.262)	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
Regulating and maintenance services	Natural water regulation	14% (0.691)	11% (1.000)	11% (1.000)	11% (1.000)	8% (1.000)	6% (1.000)	0% (0.486)	0% (0.486)	3% (1.000)
	Carbon storage and climate regulation	8% (0.658)	8% (0.658)	8% (0.370)	6% (0.603)	3% (1.000)	6% (0.305)	0% (1.000)	0% (1.000)	3% (0.278)
	Habitat and maintenance of biodiversity	3% (0.388)	8% (0.678)	6% (1.000)	3% (1.000)	6% (0.631)	3% (1.000)	3% (0.524)	3% (0.524)	3% (0.306)
	Water purification	14% (0.107)	11% (0.422)	11% (0.255)	6% (1.000)	3% (0.634)	6% (0.609)	6% (0.124)	6% (0.124)	0% (1.000)
	Nutrient retention	8% (1.000)	6% (0.691)	11% (0.190)	6% (1.000)	6% (1.000)	3% (1.000)	0% (0.543)	0% (0.543)	0% (1.000)
	Flood control or attenuation	14% (0.024)**	6% (1.000)	8% (0.370)	8% (0.119)	8% (0.119)	3% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
	Erosion control	8% (0.167)	3% (1.000)	6% (0.602)	6% (0.244)	3% (1.000)	3% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
Cultural and recreational	Ecotourism	11% (0.054)*	8% (0.338)	8% (0.167)	8% (0.061)*	6% (0.305)	0% (0.555)	0% (1.000)	0% (1.000)	3% (0.222)
	Recreation	11% (0.054)*	3% (1.000)	8% (0.167)	8% (0.061)*	8% (0.061) *	0% (0.555)	0% (1.000)	0% (1.000)	0% (1.000)
	Education and research	3% (0.541)	3% (0.541)	6% (0.090)*	3% (0.370)	3% (0.370)	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
	Spiritual use i.e. baptism, traditional healing and cleansing	3% (1.000)	3% (1.000)	0% (1.000)	3% (0.466)	6% (0.084) *	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)

	Cultural experiences/practices/significance	3% (1.000)	0% (1.000)	3% (0.488)	3% (0.370)	6% (0.045) **	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)

2.3.9 Linking wetland degradation and solutions

We used the Chi-square test to determine potential associations between threats to wetland and solutions similar to previous sections. There were significant associations between the underlying threats, root causes of wetland degradation, and solutions (see Table 2.4). For example, multi-sectoral approach and bottom-up approach were associated with politics ($p < 0.05$), and bottom-up approach was further associated with low income ($p < 0.05$) while livelihood diversification was associated with drought ($p < 0.05$). The results show that including the local community and collaboration between all stakeholders can help tackle the root causes of wetland degradation. Among the proximate threats, wetland assessment methods were significantly associated ($p < 0.05$) with unregulated wetland use, extensive agricultural practices for cultivation, and over-utilization of wetland resources. Bottom-up approach was associated with limited implementation wetland policies/laws ($p < 0.05$) while weirs were associated with incised channel/canalization ($p < 0.05$). To successfully implement wetland policies, the bottom-up approach may be effective if complemented with other solutions such as wetland assessment methods among others.

Table 2.4: Association between threats to wetlands and solutions

	Threats to wetlands	**Multi-sectoral approach (% of studies and p-value in parenthesis)**	**Weirs (% of studies and p-value in parenthesis)**	**Wetland assessment methods (% of studies and p-value in parenthesis)**	**Bottom-up approach (% of studies and p-value in parenthesis)**	**Livelihood diversification (% of studies and p-value in parenthesis)**	**Alien control programs (% of studies and p-value in parenthesis)**	**Earth berms (% of studies and p-value in parenthesis)**	**Wetlands offsetting (% of studies and p-value in parenthesis)**	**Chute-drop (% of studies and p-value in parenthesis)**
Proximate/immediate threats	High wetland dependency	19% (0.104)	11% (0.694)	17% (0.200)	14% (0.062) *	11% (0.376)	6% (1.000)	0% (0.167)	0% (0.167)	0% (0.417)
	Extensive agricultural practices for cultivation	17% (0.682)	11% (0.422)	19% (0.034) **	11% (0.634)	8% (1.000)	6% (0.609)	0% (0.124)	0% (0.124)	0% (0.361)
	Extensive agricultural practices for livestock grazing	14% (0.695)	11% (1.000)	8% (0.684)	6% (0.650)	6% (0.650)	6% (1.000)	3% (1.000)	3% (1.000)	0% (0.472)
	Over-utilization of wetland resources	14% (0.434)	8% (0.695)	17% (0.037) **	8% (0.650)	6% (1.000)	6% (1.000)	0% (0.487)	0% (0.487)	0% (1.000)

	Anthropogenic draining	3% (0.213)	8% (0.422)	11% (0.225)	0% (0.136)	3% (0.634)	6% (0.609)	0% (0.525)	0% (0.525)	3% (0.361)
	Erosion	6% (0.682)	14% (0.107)	11% (0.686)	0% (0.136)	0% (0.136)	3% (1.000)	0% (0.525)	0% (0.525)	3% (0.361)
	Invasive alien plants	8% (0.658)	11% (0.179)	8% (0.370)	3% (1.000)	0% (0.293)	6% (0.305)	0% (1.000)	0% (1.000)	3% (0.278)
	Unregulated wetland use	8% (1.000)	3% (0.224)	14% (0.029) **	8% (0.307)	6% (1.000)	6% (0.588)	0% (0.543)	0% (0.543)	0% (1.000)
	Road crossings	6% (1.000)	11% (0.179)	6% (1.000)	3% (1.000)	0% (0.293)	3% (1.000)	3% (0.484)	3% (0.484)	3% (0.278)
	Urban development	8% (0.396)	3% (0.648)	8% (0.340)	8% (0.095) *	0% (0.297)	0% (0.553)	0% (1.000)	0% (1.000)	0% (1.000)
	Incised channel/canalization i.e., ridge and furrow cultivation	3% (1.000)	11% (0.030) **	3% (1.000)	0% (0.559)	0% (0.559)	3% (1.000)	3% (0.356)	3% (0.356)	0% (1.000)
	Rural development	6% (0.639)	3% (1.000)	8% (0.116)	6% (0.244)	0% (0.559)	3% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
	Pesticides use	0% (0.309)	3% (1.000)	6% (0.602)	0% (0.559)	3% (1.000)	3% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
	Pollution i.e. acid mine drainage	6% (0.305)	3% (1.000)	3% (1.000)	3% (0.549)	0% (1.000)	0% (1.000)	3% (0.262)	3% (0.262)	0% (1.000)
	Unplanned fires	8% (0.061) *	0% (0.566)	0% (0.559)	6% (0.132	3% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
	Poor wetland co-management/collaboration	6% (0.596)	0% (0.302)	3% (1.000)	6% (0.186)	0% (0.564)	3% (0.535)	0% (1.000)	0% (1.000)	0% (1.000)
	Limited implementation of wetland policies/laws	6% (0.118)	0% (1.000)	3% (0.488)	6% (0.045) **	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
	Endangered plants and animals' species	0% (0.555)	3% (1.000)	0% (0.566)	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)	3% (0.111)
	Centralized top-down approach	3% (0.400)	0% (1.000)	0% (1.000)	3% (0.262)	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
	Lack of transparent open platform to discuss wetland issues	3% (0.541)	0% (1.000)	0% (1.000)	3% (0.370)	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
	Little knowledge on strategies to maintain wetlands	3% (0.541)	0% (1.000)	0% (1.000)	3% (0.370)	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
Ultimate/underlying threats	Population growth/pressure	8% (0.384)	0% (0.160)	11% (0.050) *	8% (0.088) *	3% (1.000)	6% (0.255)	0% (1.000)	0% (1.000)	0% (1.000)
	Drought	6% (0.305)	3% (1.000)	3% (1.000)	6% (0.132)	8% (0.013) **	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)
	Climate change	3% (0.397)	3% (0.397)	0% (0.155)	3% (1.000)	6% (0.603)	0% (0.559)	0% (1.000)	0% (1.000)	0% (1.000)
	Low income	6% (0.118)	0% (1.000)	3% (0.488)	6% (0.045) **	0% (1.000)	3% (0.305)	0% (1.000)	0% (1.000)	0% (1.000)
	Poverty	3% (1.000)	0% (0.555)	3% (1.000)	3% (0.466)	3% (0.466)	6% (0.053) *	0% (1.000)	0% (1.000)	0% (1.000)
	Unemployment	3% (0.400)	0% (1.000)	3% (0.356)	3% (0.262)	0% (1.000)	3% (0.213)	0% (1.000)	0% (1.000)	0% (1.000)
	Politics	6% (0.044) **	0% (1.000)	0% (1.000)	6% (0.016) **	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)	0% (1.000)

2.4 Discussion

2.4.1 Extent of wetland degradation and interventions in southern Africa

The review provides evidence of wetland degradation across all the wetland interventions. Population growth was reported most frequently as the underlying driving force of wetland degradation in both the wetland management and wetland rehabilitation intervention case studies. Increases in population trigger an increase in the demand for residential areas and economic activities to sustain local livelihoods (Thamaga, Dube & Shoko, 2022b). The impact of human activities on wetlands in the wetland management case studies are evident in the reported proximate threats which included increased wetland dependency, over-utilization of wetland resources, unregulated wetland use, extensive agricultural practice for cultivation and livestock grazing, pesticide use, invasive alien plants, canalization, rural and urban developments. Erosion was only significantly associated with wetland rehabilitation which suggest an advance in wetland degradation that was addressed through increasing the wetland's ability to recover from the disturbance. Invasive alien plants were mainly associated with wetland restoration and wetland management which suggest that invasive alien plants may threaten wetlands to the point of extinction if proper management action is not taken.

Remote sensing, sometimes coupled with an ecological and socio-economic surveys, was used to assess the extent of wetland degradation by some of the studies in this review. For example, Thamaga *et al.* (2022b) showed that the Maungani wetland declined by 75% between 1983 and 2019. In another study that used remote sensing to assess the land use changes in the Ga Mampa wetland between 1996 and 2004, Troy, Sarron, Fritsch and Rollin (2007) reported that the wetland declined by 52%, natural vegetation zone reduced by 44%, while residential areas increased by 43%, and agricultural areas increased by 38%. Nhamo, Magidi and Dickens (2017) reported a decline of 19% of the Witbank Dam Catchment between 2000 to 2015 and the findings showed that 21% of the wetland was still under cultivation. Even though Phethi and Gumbo (2019) do not report the decline of the Makhitha wetland in numbers, their findings show the decline in the wetland area through satellite images between 1978 and 2004.

Understanding the types of wetlands and the different hydrogeomorphic units is important in addressing wetland degradation. For example, Rivers-Moore and Cowden (2012) attempted to develop probability models of wetland degradation and the results showed that the probability

of floodplain degradation decreased for altitudes less than 400 metres while the predictor of seeps degradation was population density. Tooth (2018) explored the concept of resilience using wetland case studies of which 2 wetlands (Klip River floodplain wetland and Tshwane River floodplain wetland) were reported as resistant to environmental change or 'withstood disturbance' while Schoonspruit floodplain wetland was found to be nonresilient to environmental change.

The lack of local stakeholders' participation and poor power dynamics results in poor wetland co-management or collaboration (Alexander, Ramotadima & Sanderson, 2018; Dalu, Mukhuwana, Cuthbert, Marambanyika, Gunter, Murungweni & Dalu, 2022; Lindley & Lotz-Sisitka, 2019). It is important to understand the perceptions of the local community in responding to wetland degradation (Dalu *et al.*, 2022). Using expansive social learning may overcome the lack of participation and improve power dynamics i.e., changes in structure, practices, approaches, discourses, values, knowledge, and thinking (Lindley & Lotz-Sisitka, 2019). In an African context, involving the traditional leaders from a local village in the wetland planning and developing inclusive community consensus was found to limit the power structure's ability to control the planning process (Alexander *et al.*, 2018).

The continued degradation of the Ga-Mampa wetland indicated that the measures (i.e., procedures, formal and informal regulations or legislation or policies) and capacity for managing the wetland sustainably were not effective and insufficient (Ostrovskaya, Douven, Schwartz, Pataki, Mukuyu & Kaggwa, 2013a). Capacity development should be integrated into wetland management and built upon institutions that already exist at local levels incorporating the social and cultural aspects of the community (Ostrovskaya *et al.*, 2013a). It is important for all wetland stakeholders to understand the consequences of alternative wetland management and policy regimes (Jogo & Hassan, 2010). For example, Jogo and Hassan (2010) argue that both conservation and diversifying out of agriculture improves economic human well-being while pure conservation strategies lead to significant economic welfare losses especially for the local communities. Economic-ecological models provide insights in guiding policies aimed at reducing wetland degradation and at the same time achieve conservation goals.

2.4.2 Lessons from wetland rehabilitation and wetland restoration case studies

One of the main aims of wetland rehabilitation is to maintain habitat's integrity, reinstate ecosystem services and address the causes of wetland degradation (Sieben, Ellery, Kotze & Rountree, 2011). Planning, therefore, becomes a pre-requisite for any wetland rehabilitation programme to be successful. The planning involves a thorough analysis of the impacts of the threats causing wetland degradation, assessing the functioning and health of the wetland, identification of the spatial scales, and classification of the wetland into hydrogeomorphic units (Sieben *et al.*, 2011). Wetland rehabilitation should be targeted at addressing the root causes of wetland degradation instead of the symptoms (Sieben *et al.*, 2011). The spatial framework is considered as a systematic approach in planning prior wetland rehabilitation and it is useful in providing guidance on how to prioritize wetlands targeted for rehabilitation (Ollis, Ewart-Smith, Day, Job, Macfarlane, Snaddon, Sieben, Dini & Mbona, 2015; Reis, Hermoso, Hamilton, Bunn & Linke, 2019; Sieben *et al.*, 2011). A practical application of the spatial framework approach was illustrated by Sieben *et al.* (2011) on about 10 wetlands. The results showed the wetland health assessments, type of wetlands, priority scales (from '1' high priority to '–' not a priority), and reasons for prioritization.

Wetland rehabilitation is expensive, therefore, reliable information on which wetland should be earmarked and prioritized for rehabilitation is imperative. For example. rehabilitating a 25 hectors of wetland area with 1 hector already degraded was estimated to cost at least about 2.5 million ZAR (South African Rand) using an ecological economic model (Marais, Fischer, Kotze, Haasbroek, Govender, Pugin & Horn, 2021). Investing in wetland rehabilitation is to invest in the future. About 2.8 million ZAR was invested in rehabilitating Pietersieliekloof wetland the benefits included conserving endemic fauna and flora, increase in base waterflow (i.e., improved water security and ecotourism), increased carbon storage, employment of 44 persons which is about 7898 person days project work (Nieuwoudt, Grundling, Du Toit & Tererai, 2018). This is evidence of a good return on investment, without this rehabilitation project the red-finned minnow would have gone extinct and local farmers or households would suffer from water insecurity.

There is evidence that wetland rehabilitation improved ecosystem services, wetland health, and local livelihoods. In response to acid mine drainage, the wetland rehabilitation resulted in improved water quality (i.e., downstream algal diversity increase) and decreased the filtered

metal concentrations (De Klerk, Oberholster, Van Wyk, Truter, Schaefer & Botha, 2016). In order to accurately assess the effects of wetland rehabilitation, a thorough wetland assessment should be conducted before the rehabilitation to establish a baseline and afterwards to compare and determine changes. Two wetlands were assessed before and after the rehabilitation and the results showed improvements after 7 years post rehabilitation in vegetation composition, ecosystem services and wetland ecological integrity (Cowden, Kotze, Ellery & Sieben, 2014). A similar approach was employed to the Zaalklaspruit wetland rehabilitation case study and the immediate results showed an improvement in the water quality (i.e., an increase in pH levels and decrease in dissolved metals) even though conclusions on the ecological integrity were not possible in the short-term (Van Vuuren, 2014).

In the studies used in this review, the focus for restoration case studies was on restoring the hydrology of the wetlands in a way that the natural dynamics of the wetland are preserved (Kotze, Tererai & Grundling, 2019; Rebelo, Le Maitre, Esler & Cowling, 2015; Sieben, Procheş, Mashau & Moshobane, 2022). Some studies use the terms wetland rehabilitation and wetland restoration interchangeably (Sieben *et al.*, 2022). However, there seems to be a slight difference between wetland rehabilitation and wetland restoration which is based on the extent of wetland degradation (Elliott *et al.*, 2016). Using spatial analysis, hydrological modelling and land use/land cover change analysis, Rebelo *et al.* (2015) found that restoring the wetlands to their relative natural states they were in around the 1950s would increase the water supply by 1.13 million cubic meter per annum. The wetlands declined by 84% between 1956 and 2007 mainly caused by agriculture (about 307 hectors) and invasive alien plants (about 336 hectors). There is ample evidence of successful restoration case studies. According to Kotze *et al.* (2019), there was an overall improvement of 10-30% of the ecological condition which was mainly the hydrological aspect.

2.4.3 Nexus between ecosystems services, wetlands, and agriculture

Striking a balance between food security through wetland agriculture, local livelihoods, and wetland conservation is one of the major challenges in sustainable wetland management. An economic valuation study revealed that agriculture was 38% of the total value of the wetland and 50% of the wetland was converted to agriculture without reducing the dry season water flow (McCartney, Morardet, Rebelo, Finlayson & Masiyandima, 2011). However, the results of this review show that agricultural related activities within wetland areas are the leading cause

of continuing wetland degradation (Bootsma, Elshehawi, Grootjans, Grundling, Khosa, Butler, Brown & Schot, 2019; Chatanga & Seleteng-Kose, 2021). A multi-criteria analysis approach called Working Wetland Potential (WWP) may be a step closer toward a solution that seeks to strike a balance between wetland agriculture and conservation efforts. The WWP approach takes into account the ecological condition of the wetland, current contribution to social welfare, agricultural activities that suit the wetland, potential hazards of agricultural activities and finally combine these aspects to determine the suitability of a wetland for agricultural activities (McCartney & Houghton-Carr, 2009). Three case studies in different countries employed the WWP index and the results demonstrated the index's ability to integrate both the social and biophysical aspects of utilizing wetlands for agricultural activities (McCartney & Houghton-Carr, 2009). Approaches such as the WETwin method that evaluate management interventions in wetlands (Johnston, Cools, Liersch, Morardet, Murgue, Mahieu, Zsuffa & Uyttendaele, 2013) and WET-EcoServices which assess the demand and supply of ecosystem services (Kotze, Macfarlane, Edwards & Madikizela, 2020) can complement the WWP index.

2.4.4 Limitations

The review used peer reviewed scientific journal articles meaning there could be additional empirical evidence possibly from chapters, conference proceedings, and grey literature which may have been left out. We only used Scopus database for searching the literature due to time constraints, which may have added a limit on the total publications obtained for the final analysis. Future studies may consider using other available databases i.e., Web of Science, ProQuest, Google, etc.

2.5 Conclusion and recommendations

The assessment of the potential associations between wetland interventions and ecosystem services and/or wetland degradation render important insights into sustainable wetland management. As the population continues to increase, there is a need to carefully design mitigation measures that will proactively address local communities needs and conserve wetlands for future generations. The results of this review show that the opportunity cost of mismanagement of wetlands is high. Prolonged human activities and improper management lead to wetland degradation. Agricultural activities and invasive alien plants are the leading causes of wetland degradation mainly driven by population growth.

Most of the studies show that the wetland users are mainly focused on the provisioning services and partly on regulating and maintenance services. Cultural and recreational services were the least and at times not considered in wetland management. There is a need for assessing how individuals make trade-offs or rank ecosystem services. Ignoring the cultural aspects and history of the community is one of the causes of wetland management failures or even unsuccessful wetland rehabilitation programmes. Therefore, there is a need to assess preferences for cultural and recreational services in order for policymakers to include them in budget allocations and policy formulations. Wetland management failures lead to further degradation and often make costly interventions, like wetland rehabilitation and wetland restoration, a necessity. It is not always possible to restore the wetland back to its original natural state which implies there is a risk of reaching a threshold of irreversibility despite the wetland rehabilitation and restoration evidence of improved ecosystem services.

First, stakeholder engagement especially local community participation is important in the planning and zoning process. The institutions, power structures, wetland policies, laws, and rules coupled with the implementation, enforcements and penalties should be discussed at this stage. Second, the wetland assessments using methods like the Working Wetland Potential method can guide wetland uses and management in terms of which wetland is suitable for agriculture. Third, wetlands should be monitored constantly. Fourth, wetland health assessments should be conducted to provide a baseline before a rehabilitation or restoration project is initiated. Fifth, after the rehabilitation or restoration, the project should be evaluated and compared to the baseline meaning that there might be changes in the wetland uses. Sixth, the options for livelihood diversification should be investigated and considered as alternatives to the high dependency on wetlands and its ecosystem services. Future studies should investigate and use approaches that can provide better evidence on the wetland resilience especially for wetlands under intensive agricultural activities. There is also a need for more studies that model the degradation of wetlands in southern Africa and a database that will be used to store the data, monitor, and update it annually.

Chapter 3: Challenges and lessons learned on non-market valuation of cultural ecosystem services using a discrete choice experiment – the case of the reed dance in Eswatini

Abstract

This paper uses a discrete choice experiment to elicit preferences for cultural and provisioning services using the case of the reed dance and wetlands in Eswatini. Despite the importance of cultural services for cultural continuity, economic valuation research has paid less attention to cultural services relative to other ecosystem services. To address this gap, choice data was collected from 450 respondents using face to face interviews. The outcome highlights the challenges of incentive compatibility when asking about ecosystem services in a sensitive political context. Furthermore, the incentive compatibility challenges result in high levels of attribute non-attendance to the price attribute which is unexpectedly estimated positive and significant. This further suggests that respondents had difficulties in making trade-offs between the reed dance and money also due to the fact that the cultural services are incommensurable. The paper concludes by drawing lessons learned from eliciting preferences for cultural services that are beyond recreational benefits, ecotourism and landscape aesthetics.

Keywords: Attribute non-attendance, discrete choice experiments, cultural ecosystem services, payment vehicle, reed dance

3.1 Introduction

Individuals and society make choices, often guided by economic drivers, that may result in ecosystems degradation (Anderson, Palma & Thisse, 1992, Milleniun Ecosystem Assessment (MA), 2005). The degradation of ecosystems reduces their capacity and ability to support cultural ecosystem services (CES)[2] (Chan, Satterfield & Goldstein, 2012b). The MA (2005) defines cultural services as the nonmaterial or intangible benefits people obtain from ecosystems through aesthetic experiences, spiritual enrichment, recreation, reflection, and cognitive development. The main indirect drivers of ecosystem degradation are an increase in population, economic activity change, socio-political factors, science and technology, and cultural and religious factors (MA, 2005). Direct drivers of ecosystem degradation include overexploitation, pollution, invasive species, habitat, and climate change (MA, 2005). Despite the importance of CES to human well-being, the continuous supply of cultural goods and services depends on the presence and health of the ecosystems that produce them and public support to justify public expenditures for their production, distribution, and maintenance (Navrud & Ready, 2002; Throsby, 2010).

Research has, in general, paid less attention to CES relative to other ecosystem services (Tilliger *et al.*, 2015) and has focused largely on provisioning services and, recently, on regulating and maintenance services compared to CES (Hirons *et al.*, 2016). Consequently, policymakers often tend to ignore CES in decision-making and policy frameworks. Policymakers also neglect CES integration into the ecosystem services assessments, development strategies and decision-making processes (Chan *et al.*, 2012a; Chan *et al.*, 2012b).

If the neglect of ecosystems continues unabated, the production of CES will decline, posing a threat to cultural continuity and a potential loss of welfare in societies. Unless research is conducted to institutionalize CES, policy makers will continue to ignore CES in policy frameworks and development strategies. Without empirical evidence of public support for CES, policymakers find it hard to ensure the sustainable production and distribution of CES through

[2] Some cultural ecosystem services arise from human-ecosystems relationships as ecosystems' contribution (benefits or flows) to human well-being (for example, experiences and capabilities) (Chan et al., 2012a). The nonmaterial benefits arising from human-ecosystems interactions include: inspiration, spiritual attachment, sense of place, sense of belonging, heritage, social relations or capital or cohesion, identity, and knowledge including employment, activity, aesthetic, existence, bequest, and option values (Chan et al. 2012b). We use the words 'cultural ecosystem services' abbreviated as CES and 'cultural services' sometimes also called 'cultural and recreational services' interchangeably in this paper.

the conservation of ecosystems. Justifying public expenditure on ecosystems and distribution of CES also requires evidence of public preferences. This necessitates further research that uncovers public preferences for CES despite the difficulties in measuring them (Hernández-Morcillo. et al., 2013). Although research has uncovered preferences for ecotourism and recreation, CES are poorly reflected in economic indicators (Martín-López, Gómez-Baggethun, Lomas & Montes, 2009).

CES are classified as non-market goods as there is typically no market on which the rights to them can be exchanged or traded; moreover, their benefits arise outside conventional market processes (Throsby, 2010). CES valuation studies have been done on landscapes (see for example van Berkel & Verburg, 2014; Navrud & Ready, 2002; Tengberg *et al.*, 2012), museums (see for example Armbrecht, 2012; Bedate, Herrero & Sanz, 2004; Colombino & Nese, 2009; Morrison & Dowell, 2015; Tohmo, 2004), cultural heritage sites (see for example Choi, Ritchie, Papandrea & Bennett, 2010) and music festivals (see for example Snowball, 2005). One of the economic valuation techniques used to elicit preferences and assign a monetary value to non-market goods like CES is a stated preference technique called discrete choice experiments (DCEs) (Adamowicz *et al.*, 1994; Mazzanti, 2003). DCEs use attributes of a good to make hypothetical scenarios that model real life decision-making which are presented in choice sets made of two or more alternatives on which respondents choose their most preferred alternative (Train, 2009). DCEs rely on underlying experimental designs to generate efficient choice sets used to elicit preferences.

Green, Jacowitz, Kahneman and McFadden (1998) show that if respondents in a stated preference study accept the hypothetical frame, they will achieve the best outcome for themselves by answering truthfully, i.e., according to their true preferences, and such mechanism or frame is termed incentive compatible. Recent evidence suggests that incentive compatibility also can depend on the choice of payment vehicle (Hassan *et al.*, 2017). Incentive-compatible elicitation in stated preference surveys is based on a number of fundamental assumptions where consequentiality is important. This can further be divided into *policy consequentiality*, where respondents perceive whether a policy or project's implementation can potentially be influenced by their responses, and *payment consequentiality*, whereupon the policy's implementation respondents actually have to pay (Carson & Groves, 2007; Carson, Groves & List, 2014; Flores & Strong, 2007; Vossler *et al.*, 2012). Some empirical evidence (see for example, Vossler *et al.*, 2012; Vossler & Watson, 2013) suggests that there are effects

of consequentiality on welfare estimates, while other empirical investigations (see for example, Alexander *et al.*, 2013) find no effect. The controversies on payment consequentiality on welfare estimates demand further investigation as they influence the quality of preferences and welfare estimates presented to policymakers.

Cultural goods and services in Eswatini, especially cultural heritage, are regarded as experiences embedded in the national consciousness, cultural continuity, and traditions, and possess economic potential. For example, in Eswatini, CES contributes to about 1.85% of total employment and about 0.44% of household consumption expenditure was spent on cultural activities, goods, and services in 2009 (UNESCO, 2013). *Umhlanga*, or reed dance, is a cultural event where over 20,000 girls led by the royal princesses perform before their Majesties (Swaziland Tourism Authority, 2016). This traditional ceremony involves young maidens who honour the Queen Mother by cutting and presenting reeds to her and repairing the windbreak around the royal residence, in Eswatini. According to Chan *et al.* (2012a), this creates a strong sense of identity and traditional values arising from human-ecosystems relationships.

Despite the importance of CES, the continuous supply of cultural goods or services, especially traditional ceremonies, relies on ecosystems and public funding. Ecosystems like wetlands continue to be degraded through the changing climate and human actions threatening CES production. Public institutions must justify expenditure decisions or funding requests. Uncovering public preferences for CES could assist policymakers in making informed decisions on the sustainability of CES and the ecosystems that produce them, which ultimately leads to sustainable development. CES are at the core of ecosystem services research and present an opportunity to investigate human-ecosystems relationships. Exploring the economics of CES could provide important information on public preferences and demand for CES, which can guide decision-making and policy. Assessment and valuation of CES from ecosystems could benefit several initiatives like ecosystem-based management, planning, investments, and conservation. Implicitly, the valuation of CES could contribute to improved policy and management. Consequently, the main objective of this paper was to elicit preferences for CES.

Decision-makers would be likely to increase investments in the conservation of ecosystem stocks that produces CES if they had empirical evidence of public preferences and willingness to pay (WTP) for CES. In response to the depreciation of ecosystem stocks producing CES, the research study was designed to address the following research questions: do Swazi people have

positive preferences for cultural services and are they willing to pay for them? Are preferences for cultural services homogenous? In addition, the study was also designed to address the following research question: are welfare estimates sensitive to the choice of payment? Therefore, the study was guided by the following hypotheses: (1) The public does not have positive preferences for cultural goods and is not willing to pay for their consumption, (2) Cultural services are not homogenous, and (3) Payment vehicle is neutral to welfare estimates.

The chapter comprises seven sections. Section 1 introduces the study, followed by section 2, which reviews theoretical and empirical literature on CES and preferences for CES. Section 3 describes the research design and applied models followed. Section 4 provides the results and discussion, followed by lessons learned in section 5 and lastly section 6 provides the conclusion and recommendations.

3.2 Literature review

3.2.1 Cultural ecosystem services (CES)

The literature attributes the neglect of CES by policymakers to a variety of factors. First, CES are intertwined with other ecosystem services, making it hard to separate and value their contribution to human well-being in a way that policymakers could invest in the stock that produces them (Daniel, Muhar, Arnbergerb, Aznarc, Boydd, Chane, Robert Costanzaf, Elmqvistg, Flinth, Gobsteri, Grêt-Regameyj, Lavek, Susanne Muharl, Penkerm, Riben, Schauppenlehnerb, Sikoro, Soloviyp, Spierenburgq, Taczanowskab, Tame & Dunkj, 2012).

Second, different definitions and classifications of CES make their valuation difficult. The incorporation of CES into an ecosystem services framework is confounded with the frequent conflation of services, benefits, and values. CES are defined as nonmaterial benefits (Chan *et al.*, 2012a), values (Costanza *et al.*, 1997), services (Costanza, Kubiszewski, Ervin, Bluffstone, Boyd, Brown, Chang, Dujon, Granek & Polasky, 2011), and contributions to nonmaterial benefits (Chan *et al.*, 2012a), see Figure 3.1. Without a clear distinction between services, values, and benefits in defining and categorizing CES in frameworks, the valuation of CES will be faced with difficulties, i.e., selecting attributes defining CES. Services are the components of nature, i.e., natural assets and processes, that produce benefits (the contributions or outcomes

people obtain), whereas values are the "preferences, principles and virtues" that influence how humans interact with, appreciate, and experience these benefits (Chan *et al.*, 2012b).

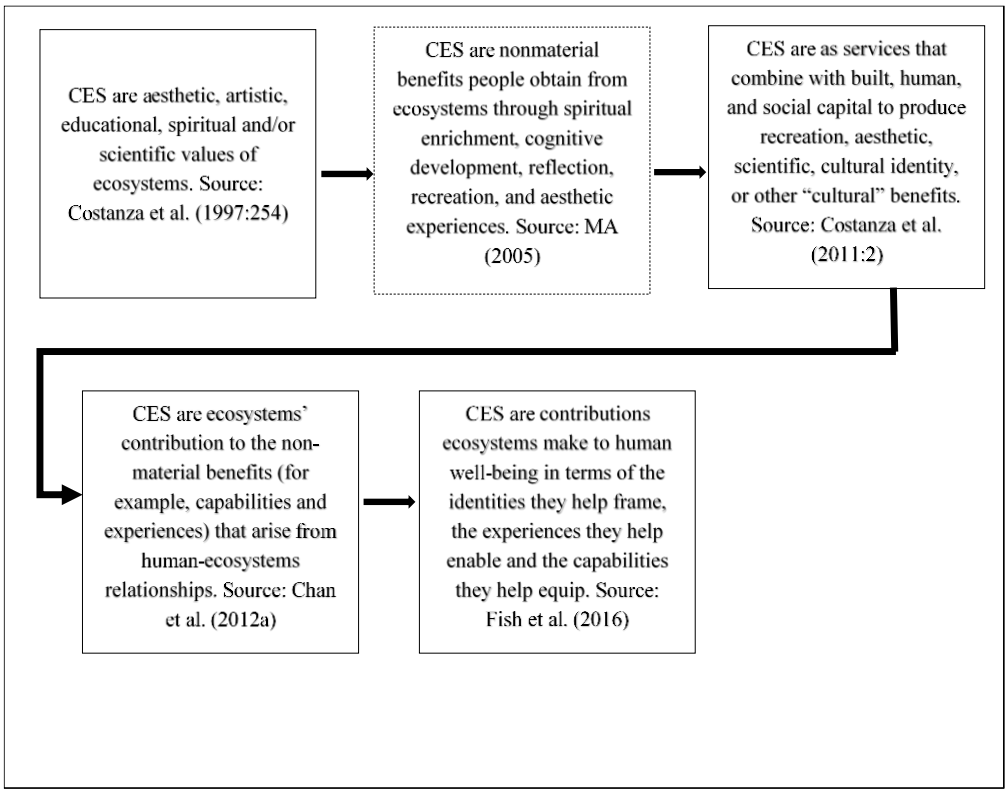

Figure 3.1: Cultural ecosystem services definitions

Third, CES values are plural (Chan *et al.*, 2012b). Value pluralism refers to the notion that ESS have different types of values, i.e., intrinsic, relational, and instrumental values (Chan, Balvanera, Benessaiah, Chapman, Díaz, Gómez-Baggethun, Gould, Hannahs, Jax & Klain, 2016; Chan & Satterfield, 2016). These values arise from the biophysical, socio-cultural, and monetary value domains (Martín-López, Gómez-Baggethun, García-Llorente & Montes, 2014). In economic valuation (instrumental or utilitarian value), the value expressed through the WTP for CES based on the benefits that the good or service confers, including the use and non-use values (existence, bequest, and option) (Milcu, Hanspach, Abson & Fischer, 2013). However, CES also have relational values, i.e., place-specific human-nature connections or interactions expressed as narratives, identity, meaning, and history, among others (Neuteleers & Hugé, 2021). Economic valuation is important for decision makers to compare and allocate funds towards the production, supply, and distribution of CES through ecosystem management. Apart from the economic value and benefits, it is important to appreciate the broad types of value, i.e., ecological value and socio-cultural value. Ecological value refers to the resilience,

functional integrity, and health of an ecosystem to sustain life (Bryan, Raymond, Crossman & King, 2011; De Groot, Brander & Finlayson, 2018; De Groot, Alkemade, Braat, Hein & Willemen, 2010). Socio-cultural values refer to the way ecosystem services are contextualized and constructed in a cultural aspect (Scholte, Van Teeffelen & Verburg, 2015). CES are associated with all three values (intrinsic, relational, and instrumental values) proceeding from humans, ecosystems, and eco-evolutionary processes, which represent the biosphere (Piccolo, 2017; Rolston, 2020).

Fourth, the valuation of CES has been limited to recreational benefits, ecotourism, and landscape aesthetics (Chan *et al.*, 2012a) with a geographical bias to the global North, i.e., Europe and North America (McElwee *et al.*, 2022). CES also cover arts and culture; for example, monuments, museums, cathedrals, historic buildings, and traditional festivals or ceremonies are part of CES. Finally, some CES, especially those in the artistic sub-category of CES, are not directly linked to ecosystems but still use material from the environment. For example, clay, stones, trees, soil, and water are used in the construction of historic buildings, museums, and monuments.

Fifth, there is a debate in the literature on the intangibility and incommensurability properties that make CES difficult to measure (Costanza *et al.*, 1997; Groot, Wilson & Boumans, 2002; MA, 2005; Satz, Gould, Chan, Guerry, Norton, Satterfield, Halpern, Levine, Woodside, Hannahs, Basurto & Klain, 2013). The intangibility of CES refers to the physical, emotional, and mental benefits that are intuitive in nature (Milcu *et al.*, 2013). CES are generally incommensurable, meaning that cultural values cannot be compared with other values (Satz *et al.*, 2013). True incommensurability of CES implies complete incomparability of cultural values with other values, which defeats possible rational decision-making and inclusion of cultural values in the overall economic assessment of an ecosystem.

3.2.2 Preferences for cultural ecosystem services using discrete choice experiments

A DCE is a method that is attribute-based used measure benefits and uncovers how individuals value selected attributes of a good, service, or program. The DCE technique is based on the assumption that alternatives are described by attributes (Lancaster, 1966) and an individual's valuation (preference, utility, benefit, or satisfaction) depends on attribute levels (Louveire & Woodworth, 1983). Unlike the revealed preference method, which uses real market choice data,

DCEs rely on constructed markets and model complex hypothetical scenarios with trade-offs between several attributes that model real-world decision-making (Adamowicz *et al.*, 1994; Oleson *et al.*, 2015).

Conditional logit (CL) models assume homogeneity of preferences or 'fixed subject effect', implying that the deterministic portion of utility V_i does not vary across individuals (McFadden, 1986). However, the value or importance individuals place on each attribute defining a good or service of an alternative varies between individuals (McFadden, 1974; Mcfadden & Train, 2000; Train, 2003). For example, larger households living adjacent to wetlands are more likely to place value, weight or importance on the quantity of fibre (sedge and reeds) than smaller households (Train, 2003). Another example is that if women are believed to have a different marginal utility compared to men, then we can introduce observed preference heterogeneity by interacting preference part-worths with socio-demographic variables. If the assumption of homogenous preferences is incorrect and, in fact, preferences vary across individuals, referred to as preference heterogeneity or 'random subject effect', the parameter estimates will be biased (Breffle & Morey, 2000). The assumption of homogenous preferences is restrictive, especially when using a nationwide survey representing the target population in which, in practice, individuals are different and may have different preferences (Scarpa, Philippidis & Spalatro, 2005).

Consumers' tastes or preferences differ from individual to individual, even for reasons that are not linked to observed good or service attributes or demographic attributes just because people are different (Train, 2003). This type of heterogeneity is called unobserved heterogeneity. Two main approaches uncover and account for preference heterogeneity in DCE: the random parameters model (RPL) and the latent class model (LC). In the RPL model, flexible preferences structures that use continuous distributions in describing how preference vary in a given population are modelled (Revelt & Train, 1998; Train, 2003). Preferences for a given attribute are assumed to follow a pre-specified distribution; among other distributions, the normal or log-normal are often used (Mcfadden & Train, 2000). In as much as it is slightly more complicated to calculate WTP from the RPL model since the distribution of WTP is actually a ratio distribution of two independent distributions, the distribution of WTP can be inferred directly (Hensher & Greene, 2011).

In the LC model, it is assumed in a given population, there is a finite number of distinct types of people and that each type is characterised by a distinct set of preferences (McFadden, 1986). Instead of observing an individual's structure, probabilistic statements about the likelihood of an individual being in a specific class which is described given utility function can be made. Therefore, homogeneity is assumed in each class, and variations in the probabilities of individuals being in a particular class are used for capturing heterogeneity (Hensher & Greene, 2011). Compared to the RPL model, distributional assumptions regarding preference are not required. One of the challenges with the LC model is determining the number of classes to use (Train, 2003). The RPL does not have a closed form; hence simulation techniques are used to approximate the integrals, and in the LC, standard optimisation routines are used (Mcfadden & Train, 2000; Train, 2003).

Experimental design and its efficiency are the most important aspect of DCEs, given that it determines the level of precision in estimates of parameters for a given sample if assumptions made hold (Kessels, Jones & Goos, 2011; Louviere, Pihlens & Carson, 2010). There are different statistical design criteria in which experimental designs can be optimised in DCEs i.e., D-, A-, G-, and V-optimality criteria. The D-optimality relates to minimisation of the determinant of the asymptotic variance-covariance while the G-optimality minimises the maximum prediction of the design (ChoiceMetrics, 2018; Scarpa & Rose, 2008). For example, experimental design theory allows for the systematic arrangement of matrices of values, and attribute levels, assigned to attributes in an alternative within a choice set. Further, there are underlying assumptions made on the model specification and different statistical design criteria that allows for the evaluation of outcomes in terms of statistical efficiency.

Economic choices are influenced by the respondents' complete information set (endogenous and exogenous information). Endogenous information refers to prior information, knowledge, and familiarity with the good valued, while exogenous information refers to objective information provided by the survey instrument or interviewer. One of the under-studied component in DCE surveys is ex-ante information about the good or knowledge already possessed by a respondent before the choice task and the respondents' belief about the quality of their information (LaRiviere, Czajkowski, Hanley, Aanesen, Falk-Petersen & Tinch, 2014). What is of interest in the literature is how preferences and welfare estimates are affected by endogenous information. The literature points to both directions regarding the effects of information on welfare estimates.

Similar to a study conducted by Ajzen, Brown and Rosenthal (1996) considered eight contingent valuation studies reaching the same conclusion that exogenous significantly influenced the mean WTP. Efforts have been made to investigate the effects of endogenous information on welfare outcomes in contingent valuation, and findings suggest that endogenous information influences welfare outcomes (for example see Bergstrom, Stoll & Randall, 1990; Boyle, Welsh & Bishop, 1993; Davis & O'Neill, 1992; Kealy, Dovidio & Rockel, 1988; Lazo, Schulze, McClelland & Doyle, 1992; McClelland, Schulze, Lazo, Waldman, Doyle, Elliott, Irwin & Carlin, 1992; Teisl, Boyle, McCollum & Reiling, 1995). Evidence of information effects (both exogenous and endogenous information) on welfare estimates is limited in DCEs, especially in the valuation of CES. In a study conducted by Czajkowski, Hanley and LaRiviere (2016), the findings suggested that welfare outputs were sensitive to information (exogenous) provided to respondents. Similar to exogenous information, endogenous information (familiarity, motivations, knowledge) has been found to influence welfare outcomes (for example see Börger & Hattam, 2017; LaRiviere *et al.*, 2014).

3.2.3 Payment vehicle

The stated preference guidelines recommendation emphasises the importance of selecting the appropriate payment vehicles for public goods (Arrow, Solow, Portney, Leamer, Radner & Schuman, 1993; Bateman, Carson, Day, Hanemann, Hanley, Hett, Jones-Lee, Loomes, Mourato & Ozdemiroglu, 2003; Johnston, Boyle, Adamowicz, Bennett, Brouwer, Cameron, Hanemann, Hanley, Ryan & Scarpa, 2017). Voluntary donations are considered less coercive and prone to free-riding, causing welfare estimates to be biased. Consensus has yet to be reached in the literature on the most appropriate payment vehicle in DCE with sufficient coverage of the targeted population for developing economies. Mixed results are found in the literature, with some empirical studies (Ajzen *et al.*, 1996; Milon, 1989) finding no significant differences between voluntary donations and more coercive payment vehicles like income taxes, while others found that voluntary donations produce a lower WTP (Carneiro & Carvalho, 2014; Champ, Flores, Brown & Chivers, 2002; Wiser, 2007) and the opposite was found for some (Stithou & Scarpa, 2012; Taylor, 1998). While income tax has good population coverage and is more coercive, respondents are likely to protest to increased taxes. Literature reveals various forms of payment vehicles, a municipal tax (Ndunda & Mungatana, 2013), a surcharge on water services (Carneiro & Carvalho, 2014), voluntary annual donations for preserving

cultural heritage (Báez-Montenegro, Bedate, Herrero & Sanz, 2012) and subsidy reduction (Hassan *et al.*, 2017).

Informed and guided by the literature review, the study was designed to incorporate information effects, i.e., providing a scored quiz before the DCE. We also used three payment vehicles in the DCE, i.e., tax, contribution, and subsidy reduction. However, a respondent received a questionnaire with either one of the payment vehicles. The study sought to contribute to the literature on conservation management by eliciting preferences for CES using different payment vehicles.

3.3 Methodology

3.3.1 Study area

The Kingdom of Eswatini is a landlocked country in southern Africa with a total area of about 17,364km^2. The country has four administrative regions and 55 constituencies. The four administrative regions, namely Hhohho, Manzini, Shiselweni, and Lubombo are shown in Figure 3.2. Eswatini's wetland ecosystem stocks continue to deteriorate, posing a threat to the production of associated cultural ecosystem services (Ministry of Toursim and Environmental Affairs, 2016). The major drivers of ecosystem degradation are climate change, overexploitation, and invasive species. An increase in population and economic development puts pressure on limited natural resources. Both ecosystems and CES have been neglected by policy makers leading to further degradation. For example, only 3% of aquatic ecosystems are legally protected (Ministry of Tourism and Environmental Affairs, 2016). Traditionally, maidens previously marched to cut and collect reeds at the Mpisi farm and Bhamusakhe wetland. Shortage of reeds in the wetlands at Mpisi farm and Bhamusakhe has made it necessary for maidens to cut reeds either from their local communities or other identified local wetlands.

3.3.2 Sampling

The target population is citizens from Eswatini. The sampling units are households across all four regions of the country, namely Hhohho, Manzini, Shiselweni, and Lubombo (see Figure 3.2). The sampling frame consisted of three constituencies in each region which were selected randomly. Further, two villages, rural and urban, were then randomly selected from the selected

constituencies in each of the four regions. Multi-stage random sampling was applied from the selection of constituencies, urban areas, rural areas, and finally, households. Central statistics in Eswatini are officially informed by the Swaziland Household Income and Expenditure Survey, which uses household sample sizes of 3,769 (in 2000/01), 3,167 (in 2009/10), and more recently 5,214 (in 2014/15) (Central Statistics Office, 2010, 2014).

In the four regions of the country, urban and rural areas (or strata) were chosen using a stratified random sample approach, and then random respondents were chosen. In each of the four regions, two urban areas and two rural areas were randomly selected. A total sample of 450 respondents were randomly interviewed by trained enumerators. Nine enumerators were trained in both a workshop and field setting. The households were distributed proportionately as follows: Hhohho (129, 29%), Manzini (153, 34%), Shiselweni (79, 17%), and Lubombo (90, 20%). Permission to carry out the survey was sought from the village leaders, and relationships were built through preliminary visits. No incentives were given to respondents, and participation in the survey was voluntary as per written and verbal consent given to the respondent before the survey.

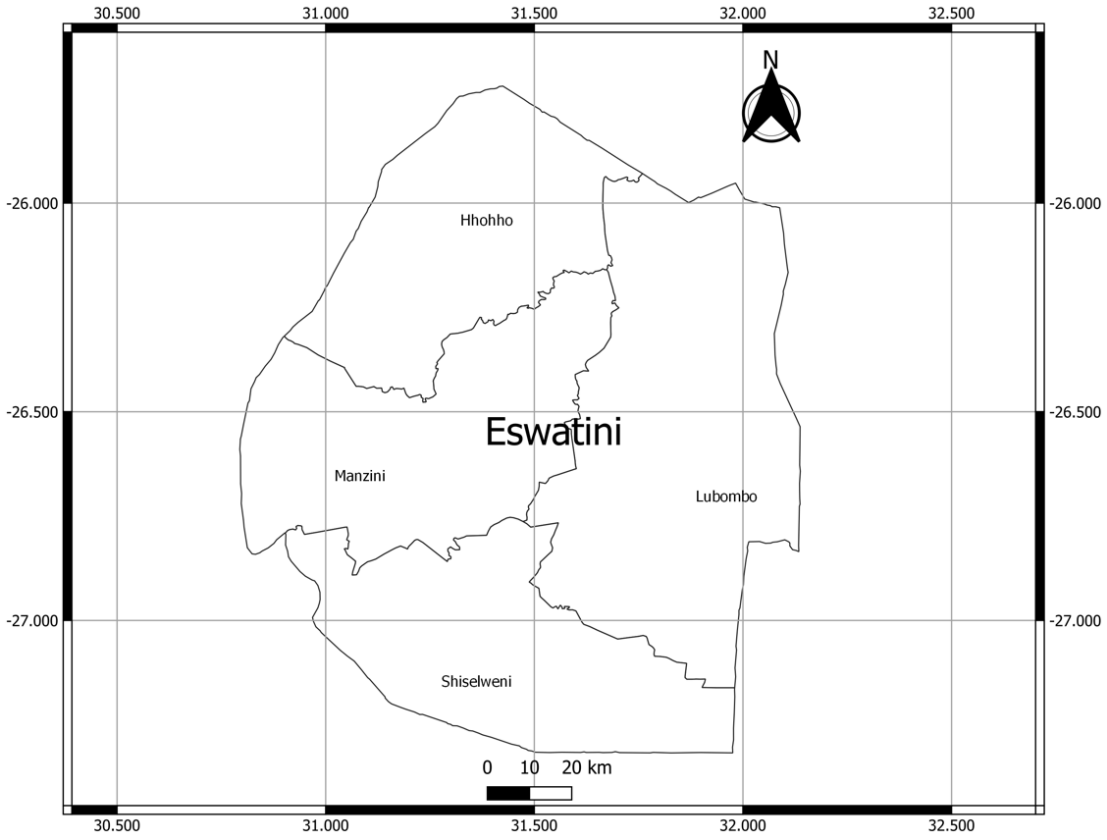

Figure 3.2: Study area

3.3.3 Environmental good valued

The reed dance '*Umhlanga*' traditional ceremony is a yearly Zulu and Swazi cultural event taking place in late August or early September. Over 20,000 girls led by the royal princesses perform before their Majesties during this traditional ceremony. In Eswatini, the reed dance started around the 1940s during the reign of King Sobhuza II, and it was adapted from an older custom called *Umchwasho* (Eswatini National Trust Commission, 2022). In the *Umchwasho* custom, girls were grouped into regiments by age until they were ready for marriage, where they would ultimately do labour for the Queen Mother, perform dances, and have a feast (Swaziland Tourism Authority, 2010). In the old custom, if a girl got pregnant before getting married, her family would be fined a cow (Swaziland Tourism Authority, 2010).

The purpose of the eight-day reed dance is to bring cohesion and preserve young women's pride and chastity whilst 'doing labour' for the Queen Mother (Eswatini National Trust Commission, 2022). Thousands of virgins from different chiefdoms annually travel to the Queen Mother's palace (Swaziland Tourism Authority, 2010). After arrival, the girls go to adjacent wetlands and cut reeds to repair windbreaks around the royal palace. The reeds are then bundled together and brought to the Queen Mother. The girls rest for a day and then prepare for the traditional dance performance. This includes preparing traditional costumes, i.e., skirts, bead necklaces, a sash, and rattling anklets. The girls carry the same bush knives used for cutting the reeds, symbolic of their virginity. The Eswatini National Trust Commission (2022) explains in greater detail the activities of the eight-day annual traditional ceremony, "*The royal family appoints a commoner maiden to be 'induna' (captain) of the girls, and she announces over the radio the dates of the ceremony. She will be an expert dancer and knowledgeable on royal protocol. One of the King's daughters will be her counterpart*".

3.3.4 Survey instrument and development

The specific objectives of the study were taken into consideration when designing the survey questionnaire. It was thoughtfully designed to gather all the pertinent data that might be used to solve the research topic. Three split samples were employed, with each sample having a different payment vehicle, a once-off annual household tax, voluntary donations/contributions, and a subsidy reduction. Bayesian priors were determined to generate a robust experimental design, referred to as the Bayesian D-efficient design (Bliemer & Collins, 2016). After that we

employed the Bayesian D-efficient design with three unlabelled alternatives, including the status quo. Ngene software was used to generate the experimental design. A pilot survey using the Bayesian D-efficient design was then carried out, and the parameter estimates obtained from the analysis were used in the construction of the final Bayesian D-efficient design with much more accurate priors through Bayesian updating method.

We used literature, expert consultations, and focus group discussions on identifying attributes defining the reed dance. Two focus group discussions, mainly composed of local households, were carried out to identify attributes and attribute levels, including identifying questions that had to be included or posed in the survey instrument (questionnaire). These two focus group discussions individually had 7-10 members, with over 60% females aged between 18 and 54. The prominent attributes were wetland conservation, informal education, and tourism presence. These attributes were perceived as important for the continuation and preservation of reed dance. The proxy for the passing of information from one generation to another and instilling traditional values and identity, was set as informal education measured in hours annually. One of the concerns raised in the focus group discussions and consultations was the loss of the Swazi culture and growing western culture. Results from the pilot survey were also used to determine if the cost attribute choked demand and assess if the attributes adhered to economic theory, i.e., the non-monetary attributes exhibited the anticipated positive sign, whereas the price attribute was significant ($p<0.01$) and negative as expected.

Table 3.1: Attribute levels and ranking

Attribute	**Levels (from least to most preferred)**
Household tax (in Rands)	R120, R80, R40, R20, R10, R0
Informal education (in hours)	8h, 12h, 16h
Tourists presence (in thousands)	1, 2.5, 5, 7.5
Wetland conservation (in %)	Conserve 3% of wetlands and there is high probability that reeds supply decreases Conserve 6% of wetlands and there is relatively high probability that reeds supply increases Conserve 12% of wetlands and there is relatively high probability that reeds supply increases

Note: The South African Rand (R) is equivalent to the Swazi Lilangeni (E).

However, we initially determined the priors for the attributes before the pilot survey. First, the range of the attribute levels defining the reed dance was determined and ranked according to expected preferences. Table 3.1 illustrates the ranking of four continuous attribute levels

defining the reed dance, including the price attribute levels. Second, the price attribute was chosen as the base attribute, and trade-offs were made to establish the mean (μ_k) and standard deviation (σ_k) for attribute k. Two methods exist for finding reasonable μ_k and σ_k values; one of them is using analysts' educated guesses.

Therefore, a straightforward two-alternative choice task was used to compare each attribute to the basic attribute. A range of attribute levels was provided such that both alternatives were utility balanced or rather equally preferred (Bliemer & Collins, 2016). Trade-offs between the base attribute and wetland conservation were made, for example, as shown in Table 3.2.

Table 3.2: Utility balancing two options

	Option 1	**Option 2**	Δ^{min}	Δ^{max}
(a)				
Household Tax (in Rands)	60	R120 → [R60, R120]	0	60
Wetland conservation (in %)	7.5	12	4.5	4.5
Probability	50%	50%		
(b)				
Household Tax (in Rands)	60	R120 → [R60, R120]	0	60
Informal education (in hours)	12	16	4	4
Probability	50%	50%		
(c)				
Household Tax (in Rands)	60	R120 → [R60, R120]	0	60
Tourists presence (in thousands)	4.25	7.5	3.25	3.25
Probability	50%	50%		

Note: The South African Rand (R) is equivalent to the Swazi Lilangeni (E).

Midpoints of the attribute range levels for household tax and wetland conservation (for instance, R60 and 7.5%, respectively) were used for Option 1, while levels for Option 2 were tentatively set to the highest ranked levels (for instance, R120 and 12% respectively). Only one of the levels was modified in Option 2 to obtain a utility balance between both options, but a range considered, including the level containing a 95% certainty, was determined. Let Δ_k (Δ_b) represent the variation in attribute k's value across all trade-offs between the two Options, 1 and 2, of which the range then results in minimum and maximum trade-offs with each attribute, $\Delta_k^{\min}$ and $\Delta_k^{\max}$. The wetland conservation range was changed to [R60, R120], meaning that the

analysts believed that an individual (survey respondent) is actually willing to pay R0 to R60 for 4.5% increase in conserved wetlands, for instance, R7 per percentage increase in conserved wetlands on average. The substitution rates for computing μ_k and σ_k were used, see equation 1 below.

$$\mu_k = \frac{\Delta_b^{\min} + \Delta_b^{\max}}{\Delta_k^{\min} + \Delta_k^{\max}} \quad \text{, and} \quad \sigma_k = \frac{1}{1.96}\left|\frac{\Delta_b^{\max}}{\Delta_k^{\max}} - \mu_k\right| \qquad \text{Eq 1}$$

For wetland conservation, this resulted in a Bayesian prior of **N**(6.7$\tilde{\lambda}$, 3.4$\tilde{\lambda}$), where $\tilde{\lambda}$ is the prior scale parameter which was determined in the following stage. It was assumed that one prefers more of wetland conservation, informal education, and tourist presence in the reed dance. This assumption was guided by the results obtained from three focus group discussions. In this case, the analysts were certain of the sign of the parameter but not the range of the base attribute level; thus, a wider range was assumed (R60, R120). The resulting Bayesian priors for informal education and tourist presence were **N**(7.5$\tilde{\lambda}$, 3.8$\tilde{\lambda}$) and **N**(9.2$\tilde{\lambda}$, 4.7$\tilde{\lambda}$) , respectively.

Lastly, a manual calibration of the scale $\tilde{\lambda}$ was done as it cannot be obtained from literature. The scale was developed by taking into account 12 choice tasks for which an estimation of the likelihood that each alternative would be selected was given. There are 12 distinct profiles when accounting for only the levels listed in Table 3.1. By selecting the subsequent attribute level from Table 3.2, the 12 profiles in a sequence of choice tasks for Option 1 were utilized to generate profiles for Option 2, following the methodology recommended by Street, Burgess and Louviere (2005) and Bliemer and Collins (2016). This enabled trading off of all attributes and guaranteed that there was little overlap between the two profiles. Following Street *et al.* (2005), three generators (2101, 1021, and 1212) were added to Option 1 utilizing the modulo-3 arithmetic in a theoretical formulation of an experimental design to produce the profiles in Option 2. Compared to the other constructed designs with single generators, including a fractional factorial orthogonal design generated in Ngene version 1.1.2 (Rose & Bliemer, 2009), the one with three generators (1212, 1021, and 2101) proved to be superior.

All of the constructed 12 choice tasks are shown in Table 3.**3**; however, four of them were dropped because they had dominating profiles. The expected probability f_{s1} of selecting Option 1 is such that, for the eight remaining choice tasks, the expected probability for selecting the Option is $f_{s2} = 1 - f_{sj}$. Additionally, by applying Eq. (2) and maximizing the preceding

loglikelihood function while subindex *n*, the scaling parameter that best suited these predicted probabilities was derived.

$$L(\tilde{\lambda}) = \sum_{s}^{S}\sum_{j}^{J} f_{sj}\log P_{sj} = -\sum_{s=1}^{S}\left(f_{sj}\log\left(1+\exp\left(-\tilde{\lambda}\sum_{k=1}^{K}\mu_k\Delta_{sk}\right)\right)+\left(1-f_{sj}\right)\log\left(1+\exp\left(\tilde{\lambda}\sum_{k=1}^{K}\mu_k\Delta_{sk}\right)\right)\right)$$

Eq 2

Table 3.3: Determining scale

$\tilde{\lambda}$		0.030752						
μ_k		-0.030752	0.205013	0.230640	0.283864			
s	j	Household Tax	Wetland conservation	Informal education	Tourist presence	P_{js}	f_{sj}	$f_{sj}\log P_{sj}$
1	1	0	3	8	1	0.395	0.4	-0.371
1	2	20	6	8	2.5	0.605	0.6	-0.302
2	1	0	6	12	5	0.401	0.4	-0.366
2	2	20	12	8	7.5	0.599	0.6	-0.307
3	1	10	12	16	2.5	0.952	-	-
3	2	40	3	12	5	0.048	-	-
4	1	10	3	12	2.5	0.627	0.6	-0.280
4	2	40	6	8	5	0.373	0.4	-0.395
5	1	20	6	16	2.5	0.696	0.7	-0.254
5	2	80	12	12	5	0.304	0.3	-0.357
6	1	20	12	8	1	0.805	0.7	-0.152
6	2	80	3	16	2.5	0.195	0.3	-0.491
7	1	40	3	16	7.5	0.990	-	-
7	2	120	6	12	1	0.010	-	-
8	1	40	6	8	7.5	0.774	0.8	-0.205
8	2	120	12	16	1	0.226	0.2	-0.297
9	1	80	12	12	7.5	0.896	0.95	-0.104
9	2	0	3	8	1	0.104	0.05	-0.113
10	1	80	3	8	1	0.005	-	-
10	2	0	6	16	2.5	0.995	-	-
11	1	120	6	12	5	0.012	-	-
11	2	10	12	8	7.5	0.988	-	-
12	1	120	12	16	5	0.210	0.2	-0.312
12	2	10	3	12	7.5	0.790	0.8	-0.189
								-4.495

The prior means μ_k were used to evaluate probabilities. After that, the function was maximized using Microsoft Excel, producing a globally concave function with a distinct maximum. Table 3.3 illustrates some of the assumed probabilities f_{sj} used to maximize of the log likelihood function. For example, the scale that maximizes Eq. (2) is 0.030752, and as a result, the

Bayesian priors for wetland protection, informal education, and tourist presence were N(0.205, 0.105), N(0.231, 0.118), and N(0.284, 0.145), respectively.

Bayesian priors obtained in Table 3.3 were used in generating the Bayesian D-efficient design in Ngene, which had a D-error of 0.009 (high efficiency), overall utility balance indicated by the B-estimate of 83.5%, and an S-estimate of 6 (minimum sample size required). In addition, manual swapping of attribute levels was performed in cases where the profile was not appropriate or dominant. In this exercise, efficiency was traded off with utility balance.

In order to conduct a pre-test of the questionnaire, 28 respondents were interviewed, recording the time spent answering the questionnaire. The pilot survey helped determine the choke price, more accurate priors (through Bayesian updating), and relevance of selected attributes and attribute levels.

Before launching the study survey, a comprehensive questionnaire was revised in light of the findings was undertaken. A final revision of the DCE with demographic questions was done. Nine data collectors were then coached and supervised after problems in the questionnaire wording were further discovered and rectified. The results of the informal interviews and pilot survey were expected to provide crucial information that was utilized to make sure the questionnaire follows the customary morals of the community and is logically sound and clear.

3.3.5 Valuation scenario

The valuation scenarios presented to respondents were the same except for the payment vehicles, which were different for the three sub-samples, i.e., household tax, voluntary donations or contributions, and reduced subsidy. The aim of the subsamples was to test the effect of payment vehicles on the preferences for the reed dance. Each survey respondent received 12 choice cards, and each of the choice cards had three options, also referred to as alternatives (see Figure 3.3 for an illustration of a choice card). Below is a presentation of the valuation scenario.

<u>Sub sample 1</u>

"Umhlanga (reed dance) is important in promotion and transmission of culture in the Kingdom of Eswatini. The cultural event depends on traditions and humans but also on the existence of wetlands

and rivers. The purpose of the following choice experiment is to understand how you value the reed dance and its preservation for future generations.

Wetlands have, among other factors, decreased in size due to climate change, livestock grazing, extraction of wetland resources which has affected the production of reeds. Currently, only 3% of wetlands are protected in the Kingdom of Eswatini. During the reed dance, maidens previously marched to cut and collect reeds at Mpisi farm and Bhamusakhe wetland. Shortage of reeds in the wetlands at Mpisi farm and Bhamusakhe, has made it necessary for maidens to cut reeds either from their local communities or other identified local wetlands. The current state will further deteriorate the quality and quantity of the wetlands unless there is an intervention. Consequently, the ability to use reeds harvested in the Kingdom of Eswatini in the future is threatened. Wetlands can be conserved by fencing with controlled access and extraction of wetland resources and water balance maintained to increase wetland resilience, and the more areas that are conserved the higher the likelihood that there will be continued supply of reeds in the future. The conservation comes with a cost but if nothing is done in conserving the current wetlands that produce reeds, reeds supply will decrease.

During the preparation for the reed dance, the maidens are given informal education which includes peer education (sharing of health information like HIV/AIDS prevention and control, domestic abuse, values and behaviour), entrepreneurial skills, and traditional and indigenous knowledge. Today, the maiden's receive 12 hours of education but in the future the number of lessons could be changed, as the education comes with a cost.

At the reed dance in 2017 it was estimated that about 2,500 tourists (non-Swatis from outside the Kingdom of Eswatini) attended. This number of tourists is, among other things, the result of advertising efforts made by Eswatini Tourism Authority, and if the amount used for advertising is changed the number of tourists will react accordingly.

A policy to implement an intervention for the reed dance will require funding for the costs of the intervention that supplements the government budget. The government of the Kingdom of Eswatini is planning to do so by increasing/charging an income tax which will be collected by the Eswatini National Trust Commission (ENTC) into a national fund and used for conserving wetlands that supply reeds for the reed dance, increase informal education and tourist presence. All households in the Kingdom of Eswatini are expected to pay this annual charge.

In each card, we list the attributes related to the reed dance that could be changed and an annual cost to your household for the management required. For each choice card, we kindly ask you to choose the option you prefer given the amount indicated for the changes in the alternatives. You can only choose

one option in each choice card, so please pick the one that you prefer. There are no right or wrong answers so please provide your personal answers and choices. The status quo option represents the current situation and there is no additional cost to your household. Every choice in the following choice cards must be treated independently. Results from similar studies have shown that respondents tend to overestimate how much they are willing to pay. We ask you to think carefully about the different alternatives in relation to your household's income. Please note that the additional payment will reduce your spending on other goods and services in your everyday life."

<u>Sub sample 2 – we only changed one paragraph and everything else was the same</u>

"…

A policy to implement an intervention for the reed dance will require funding for the costs of the intervention that supplements the government budget. The government of the Kingdom of Eswatini is planning to do so through voluntary donations/contributions which will be collected by the Eswatini National Trust Commission (ENTC) into a national fund and used for conserving wetlands that supply reeds for the reed dance, increase informal education and tourist presence. All households in the Kingdom of Eswatini are expected to make a contribution annually.

… ."

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 
Informal education	12 hours	16 hours	8 hours
Tourist presence	2500 tourists	1000 tourists	5000 tourists
Annual household tax (in Emalangeni (E))	E0 per year	E40 per year	E20 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Figure 3.3: Choice card

Sub sample 3 – we only changed one paragraph and everything else was the same

"…

A policy to implement an intervention for the reed dance will require funding for the costs of the intervention that supplements the government budget. The government of the Kingdom of Eswatini is planning to do so through annual price increase on household goods (lowering the current subsidies for groceries such as flour, sugar, maize meal and fuel enjoyed by you and other households). In other words, these goods will become more expensive for you to buy. The money from an annual price increase on household goods (subsidies) will be collected by the Eswatini National Trust Commission (ENTC) into a national fund and used for conserving wetlands that supply reeds for the reed dance, increase informal education and tourist presence. All households in the Kingdom of Eswatini are expected to pay this annual charge. … ."

3.3.6 Data analysis

DCEs are founded on the random utility theory (McFadden, 1974; McFadden, 1986), which we modelled as follows. Assuming that individual decision-maker n (i.e. a local Swazi resident) chooses among alternatives J such as wetland management or conservation programs. The individual receives utility from alternative j which is U_{nj}, j=1 …, J and presume that the individual will select the option that provides the most utility. This implies that an individual chooses alternative i only if $U_{ni} > U_{nj}$ for all $j \neq i$ (Train, 2003; Train, 2009). The unobserved or latent consumer utility U_{nj} is composed of the representative or indirect utility V_{ni} which is systematic and observable from attributes presented to the individual, and the random component or error term ε_{nj}.

$$U_{nj} = V_{nj} + \varepsilon_{nj} \qquad \text{Eq 3}$$

A conditional logit (CL) model was used to elicit the preferences of the general public and WTP for CES. The CL model, which is connected to the random utility functions, serves as the foundation for the majority of expansions to complex models. The stochastic disturbance terms or error terms are considered to have type I extreme values that are independently and identically distributed. One issue with the CL is its reliance on constrained assumptions such as the independence of irrelevant alternatives (IIA) (Train, 2003). Despite the restrictive assumption of IIA, we used and followed the CL specification as the closed form makes it

readily interpretable (Lancsar, Fiebig & Hole, 2017). The random utility model's indirect utility function can be expressed as:

$$V_{ni} = \alpha_i + \acute{X}_{ni}\beta \qquad \text{Eq 4}$$

Where X_{ni} is a vector of attributes that describes a good or service in alternative *i*, V_i is a vector of a decision-maker, while α_i, and β are parameters to be estimated. The multinomial logit (MNL) is useful if we account for interactions with socio-demographic variables where an additional vector $\acute{Z}_n$ of socio-demographic variables is added to the model together with γ_i as a parameter that is estimated.

$$P_{ni} = \frac{exp(\lambda V_{ni})}{\sum_{j=1}^{J} exp(\lambda V_{nj})}, \lambda \text{ is normalised to 1} \qquad \text{Eq 5}$$

Where λ is the scale parameter, which is the inverse of the disturbance's standard deviation, as discussed in the literature review.

To estimate the WTP for changes in the CES attributes, we use a ratio derived from the coefficient of the non-monetary attribute β and a monetary or price attribute (Train, 2003).

$$\text{WTP (implicit price)} = -(\beta_{\textit{non-monetary attribute}} / \beta_{\textit{price attribute}}) \qquad \text{Eq 6}$$

WTP estimates in each of the three split samples is usually compared using the one-way analysis of variance (ANOVA) to determine if the mean WTPs from the payment vehicle types are different from the other. A follow-up t-test is often used to determine the payment vehicle types when the difference occurs, *ceteris paribus*.

Using a latent class (LC) model, we investigated the heterogeneity of preferences (Greene & Hensher, 2003). The LC model makes use of two sub-models. The first sub-model is used to evaluate the likelihood of that an individual belongs to any of the classes. After that a second sub-model calculates the probability of selecting one option when a member of that class. The conditional logistic formulation is used in both sub-models.

It is possible to calculate the likelihood that individual *i* who belongs to class $c \in \{1, \dots, C\}$ will select one of the options $j \in \{1, \dots, J\}$ offered in a choice situation *t* by writing the probability as (Greene & Hensher, 2003):

$$Pr(y_{i,j,t} = 1 | i \in c) = \frac{exp\,(\beta_c'.X_{i,j,t})}{\sum_{j'=1}^{J} exp\,(\beta_c'.X_{i,j',t})} \qquad \text{Eq 7}$$

where $y_{i,j,t}$, an indicator variable, takes the value 1 when an individual *i* selects option *j* and 0 otherwise. The vectors $X_{i,j,t}$ describe the choice situation's attributes and the notation β_c denotes a vector of class *c*-specific utility parameters.

The model calculates the probability that respondents fall into a certain category since the analyst is unable to identify which individual belongs to which class. Individual *i*, therefore, has membership in class *c* with a prior probability π_c.

$$\pi_{i \in c} = \pi_c = \frac{exp(\theta_c'.Z_i)}{\sum_{c'=1}^{C} exp\,(\theta_{c'}'.Z_i)}; \quad c = 1, \dots, C\,; \quad \theta_1 = 0 \qquad \text{Eq 8}$$

where Z_i , the vector of observable individuals' attributes, is associated with a class membership, belonging to a particular class (Greene & Hensher, 2003). To ensure the identification of the model, $\theta_1$is normalized to zero in equation (8). Since each of the N respondents received T unique choice sets, presented in a quasi-panel format, we maximized the following log-likelihood function (Greene & Hensher, 2003):

$$lnL = \sum_{i=1}^{N} ln\left(\sum_{c=1}^{C} \pi_c \cdot \prod_{t=1}^{T} y_{i,j,t} \cdot \frac{exp\,(\beta_c'.X_{i,j,t})}{\sum_{j=1}^{J} exp\,(\beta_c'.X_{i,j,t})} \right) \qquad \text{Eq 9}$$

The LC model sometimes called as the equality-constrained latent class model, can be used to identify ANA (Campbell, Hensher & Scarpa, 2011; Caputo, Van Loo, Scarpa, Nayga & Verbeke, 2018; Jourdain & Vivithkeyoonvong, 2017). The pre-defined ANA classes are obtained from various combinations of attributes of non-attendance as well as attendance. Each attribute that is used in the attendance classes has a non-zero coefficient, whereas the non-attendance classes attributes have a zero coefficient (Hensher & Greene, 2010).

Assuming an ANA rule a and the preference vector β, the probability of observing a sequence y is specified as (Hensher, Rose & Greene, 2012; Jourdain, Lairez, Striffler & Lundhede, 2022):

$$P(y_n \mid \beta, ANA_a) = \prod_{t=1}^{T} \frac{exp((\beta \circ \beta_a)\prime . X_{nit})}{\sum_{j=1}^{J} exp((\beta \circ \beta_a)\prime . X_{njt})} \quad \text{Eq 10}$$

where the element-to-element vector multiplication is represented by the function $\circ$, and β_a is represents the K-vector with ones for attended attributes and zeros for non-attended attributes.

We also investigated preference heterogeneity using the mixed logit (ML) which is also called the random parameters logit (RPL) model following (Train, 2003). The ML model is an integral of the standard conditional logit function calculated at different β's with the density function being a mixing distribution that captures variance and correlations in unobserved factors. It allows a number of assumptions about the distributions of β's i.e., normal, log-normal, uniform, and triangular (see Greene & Hensher, 2003; Hensher & Greene, 2003).

$$P_{ni} = \int \frac{exp(\beta_n X_{ni})}{\sum_{j=1}^{J} exp(\beta_n X_{nj})} f(\beta) d(\beta) \quad \text{Eq 11}$$

3.4 Results and discussion

3.4.1 Sample socio-demographic characteristics and respondents' perceptions and attitudes

The respondents' socio-demographic characteristics are shown in Table 3.4. The respondents had an average age of 34.6 years, with 59% being females. Our estimate is higher than the country's population average age of 20.7 years because we only interviewed respondents who were 18 years or older (United Nations, 2019), and the population's share of females 50.8 is higher compared to males, similar to our estimates (The Work Bank, 2022). In addition, a majority (56.3%) of the respondents had attained high school education with a mean household monthly income of 6,166 SZL (US $392). This findings explains the relatively high population literacy rate of 88.4% among individuals who are 15 years and older (UNESCO Institute for Statistics, 2010). On the other hand, the population's average income is about 4,206 SZL (US $261) (Central Statistics Office of Swaziland, 2015), which is understandably lower than our

estimate because we recorded the total monthly household income. For example, if more than one person earns wages in a particular household then the combined household income can be more or less than our estimate.

Table 3.4: Socio-demographic characteristics of the respondents

Variable	Variable description and type	Mean	Std. error	Min	Max
Gender	Share of female respondents (dummy variable: 0 male, 1 female)	0.59	0.49	0	1
Age	Respondents number of years (continuous variable)	34.55	13.64	18	83
Education	Respondent education level (categorical: 1 No formal education (5%), 2 Adult education (1%), 3 Primary (13%), 4 High school (56%), 5 Tertiary (24%)	3.9	0.95	1	5
Household income	Average monthly earnings in Swaziland Lilangeni SZL (continuous variable)	6,165.59	7,081.37	200	60,000
Quiz Score	Mean total score (/7) to correct answers on information about the reed dance	5.71	0.95	1	7
Reed dance attendance	Share of respondents who attended the reed dance (dummy variable: 0 not attend, 1 attended)	0.59	0.49	0	1
Number of times attending reed dance	Number of times respondent attended the reed dance	4.70	4.35	0	40

The results show that a larger share (59%) of the respondents attended the reed dance at least five times, while 80% indicated that they intend to attend the reed dance in the future. In additional, respondents were given a short quiz with seven questions which was graded and allocated a quiz score. Further, results show that respondents were familiar with the reed dance, thus possessing endogenous information, with a mean quiz score of 5.71 (81.6%).

To determine the respondents' perceptions, knowledge, and attitudes, we presented statements on a five-point Likert scale, with 1 signifying "strongly agree" and 5, "strongly disagree". The statements were related to wetland conservation, informal education, and ecotourism during the reed dance. Table 3.5 presents the analysis of these results. The respondents seem to be aware that the reduction in the natural supply of reeds by wetlands threatens the continuation of reed dance. Similarly, respondents agreed that improved wetland management, i.e., wetland conservation, can help address the decreasing reeds production.

Table 3.5: Respondents knowledge, perceptions and attitude towards the reed dance and wetland management

Statement	Strongly agree (1)	Agree (2)	Neutral (3)	Disagree (4)	Strongly disagree (5)
Reduction in wetland size and in subsequent reduction in the production of reeds negatively affects the ability to host the reed dance	270 (60.81%)	122 (27.48%)	17 3.83%)	20 (4.50%)	15 3.38%)
There is a shortage of reeds at Bhamusakhe and Mpisi farm which can be addressed by conservation of wetlands	250 (56.31%)	144 (32.43%)	30 (6.76%)	12 (2.70%)	8 (1.80%)
There is a problem of decreasing wetland size that in turn decreases production of reeds which can be mitigated by conservation of wetlands	246 (55.41%)	148 (33.33%)	27 (6.08%)	14 (3.15%)	9 (2.03%)
During the reed dance, peer education (sharing of health information like HIV/AIDS prevention and control, domestic abuse, abstinence, values and good behaviour) is important shaping health behaviour of maidens	302 (68.02%)	96 (21.62%)	24 (5.41%)	14 (3.15%)	8 (1.80%)
It is important to share indigenous knowledge that instils respect and Swati culture in the maidens, and transfer skills (handicraft skills, sewing, pottery etc) to maidens during the reed dance through entrepreneurship workshops	326 (73.42%)	100 (22.52%)	12 (2.70%)	4 (0.90%)	2 (0.45%)
I enjoy seeing tourists from all over the world at the reed dance	314 (70.72%)	95 (21.40%)	18 (4.05%)	9 (2.03%)	8 (1.80%)
The results of this study will influence public and cultural policies in the Kingdom of Eswatini	248 (55.86%)	130 (29.28%)	44 (9.91%)	5 (1.13%)	17 (3.83%)

Note: The values represent the number of respondents and the values in parenthesis are the percentage of respondents.

To assess the association between the respondents' knowledge on the reed dance and socio-demographic variables, the Chi-square (x^2) was used if both variables were categorical while the One-way Analysis of Variance (ANOVA) method was employed for categorical and continuous variables. Table 3.6 presents the magnitude of the x^2 and F-tests with the respective p-value in brackets.

Table 3.6: Influence of gender, education, age and income on respondents' knowledge, perceptions and attitude towards the reed dance and wetland management

Statement	Gender	Education	Age	Income
Reduction in wetland size and in subsequent reduction in the production of reeds negatively affects the ability to host the reed dance	10.24 (0.037)**	25.82 (0.057)*	2.30 (0.058)*	2.39 (0.051)*
There is a shortage of reeds at Bhamusakhe and Mpisi farm which can be addressed by conservation of wetlands	3.66 (0.453)	22.45 (0.129)	2.17 (0.071)*	0.04 (0.997)
There is a problem of decreasing wetland size that in turn decreases production of reeds which can be mitigated by conservation of wetlands	0.74 (0.946)	35.21 (0.004)***	3.77 (0.005)***	0.97 (0.424)
During the reed dance, peer education (sharing of health information like HIV/AIDS prevention and control, domestic abuse, abstinence, values and good behaviour) is important shaping health behaviour of maidens	14.52 (0.006)***	33.04 (0.007)***	2.78 (0.027)**	0.81 (0.520)
It is important to share indigenous knowledge that instils respect and Swati culture in the maidens, and transfer skills (handicraft skills, sewing, pottery etc) to maidens during the reed dance through entrepreneurship workshops	6.71 (0.152)	18.21 (0.311)	0.91 (0.460)	1.82 (0.125)
I enjoy seeing tourists from all over the world at the reed dance	5.67 (0.225)	34.35 (0.005)***	0.88 (0.477)	3.64 (0.006)***
The results of this study will influence public and cultural policies in the Kingdom of Eswatini	3.78 (0.436)	21.02 (0.178)	2.24 (0.064)*	0.46 (0.762)

Note: *, ** and *** denote $p < 0.1$, $p < 0.05$ and $p < 0.01$ respectively.

The findings indicate that the respondents' perceptions and attitudes regarding wetland management and the reed dance were influenced by gender, education, age, and income. Females seem to be more cognizant of the importance of wetland conservation and the role of informal education in preserving the reed dance. Swazi traditions, values, identity, and other cultural aspects are instilled in the young maidens. At the same time, they are also taught about health-related issues during the reed dance to preserved it for future generations. We attribute these findings to the fact that the prominent participants in the reed dance are the young maidens. The results show that the more you are educated (and older) you are likely to know about wetland management and informal education. However, respondents with higher levels of education are more likely to know about ecotourism while age did not seem to be associated with ecotourism. Similarly, respondents with higher income appear to know about wetland management and ecotourism. There seemed to be no significant relationship between income

and informal education including some statements on wetland conservation i.e., “There is a shortage of reeds at Bhamusakhe and Mpisi farm which can be addressed by conservation of wetlands.”

3.4.2 Utility function and willingness to pay

Table 3.7 reports the basic conditional logit (CL) econometric model with coefficients of the attributes. Six of the 450 questionnaires administered were incomplete and had to be excluded in the analysis. We also identified about 115 protesters who were also excluded from the analysis. Respondents who always selected the status quo (current situation) more than once or showed a protest attitude in the debriefing statements were identified as protesters. Correcting the sample by protest responses further reduced its size to 329 respondents. It is not unusual to remove protesters in discrete choice experiments (see for example Barrio & Loureiro, 2013).

Since we created three sub-samples, split according to the payment vehicles (tax, contribution, and reduced subsidy), we tested whether different payment vehicles would lead to different parameters for price. The results are reported in Table 3.8 and show that the sign of the price parameters were all positive and of the same magnitude across the three sub-samples. The payment vehicle was therefore discarded as a potential problem.

Table 3.7: Overall conditional logit estimations

Attributes	CL		
	Coefficient	Std Error	t value
ASC	-2.261	0.113	-19.960***
Wetland Conservation	0.031	0.012	2.531**
Informal Education	-0.095	0.017	-5.646***
Tourist Presence	-0.191	0.032	-6.020***
Price	0.021	0.002	8.961***
Log-Likelihood	-2714.4		
Adj.Rho-squared	0.122		
AIC	5438.81		
BIC	5470.21		

Note: *, ** and *** denote $p < 0.1$, $p < 0.05$ and $p < 0.01$ respectively.

The results show that there is a negative utility attributed to the status quo (described by the ASC parameter). Furthermore, respondents have positive preferences for a change in wetland conservation but do not favour either the informal education or the presence of further tourists in attending the reed dance. This is all in line with our expectations. However, the price attribute

is estimated with a positive sign. This indicates that respondents are experiencing marginal utility of an increasing cost for the respondents getting a positive utility of parting with their money which defies economic theory. This is unfortunate and indicates that our results are therefore inconclusive, i.e., we cannot determine respondents' WTP for improvements on wetland conservation, information education, and tourist presence.

Table 3.8: Conditional logit estimations per payment vehicle type

Attributes	CL (Tax)			CL (Contribution)			CL (Reduced subsidy)		
	Coefficient	Std Error	t value	Coefficient	Std Error	t value	Coefficient	Std Error	t value
Intercept	-2.541	0.200	-12.717***	-2.307	0.208	-11.073***	-1.916	0.185	-10.376***
Wetland Conservation	0.019	0.020	0.958	0.025	0.021	1.183	0.052	0.022	2.336**
Informal Education	-0.095	0.027	-3.475***	-0.130	0.030	-4.351***	-0.057	0.031	-1.857
Tourist Presence	-0.215	0.052	-4.137***	-0.232	0.056	-4.138***	-0.118	0.058	-2.046**
Price	0.020	0.004	5.113***	0.025	0.004	5.920***	0.019	0.004	4.478***
Log-Likelihood	-984.48			-866.62			-850.75		
Adj.Rho-squared	0.093			0.134			0.144		
AIC	1978.96			1743.25			1711.49		
BIC	2005.19			1769.08			1737.14		

Note: *, ** and *** denote $p < 0.1$, $p < 0.05$ and $p < 0.01$ respectively.

Since the price attribute had an unexpected positive sign which defies economic theory (it corresponds), we tested several possible explanations for these counterintuitive results. They include the internal validity of the experiment, especially with the possible presence of attribute dominance, the heterogeneity of preferences with the possible presence of a group with the positive marginal utility of cost, and finally, the presence of attribute-non-attendance (ANA). They are reported in the following sections.

3.4.2.1 Attribute dominance

We tested for the internal validity of the experiment (Johnson, Yang & Reed, 2019). Among the possible problems, one attribute's dominance may cause some issues when analysing final results (Johnson *et al.*, 2019). When respondents choose the alternative that *"... has the better level of one attribute in all or almost all the choice questions,"* attribute dominance has occurred (Johnson *et al.*, 2019). We show the results of the attribute dominance analysis in Table 3.9. They suggest that 61 out of the 329 non-protester respondents (or 18% of the valid respondents) always chose the best level for wetland conservation, no matter the level of the price attributes. The other attributes (education and tourist presence) do not show any signs of dominance.

While 18% of potential attribute dominance for wetland conservation does not correspond to a large proportion of the respondents, it suggests that some respondents were neglecting the cost attribute, which might influence our results. To test this, we ran a CL model with the subset of respondents that did not choose the best level of wetland conservation more than 10 times out of 12. According to the findings in Table 3.10, the elimination of respondents who demonstrated a preference for wetland conservation did not have an impact on the sign of the price parameter. It did, however, have an impact on the wetland conservation parameters, even if the difference from zero was not significant.

Table 3.9: Analysis of dominance of the different attributes

No. of times (out of 12) the best level was chosen	Attribute					
	Wetland conservation (max)	Wetland conservation (min)	Education (max)	Education (min)	Tourist presence (max)	Tourist presence (min)
0	0	272	4	0	3	0
1	0	34	10	12	8	32
2	4	16	22	27	25	48
3	13	5	30	80	78	32
4	31	2	53	84	72	64
5	17	0	59	61	47	117
6	39	0	98	28	39	24
7	39	0	33	28	26	7
8	42	0	18	5	12	4
9	37	0	1	1	13	1
10	46	0	1	3	4	0
11	53	0	0	0	1	0
12	8	0	0	0	1	0

Any cell represents the number of respondents who chose the best level the number of times corresponding to the row. For example, 8 respondents chose the best level of wetland conservation in 12 out of the 12 questions they were asked.

The results of the analysis of dominance (Table 3.9) also show that a significant portion of the respondents did not choose an alternative with a low level of wetland conservation. This tends to indicate another kind of choice heuristic, whereby alternatives with a low level of wetland conservation were not considered in the choice set. This suggests an Elimination-By-Aspects (EBA) technique, that manifests when a decision-maker eliminates any given option from the choice set that either has an undesired feature or does not include the desired one (see for example Batley & Daly, 2006; Erdem, Campbell & Thompson, 2014; Hess, Stathopoulos &

Daly, 2012; Jourdain *et al.*, 2022; Tversky, 1972). However, such a strategy is unlikely to have an influence on the sign of the cost parameter, and we did not test for that heuristic here.

Table 3.10: Parameter estimates of a conditional logit model ran on respondents who did not show attribute dominance for wetland conservation

Attributes	Coefficient	Std Error	t value
ASC	-2.350	0.124	-18.971***
Wetland Conservation	0.019	0.066	0.290
Informal Education	-0.093	0.018	-5.085***
Tourist Presence	-0.146	0.035	-4.233***
Price	0.020	0.003	7.623***

Note: *, ** and *** denote $p < 0.1$, $p < 0.05$ and $p < 0.01$ respectively.

3.4.2.2 Heterogeneity of preferences

We also tested whether the positive parameter for money would be the fact of a subgroup of respondents that would have treated the price parameter differently. To that avail, we ran a Latent Class (LC) model to detect possible and potential heterogeneity of preferences for the price attribute. We tested LC models with two and three classes. The model with three classes did not show an improvement over the model with two classes, and we present only the model with two classes here.

Table 3.11: Parameter estimates of a Latent Class model with 2 classes

Attributes	Class A	p = 0.491		Class B	p= 0.509	
	Estimate	Std Error.	t value	Estimate	Std Error	t value
ASC	-2.079	0.144	-14.437***	-2.765	0.313	-8.838***
Wetland Conservation	-0.018	0.018	-1.046	0.095	0.026	3.688***
Informal Education	-0.101	0.024	-4.230***	-0.089	0.034	-2.599***
Tourist Presence	-0.011	0.046	-0.233	-0.492	0.072	-6.848***
Price	0.015	0.003	4.339***	0.034	0.005	7.296***
Delta_b	0.036	0.155	0.230			
LL Final	-2469.13					
Adj.Rho-squared	0.1884					
AIC	4960.26					
BIC	5029.29					

Note: *, ** and *** denote $p < 0.1$, $p < 0.05$ and $p < 0.01$ respectively.

The results, shown in Table 3.11, demonstrate the presence of two classes of preferences that differ regarding their preferences for wetland conservation and the presence of tourism. In class

A, wetland conservation and tourist presence parameters were negative but not significant. In contrast, the wetland conservation parameter was positive and significant as expected while the tourist presence parameter was negative and significant. However, both classes had some positive and significant parameters for the price parameter. Therefore, the study of the heterogeneity of preferences did not indicate that a part of the population would have a negative price coefficient.

Table 3.12: Overall mixed logit estimations

Attributes	Random Parameter	ML		
		Coefficient	Std Error	t value
ASC		-2.175	0.120	-18.146***
Wetland Conservation	Mean	0.071	0.019	3.749***
	Standard deviation	0.174	0.015	11.666***
Informal Education	Mean	-0.121	0.023	-5.294***
	Standard deviation	0.151	0.020	7.715***
Tourist Presence	Mean	-0.251	0.044	-5.662***
	Standard deviation	0.306	0.028	10.728***
Price	Mean	0.032	0.003	9.746***
	Standard deviation	-0.018	0.002	-8.317***
Log-Likelihood		-2381.92		
Adj.Rho-squared		0.229		
AIC		4781.84		
BIC		4838.37		

Note: *, ** and *** denote $p < 0.1$, $p < 0.05$ and $p < 0.01$ respectively.

Table 3.13: Mixed logit estimations per payment vehicle type

Attributes	Random Parameter	ML (Tax)			ML (Contribution)			ML (Reduced subsidy)		
		Coefficient	Std Error	t value	Coefficient	Std Error	t value	Coefficient	Std Error	t value
Intercept		-2.479	0.208	-11.892***	-2.330	0.224	-10.421***	-1.669	0.202	-8.276***
Wetland Conservation	Mean	0.042	0.028	1.501	0.068	0.036	1.864	0.109	0.037	2.933***
	Standard deviation	0.134	0.025	5.368***	-0.205	0.027	-7.475***	-0.222	0.030	-7.345***
Informal Education	Mean	-0.113	0.037	-3.090***	-0.179	0.040	-4.434***	-0.060	0.045	-1.336
	Standard deviation	-0.163	0.028	-5.879	0.084	0.031	2.704***	-0.248	0.036	-6.831***
Tourist Presence	Mean	-0.287	0.070	-4.091***	-0.316	0.080	-3.967***	-0.122	0.081	-1.507
	Standard deviation	-0.258	0.045	-5.705***	-0.320	0.051	-6.285***	-0.384	0.070	-5.471***
Price	Mean	0.027	0.005	5.446***	0.038	0.006	6.473***	0.029	0.006	4.890***
	Standard deviation	-0.015	0.003	-5.001***	-0.017	0.003	-5.617***	-0.019	0.005	-3.647***
Log-Likelihood		-894.76			-741.57			-721.95		
Adj.Rho-squared		0.173			0.256			0.270		
AIC		1807.51			1501.14			1461.89		
BIC		1854.54			1547.64			1508.05		

Note: *, ** and *** denote $p < 0.1$, $p < 0.05$ and $p < 0.01$ respectively.

We further conducted a sensitivity analysis by estimating the mixed logit (ML) model. The ML model allows a number of assumptions about the distribution, which the LC model is not

restricted by (see Greene & Hensher, 2003). Table 3.12 reports on the mixed logit (ML) model estimations of the mean and standard deviation for each random coefficient. We modelled all the attributes as random parameters that are normally distributed. In the overall mixed logit estimations, wetland conservation parameter was positive and significant as expected while informal education and tourist presence were negative and significant. However, the price parameter was still positive and significant. We also ran ML models per payment vehicle type, and they did not show any improvements (see Table 3.13). However, in the reduced subsidy split sample, informal education and tourist presence parameters were negative but not significant. We interpret the negative values on the standard deviation of the price parameter as positive as they indicate how the algorithm of the maximum simulated likelihood estimation works given that the normal distribution is symmetric. Taking into account the heterogeneity of preferences did not yield a negative price coefficient.

3.4.2.3 Attribute Non-Attendance

Another possible explanation for the counterintuitive sign of the cost attributes would be that respondents did not consider the cost, regardless of the payment vehicle, when making their choices. This phenomenon, generally known as Attribute Non-Attendance (ANA), is not unknown in the DCE literature, and it has been identified as a potential problem in several studies (Campbell *et al.*, 2011; Caputo *et al.*, 2018; Hensher *et al.*, 2012; Rodríguez-Entrena, Villanueva & Gómez-Limón, 2019). When a decision-maker takes into account just a subset of the attributes defining the given alternatives, they are said to be not attending to (ignoring) one or more of the attributes. (Hensher, 2014; Hensher *et al.*, 2012; Hensher & Rose, 2009; Scarpa, Gilbride, Campbell & Hensher, 2009; Scarpa, Zanoli, Bruschi & Naspetti, 2013). The respondent will not take into account part of the suggested trade-offs, which is ANA that corresponds to a non-compensatory behaviour.

When all conceivable non-attendance combinations are taken into account, this develops into a latent class model with 2^k preset classes. Since we have only 4 attributes, the model remains manageable with 16 possible ANA classes.

Since the presence of 16 classes can potentially render the statistical model to converge, we employed an iterative method (Hole, 2011; Jourdain & Vivithkeyoonvong, 2017). We first ran a model containing the 16 possible ANA classes and evaluated their posterior probability of

occurrence. The results, presented in Table 3.14, allowed to eliminate 9 classes that were not significantly probable.

Table 3.14: Latent Class model with Equality Constraints with 16 ANA classes: description of the classes and posterior probabilities

Class acronym	Attributes				Probability
	Wetland Conservation	Education	Tourist presence	Price	
FULL	1	1	1	1	0.002
ANAW	0	1	1	1	0.000
ANAE	1	0	1	1	0.003
ANAT	1	1	0	1	0.000
ANAP	1	1	1	0	0.054
ANATP	1	1	0	0	0.207
ANAWP	0	1	1	0	0.000
ANAWE	0	0	1	1	0.004
ANAEP	1	0	1	0	0.000
ANAET	1	0	0	1	0.000
ANAWT	0	1	0	1	0.000
ANAETP	1	0	0	0	0.260
ANAWTP	0	1	0	0	0.052
ANAWEP	0	0	1	0	0.111
ANAWET	0	0	0	1	0.018
ANA0	0	0	0	0	0.288

Based on this first iteration, we ran a second model with the remaining seven ANA classes to be evaluated. Table 3.15 presents the results of this second model's class probabilities.

Table 3.15: Latent Class model with Equality Constraints with 7 most probable ANA classes: description of the classes and posterior probabilities

Class acronym	Attributes				Probability
	Wetland Conservation	Education	Tourist presence	Price	
FULL	1	1	1	1	0.028
ANAP	1	1	1	0	0.054
ANATP	1	1	0	0	0.215
ANAETP	1	0	0	0	0.258
ANAWTP	0	1	0	0	0.052
ANAWEP	0	0	1	0	0.108
ANA0	0	0	0	0	0.286

The results suggest that for all the most probable classes when respondents made their choices, they did not take into account the price attribute since only 3% of the respondents are likely to

have considered the full set of attributes. This also means that 97% of the respondents are most likely to have ignored the price attribute either alone or in conjunction with other attributes. The most common combinations of ANA were to jointly ignore Tourist Presence and Price (21%), Education, Tourist Presence and Price (25%), and ignoring all the attributes altogether (28%).

This very high level of ANA, especially for the price attribute, provides a likely explanation for the counterintuitive sign of the cost parameter. It further indicates that the parameter associated with price does not bear a real meaning and should not be interpreted, although estimated significantly different from zero.

3.5 Lessons learned

The question that remains is why our survey has not succeeded in obtaining incentive compatibility leading to respondents largely ignoring the cost related to each alternative in the choice sets. However, having engaged three different payment vehicles in the split survey design without any significant difference between the payment vehicles suggests that this is not the reason.

Several other lessons can be drawn from the study's findings. First, the dominance of the wetland conservation attribute may suggest that respondents used either a heuristic, strategic, or 'rule of thumb' behaviour in making a decision, i.e., always select the alternative where wetland conservation is the best. This non-compensatory decision-making behaviour violates the continuity axiom as respondents choose the alternative based on a single or selective subset of attributes without making trade-offs between all the attributes across the given alternatives (see Campbell, Hutchinson & Scarpa, 2006; DeShazo & Fermo, 2002; Rekola, 2003; Rosenberger *et al.*, 2003; Sælensminde, 2001; Spash, 2000; Spash & Hanley, 1995; Swait & Adamowicz, 2001). One of the factors contributing to the strategic behaviour may be that the respondents already knew that the theme of the survey was centred around wetland conservation. Respondents may have opted to make the researcher happy by choosing the alternative where wetland conservation levels are the best. On another note, the strong preference for wetland conservation may reflect a strong belief that it was indeed the most important and they were not prepared to trade it off with any other attribute. Identifying lexicographic preference orderings in the preliminary results is important, proactively refining

the dominant attribute to be more specific and ensure that all the attributes, including the price attribute, influence the respondents' choice. Finally, there is a need to examine the internal factors, i.e., the complexity of the DCE (Boxall, Adamowicz & Moon, 2009; DeShazo & Fermo, 2002; Heiner, 1983; Swait & Adamowicz, 2001) and external factors, i.e., socio-political contexts, beliefs, and attitudes of respondents prior the final DCE (Rosenberger *et al.*, 2003).

Second, the results suggest that about 28% of the respondents selected the options or scenarios without considering any of the attributes, which means the choices were random. There are three main factors that can explain why respondents did not consider (ignored) all the attributes in making a decision. One of the reasons could be that the choice task was complex making it difficult for respondents to make a choice, which led to heuristic or strategic behaviour. Few choice sets may help reduce the cognitive burden. However, 12 choice sets are not uncommon in DCE surveys. For example, Hess, Hensher and Daly (2012) found that a high number of choice sets does not mean a lot as surveys have used up to 20 choice sets. Another reason could be information overload which may have increased the cognitive burden on the respondents. The other reason could be the socio-political context and sensitivity of the reed dance in the country, which led respondents not to reveal their true preferences or opinions. In a way, respondents may have only proceeded which the DCE survey to get rid of the researcher. In cases where respondents are suspected of making random choices in a DCE survey, at least one of the choice cards may be presented again, i.e., presenting the first choice card twice to determine if the same choice is made. Partial profiles where some attribute levels are held constant across the choice sets leading to relatively easier choice tasks may be considered (Kessels, Jones & Goos, 2015).

Third, price (or cost) attributes have been seen to be ignored in other studies as well (see Balcombe, Fraser & McSorley, 2015; Campbell *et al.*, 2006; Colombo, Christie & Hanley, 2013; Hole, Kolstad & Gyrd-Hansen, 2013; Kragt, 2013; Lagarde, 2013; Nguyen, Robinson, Whitty, Kaneko & Nguyen, 2015; Scarpa *et al.*, 2009). The LC with equality constraints i.e. constraining the coefficients to zero, yielded high probabilities for ANA confirming that respondents probably ignored the price attribute. Fourth, the price vector may not have been large enough to choke the demand, although this was tested in the focus group tests prior to the data collection. It would be important to consider increasing the upper bound of the price vector in this particular case assuming that the good or service is commensurable. A positive

relationship between price and utility may be evident for market goods at low price levels (Contini, Boncinelli, Romano, Scozzafava & Casini, 2019; Lockshin, Jarvis, d'Hauteville & Perrouty, 2006; Mtimet & Albisu, 2006). Further studies may consider using a non-monetary attribute as the price attribute when eliciting preferences for CES.

Fifth, CES are often known to be incommensurable (Chan *et al.*, 2012a; Chan *et al.*, 2012b; Satz *et al.*, 2013). Respondents may have found it hard to consider the price attribute when making trade-offs with the CES. As Throsby (2003) mentioned, "*First, I may acknowledge that a good has value to me, but I cannot trade this benefit for other goods – in other words I cannot meaningfully represent the benefit I gain from this good in monetary terms*." The choice context matters, i.e., politically sensitive services like the reed dance may pose incentive compatibility challenges. Respondents tend to select the status quo option when faced with a good or service that is less incentive compatible (see Collins & Vossler, 2009).

3.6 Conclusion

With the increased interest in valuing CES beyond recreational benefits, ecotourism, and landscape aesthetics, this paper attempted to elicit preferences for cultural services using the reed dance and wetlands case. Despite correcting the sample by protest responses, testing the influence of three payment vehicle types, accounting for attribute dominance, and modelling preference heterogeneity using the ML and LC models, the price attribute unexpectedly remained positive and significant. While the qualitative results suggest that the reed dance has value to respondents, it seems that respondents did not make trade-offs between the reed dance benefits with money in the choice data. We found that respondents probably used some non-compensatory heuristics in making decisions as there were high levels of ANA. For example, 28% of the respondents selected the scenarios without considering any of the attributes. Given that the price attribute was not considered when making the trade-offs, we suspect that the CES may be incommensurable in this particular case. Therefore, the respondents probably had lexicographic preference orderings.

Even though CES are complex and difficult to measure, it is our view that eliciting preferences for CES contributes to institutionalizing and including CES in ESS frameworks, conservation management, decision-making, and funding. However, we suggest that future studies should take extra care in designing DCE for CES that are beyond recreational benefits, ecotourism,

and landscape aesthetics. Future research may consider strategies for dealing with incommensurability of CES, i.e., asking respondents how they think other individuals can value CES using different price vectors or a non-monetary attribute as the price attribute. Future studies should consider having samples in at least two locations with different socio-political settings. For example, one sample could be from Eswatini and another from South Africa.

Chapter 4: Diverse stakeholder perspectives and ecosystem services ranking: Application of the Q-methodology to Hawane Dam and Nature Reserve in Eswatini[3]

Linda Siphiwo Mahlalela[*1], Damien Jourdain[1,2,3], Eric Dada Mungatana[1], Thomas Hedemark Lundhede[1,4,5]

[*] Corresponding author: University of Pretoria, Private Bag X20, Hatfield, Pretoria, South Africa, 0028. E-mail address: linda.mahlalela@up.ac.za

[1] Centre for Environmental Economics and Policy in Africa, Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, South Africa

[2] CIRAD, UMR G-EAU, Hatfield 0028, South Africa

[3] G-EAU, Univ Montpellier, AgroParisTech, CIRAD, IRD, IRSTEA, Montpellier SupAgro, Montpellier, France

[4] Centre for Macroecology, Evolution and Climate, University of Copenhagen, Rolighedsvej 23, 1958, Frederiksberg C, Denmark

[5] Department of Food and Resource Economics, Faculty of Science, University of Copenhagen, Rolighedsvej 23, 1958, Frederiksberg C, Denmark

Abstract

This research study aims to identify and analyse different perspectives held by various stakeholders on wetland ecosystem services (ESS) provided by Hawane Dam and Nature Reserve (HDNR) to inform conservation management. Data were collected from 72 representative stakeholders who sorted 40 statements that described ESS into a predefined distribution. The Q methodology's by-person factor analysis was used to analyse the data. The findings revealed three diverse viewpoints held by stakeholders that we labelled "water users", "conservationists", and "traditional users". Stakeholders had a consensus on the wetland purifying and regulation functions which they ranked as relatively highly important, whereas the recreation function was relatively less important. Regulatory, extractive and cultural

[3] This chapter is based on the published paper: "Mahlalela, L.S., Jourdain, D., Mungatana, E.D. and Lundhede, T.H., 2022. Diverse stakeholder perspectives and ecosystem services ranking: Application of the Q-methodology to Hawane Dam and Nature Reserve in Eswatini. *Ecological Economics*, *197*, p.107439. DOI: https://doi.org/10.1016/j.ecolecon.2022.107439" The authors are grateful to the Editor and two anonymous reviewers for the useful comments. To avoid self-plagiarism some modifications were made to meet the requirements for the Ph.D. degree at the University of Pretoria.

services were ranked relatively higher among households that were either neighboring HDNR or farming with comparatively less livestock. On the other hand, urban households ranked extractive water uses higher than traditional uses. Lastly, after being ranked by at least two groups as highly important and ranked neutral by a third one, water uses for farming and household activities emerged as non-controversial services. The results are essential for conservation management and the reduction of the problem "wickedness" (or improved problem definition).

Keywords: Ecosystem services, factor analysis, Hawane Dam and Nature Reserve, Q methodology

4.1 Introduction

Wetlands are complex ecosystems that present several challenges for public agencies tasked with their sustainable utilisation and management. These include policy intervention failures (Turner, 1991; Vélez *et al.*, 2018), information and market failures (Euliss, Smith, Wilcox & Browne, 2008; Turner, 1991), management of power dynamics (Reed, Vella, Challies, De Vente, Frewer, Hohenwallner-Ries, Huber, Neumann, Oughton & Sidoli del Ceno, 2018) , and unclear ownership structures and ill-defined tenure (Adger & Luttrell, 2000). Concurrently, inadequate knowledge and data on the whole range of ecosystem services (ESS) they offer and a lack of comprehension the dynamics of wetlands, functioning, and processes (e.g., see De Groot *et al.*, 2018; Euliss *et al.*, 2008) could cause stakeholders to make ill-informed decisions about their use collectively and individually (private agents). Failures of policy interventions are caused by a lack of or ineffective enforcement of wetland regulations, policies and legislations (Turner, 1991; Vélez *et al.*, 2018)[4]. For instance, fragmentation between various governmental levels or agencies, which may show up as a lack of institutional coordination and public involvement, might have a negative impact on wetlands management (Byomkesh, Nakagoshi & Shahedur, 2009). Additionally, governmental agencies frequently lack sufficient budget, resources, and qualified staff, which restricts their capacity for efficient public participation in wetlands management and conservation (Dugan, 1990; Ostrovskaya, Douven,

[4] As pointed out by one of the examiners, most policies are fervently endorsed based on week empirical evidence, i.e., they are just copied and pasted from one context to another. Another important source of failure is lack of information or evidence to inform policy processes. Policies also fail to provide incentives to resources users to use natural resources sustainably.

Schwartz, Pataki, Mukuyu & Kaggwa, 2013b)[5]. Wetland boundaries are frequently obfuscated, resulting in ambiguous ownership structures and land tenure (Adger & Luttrell, 2000) because wetlands are subject to continual timely changes and place due to interventions by humans and climatic changes (Pavlikakis & Tsihrintzis, 2000).

Several strategies, including multistakeholder dialogues, decision-making across boundaries, multisector decision-making and, natural capital accounting, have been employed by policymakers to address these complex wetland management issues (DeFries & Nagendra, 2017). In order to promote multilevel governance and national-level spatial planning, multisector decision-making techniques have been adopted (Burton, Poulsen, Lee, Medjibe, Stewart, Venkataraman & White, 2017; Nagendra & Ostrom, 2012). This has led to governance systems that value user communities. Whenever ecological processes surpass administrative boundaries, decision-making over several administrative boundaries has proven to be effective (Chester, 2015; Dore & Lebel, 2010). Examples are water governance in river basin programs (Dore & Lebel, 2010) and wetland governance in conservation programs (Joshi & Bhandari, 2016). Uncertainties brought on by intricate wetland dynamics have been addressed through adaptive wetland management (Balint, Stewart, Desai & Walters, 2011). Market failures have been addressed through ESS market integration and natural capital accounting (Guerry, Polasky, Lubchenco, Chaplin-Kramer, Daily, Griffin, Ruckelshaus, Bateman, Duraiappah & Elmqvist, 2015). Governmental organisations have set up management structures and plans for delicate wetlands and related ecosystems, many of which run into implementation and execution issues (Vélez *et al.*, 2018) frequently resulting in disputes among authorities and wetland users, among different user types, and occasionally among the various institutions with authority and responsibility over various wetlands-related tasks. Power dynamics posit that certain stakeholders in the management of ecosystems have power (or influence) over the others' actions (Berbés-Blázquez, González & Pascual, 2016). Power dynamics, therefore, mediate the usage, accessibility, and how ESS are distributed since they are incorporated in institutions (both formal as well as informal) especially governance systems; as a result, they are essential to how people (collectively and individually) value and perceive ESS (Berbés-

[5] As correctly mentioned by one of the examiners, we acknowledge that wetlands are common pool resources although they are often managed and/or controlled by the state due to their significance. Given that de jure some wetlands could be classified as state managed resources, de facto such resources can quickly degenerate into open access resources if the government does not have enough budget to monitor and enforce the rule of law.

Blázquez *et al.*, 2016; Díaz, Demissew, Carabias, Joly, Lonsdale, Ash, Larigauderie, Adhikari, Arico & Báldi, 2015).

One of the significant barriers to sustainable wetlands management is that public decision-makers and users frequently have contrasting views of how wetlands work and disagreements on the relative importance of the various ESS, i.e., the intangible benefits and tangible benefits individuals obtain from ecosystems, generally categorised into provisioning, regulatory and maintenance, and cultural and recreational services (Haines-Young & Potschin, 2010; Millennium Ecosystem Assessment, 2005). Making a distinction between the various stakeholders, who could have wetlands-related perspectives, values, and worldviews that differ from one another, may thus be useful for policy analysis. The numerous government entities and agencies, each of which has distinct and perhaps individualist goals regarding wetlands management, add another degree of complication. Thus, conventional procedures that rely on governmental expertise, top-down legislation, or legal disputes over rights and obligations may fail to alter patterns of resource usage (Innes & Booher, 2018). Given these complexities, it is becoming more apparent that all stakeholders, especially the various authorities, ESS users, non-governmental organisations (NGOs) and landowners, must be committed to restoring or sustaining wetland ESS (Davenport, Bridges, Mangun, Carver, Williard & Jones, 2010). In order to increase wetlands stewardship and foster collaborative strategic relationships, programs and regulations must take into account these various perspectives (Davenport *et al.*, 2010).

Wicked problems are the social or policy issues that are often complex, difficult to define and difficult to solve (Rittel & Webber, 1973). Following from the wicked problems literature (Carter, 2019; Conklin, 2006; DeFries & Nagendra, 2017; Kumlien & Coughlan, 2018; Rittel & Webber, 1973), stakeholder participation is essential for creating long-term remedies to wetland management problems (Camillus, 2008). A deeper comprehension of the various stakeholder views aids in lessening the "wickedness" of ecosystem management challenges (DeFries & Nagendra, 2017; Head, 2008; Head & Xiang, 2016; Mason, Pollard, Chimalakonda, Guerrero, Kerr-Smith, Milheiras, Roberts, R. Ngafack & Bunnefeld, 2018; Rissman & Carpenter, 2015). As mentioned by Rissman and Carpenter (2015), "*Ecosystem management decisions that may seem to be a simple matter of setting scientific limits on resource use frequently fail because of the political process of decision-making, differing values and norms, and power imbalances*". Camillus (2008) added, "*the aim should be to create a shared*

understanding of the problem and foster a joint commitment to possible ways of resolving it. Not everyone will agree on what the problem is, but stakeholders should be able to understand one another positions well enough to discuss different interpretations of the problem and work together to tackle it". To assist dialogue when it becomes necessary to resolve trade-offs between various ESS, it is therefore essential to identify areas of agreement and disagreement among stakeholders on the management of wetlands (Armatas *et al.*, 2017; Clare, Krogman & Caine, 2013).

There is mounting evidence that wetlands continue degrade unabatedly despite strong conservation management plans for Eswatini's Hawane Dam and Nature Reserve (HDNR) (Ramsar, 2016). The environment is being impacted by the marshes' (grasslands) conversion into farmlands and animal overgrazing, which are typically ascribed to nearby stakeholders. Mbabane City's inadequate solid waste management practices are causing effluent discharge into the wetlands (Ramsar, 2016). Overexploitation of wetlands resources often occurs in communal areas (Ramsar National Working Group, 2015), with terrestrial animal collection and subsistence hunting being prominent (Ramsar, 2016). Wetlands degradation is further exacerbated by developments, such as the expansion of human settlements and the construction of at least two roadways during the previous 20 years (Ramsar, 2016). Wetland ecological processes are being harmed by the continued use of fertilizer in nearby farmed areas (Chonguiça & Brett, 2003; Ramsar, 2016). Given the numerous stakeholders involved and the variety of interests in the ESS, HDNR's management is a prime example of a "wicked" problem. Despite some objective biophysical data on the condition of the HDNR wetland (Ramsar, 2016), stakeholder viewpoints on its various ESS are lacking, even though we anticipate that its neighbours will place extractive ESS comparatively higher on the rankings.

Informed by this gap, to understand stakeholders' perspectives on the ESS they receive from HDNR, this study enlisted participants from local businesses, local media, recreational users, research institutions, leisure resorts, leisure companies, neighbouring households, and government institutions and parastatals. It then used the Q method to analyse those perspectives. This is a semi-qualitative methodology which is often applied to detect subjective perspectives maintained across multiple stakeholder groups on a specific issue (Watts & Stenner, 2005; Watts & Stenner, 2012). It is becoming acknowledged as an efficient method for assessing viewpoints held by participants across stakeholder groups (e.g., Cuppen, Breukers, Hisschemöller & Bergsma, 2010), and was employed to study "wicked" problem issues related

to the environment (e.g., Curry, Barry & McClenaghan, 2013; Lehrer & Sneegas, 2018), including elicitation of preferences in health economics (Baker, Thompson & Mannion, 2006) and ranking of ESS in environmental economics (e.g., Armatas, Venn & Watson, 2014; Bredin, Lindhjem, van Dijk & Linnell, 2015; Jensen, 2019; Sy *et al.*, 2018). Instead of focus groups, open discussions, or other deliberative methods, Q method evaluations are carried out via one-to-one personal interviews. All points of view are gathered and evaluated to find groupings of connected perspectives. The Q approach is therefore comparatively systematic and transparent than open discussions based methodologies, where discourse and group dynamics may bias the collected data (Sy *et al.*, 2018).

The objective of this study was to assess how stakeholders rank the ESS provided by HDNR by extracting different latent perspectives using factor analysis before determining consensus and non-controversial viewpoints. This chapter includes the following sections. The methodology entailing the study area, collection of data and empirical analysis, is presented in section 2. Then the results are presented in section 3, and discussions in section 4. Finally, section 5 presents the conclusions and recommendations.

4.2 Methodology

4.2.1 Study area

Hawane Dam and Nature Reserve (HDNR) (26°12'48"S, 31°05'12"E) lies in the Hhohho region of Eswatini (Figure 4.1). In order to conserve the marshes along the Mbuluzi, one of Eswatini's major rivers, HDNR (Ramsar site 2121) was officially established in 1978 as a nature reserve. The nature reserve was expanded to better safeguard the resources after the dam's completion in 1988. In addition to supporting a tiny but vital population of the rare and regionally endangered plant species Swati red-hot poker (*Kniphofia gracilis*), HDNR is home to a variety of aquatic birds (Ramsar, 2016). The existing protected area is 232 hectares large. The main water supply security system for Mbabane, the nation of Eswatini’s capital city, is HDNR.

HDNR's management decisions affect or are influenced by a number of stakeholders (see Appendix A). The domestic water supply for nearby households as well as those from Mbabane City is provided by HDNR (piped or fetched straight from the wetland water sources). Businesses in the area, landowners, as well as nearby communities in the HDNR watershed

graze cattle on the territory and harvest resources including fish, soapstone, and fibre. HDNR is used as a production input by recreationists and local resort/leisure businesses to create cultural experiences including recreational benefits like aesthetic values, bird watching, and landscape beauty. The Eswatini National Trust Commission, NGOs, Eswatini Environment Authority, Malolotja Nature Reserve, prioritize biodiversity and ESS protection, while the Ministry of Natural Resources and Energy prioritizes water supply, the Ministry of Tourism and Environmental Affairs prioritizes recreation and business, the Ministry of Agriculture prioritizes food security, and the Ministry of Tinkhundla Administration prioritises public administration. Data generated by the research institute, Malkerns Research Station, is used to guide decision-making. Finally, politics and public opinion on wetland utilisation, management, and conservation are influenced by local media.

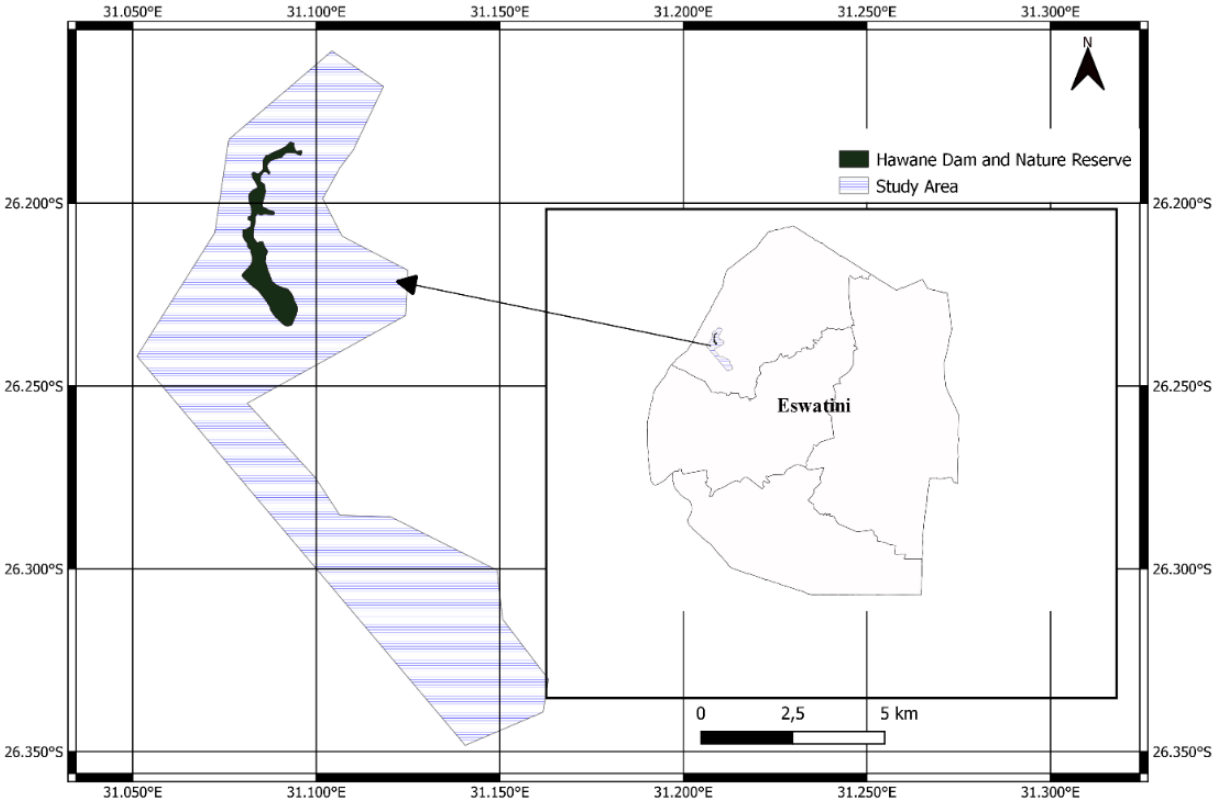

Figure 4.1: Study area and HDNR in Eswatini

The multiplicity of stakeholders with competing interests presents a management challenge that is not easily formulated and could potentially precipitate into conflicts between public authorities and households, and even among public authorities. Therefore, such intricacy motivates studies that reveal stakeholder group unanimity on the dominant views and priority

ESS. Finding consensus may help manage and lessen the "wickedness" of wetland management challenges. Once all parties have agreed on ESS priorities, they may have open talks to collectively identify pressing issues and potential remedies. Divergent prevailing worldviews allow stakeholders to start engaging in open discussions in which it is possible to reach potential agreements on priority ESS and even compromises on conservation initiatives, as well as sustainable use patterns through inclusive wetland management. This kind of research might also help the government achieve its strategic aim of establishing by 2022 well-connected and environmentally representative important protected areas with a focus on ESS and biodiversity (Swaziland Environment Authority, 2014).

4.2.2 Data collection

The process collecting data followed a four-step standard Q methodology procedure which involves developing the concourse, selecting statements that respondents will sort out or the Q-set, selecting respondents to participate in the study or the P-set, interviews where respondents in the P-set sorted out the Q-set into Q-sorts, and finally exit interviews (Watts & Stenner, 2012).

A thorough list of all potential statements (i.e., the concourse) pertinent to ESS was generated using literature reviews (e.g., Armatas *et al.*, 2014; Boyd & Banzhaf, 2007; Haines-Young & Potschin, 2010; Millennium Ecosystem Assessment, 2005; TEEB 2010), expert interviews, and focus groups comprised of local households nearby HDNR and in the Mbabane City. This procedure led to a concourse of 46 statements. We further condensed the concourse to 40 statements, the final Q-set, after pretesting it on nine participants, as shown in Table 4.1.

Table 4.1: Definitions of ecosystem services related to HDNR

ID[a]	Ecosystem service	Statement	Type[b]
1	Purifying water	Hawane wetland purifies water naturally, resulting in clean water.	R
2	Aquatic habitat	The remaining water in Hawane wetland and its streams help to create and maintain healthy aquatic (water) habitats.	R
3	Conservation of threatened plants and animal species	Hawane wetland supports different important and threatened plants (e.g. Swati red hot poker ‘licacalatikoloshi’) and animals (e.g. Southern Bald Ibis ‘inkondla’) of international importance.	R
4	Gradual discharge of stored water (water regulation)	Hawane wetland and its underground water base (wells, boreholes, etc) naturally regulate water released into streams, rivers, and Hawane dam, providing gradual flow of water throughout the year.	R
5	Natural flood control	The storage of water in Hawane wetland and its underground water base (wells, boreholes, etc) provides natural flood control, which avoids flooding damage costs.	R

ID[a]	Ecosystem service	Statement	Type[b]
6	Carbon sequestration	Hawane wetland removes large quantities of toxic gases that cause increase in temperatures and lung diseases, from the atmosphere and store them.	R
7	Nutrient cycling and sediment transport	Hawane wetland water cycle nutrients and transport sediments thus maintain healthy and diverse aquatic habitats.	R
8	Pollination	Hawane wetland plants support the distribution, abundance, and effectiveness of pollinators e.g., bees.	R
9	Erosion control	Vegetation cover plays an important role in soil retention and prevalence of landslides.	R
10	Regulation of human diseases	Hawane wetland regulates disease vectors or agents, such as mosquitos.	R
11	Waste treatment	Hawane wetland can help filter out and decompose organic waste seepage from pit latrines.	R
12	Biological control	Hawane wetland regulates crop and livestock pests and diseases.	R
13	Air quality maintenance	Hawane wetland both releases chemicals to and extract/absorb chemicals from the atmosphere resulting in clean air.	R
14	Fibre	Hawane wetland provides indigenous wetland plant species that are used to make craft products like mats, thatching ropes, and brooms, e.g., 'likhwane', 'inchoboza' etc.	P
15	Food	Hawane wetland provides food from hunted or collected snails, grasshoppers, fish, and birds, etc.	P
16	Medicinal plants	Hawane wetland is a habitat for medicinal plants.	P
17	Household/municipal water	Hawane wetland surface water and groundwater is used for drinking, washing, and other in-house uses.	P
18	Hydropower	Hawane wetland water can be used to generate hydropower or electricity.	P
19	Commercial irrigation	Hawane wetland surface water and groundwater is used to irrigate commercial crops, which could include hay, sugar beets, corn, grain, and beans.	P
20	Personal irrigation	Hawane wetland surface water and groundwater can be used to fill private ponds, and irrigate gardens and lawns.	P
21	Water for livestock	Hawane wetland water is used for livestock drinking.	P
22	Manufacturing and industrial	Hawane wetland surface water and groundwater can be used for manufacturing and industrial purposes.	P
23	Mining of soapstone	Hawane wetland is used for the mining of soapstone.	P
24	Fighting fires	Hawane wetland water can be used for extinguishing forest fires and related fire outbreaks.	P
25	Supporting commercial land-based recreation	Hawane wetland water facilitates land-based recreational activities like boating.	C
26	Fishing	Hawane dam, ponds, and streams are used for the harvesting/catching of fish for personal consumption.	C
27	Dam/reservoir hunting	Hawane dam/reservoir throughout the study area provides opportunities for hunting waterfowl (water/wetland birds) from the water in a boat.	C
28	Land-based hunting	Hawane wetland provides habitat for game and, as a result, it can be used for land-based hunting.	C
29	Dam/reservoir recreation	The rivers/streams flowing in and out of the Hawane wetland can be used for both water and scenic recreational activities like rafting, kayaking/canoeing, and bird watching.	C
30	Commercial wetland-based recreation	Water rafting trips and guided fishing trips are two examples of commercial wetland-based recreation I can pay for when provided by Hawane wetland.	C
31	Recreation/leisure activities done near wetland	The experience of wildlife viewing and hiking could be done in close proximity to Hawane wetland together with reflective recreational activities like introspective thoughts.	C
32	Physically and mentally challenging recreation	Hawane wetland provides opportunities for physically and mentally challenging recreational opportunities.	C
33	Education, management and science	Hawane wetland water habitats and processes are studied with the goal of improving both management and knowledge of natural and social sciences, which include ecology, history, agriculture, and economics.	C
34	Knowledge systems	Hawane wetland contributes to the sharing, preservation, and collection of indigenous knowledge which improves human-ecosystem (wetland) relationships.	C

ID[a]	Ecosystem service	Statement	Type[b]
35	Swati spiritual values	Hawane wetland has a special meaning to emaSwati, and can be used for spiritual and religious purposes, like the use of 'Imphepho' – Africa's Sacred Herb. (African Sage).	C
36	Swati cultural values	Hawane wetland has a special meaning to emaSwati, and can be used for ceremonial purposes, e.g., reeds used for the reed dance 'Umhlanga'	C
37	Preserving landscapes	The water flowing and grasslands (including fibre) from the wetland are used to support healthy agricultural communities and working farms and ranches.	R
38	Preserving livelihoods through income generation	The wetland resources like fibre (for making mats, brooms etc) and soapstone (for making sculptures) presents an alternative source of livelihood.	P
39	Inspirational values	Hawane wetland provides inspiration and enjoyment, for example, the scenic wetland provides the motivation for an artist's work like carving sculptures using soapstone from the wetland.	C
40	Aesthetic values	Hawane wetland provides enjoyment from the beauty of the landscape and the sound of birds.	C

[a] The numbers assigned to the ecosystem services are random nominal and only used for identifying the statements.
[b] The ecosystem services were classified *ex-post* into (P) provisioning, (R) regulatory & maintenance, and (C) cultural & recreational.

Following the establishment of the Q-set, 72 representative participants from the stakeholder groups were purposely chosen for the Q-sorting exercise based on the current power dynamics and their interest for various ESS provided by HDNR (see Appendix A). Over 50% of the survey participants were residents of households close to Mbabane City and HDNR. Respondents were not compensated for participating in the survey during the individual interviews in any form. Each participant completed a Q-sorting exercise and an exit interview. In the Q-sorting exercise, participants ranked 40 cards across the x-axis of a Q-board (see Figure 4.2).

The Q-board represents a predefined quasi normal distribution (McKeown & Thomas, 1988; McKeown & Thomas, 2013; Watts & Stenner, 2005; Watts & Stenner, 2012), while the 40 cards represent the 40 statements identified on the Q-set (Table 4.1). Following an explanation of the study's goals, respondents were requested to carefully read the statements on the 40 cards, arrange them into three stacks indicating how they perceived the importance each statement, i.e., "important", "neutral", or "not important". The three stacks were then ranked in order by participants using an 11-point quasi-normal (forced-choice) distribution on a Q-board with a scale from -5 (not at all important) to +5 (extremely important) (see Figure 4.2). The selection of the 11-point quasi-normal (forced-choice) distribution was guided literature i.e. Q sets with less than 40 items should use 9-point (-4 to +4), 40 to 60 should use a 11-point (-5 to +5), and over 60 items should use a 13-point (-6 to +6) distribution (Brown, 1980; Watts & Stenner, 2012). After that, informal discussions known as exit interviews were held in order to

comprehend interviewee ranks and gather socio-demographic data. Finally, we coded the Q-sorts and recorded them in a results matrix.

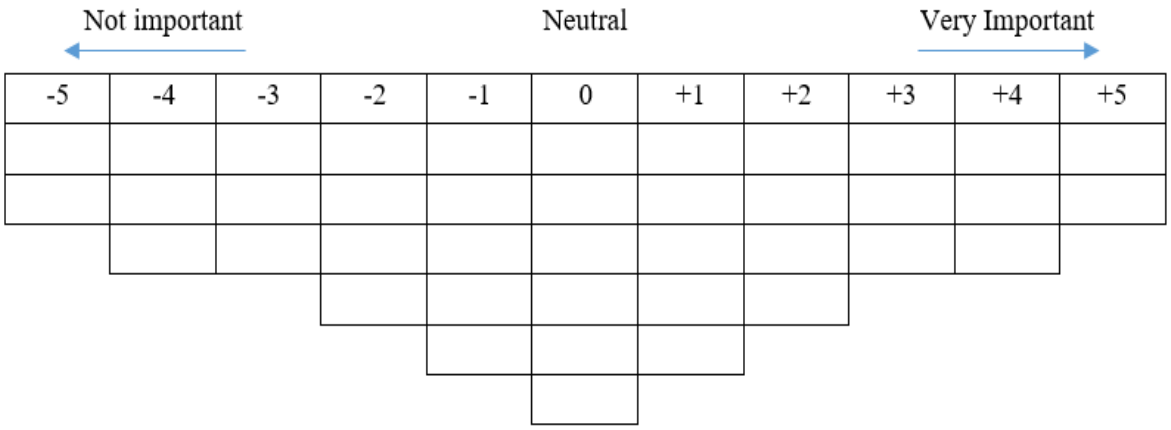

Figure 4.2: Q-board

4.3 Data analysis

The Q method employs factor analysis to correlate all of the participants' Q-sorting responses (Zabala & Pascual, 2016). Strongly correlated Q-sorts, in this study, demonstrate that stakeholders held similar viewpoints when they ranked the ESS. After that, the standard statistical approach proceeded from factor extraction, through factor rotation, to generating factor scores, and finally determined the consensual and distinguishing statements, which were then used to describe the various views and recommend potential solutions to decision-makers and policymakers.

We selected the principal component analysis (PCA) over other possible factor extraction techniques, a strategy that minimises the loss of information while lowering complexity of the dataset and improves its interpretability (Jolliffe & Cadima, 2016). The variance accounted for by the factors (first and successive) was maximised by the unrotated (PCA) output. As a result, the maximisation frequently results in several elements considerably loading on multiple factors. Factor rotation was used to provide a solution where each item loads heavily on one factor while loading lightly on the others. We examined the usefulness and relevance of the resultant interpretations from several rotation techniques before settling on the oblimin rotation.

With the aim of choosing a feasible number of factors from all the Q sorts, we employed three generally used criteria in factor analyses and Q methodology: Humpfrey’s rule, parallel analysis

(Horn, 1965), and the minimum number of significant Q-sorts. The parallel analysis uses a dataset that is random with the exact number of variables and observations as the original data to compare the model-computed eigenvalues with those obtained from the original dataset, and to determine the point where the additional components are primarily random noise. Following Brown (1980), a Q-sort was deemed significantly loaded on a factor at $p < 0.01$ if its loading was greater than $2.58/\sqrt{S} = 0.408$, where S=40 is the number of statements or the Q-set and 2.58 corresponds the 99.5% threshold of a normal distribution (Brown, 1980). The Humphrey's rule states that if the cross-product of the factor's two highest loadings are greater than twice the standard error it is significant, irrelevant of the sign (Brown, 1980). We extracted and inspected two to four factor solutions to reach a final decision regarding the number of extracted factors that were meaningful.

After the rotation, in each factor we selected representative Q-sorts. To allocate a Q-sort to a factor, also described as flagging the Q-sorts, we used the communality (h^2) concept, which is the amount of variance that a completed Q-sort shares with other respondents' completed Q-sorts (Brown & Perkins, 2019), and calculated as the summation of squared loadings in each row. Q-sorts with high communalities load on the same factor. We used a pre-flagging algorithm in the Q-sorts selection to only flag clear-cut cases, defined as cases that load on only one factor. A Q-sort with a loading a on a factor is pre-flagged if its loading is significant at $p < 0.05$, and if $a^2 > h^2/2$, i.e. over half of the common variance is explained by the factor.

In order to test a Q methodology study's internal replication, Fairweather (2002) suggests that the sub-samples of responses should be analysed and the results interpreted in relation to the results of the entire sample, as some of the recovered views may be less robust relative to others. More recently, Zabala and Pascual (2016) systematised this suggestion using a bootstrapping procedure that allows obtaining new measures of internal variability. In our case, we used the package *qmethod* developed for the R software (Zabala, 2014) for the bootstrapping.

Zabala and Pascual (2016) draw attention to two different forms of outcome variability. First, although certain participants are consistently detected (in a flagging process) for the same factors, which makes them better descriptors of a factor, others are detected for various factors when utilising various sub-samples. We filtered away the most confusing responders with ambiguous loading in this operation by looking at how often a Q-sort got flagged in the bootstrapping. Statements' ranking inside a factor may also change depending on the various

sub-samples. As a result, certain statements exhibit a better consistent relationship with one factor compared to other factors. The standard deviation of the scores makes it possible to identify statements significantly ranked differently across factors and provides a clearer picture of a statement's reliability in defining a factor.

To interpret Q sorts related to a factor, we created factor scores denoting how a weighted average group member arranged his/her statements (Watts & Stenner, 2005; Watts & Stenner, 2012; Yarar & Orth, 2018). Factor scores are centred on Z-scores of each statement[6]. The Z-scores make it possible to directly compare the same statements across numerous factors because they all have the same means (zero) and standard deviations (one). By choosing the item with the greatest Z-score and assigning it a value of +5, the next highest Z-score assigning a value of +4, etc., we reconstructed the original Q-sorts format as statements were initially arranged into a quasi-normal distribution. Although the rounded factor scores and the discretionary grouping generated some marginal inaccuracies, factor scores are often the best for interpretation since they adhere to the original data gathering structure. Analysing these factor scores form the basis for qualitative interpretations, where consensual and distinguishing statements are utilized to describe the various stakeholder views and eventually recommend solutions to decision-makers and policymakers.

We employed two graphic aids to make it easier to identify the consensus statements. First, to readily determine consensual statements in the overlapping regions, we developed Venn diagrams of the most important ESS. Second, as suggested in Zabala and Pascual (2016), we displayed the bootstrapped z-scores for each factor's mean and standard deviation, which are shown as error bars. The figure makes it possible to distinguish between consensus-based (bars that overlap) and non-consensus-based (bars that do not overlap) perspectives regarding the ESS across stakeholder groups. We calculated the salience given by the factors to the three broad ESS categories to analyse how relatively important the ESS categories are (see Table 4.2). The absolute mean of the Z scores for each category is known as salience. As low salience themes are of the least importance to stakeholders under investigation, it also enables comparisons between ESS categories and offers a mechanism to validate each ESS type

[6] A Z-score is a weighted average of the values (in our case ranging from -5 to +5) that the Q-sorts flagged on the factor gave to a statement, and it is continuous and is standardized (see Brown, 1980 for an in-depth Z-score calculation details).

included in the study. Along with salience, we calculated a (relative) mean Z-score for each ESS category.

4.4 Results

After we applied parallel analysis and Humpfrey Rule on our initial 72 Q-sorts, the PCA extracted three factors. We thus ran a bootstrapped Q-factor analysis with the three factors, an oblimin rotation, and 3,000 resamplings. The findings indicated that 16 Q-sorts contained equivocal information, as evidenced by flagging frequencies that were less than 0.5 on all three factors; thus, we removed them from any further analysis. Results emanating from rotating and selecting the active Q-sorts are shown in Appendix B after analysing the 56 Q-sorts that were left.

The first factor summarised 27 Q-sorts and captured 18% of the variance, and based on the statements defining the factor, we labelled it "water users". The second factor summarised 20 Q-sorts and captured 14% of the variance, and we labelled it "conservationists". The third factor summarized eight Q-sorts and captured 9% of the variance, and we labelled it "traditional users". One Q-sort, a stakeholder from the Tourism Ministry, was not used in the analysis as it was loading equally between two factors.

The correlations between factors 1 and 2 was 0.34, 1 and 3 was 0.32, and 2 and 3 was 0.35, all below the threshold value of $2.58/\sqrt{40} = 0.41$ required to ascertain significance at $p < 0.01$ (Brown, 1980). These correlations suggest that the three factors represented distinct viewpoints. We depict the weighted average Q-sorts for factor 1 in Figure 4.3, factor 2 in Figure 4.4, and factor 3 in Figure 4.5. We also present a more detailed table with weighted average factor scores and Z-scores in Appendix C.

4.4.1 Distinct latent views (factors) about the importance of wetland ecosystem services

The information between brackets in the factor descriptions below refer to the statements in Table 4.1 numbered from #01 to #40, with the normalized ranks assigned to them ranging from −5 (not important at all) to +5 (extremely important).

4.4.1.1 Factor 1: Water users: "Wetland supports direct consumptive uses of water"

Stakeholders with the above viewpoint gave high priority to major wetland provisioning services (Figure 4.3): household/municipal water supply (#17: +5), hydropower generation (#18: +5), water for livestock use (#21: +4), commercial uses (#19: +3), commercial and personal irrigation (#19: +3; #20: +3), and manufacturing or industrial uses (#22: +3). Two wetland regulatory services were also given high priority: water purification (#1: +4) and water flow regulation (#4: +4). Although it is one of the main regulatory ESS, water purification also makes a significant direct contribution to the generation of clean water for primary consumption purposes, particularly for livestock watering and crop and vegetation irrigation, including household drinking and cooking. These findings bring us to the conclusion that this mix of services makes sense: stakeholders view wetlands as vital since they supply clean water for several consumption purposes.

The group placed wetland provisioning services that were not explicitly connected to water consumption in the middle of the distribution, showing some level of indifference to them (food: #15: +1; medicinal plants: #16: +1; income generation #38: +1; fiber #14: 0). Hunting, classified as a provisioning service (#27: -5; #28: -3) and soapstone mining (an illegal activity), were rated as unimportant (#23: -2).

-5	-4	-3	-2	-1	0	1	2	3	4	5
27	25	8	29	10	5	11	9	20	1	17
35	31	36	23	30	14	16	24	19	21	18
	32	28	12	7	6	13	33	22	4	
			40	34	37	38	26			
				39	3	15				
					2					

Figure 4.3: Average weighted Q-sort of factor 1. The numbers are statement numbers as in table 1. Background colours indicate ecosystem services category: i) light grey = provisioning services, ii) medium grey = regulation and maintenance services, and iii) dark grey = cultural and recreational services.

In contrast, this group ranked most of the wetland cultural and recreational services (spiritual values #35: -5; recreation related statements #25: -4; #31: -4; #32: -4; cultural values #36: -3;

reservoir recreation #29: -2; aesthetics: #40: -2) as unimportant. Hunting, classified as a recreation activity, was rated as unimportant (#27: -5; #28: -3).

Finally, the group classified most of the regulation and maintenance services at the center of the distribution. This is particularly the case for carbon sequestration (#6: 0), natural flood control (#5: 0), and conservation of threatened plant and animal species (#3: 0).

Similar to Sy *et al.* (2018) we noticed that negative scores were occasionally used to express rejection yet they are generally presented as relatively "not important". For example, stakeholders in group 1 and 2 chose #35: -5 to express their strong rejection for spiritual values, i.e. a stakeholder in group 1 in the exit interview said, "I do not believe in water or wetland spiritual values as it conflicts with my … faith".

Appendix D presents the group's composition and selected characteristics. This group mainly comprises urban households that infrequently access the HDNR and a small number of rural agricultural households that reside nearby and within the HDNR. These agricultural households often seem to have far more cattle than the typical Eswatini household, which may help to explain why the "water for livestock" benefit is so important. Further investigation revealed that agricultural households exhibited lower factor loadings than urban households, indicating that they contribute lesser weight to the average ranking's calculation. These results imply that factor one (general viewpoint of the group) mostly represents households in urban areas depending on water-related ESS offered by HDNR, with a lesser degree representing farmers adjacent and from within HDNR that depend on it for their cattle specifically and in general, livestock.

4.4.1.2 Factor 2: The conservationists: "Wetlands as a natural regulator"

Stakeholders with this perspective gave high priority to major regulation and maintenance services (Figure 4.4): water purification (#1: +5), conservation of threatened species (#3: +5), aquatic habitat (#2: +4), gradual discharge of water (#4: +4), natural flood control (#5: +3), and carbon sequestration (#6: +3). One provisioning service, medicinal plants (#16: +4) was also ranked as important.

-5	-4	-3	-2	-1	0	1	2	3	4	5
35	27	36	30	31	8	12	13	6	2	1
28	22	19	20	29	34	38	15	33	4	3
	23	18	25	21	40	9	11	5	16	
			39	26	10	17	7			
				24	32	37				
					14					

Figure 4.4: Average weighted Q-sort of factor 2

The current group i.e. “the conservationists” ranked provisioning services differently from the “water users” group in two ways. First, they did not consider some of the commercial and business water uses as important, including commercial irrigation (#19: -3), hydropower generation (#18: -3), manufacturing and industrial uses (#22: -4). Second, they were indifferent to individual wetland uses such as fiber (#14: 0), water for livestock (#21: -1), fishing (#26: -1), and personal irrigation (#20: -2). They however agreed with the first group that extractive uses like soapstone mining (#23: -4), dam/reservoir and land-based hunting (#27: -4; #28: -5) were not important. This group also ranked cultural services like spiritual values (#35: -5), cultural values (#36: -3), and inspirational values (#39: -2) as not important. The group is indifferent to most recreational services (#29: -1; #31: -1), and they ranked commercial land-based recreation (#25: -2) even less.

Appendix D presents the group’s composition and selected characteristics. This group is made up of civil employees that work for various government agencies, research facilities, or environmental organizations. There were some agricultural households in this category as well, but compared to the earlier group in factor 1, they had less livestock and smaller farms. As a result, they are probably less reliant on the water supply ESS provided by HDNR. The relatively lower factor loadings of households engaged in farming therefore indicate that they contributed lesser weight to the definition of that factor. Overall, this second category is primarily focused on the regulatory and maintenance services offered by HDNR.

4.4.1.3 Factor 3: The traditional users: "find a balance between private uses and conservation"

Stakeholders in this group held a more balanced view about the services rendered by the HDNR wetlands (Figure 4.5). First, they rank major regulation and maintenance services as very important: water purification (#1: +5), gradual discharge of stored water (#4: +5), conservation of threatened species (#3: +4), and natural flood control (#5: +3).

-5	-4	-3	-2	-1	0	1	2	3	4	5
22	28	32	18	39	36	2	31	20	17	1
7	8	33	10	19	30	37	9	21	3	4
	6	23	13	12	24	27	40	5	38	
			11	29	16	34	35			
				14	15	26				
					25					

Figure 4.5: Weighted-Average Q-sort of factor 3

They also rank provisioning services as equally important: household/municipal water (#17: +4), income generation (#38: +4), personal irrigation (#20: +3), water for livestock (#21: +3), and to a lesser extent fishing (#26: +1) and reservoir hunting (#27: +1). In contrast, they rank the more commercial or industrial wetland uses low: manufacturing and industrial water (#22: -5); hydropower generation (#18: -2); soapstone mining (#23: -3); and commercial irrigation (#19: -1). While not seeing them as the most important, they valued cultural services higher than the other two groups: spiritual values (#35: +2), aesthetic values (#40: +2). Finally, they rank key supporting services as low: carbon sequestration (#6: - 4); pollination (#8: - 4); nutrient cycling and sediment transport (#7: -5).

Appendix D presents the group's composition and selected characteristics. The majority of the households in this comparatively small category were primarily agricultural households. The relatively high rankings accorded to cultural values may be explained by the existence of a person who works in the Tourism sector and a wetland user who enjoyed recreational benefits.

While the aforementioned analysis made it possible to characterise stakeholder views, we went on to determine if stakeholder rankings of the ESS categories in Table 4.1 differ by perspective by using the mean Z-scores and salience (see Table 4.2).

Table 4.2: Salience and mean scores per type of ecosystem services

Type of ecosystem service	Salience			Mean Z-Score		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Provisioning	0.95	0.842	0.858	0.814	-0.346	0.0016
Regulation & maintenance	0.518	0.879	1.12	0.124	0.871	0.114
Cultural & recreational	0.959	0.781	0.526	-0.822	-0.575	-0.116

The mean Z-scores for Factor 1 (Table 4.2) suggest that on average, “water users” expressed strong positive views about provisioning services (0.814) and strong negative views about cultural and recreation services (-0.822). They were however more neutral about regulation and maintenance services (0.124). The salience scores of 0.95 (provisioning services) and 0.959 (cultural & recreation services) suggest high intensity of expressed views. Similarly, with a mean Z-score of 0.871 for the regulation and maintenance services, the “conservationists” (Factor 2) expressed strong positive views with high intensity (salience score of 1.21). The mean Z-scores for the provisioning services (-0.346) and cultural & recreation services (-0.575) suggest that “conservationists” did not view them as important. Finally, the low mean Z-scores of the “traditional users” (Factor 3) across the three ESS groups reflect their more balanced views. In the following section, we further interrogate the variation in ESS rankings by stakeholder groups observed in Table 4.2.

4.4.2 Consensus and un-controversial views about ecosystem services ranking

The most important ESS are those ranked with an absolute factor score of three or higher by at least one stakeholder group. Given the distribution of -5 to +5, ESS ranked +3 or higher were considered as most important and -3 or lower as least important. The information about these ESS is summarized in the Venn diagrams in Figure 4.6, with Figure 4.7 and 4.8 displaying the related standard deviations and mean z-scores. In the subsequent figures, non-overlapping bars indicate significantly different perspectives on a particular service.

The discrepancy between "water users" and "conservationists," as shown in Figure 4.7 and 4.8, there is a significant difference between "water users" and "conservationists," with certain ESS that "water users" believe to be most important being viewed as least important. The viewpoints of "conservationists" and "water users" were frequently shared by "traditional users." "Traditional users" agreed with "water users" that it was of importance to extract water for livestock, personal irrigation, and local municipalities. They agreed with "conservationists" that protecting endangered animals and preventing flooding were of importance, but soapstone mining and industrial water usage were not of importance. Despite these differences, all three groups agreed that hunting on land was relatively less important (extraction of such ESS must not be done) and that natural regulation of water flow and water purification were important regulating functions.

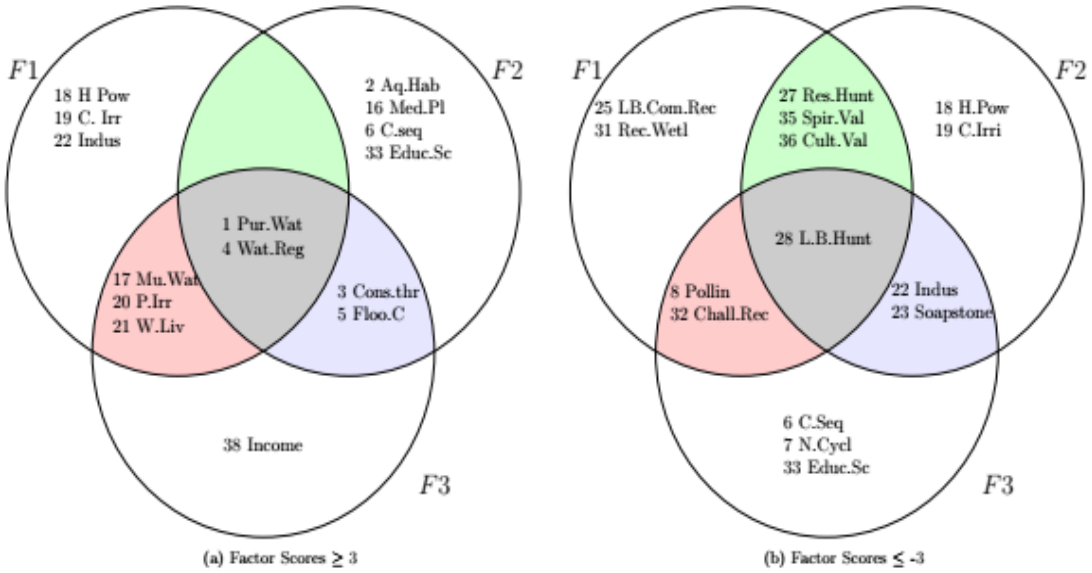

Figure 4.6: Venn diagrams of the most salient ecosystem services: (a) highest ranked, and (b) lowest ranked

Finally, personal irrigation, water supply to local municipalities, and livestock watering emerged as less polarizing services across the groups, since “water users” (Factor 1) and “traditionalist” (Factor 3) ranked them to be of utmost importance, while “conservationists” (Factor 3) ranked them as neutral. These emerging consensus and non-polarizing services can serve as a starting point for engaging and involving stakeholders in wetlands management.

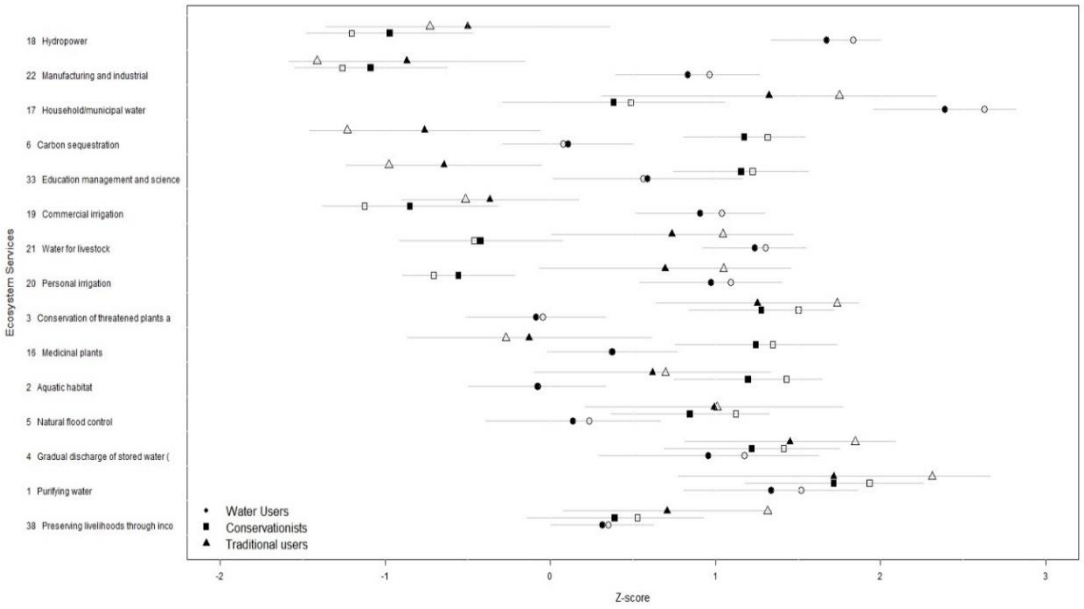

Figure 4.7: Distinguishing ecosystem services – Ranking >= 3 on at least one factor (“Empty symbol”: Z-score under the standard Q-factor analysis (no-bootstrap), "Filled symbol”: Mean of the 3,000 bootstrap Z-scores, “Error bars”: Standard deviations of the 3,000 bootstrap Z-scores)

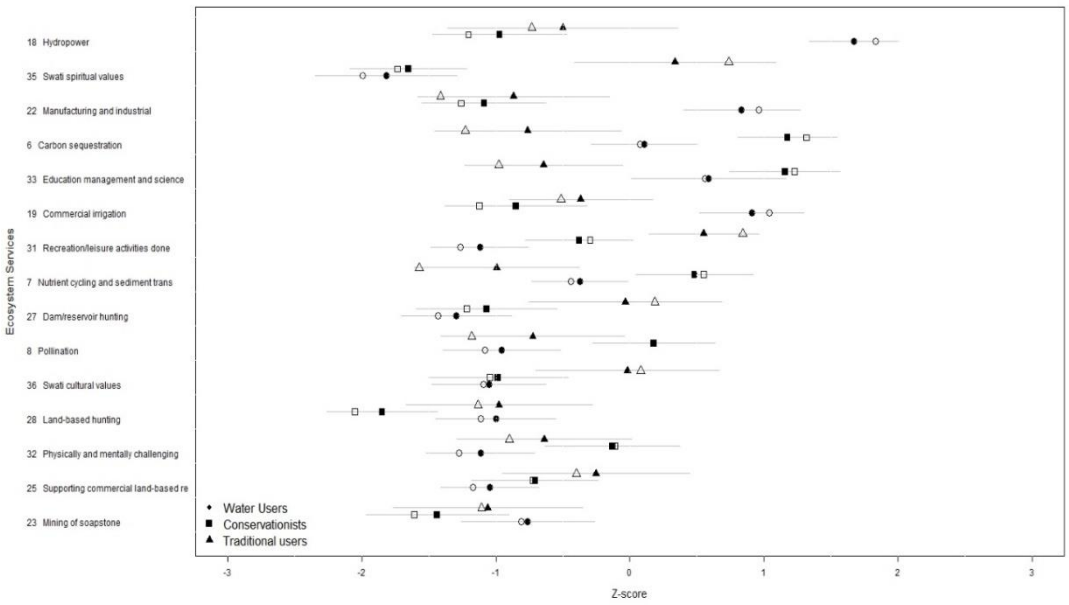

Figure 4.8: Distinguishing ecosystem services – Ranking ≤ -3 on at least one factor (“Empty symbol”: Z-score under the standard Q-factor analysis (no-bootstrap), "Filled symbol”: Mean of the 3,000 bootstrap Z-scores, “Error bars”: Standard deviations of the 3,000 bootstrap Z-scores)

4.5 Discussion

Our results show three opposing views on how ESS obtained from HDNR are relatively important to multiple stakeholders. Despite the evident differing viewpoints, stakeholders all agreed that natural water purification and water flow regulation were two regulating functions of importance. These findings suggest that while developing initiatives to encourage changes in stakeholder habits and how they utilise wetland resources, sustainably maintaining these services should be given top importance and exposure. Priority should be given to investigations and communications that examine any connections between existing wetland utilisation and the wetland's ability and capacity to produce these ESS in a sustainable manner. An interesting research question is the severity to which development into areas in their natural state could diminish the wetland's capacity and capability to produce, naturally, these regulation functions from the territory that stakeholders could ultimately inhabit. Given that such findings could draw the attention of stakeholders and public decision-makers to the potential ESS trade-offs, this could necessitate further quantitative research focusing on the value of the various ESS. Specifically, how would wetland ESS and how they are distributed vary with changes in land use practices?

Second, farming households with lesser livestock and those near HDNR appeared to have a rather more balanced viewpoint on the diverse ESS because they gave a combination of cultural, regulatory, and extractive ESS a comparatively higher ranking. This demonstrates how being nearby aids in their comprehension of many ESS as well as the possible trade-offs and losses in the case that the wetland deteriorates. Contrary to what we had previously expected, adjacent families could be better wetland resource stewards since they have been more frequently forced to strike a balance between protecting and extracting uses, suggesting that they could be eager to find improvements to the *status quo*. Thus, they might willingly accept advice on managing natural resources that is based on research. We must thus qualify and support our idea of a balanced viewpoint with further research, drawing on theories such as the tragedy of the commons and community-based natural resource management.

Third, urban households ranked extractive water uses that go beyond the more traditional uses relatively higher. As a result, urban households are possibly the portion of the population that is less *"cognizant of biodiversity and ecosystems, their value and the steps they can take to conserve and use these sustainably"* (GOS-SEA, 2016). Suppose the government is determined

to reach its stated objective. In that case, it should perhaps pay greater attention to the urban population and educate it about the advantages of wetlands and their potential role in sustainability.

Fourth, the promotion of land-based practices that enable the provision of uncontroversial ESS, such as water supply for livestock watering, local municipalities, and irrigation, requires that all stakeholders implement the conservation policy. This has to be done in conjunction with knowledgeable discussions about extraction rates which avoid jeopardizing the wetland's ability to provide regulation services.

Beyond natural resource management, we emphasise that both worldviews give all stakeholders the chance to comprehend one another's points of view and candidly debate issues and potential solutions (e.g., see (Armatas *et al.*, 2017; Camillus, 2008; Clare *et al.*, 2013). We agree with Sy *et al.* (2018) that these research encourage stakeholder involvement and participation in decision-making, which helps to reduce the "wickedness" of management challenges. Finally, it is crucial to assess the effectiveness and extent various viewpoints contribute to the managing wetlands in certain socio-cultural context. The institutional setting in Eswatini has traditionally been influenced by power dynamics, which in turn have been affected by habits, customs, norms, and different kinds of knowledge systems. It is necessary to identify, modify, and manage power connections in order to provide all stakeholders with equal opportunity to influence outcomes in the pursuit of social justice and environmental sustainability (Reed *et al.*, 2018).

4.6 Concluding remarks

The application of Q methodology in this paper attempted to provide a more systematic analysis of the complexity that emerges when public agencies base the design of wetlands management policies on various stakeholder viewpoints. Although diversity is a barrier to policymaking, from our point of view, the first step towards better policymaking is understanding what diversity is about and its consequences for stakeholders and the resource. The results suggest three main viewpoints which we labelled, "water users", "traditional users", and "conservationists". There was consensus on the relative importance of water purification and water flow regulation. The different emerging points of view may assist in stimulating and promoting meaningful dialogues, commitment, and future multi-stakeholder collaborations.

Without such consensual agreements, society would find it difficult to slow down the loss and degradation of wetlands. The different and agreed-upon points of view might potentially be used as a basis for future wetland valuation studies that aim to empirically address trade-offs in wetlands management. Studies of this nature, for instance, might help define the attributes for a choice experiment that aims to determine if society is better off with HDNR's major conversion to farmlands for food production. Following acknowledged drawbacks of the Q methodology, such as smaller samples that are conditional on the number of statements (Jensen, 2019; Watts & Stenner, 2012), and that it does not analyze power dynamics (Sy *et al.*, 2018), it is advised to use it as a compliment to other methods employed to address wetland management challenges (e.g., natural capital accounting, multi-stakeholder engagements, decision-making across boundaries, and multisector decision-making) for the benefit of present and future generations. Future studies can model additional drivers of the main different viewpoints and consensus views in order to inform policy.

Chapter 5: Summary, conclusions, and recommendations

5.1 Introduction

The general objective of this study was to investigate stakeholder preferences for cultural services and stakeholder perspectives in Eswatini. In the first specific objective, the study used a systematic review of studies in southern Africa to investigate the associations between ecosystem services, threats to wetlands and wetland interventions. Compared to other ESS, cultural services were the least reported. Cultural services together with regulating and maintenance services were not associated with wetland interventions while provisioning services were associated with wetland management and wetland rehabilitation interventions. In the second objective, the study attempted to elicit public preferences for cultural services using the case of the reed dance and wetlands. The results were inconclusive as the price attribute was positive. In the last objective, the study investigated how different types of stakeholders rank the ESS provided by HDNR and evaluated if there are diverging and converging views about the importance of these different services. The results suggested three distinct viewpoints which were labelled, “water users”, “traditional users”, and “conservationists”. There was consensus among stakeholders on the relative importance of water purification and water flow regulation. This chapter presents the key findings along with the respective implications for policy and research. Following this introduction is Section 5.2, which presents the summary, conclusions, and limitations, while section 5.3 presents recommendations for future research.

5.2 Summary, conclusions, and limitations

The study first assessed the potential associations between wetland interventions, ecosystem services, and threats to wetlands. The results revealed that agricultural activities and invasive alien plants are the leading causes of wetland degradation mainly driven by population growth. Cultural services were the least and at times not reported in the wetland interventions. Ignoring the cultural aspects and history of the community is one of the causes of wetland management failures posing a threat to cultural continuity. Wetland management failures lead to further degradation and often make costly interventions, like wetland rehabilitation and wetland restoration, a necessity. The results showed that wetland management and wetland rehabilitation interventions were associated with wetland agriculture and fibre (reeds and sedge) production. Assessing the stakeholder preferences through ecosystem services ranking and

eliciting preferences for cultural services can help make cultural services more visible to policymakers.

This study initially sought to address wetland management challenges by eliciting public preferences for cultural services using the case of the reed dance and wetlands. There is ample evidence that suggests that respondents had high levels of knowledge about the reed dance and wetlands management, i.e., the mean quiz score was 5.71 out of 7 points. In addition, the findings suggest that the respondents seemed to have positive attitudes and perceptions towards the reed dance and wetland management influenced by gender, education, age, and income. In contrast, the choice data revealed that respondents possibly used some non-compensatory heuristics and ignored some attributes, especially the price attributes, in selecting the alternatives. This was evident in the high levels of ANA coupled attribute-dominance, i.e., wetland conservation attributes, which explain the unexpected positive and significate sign of the price attribute. The welfare estimates, in particular the price attributes, were not sensitive to the choice of payment vehicle. These findings imply that respondents may have resorted to making non-compensatory heuristics due to the difficulty in making trade-offs between the cultural services benefits and money, among other factors, i.e., cultural services are incommensurable. One of the important lessons is that the incommensurability of cultural services further possibly adds complexity and difficulty to valuation efforts, which explains why previous studies are limited to recreational benefits, ecotourism, and landscape aesthetics. This calls for innovative strategies in designing and executing DCE, i.e., the use of non-monetary attributes as price attributes or perhaps more qualitative approaches that can better assess trade-offs between cultural services and other ESS.

In an attempt to understand the unexpected DCE results, a complementary survey using a semi-qualitative trade-off approach, Q methodology, was carried out. Therefore, the third objective was to investigate how different types of stakeholders rank ESS provided by HDNR and evaluate if there are diverging and converging views about the importance of these different services. Interestingly, the findings revealed that stakeholders ranked cultural services lower than the other ESS categories. This confirms our suspicion that stakeholders did not care that much about cultural services as the study imagined especially when trade-offs have to be made either with other ESS or money. The findings revealed that stakeholders held three distinct latent views, which were labelled “water users”, “conservationists”, and “traditional users”. The different views provide an enabling environment for stakeholders to engage in fruitful and

meaningful discussions where commitments and future collaborations can be made. Stakeholders need to understand other stakeholders' priorities and interests in wetland ESS so that they position themselves and prepare for negotiations. Despite the three contrasting views, a consensus emerged on two regulatory services that stakeholders ranked as important: water purification and water flow regulation. Consensus views could help stakeholders collectively prioritize important ESS. The findings contribute to making the wetland management challenges "less wicked".

Overall, the study attempted to address complex wetland management challenges which were defined as 'wicked'. The first essay broadly assessed ESS in southern Africa and their association with threats to wetlands, and wetland interventions. The results suggested that cultural services were not taken into account in wetland interventions, yet they are important for cultural continuity. In the third essay, the study assessed ESS and stakeholder perspectives but focused in Eswatini. Consistent with the results in the first essay, cultural services were ranked the least important. Using the case of the reed dance in Eswatini, the study attempted to elicit public preferences for cultural services in a unique socio-political context in the second essay. Despite the inconclusive results in the second essay, the results in the first and third essays show that cultural services are the least reported and often not considered in wetland interventions.

The findings of this study have three implications. First, given the acknowledged limitation of economic approaches in valuing cultural services that are often incommensurable, the study should have started with Q methodology before carrying out the DCE survey. In the focus group discussions, some stakeholders might it challenging to openly discuss their true preferences for politically sensitive cultural services such as the reed dance. For example, it was difficult to pick up that cultural services are perceived as least important compared to other ESS in the focus group discussions. Qualitative methods based on individual assessments such as the Q methodology allow participate to openly reveal their preferences without any fear. Focus group discussions should have been complemented with the Q method before undertaking the DCE presurvey. The Q method essay confirms that cultural services are perceived as least important while the systematic review essay shows that cultural services were the least reported ESS and often not considered in wetland interventions. Since the public preferences for cultural services were inconclusive, authorities will continue having difficulty in formulating budget estimates

and policy proposals for cultural services. However, conservation of wetlands is key ensuring a continued supply of ESS especially cultural services that are important for cultural continuity.

Second, stakeholders can use the ESS rankings distinct and consensus views to better define wetland management challenges and discuss possible solutions. ESS ranking can help in the selection of attributes for DCEs. Even though cultural services were ranked lower than other ESS categories, policymakers need to appreciate that cultural services are intertwined with other ESS. Third, policymakers and decision makers can consider approaches that have been successful in neighbouring southern African countries such as livelihood diversification, bottom-up approaches, multi-sectoral approaches, and wetland assessment methods to inform planning. Wetland offsetting can also be used to compensate for the adverse effects of developments while earth berms and weirs can be used in wetland rehabilitation and restoration interventions.

One of the study's limitations is using the DCE before the Q methodology. This is also a key lesson of the study. The Q method has an acknowledged limitation of small sample sizes conditional to the number of statements. Moreover, the sample size for the DCE survey was limited due to time and budget constraints. The timing of the study may also have negatively influenced the results as the socio-political tensions were reaching a tipping point.

5.3 Recommendations

Striking a balance between wetland use and wetland conservation is one of the challenges faced by policymakers and decision makers especially in the face of population growth and climate change. Policymakers and decision makers in collaboration with wetland users should use both incentives and regulatory legislation to encourage sustainable management of wetlands without adversely affecting local livelihoods. For example, the income and livelihood diversification approach may help ease the high dependence on wetlands. Wetland agriculture and invasive alien species should be monitored and regulated using bottom-up approaches. The public authorities and non-governmental organisations or public benefits organisations should proactively lobby funding for interventions such as wetland rehabilitation and restoration after conducting thorough wetland assessments. Traditional and indigenous knowledge should be disseminated through both informal and formal education systems i.e., environmental education on wetlands and their role in the preservation of cultural services.

Firstly, future studies should use semi-qualitative approaches like the Q methodology to assess how stakeholders make trade-offs between ESS. Second, there is a need to investigate how to deal with possibly incommensurable ESS in economic valuation and resultant lexicographic preference orderings. Third, despite the distinct and consensus views on ESS ranking, further studies are required to understand stakeholder power dynamics. All stakeholders should be given equal opportunities in influencing outcomes; therefore, the socio-political context should be investigated. This can be done by uncovering, transforming, and managing power dynamics to achieve social justice and environmental sustainability. Fourth, understanding the drivers of the distinct and consensus views can help design more focused wetland interventions and policies. Fifth, future research on cultural services should also focus on better understanding other valuation approaches where economic valuation is not feasible, i.e., socio-cultural and ecological valuation. Finally, the study calls for a multidisciplinary approach for evaluating stakeholder preferences for ESS and the decision-making process.

List of references

Adamowicz, W., Louviere, J.J. & Williams, M. 1994. Combining revealed and stated preference methods for valuing environmentalamenities. *Journal of Environmental Economics and Management,* 26(3):271-292.

Adeeyo, A.O., Ndlovu, S.S., Ngwagwe, L.M., Mudau, M., Alabi, M.A. & Edokpayi, J.N. 2022. Wetland resources in South Africa: threats and metadata study. *Resources,* 11(6):54.

Adger, W.N. & Luttrell, C. 2000. Property rights and the utilisation of wetlands. *Ecological economics,* 35(1):75-89.

African Union. 2022. *African Union Handbook: A guide for those working with and within the African Union.* [Online] Available from: https://au.int/en/handbook.

Ajzen, I., Brown, T.C. & Rosenthal, L.H. 1996. Information bias in contingent valuation: effects of personal relevance, quality of information, and motivational orientation. *Journal of Environmental Economics and Management,* 30(1):43-57.

Alexander, K., Ramotadima, M. & Sanderson, C.E. 2018. The power of consensus: Developing a community voice in land use planning and tourism development in biodiversity hotspots. *Ecosystem Services,* 30:350-361.

Alexander, L., Allen, S. & Bindoff, N.L. 2013. *Working Group I Contribution to the IPCC Fifth Assessment Report Climate Change 2013: The Physical Science Basis Summary for Policymakers.*

Anderson, S.P., Palma, A.d. & Thisse, J.-F. 1992. *Discrete choice theory of product differentiation.* Cambridge, London: The MIT Press.

Armatas, C., Venn, T. & Watson, A. 2017. Understanding social–ecological vulnerability with Q-methodology: a case study of water-based ecosystem services in Wyoming, USA. *Sustainability Science,* 12(1):105-121.

Armatas, C.A., Venn, T.J. & Watson, A.E. 2014. Applying Q-methodology to select and define attributes for non-market valuation: A case study from Northwest Wyoming, United States. *Ecological Economics,* 107(2014):447-456.

Armbrecht, J. 2012. *The value of cultural institutions: measurement and description.* Doctoral thesis. GÖTEBORG, Sweden: University of Gothenburg. [Online] Available from: http://hdl.handle.net/2077/30684.

Arrow, K., Solow, R., Portney, P.R., Leamer, E.E., Radner, R. & Schuman, H. 1993. Report of the NOAA panel on contingent valuation. *Federal register,* 58(10):4601-4614.

Asselen, S.v., Verburg, P.H., Vermaat, J.E. & Janse, J.H. 2013. Drivers of wetland conversion: a global meta-analysis. *PloS one,* 8(11):e81292.

Baas, J., Schotten, M., Plume, A., Côté, G. & Karimi, R. 2020. Scopus as a curated, high-quality bibliometric data source for academic research in quantitative science studies. *Quantitative science studies,* 1(1):377-386.

Báez-Montenegro, A., Bedate, A.M., Herrero, L.C. & Sanz, J.Á. 2012. Inhabitants' willingness to pay for cultural heritage: a case study in Valdivia, Chile, using contingent valuation. *Journal of Applied Economics,* 15(2):235-258.

Baker, R., Thompson, C. & Mannion, R. 2006. Q methodology in health economics. *Journal of health services research & policy,* 11(1):38-45.

Balcombe, K., Fraser, I. & McSorley, E. 2015. Visual attention and attribute attendance in multi-attribute choice experiments. *Journal of Applied Econometrics,* 30(3):447-467.

Balint, P.J., Stewart, R.E., Desai, A. & Walters, L.C. 2011. *Wicked environmental problems: managing uncertainty and conflict.* Island Press.

Barrio, M. & Loureiro, M. 2013. The impact of protest responses in choice experiments: an application to a Biosphere Reserve Management Program. *Forest Systems,* 22(1):94-105.

Bateman, I., Carson, R., Day, B., Hanemann, W., Hanley, N., Hett, T., Jones-Lee, M., Loomes, G., Mourato, S. & Ozdemiroglu, E. 2003. *Guidelines for the use of stated preference techniques for the valuation of preferences for non-market goods.* Cheltenham, United Kingdom: Edward Elgar Publishing.

Batley, R. & Daly, A. 2006. On the equivalence between elimination-by-aspects and generalised extreme value models of choice behaviour. *Journal of Mathematical Psychology,* 50(5):456-467.

Baumgart, K. 2005. *Bewertung landschaftsrelevanter Projekte im Schweizer Alpenraum: die Methode der Discrete-Choice-Experimente.* Geographica Bernensia Berne, Switzerland.

Bedate, A., Herrero, L.C. & Sanz, J.Á. 2004. Economic valuation of the cultural heritage: application to four case studies in Spain. *Journal of cultural heritage,* 5(1):101-111.

Berbés-Blázquez, M., González, J.A. & Pascual, U. 2016. Towards an ecosystem services approach that addresses social power relations. *Current Opinion in Environmental Sustainability,* 19:134-143.

Bergstrom, J.C., Stoll, J.R. & Randall, A. 1990. The impact of information on environmental commodity valuation decisions. *American Journal of Agricultural Economics,* 72(3):614-621.

Berkel, D.B.v. & Verburg, P.H. 2014. Spatial quantification and valuation of cultural ecosystem services in an agricultural landscape. *Ecological Indicators,* 37:163-174.

Bliemer, M.C. & Collins, A.T. 2016. On determining priors for the generation of efficient stated choice experimental designs. *Journal of Choice Modelling,* 21:10-14.

Bootsma, A., Elshehawi, S., Grootjans, A., Grundling, P.-L., Khosa, S., Butler, M., Brown, L. & Schot, P. 2019. Anthropogenic disturbances of natural ecohydrological processes in the Matlabas mountain mire, South Africa. *South African Journal of Science,* 115(5-6):1-9.

Börger, T. & Hattam, C. 2017. Motivations matter: Behavioural determinants of preferences for remote and unfamiliar environmental goods. *Ecological Economics,* 131:64-74.

Boxall, P., Adamowicz, W.L. & Moon, A. 2009. Complexity in choice experiments: choice of the status quo alternative and implications for welfare measurement. *Australian Journal of Agricultural and Resource Economics,* 53(4):503-519.

Boyd, J. & Banzhaf, S. 2007. What are ecosystem services? The need for standardized environmental accounting units. *Ecological Economics,* 63(2-3):616-626.

Boyle, K.J., Welsh, M.P. & Bishop, R.C. 1993. The role of question order and respondent experience in contingent-valuation studies. *Journal of Environmental Economics and Management,* 25(1):S80-S99.

Bredin, Y.K., Lindhjem, H., van Dijk, J. & Linnell, J.D.C. 2015. Mapping value plurality towards ecosystem services in the case of Norwegian wildlife management: A Q analysis. *Ecological Economics,* 118(2015):198-206.

Breffle, W.S. & Morey, E.R. 2000. Investigating preference heterogeneity in a repeated discrete-choice recreation demand model of Atlantic salmon fishing. *Marine Resource Economics,* 15:1-20.

Brown, S.R. 1980. *Political subjectivity : applications of Q methodology in political science.* New Haven: Yale University Press.

Brown, Z. & Perkins, H. 2019. *Using Innovative Methods in Early Years Research: Beyond the Conventional.* Routledge.

Bryan, B.A., Raymond, C.M., Crossman, N.D. & King, D. 2011. Comparing spatially explicit ecological and social values for natural areas to identify effective conservation strategies. *Conservation Biology,* 25(1):172-181.

Burnham, J.F. 2006. Scopus database: a review. *Biomedical digital libraries,* 3(1):1-8.

Burton, M.E., Poulsen, J.R., Lee, M.E., Medjibe, V.P., Stewart, C.G., Venkataraman, A. & White, L.J. 2017. Reducing carbon emissions from forest conversion for oil palm agriculture in Gabon. *Conservation Letters,* 10(3):297-307.

Byomkesh, T., Nakagoshi, N. & Shahedur, R.M. 2009. State and management of wetlands in Bangladesh. *Landscape and Ecological Engineering*, 5(1):81.

Camillus, J.C. 2008. Strategy as a wicked problem. *Harvard business review*, 86(5):98.

Campbell, D., Hensher, D.A. & Scarpa, R. 2011. Non-attendance to attributes in environmental choice analysis: a latent class specification. *Journal of Environmental Planning and Management*, 54(8):1061-1076.

Campbell, D., Hutchinson, W.G. & Scarpa, R. 2006. Lexicographic preferences in discrete choice experiments: Consequences on individual-specific willingness to pay estimates.

Caputo, V., Van Loo, E.J., Scarpa, R., Nayga, R.M. & Verbeke, W. 2018. Comparing Serial, and Choice Task Stated and Inferred Attribute Non-Attendance Methods in Food Choice Experiments. *Journal of Agricultural Economics*, 69(1):35-57.

Carneiro, D.Q. & Carvalho, A.R. 2014. Payment vehicle as an instrument to elicit economic demand for conservation. *Ocean & coastal management*, 93:1-6.

Carson, R.T. & Groves, T. 2007. Incentive and informational properties of preference questions. *Environmental and resource economics*, 37(1):181-210.

Carson, R.T., Groves, T. & List, J.A. 2014. Consequentiality: A theoretical and experimental exploration of a single binary choice. *Journal of the Association of Environmental and Resource Economists*, 1(1/2):171-207.

Carter, D.J. 2019. *Naming elephants and situating dragons: appreciating designerly ways of knowing across ecosystems.* University of British Columbia.

Central Statistic Office of Swaziland (CSO). 2015. *Socio Economics Database of Swaziland 2016*. [Online] Available from: https://swaziland.opendataforafrica.org/SEDSW2016/socio-economics-database-of-swaziland-2016?region=1000000-eswatini&indicator=1005080-average-wage-income-public-administration-and-defence-thousand-emalangeni#

Chadegani, A.A., Salehi, H., Yunus, M.M., Farhadi, H., Fooladi, M., Farhadi, M. & Ebrahim, N.A. 2013. A comparison between two main academic literature collections: Web of Science and Scopus databases. *arXiv preprint arXiv:1305.0377*.

Champ, P.A., Flores, N.E., Brown, T.C. & Chivers, J. 2002. Contingent valuation and incentives. *Land Economics*, 78(4):591-604.

Chan, E.K., Timmermann, A., Baldi, B.F., Moore, A.E., Lyons, R.J., Lee, S.-S., Kalsbeek, A.M., Petersen, D.C., Rautenbach, H. & Förtsch, H.E. 2019. Human origins in a southern African palaeo-wetland and first migrations. *Nature*, 575(7781):185-189.

Chan, K.M., Balvanera, P., Benessaiah, K., Chapman, M., Díaz, S., Gómez-Baggethun, E., Gould, R., Hannahs, N., Jax, K. & Klain, S. 2016. Why protect nature? Rethinking values and the environment. *Proceedings of the national academy of sciences*, 113(6):1462-1465.

Chan, K.M.A., Guerry, A.D., Balvanera, P., Klain, S., Satterfield, T., Basurto, X., Bostrom, A., Chuenpagdee, R., Gould, R., Halpern, B.S., Hannahs, N., Levine, J., Norton, B., Ruckelshaus, M., Russel, R., Tam, J. & Woodside, U. 2012a. Where are cultural and social ecosystem services? A framework for constructive engagement. *Bioscience*, 62(8):744-756.

Chan, K.M.A. & Satterfield, T. 2016. Managing cultural ecosystem services for sustainability. In: Potschin, M., Haines-Young, R., Fish, R. & Turner, R.K. (eds.). *Routledge Handbook of Ecosystem Services*. Abingdon, Oxon, Routledge: Routledge Taylor and Francis Group.

Chan, K.M.A., Satterfield, T. & Goldstein, J. 2012b. Rethinking ecosystem services to better address and navigate cultural values. *Ecological Economics*, 74:8-18.

Chatanga, P. & Seleteng-Kose, L. 2021. Montane palustrine wetlands of Lesotho: vegetation, ecosystem services, current status, threats and conservation. *Wetlands*, 41(6):67.

Chester, C.C. 2015. Yellowstone to Yukon: transborder conservation across a vast international landscape. *Environmental Science & Policy*, 49:75-84.

Choi, A.S., Ritchie, B.W., Papandrea, F. & Bennett, J. 2010. Economic valuation of cultural heritage sites: A choice modeling approach. *Tourism Management*, 31(2):213-220.

Chonguiça, E. & Brett, R. 2003. Assessing the Need for a Regional Approach to Environmental Impact Assessment in Southern Africa.

Clare, S., Krogman, N. & Caine, K.J. 2013. The "balance discourse": A case study of power and wetland management. *Geoforum,* 49:40-49.

Collins, J.P. & Vossler, C.A. 2009. Incentive compatibility tests of choice experiment value elicitation questions. *Journal of Environmental Economics and Management,* 58(2):226-235.

Colombino, U. & Nese, A. 2009. Preference heterogeneity in relation to museum services. *Tourism Economics,* 15(2):381-395.

Colombo, S., Christie, M. & Hanley, N. 2013. What are the consequences of ignoring attributes in choice experiments? Implications for ecosystem service valuation. *Ecological Economics,* 96:25–35.

Conklin, J. 2006. Dialogue mapping. *Building Shared Understanding of Wicked Problems. West Sussex, England: John Wiley & Sons*.

Contini, C., Boncinelli, F., Romano, C., Scozzafava, G. & Casini, L. 2019. Price vector issue in a choice experiment: a methodological proposal. *Food Qual. Prefer,* 75:23-27.

Costanza, R., D'arge, R., Groot, R.D., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P. & Belt, M.V.D. 1997. The value of the world's ecosystem services and natural capital. *Nature,* 387:253-260.

Costanza, R., Kubiszewski, I., Ervin, D., Bluffstone, R., Boyd, J., Brown, D., Chang, H., Dujon, V., Granek, E. & Polasky, S. 2011. Valuing ecological systems and services. *F1000 biology reports*, 3.

Cowden, C., Kotze, D.C., Ellery, W. & Sieben, E. 2014. Assessment of the long-term response to rehabilitation of two wetlands in KwaZulu-Natal, South Africa. *African journal of aquatic science*, 39(3):237-247.

Cuppen, E., Breukers, S., Hisschemöller, M. & Bergsma, E. 2010. Q methodology to select participants for a stakeholder dialogue on energy options from biomass in the Netherlands. *Ecological Economics,* 69(3):579-591.

Curry, R., Barry, J. & McClenaghan, A. 2013. Northern Visions? Applying Q methodology to understand stakeholder views on the environmental and resource dimensions of sustainability. *Journal of Environmental Planning and Management,* 56(5):624-649.

Czajkowski, M., Hanley, N. & LaRiviere, J. 2016. Controlling for the effects of information in a public goods discrete choice model. *Environmental and resource economics,* 63(3):523-544.

Dalu, M.T., Mukhuwana, O., Cuthbert, R.N., Marambanyika, T., Gunter, A.W., Murungweni, F.M. & Dalu, T. 2022. Understanding communities' perceptions, demographics and uses of wetlands in Vhembe Biosphere Reserve, South Africa. *Wetlands Ecology and Management,* 30(6):1231-1244.

Daniel, T.C., Muhar, A., Arnbergerb, A., Aznarc, O., Boydd, J.W., Chane, K.M.A., Robert Costanzaf, Elmqvistg, T., Flinth, C.G., Gobsteri, P.H., Grêt-Regameyj, A., Lavek, R., Susanne Muharl, Penkerm, M., Riben, R.G., Schauppenlehnerb, T., Sikoro, T., Soloviyp, I., Spierenburgq, M., Taczanowskab, K., Tame, J. & Dunkj, A.v.d. 2012. Contributions of cultural services to the ecosystem services agenda. *Proceedings of the National Academy of Science (PNAS),* 109(23):8812–8819.

Davenport, M., Bridges, C., Mangun, J., Carver, A., Williard, K. & Jones, E. 2010. Building Local Community Commitment to Wetlands Restoration: A Case Study of the Cache River Wetlands in Southern Illinois, USA. *Environmental Management,* 45(4):711-722.

Davidson, N.C. 2014. How much wetland has the world lost? Long-term and recent trends in global wetland area. *Marine and Freshwater Research,* 65(10):934-941.

Davis, J. & O'Neill, C. 1992. Discrete-choice valuation of recreational angling in Northern Ireland. *Journal of Agricultural Economics,* 43(3):452-457.

De Groot, D., Brander, L. & Finlayson, C. 2018. Wetland ecosystem services. *The wetland book I: Structure and function, management and methods*: Springer.

De Groot, R.S., Alkemade, R., Braat, L., Hein, L. & Willemen, L. 2010. Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. *Ecological complexity*, 7(3):260-272.

De Klerk, A., Oberholster, P., Van Wyk, J., Truter, J., Schaefer, L. & Botha, A. 2016. The effect of rehabilitation measures on ecological infrastructure in response to acid mine drainage from coal mining. *Ecological Engineering*, 95:463-474.

DeFries, R. & Nagendra, H. 2017. Ecosystem management as a wicked problem. *Science*, 356(6335):265-270.

DeShazo, J. & Fermo, G. 2002. Designing choice sets for stated preference methods: the effects of complexity on choice consistency. *Journal of Environmental Economics and management*, 44(1):123-143.

Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N., Larigauderie, A., Adhikari, J.R., Arico, S. & Báldi, A. 2015. The IPBES Conceptual Framework—connecting nature and people. *Current opinion in environmental sustainability*, 14:1-16.

Dore, J. & Lebel, L. 2010. Deliberation and scale in Mekong region water governance. *Environmental Management*, 46(1):60-80.

Dugan, P.J. 1990. *Wetland conservation: A review of current issues and required action.*96. [Online] Available from: https://policycommons.net/artifacts/1371390/wetland-conservation/1985562/.

Elliott, M. 2014. Integrated marine science and management: wading through the morass. *Marine Pollution Bulletin*, 86(1-2):1-4.

Elliott, M., Mander, L., Mazik, K., Simenstad, C., Valesini, F., Whitfield, A. & Wolanski, E. 2016. Ecoengineering with ecohydrology: successes and failures in estuarine restoration. *Estuarine, Coastal and Shelf Science*, 176:12-35.

Enu, K.B., Zingraff-Hamed, A., Rahman, M.A., Stringer, L.C. & Pauleit, S. 2023. Potential of nature-based solutions to mitigate hydro-meteorological risks in sub-Saharan Africa. *Natural Hazards and Earth System Sciences*, 23(2):481-505.

Erdem, S., Campbell, D. & Thompson, C. 2014. Elimination and selection by aspects in health choice experiments: prioritising health service innovations. *Journal of health economics*, 38:10-22.

Eswatini National Trust Commission. 2022. *Swazi Culture. The Umhlanga or Reed Dance*. [Online] Available from: http://eswatininaturereserves.com/cultural/umhlanga.asp

Euliss, N.H., Smith, L.M., Wilcox, D.A. & Browne, B.A. 2008. Linking ecosystem processes with wetland management goals: charting a course for a sustainable future. *Wetlands*, 28(3):553-562.

Fairweather, J. 2002. Factor stability, number of significant loadings and interpretation: Results from three case studies and suggested guidelines. *Operant Subjectivity*, 25(1):37-58.

Falagas, M.E., Pitsouni, E.I., Malietzis, G.A. & Pappas, G. 2008. Comparison of PubMed, Scopus, web of science, and Google scholar: strengths and weaknesses. *The FASEB journal*, 22(2):338-342.

Flores, N.E. & Strong, A. 2007. Cost credibility and the stated preference analysis of public goods. *Resource and Energy Economics*, 29(3):195-205.

Ganda, F. 2020. The influence of corruption on environmental sustainability in the developing economies of Southern Africa. *Heliyon*, 6(7).

Government of Swaziland (GOS-SEA). 2016. *Swaziland's Second National Biodiversity Strategy and Action Plan.* [Online] Available from: https://www.cbd.int/doc/world/sz/sz-nbsap-v2-en.pdf.

Green, D., Jacowitz, K.E., Kahneman, D. & McFadden, D. 1998. Referendum contingent valuation, anchoring, and willingness to pay for public goods. *Resource and energy economics*, 20(2):85-116.

Greene, W.H. & Hensher, D.A. 2003. A latent class model for discrete choice analysis: contrasts with mixed logit. *Transportation Research Part B: Methodological*, 37(8):681-698.

Groot, R.S.d., Wilson, M.A. & Boumans, R.M.J. 2002. A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecological Economics*, 41(3):393–408.

Guerry, A.D., Polasky, S., Lubchenco, J., Chaplin-Kramer, R., Daily, G.C., Griffin, R., Ruckelshaus, M., Bateman, I.J., Duraiappah, A. & Elmqvist, T. 2015. Natural capital and ecosystem services informing decisions: From promise to practice. *Proceedings of the National Academy of Sciences*, 112(24):7348-7355.

Haines-Young, R. & Potschin, M. 2010. The links between biodiversity, ecosystem services and human well-being. *Ecosystem Ecology: a new synthesis*:110-139.

Hassan, S., Olsen, S.B. & Thorsen, B.J. 2017. Appropriate Payment Vehicles in Stated Preference Studies in Developing Economies. *Environmental and Resource Economics*:1-23.

Hasund, K.P., Kataria, M. & Lagerkvist, C.J. 2011. Valuing public goods of the agricultural landscape: a choice experiment using reference points to capture observable heterogeneity. *Journal of Environmental Planning and Management*, 54(1):31-53.

Hatan, S., Fleischer, A. & Tchetchik, A. 2021. Economic valuation of cultural ecosystem services: The case of landscape aesthetics in the agritourism market. *Ecological Economics*, 184:107005.

Head, B.W. 2008. Wicked problems in public policy. *Public policy*, 3(2):101.

Head, B.W. & Xiang, W.-N. 2016. Working with wicked problems in socio-ecological systems: More awareness, greater acceptance, and better adaptation. *Landscape and Urban Planning*, 154(2016):1-3.

Heiner, R.A. 1983. The origin of predictable behavior. *The American economic review*, 73(4):560-595.

Hensher, D. 2014. Attribute processing as a behavioural strategy in choice making. *Handbook of choice modelling*: Edward Elgar Publishing.

Hensher, D.A. & Greene, W.H. 2003. The mixed logit model: the state of practice. *Transportation,* 30:133-176.

Hensher, D., Rose, J. & Greene, W. 2012. Inferring attribute non-attendance from stated choice data: implications for willingness to pay estimates and a warning for stated choice experiment design. *Transportation,* 39(2):235-245.

Hensher, D.A. & Greene, W.H. 2010. Non-attendance and dual processing of common-metric attributes in choice analysis: a latent class specification. *Empirical economics,* 39(2):413-426.

Hensher, D.A. & Greene, W.H. 2011. Valuation of travel time savings in WTP and preference space in the presence of taste and scale heterogeneity. *Journal of Transport Economics and Policy,* 45(3):505–525.

Hensher, D.A. & Rose, J.M. 2009. Simplifying choice through attribute preservation or non-attendance: Implications for willingness to pay. *Transportation Research Part E,* 45:583–590.

Hess, S., Hensher, D.A. & Daly, A. 2012. Not bored yet–revisiting respondent fatigue in stated choice experiments. *Transportation research part A: policy and practice,* 46(3):626-644.

Hess, S., Stathopoulos, A. & Daly, A. 2012. Allowing for heterogeneous decision rules in discrete choice models: an approach and four case studies. *Transportation,* 39(3):565-591.

Hirons, M., Comberti, C. & Dunford, R. 2016. Valuing cultural ecosystem services. *Annual Review of Environment nd Resources Journal,* 41:545-574.

Hole, A.R. 2011. A discrete choice model with endogenous attribute attendance. *Economics Letters,* 110(3):203-205.

Hole, A.R., Kolstad, J.R. & Gyrd-Hansen, D. 2013. Inferred vs. stated attribute non-attendance in choice experiments: A study of doctors' prescription behaviour. *Journal of Economic Behavior & Organization,* 96:21-31.

Hook, D.D. 1993. Wetlands: history, current status, and future. *Environmental Toxicology and Chemistry: An International Journal*, 12(12):2157-2166.

Horn, J.L. 1965. A rationale and test for the number of factors in factor analysis. *Psychometrika*, 30(2):179-185.

Huber, R., Hunziker, M. & Lehmann, B. 2011. Valuation of agricultural land-use scenarios with choice experiments: a political market share approach. *Journal of Environmental Planning and Management*, 54(1):93-113.

Innes, J.E. & Booher, D.E. 2018. *Planning with complexity: An introduction to collaborative rationality for public policy.* Routledge.

Jensen, A.K. 2019. A structured approach to attribute selection in economic valuation studies: using q-methodology. *Ecological Economics*, 166:106400.

Jobstvogt, N., Watson, V. & Kenter, J.O. 2014. Looking below the surface: The cultural ecosystem service values of UK marine protected areas (MPAs). *Ecosystem Services*, 10:97-110.

Jogo, W. & Hassan, R. 2010. Balancing the use of wetlands for economic well-being and ecological security: The case of the Limpopo wetland in southern Africa. *Ecological Economics*, 69(7):1569-1579.

Johnson, F.R., Yang, J.-C. & Reed, S.D. 2019. The internal validity of discrete choice experiment data: a testing tool for quantitative assessments. *Value in Health*, 22(2):157-160.

Johnston, R., Cools, J., Liersch, S., Morardet, S., Murgue, C., Mahieu, M., Zsuffa, I. & Uyttendaele, G. 2013. WETwin: a structured approach to evaluating wetland management options in data-poor contexts. *Environmental Science & Policy*, 34:3-17.

Johnston, R.J., Boyle, K.J., Adamowicz, W., Bennett, J., Brouwer, R., Cameron, T.A., Hanemann, W.M., Hanley, N., Ryan, M. & Scarpa, R. 2017. Contemporary guidance for stated preference studies. *Journal of the Association of Environmental and Resource Economists*, 4(2):319-405.

Jolliffe, I.T. & Cadima, J. 2016. Principal component analysis: a review and recent developments. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 374(2065):20150202.

Joshi, D. & Bhandari, A.R. 2016. Shifting Paradigms in Wetland Governance: Shaping and Reshaping Conservation. *Journal of Forest and Livelihood*, 14(1):67-83.

Jourdain, D., Lairez, J., Striffler, B. & Lundhede, T. 2022. A choice experiment approach to evaluate maize farmers' decision-making processes in Lao PDR. *Journal of Choice Modelling*, 44:100366.

Jourdain, D. & Vivithkeyoonvong, S. 2017. Valuation of ecosystem services provided by irrigated rice agriculture in Thailand: a choice experiment considering attribute non-attendance. *Agricultural Economics*, 48(5):655-667.

Kealy, M.J., Dovidio, J.F. & Rockel, M.L. 1988. Accuracy in valuation is a matter of degree. *Land Economics*, 64(2):158-171.

Kessels, R., Jones, B. & Goos, P. 2011. Bayesian optimal designs for discrete choice experiments with partial profiles. *Journal of Choice Modelling*, 4(3):52-74.

Kessels, R., Jones, B. & Goos, P. 2015. An improved two-stage variance balance approach for constructing partial profile designs for discrete choice experiments. *Applied Stochastic Models in Business and Industry*, 31(5):626-648.

Kotze, D., Macfarlane, D., Edwards, R. & Madikizela, B. 2020. WET-EcoServices Version 2: A revised ecosystem services assessment technique, and its application to selected wetland and riparian areas. *Water SA*, 46(4):679-688.

Kotze, D.C., Tererai, F. & Grundling, P.L. 2019. Assessing, with limited resources, the ecological outcomes of wetland restoration: a South African case. *Restoration Ecology*, 27(3):495-503.

Kragt, M.E. 2013. Stated and inferred attribute attendance models: A comparison with environmental choice experiments. *Journal of Agricultural Economics*, 64(3):719-736.

Kumlien, A.C.d.A. & Coughlan, P. 2018. Wicked problems and how to solve them. *The Conversation*.

Lagarde, M. 2013. Investigating attribute non-attendance and its consequences in choice experiments with latent class models. *Health economics,* 22(5):554-567.

Lancaster, K.J. 1966. A new approach to consumer theory. *Journal of Political Economy,* 74(2):132-157.

Lancsar, E., Fiebig, D.G. & Hole, A.R. 2017. Discrete choice experiments: a guide to model specification, estimation and software. *PharmacoEconomics,* 35(7):697–716.

LaRiviere, J., Czajkowski, M., Hanley, N., Aanesen, M., Falk-Petersen, J. & Tinch, D. 2014. The value of familiarity: effects of knowledge and objective signals on willingness to pay for a public good. *Journal of Environmental Economics and Management,* 68(2):376-389.

Lazo, J.K., Schulze, W.D., McClelland, G.H. & Doyle, J.K. 1992. Can contingent valuation measure nonuse values? *American Journal of Agricultural Economics,* 74(5):1126-1132.

Le Maitre, D.C., Blignaut, J.N., Clulow, A., Dzikiti, S., Everson, C.S., Görgens, A.H. & Gush, M.B. 2020. Impacts of plant invasions on terrestrial water flows in South Africa. *Biological Invasions in South Africa*: Springer International Publishing Cham.

Lee, H. & Lautenbach, S. 2016. A quantitative review of relationships between ecosystem services. *Ecological Indicators,* 66:340-351.

Lehrer, N. & Sneegas, G. 2018. Beyond polarization: using Q methodology to explore stakeholders' views on pesticide use, and related risks for agricultural workers, in Washington State's tree fruit industry. *Agric Human Values,* 35(1):131-147.

Lindley, D. & Lotz-Sisitka, H. 2019. Expansive social learning, morphogenesis and reflexive action in an organization responding to wetland degradation. *Sustainability,* 11(15):4230.

Lockshin, L., Jarvis, W., d'Hauteville, F. & Perrouty, J.-P. 2006. Using simulations from discrete choice experiments to measure consumer sensitivity to brand, region, price, and awards in wine choice. *Food quality and preference*, 17(3-4):166-178.

Louveire, J.J. & Woodworth, G. 1983. Design and analysis of simulated consumer choice or allocation experiments: an approach based on aggregate data. *Journal of Marketing Research*, 20(4):350-367.

Louviere, J.J., Pihlens, D. & Carson, R. 2010. Design of discrete choice experiments: a discussion of issues that matter in future applied research. *Journal of Choice Modelling*, 4(1):1-8.

Manyatsi, A. & Singwane, S. 2019. Land governance in Eswatini.

Marais, D., Fischer, T., Kotze, D., Haasbroek, B., Govender, M., Pugin, J. & Horn, A. 2021. Economic valuation of the averted degradation of the Vyeboom Wetland in the Theewaterskloof Dam catchment, South Africa. *Water SA*, 47(1):24-34.

Mariel, P., Hoyos, D., Meyerhoff, J., Czajkowski, M., Dekker, T., Glenk, K., Jacobsen, J.B., Liebe, U., Olsen, S.B., Sagebiel, J. & Thiene, M. 2021. *Environmental valuation with discrete choice experiments: Guidance on design, implementation and data analysis*. Springer Nature. [Online] Accessed from: https://library.oapen.org/bitstream/handle/20.500.12657/43295/2021_Book_EnvironmentalValuationWithDisc.pdf?sequence=1&isAllowed=y

Martín-López, B., Gómez-Baggethun, E., García-Llorente, M. & Montes, C. 2014. Trade-offs across value-domains in ecosystem services assessment. *Ecological indicators*, 37:220-228.

Martín-López, B., Gómez-Baggethun, E., Lomas, P.L. & Montes, C. 2009. Effects of spatial and temporal scales on cultural services valuation. *Journal of Environmental Management*, 90(2):1050–1059.

Masarirambi, M., Manyatsi, A. & Mhazo, N. 2010. Distribution and utilisation of wetlands in Swaziland. *Research Journal of Environmental and Earth Sciences*, 2(3):146-152.

Mason, T.H., Pollard, C.R., Chimalakonda, D., Guerrero, A.M., Kerr-Smith, C., Milheiras, S.A., Roberts, M., R. Ngafack, P. & Bunnefeld, N. 2018. Wicked conflict: Using wicked problem thinking for holistic management of conservation conflict. *Conservation letters,* 11(6):e12460.

Matthews, G.V.T. 1993. The Ramsar Convention on Wetlands: its history and development. Gland: Ramsar Convention Bureau. [Online] Available from: https://globalpact.informea.org/sites/default/files/documents/Matthews-history.pdf

Mazzanti, M. 2003. Valuing cultural heritage in a multi-attribute framework microeconomic perspectives and policy implications. *The Journal of Socio-Economics,* 32(5):549-569.

McCartney, M., Morardet, S., Rebelo, L.-M., Finlayson, C.M. & Masiyandima, M. 2011. A study of wetland hydrology and ecosystem service provision: GaMampa wetland, South Africa. *Hydrological sciences journal,* 56(8):1452-1466.

McCartney, M.P. & Houghton-Carr, H.A. 2009. Working Wetland Potential: An index to guide the sustainable development of African wetlands.99-110.

McClelland, G.H., Schulze, W.D., Lazo, J.K., Waldman, D.M., Doyle, J.K., Elliott, S.R., Irwin, J.R. & Carlin, A. 1992. *For measuring non-use values: A contingent valuation study of groundwater cleanup.* [Online] Available from: https://www.epa.gov/sites/default/files/2018-03/documents/ee-0013a_all.pdf

McElwee, P., He, J. & Hsu, M. 2022. Challenges to understanding and managing cultural ecosystem services in the global South. *Ecology and Society,* 27(3).

McFadden, D. 1974. Conditional logit analysis of qualitative choice behavior. In: Zarembka, P. (ed.). *Frontiers in Econometrics*. New York: Academic Press.

McFadden, D. 1986. The choice theory approach to market research. *Marketing Science,* 5(4):275-297.

Mcfadden, D. & Train, K. 2000. Mixed MNL models for discrete response. *Journal of applied econometrics,* 15:447-470.

McHugh, M.L. 2013. The chi-square test of independence. *Biochemia medica*, 23(2):143-149.

McKeown, B. & Thomas, D. 1988. *Q methodology*. Newbury Park, Calif.: Sage Publications. [Online] Available from: http://site.ebrary.com/id/10669140.

McKeown, B. & Thomas, D.B. 2013. *Q methodology*. Second edition. ed. Los Angeles: SAGE. [Online] Available from: http://srmo.sagepub.com/view/q-methodology-2e/SAGE.xml.

Mermet, L. 1991. Participation, strategies and ethics: roles of people in wetland management. *Landscape and urban planning*, 20(1-3):231-237.

Milcu, A.I., Hanspach, J., Abson, D. & Fischer, J. 2013. Cultural ecosystem services: a literature review and prospects for future research. *Ecology and Society*, 18(3):44-78.

Millennium Ecosystem Assessment. 2005. *Ecosystems and human well-being: Current state and trends.* Washington D.C.: Island Press.

Millenium Ecosystem Assessment (MA). 2005. Ecosystems and their services In: Sarukhán, J. & Whyte, A. (eds.). *Ecosystems & Human Well-being*. Washington, DC: Island Press.

Milon, J.W. 1989. Contingent valuation experiments for strategic behavior. *Journal of Environmental Economics and Management*, 17(3):293-308.

Ministry of Tourism and Environmental Affairs. 2016. *Swaziland's second national biodiversity strategy and action plan.*1-54. [Online] Available from: https://www.cbd.int/doc/world/sz/sz-nbsap-v2-en.pdf.

Mitchell, R.K., Agle, B.R. & Wood, D.J. 1997. Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *Academy of management review*, 22(4):853-886.

Morrison, M. & Dowell, D.J. 2015. Sense of place and willingness to pay: Complementary concepts when evaluating contributions of cultural resources to regional communities. *Regional Studies*, 49(8):1374-1386.

Mtimet, N. & Albisu, L.M. 2006. Spanish wine consumer behavior: a choice experiment approach. *Agribusiness: An International Journal*, 22(3):343-362.

Mwonzora, G. 2022. Local governance and wetlands management: a tale of Harare City in Zimbabwe.309-328.

Nagendra, H. & Ostrom, E. 2012. Polycentric governance of multifunctional forested landscapes. *International Journal of the Commons*, 6(2).

United Nations. 2019. *World population prospects 2019*.

United Nations. 2023. *World Statistics Pocketbook.* New York, United States of America: Publication, U.N. [Online] Available from: https://unstats.un.org/UNSDWebsite/Publications/StatisticalPocketbook/.

Navrud, S. & Ready, R.C. 2002. *Valuing cultural heritage: applying environmental valuation techniques to historic buildings, monuments and artifacts.* United Kingdom: Edward Elgar Publishing Ltd.

Ndunda, E.N. & Mungatana, E.D. 2013. Evaluating the welfare effects of improved wastewater treatment using a discrete choice experiment. *Journal of environmental management*, 123:49-57.

Neuteleers, S. & Hugé, J. 2021. Value pluralism in ecosystem services assessments: Closing the gap between academia and conservation practitioners. *Ecosystem Services*, 49:101293.

ChoiceMetrics, 2018. Ngene 1.2 User Manual & Reference Guide, Sydney. [Online] Available from: https://choice-metrics.com/NgeneManual120.pdf.

Nguyen, T.C., Robinson, J., Whitty, J.A., Kaneko, S. & Nguyen, T.C. 2015. Attribute non-attendance in discrete choice experiments: A case study in a developing country. *Economic Analysis and Policy*, 47:22-33.

Nhamo, L., Magidi, J. & Dickens, C. 2017. Determining wetland spatial extent and seasonal variations of the inundated area using multispectral remote sensing. *Water Sa*, 43(4):543-552.

Nieuwoudt, H., Grundling, P.-L., Du Toit, L. & Tererai, F. 2018. Pietersieliekloof wetland rehabilitation project–Investing in the future. *Water Wheel*, 17(2):26-28.

Ntuli, H., Muchapondwa, E. & Okumu, B. 2020. Can local communities afford full control over wildlife conservation? The case of Zimbabwe. *Journal of choice modelling*, 37:100231.

Oleson, K.L.L., Barnes, M., Brander, L.M., Oliver, T.A., Beek, I.v., Zafindrasilivonona, B. & Beukering, P.v. 2015. Cultural bequest values for ecosystem service flows among indigenous fishers: A discrete choice experiment validated with mixed methods. *Ecological Economics*, 114:104-116.

Ollis, D., Ewart-Smith, J., Day, J., Job, N., Macfarlane, D., Snaddon, C., Sieben, E., Dini, J. & Mbona, N. 2015. The development of a classification system for inland aquatic ecosystems in South Africa. *Water Sa*, 41(5):727-745.

Onofri, L. & Boatto, V. 2020. On the economic valuation of cultural ecosystem services: A tale of myths, vine and wine. *Ecosystem Services*, 46:101215.

Ostrovskaya, E., Douven, W., Schwartz, K., Pataki, B., Mukuyu, P. & Kaggwa, R. 2013a. Capacity for sustainable management of wetlands: Lessons from the WETwin project. *Environmental science & policy*, 34:128-137.

Ostrovskaya, E., Douven, W., Schwartz, K., Pataki, B., Mukuyu, P. & Kaggwa, R. 2013b. Capacity for sustainable management of wetlands: Lessons from the WETwin project. *Environmental Science & Policy*, 34(December 2013):128-137.

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E.A. & Brennan, S.E. 2021. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *International journal of surgery*, 88:105906.

Pathak, H.N., Bhuju, D.R., Shrestha, B.B. & Ranjitkar, S. 2021. Impacts of invasive alien plants on ecosystem services of Ramsar lake cluster in middle mountain Nepal. *Global Ecology and Conservation*, 27:e01597.

Pavlikakis, G.E. & Tsihrintzis, V.A. 2000. Ecosystem management: a review of a new concept and methodology. *Water Resources Management,* 14(4):257-283.

Phethi, M.D. & Gumbo, J.R. 2019. Assessment of impact of land use change on the wetland in Makhitha village, Limpopo province, South Africa. *Jàmbá: Journal of Disaster Risk Studies,* 11(2):1-6.

Piccolo, J.J. 2017. Intrinsic values in nature: Objective good or simply half of an unhelpful dichotomy? *Journal for Nature Conservation,* 37:8-11.

Rai, P.K. & Singh, J. 2020. Invasive alien plant species: Their impact on environment, ecosystem services and human health. *Ecological indicators,* 111:106020.

Ramsar. 1971. *Convention on Wetlands of International Importance especially as Waterfowl Habitat.* [Online] Available from: https://www.ramsar.org/sites/default/files/documents/library/current_convention_text_e.pdf.

Ramsar. 2016. *Ramsar Information Sheet: Eswatini Hawane Dam and Nature Reserve.* [Online] Available from: https://rsis.ramsar.org/ris/2121.

Ramsar National Working Group, R. 2015. *Swaziland National Wetlands.*

Rebelo, A.J., Le Maitre, D.C., Esler, K.J. & Cowling, R.M. 2015. Hydrological responses of a valley-bottom wetland to land-use/land-cover change in a South African catchment: making a case for wetland restoration. *Restoration ecology,* 23(6):829-841.

Reed, M.S., Vella, S., Challies, E., De Vente, J., Frewer, L., Hohenwallner-Ries, D., Huber, T., Neumann, R.K., Oughton, E.A. & Sidoli del Ceno, J. 2018. A theory of participation: what makes stakeholder and public engagement in environmental management work? *Restoration ecology,* 26:S7-S17.

Reis, V., Hermoso, V., Hamilton, S.K., Bunn, S.E. & Linke, S. 2019. Conservation planning for river-wetland mosaics: A flexible spatial approach to integrate floodplain and upstream catchment connectivity. *Biological Conservation,* 236:356-365.

Rekola, M. 2003. Lexicographic preferences in contingent valuation: a theoretical framework with illustrations. *Land Economics,* 79(2):277-291.

Revelt, D. & Train, K. 1998. Mixed logit with repeated choices: households' choices of appliance efficiency level. *Review of Economics and Statistics,* 80(4):647-657.

Rewitzer, S., Huber, R., Grêt-Regamey, A. & Barkmann, J. 2017. Economic valuation of cultural ecosystem service changes to a landscape in the Swiss Alps. *Ecosystem services,* 26:197-208.

Rissman, A.R. & Carpenter, S.R. 2015. Progress on nonpoint pollution: barriers & opportunities. *Daedalus,* 144(3):35-47.

Rittel, H.W. & Webber, M.M. 1973. Dilemmas in a general theory of planning. *Policy sciences,* 4(2):155-169.

Rivers-Moore, N.A. & Cowden, C. 2012. Regional prediction of wetland degradation in South Africa. *Wetlands Ecology and Management,* 20:491-502.

Rodríguez-Entrena, M., Villanueva, A.J. & Gómez-Limón, J.A. 2019. Unraveling determinants of inferred and stated attribute nonattendance: Effects on farmers' willingness to accept to join agri-environmental schemes. *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie,* 67(1):31-52.

Rolston, H. 2020. *A new environmental ethics: the next millennium for life on earth.* Routledge.

Rose, J.M. & Bliemer, M.C.J. 2009. Constructing efficient stated choice experimental designs. *Transport Reviews,* 29(5):587–617.

Rosenberger, R.S., Peterson, G.L., Clarke, A. & Brown, T.C. 2003. Measuring dispositions for lexicographic preferences of environmental goods: integrating economics, psychology and ethics. *Ecological Economics,* 44(1):63-76.

Sælensminde, K. 2001. Inconsistent choices in stated choice data; use of the logit scaling approach to handle resulting variance increases. *Transportation,* 28(3):269-296.

Satz, D., Gould, R.K., Chan, K.M.A., Guerry, A., Norton, B., Satterfield, T., Halpern, B.S., Levine, J., Woodside, U., Hannahs, N., Basurto, X. & Klain, S. 2013. The Challenges of incorporating cultural ecosystem services into environmental assessment. *Ambio,* 42(6):675-684.

Scarpa, R., Gilbride, T.J., Campbell, D. & Hensher, D.A. 2009. Modelling attribute non-attendance in choice experiments for rural landscape valuation. *European review of agricultural economics,* 36(2):151-174.

Scarpa, R., Philippidis, G. & Spalatro, F. 2005. Product-country images and preference heterogeneity for Mediterranean food products: A discrete choice framework. *Agribusiness,* 21(3):329-349.

Scarpa, R., Zanoli, R., Bruschi, V. & Naspetti, S. 2013. Inferred and stated attribute non-attendance in food choice experiments. *American Journal of Agricultural Economics,* 95(1):165-180.

Scholte, S.S., Van Teeffelen, A.J. & Verburg, P.H. 2015. Integrating socio-cultural perspectives into ecosystem service valuation: A review of concepts and methods. *Ecological economics,* 114:67-78.

Schuyt, K.D. 2005. Economic consequences of wetland degradation for local populations in Africa. *Ecological economics,* 53(2):177-190.

Sieben, E., Ellery, W., Kotze, D.C. & Rountree, M. 2011. Hierarchical spatial organization and prioritization of wetlands: a conceptual model for wetland rehabilitation in South Africa. *Wetlands Ecology and Management,* 19:209-222.

Sieben, E.J., Procheş, Ş., Mashau, A.C. & Moshobane, M.C. 2022. The alignment of projects dealing with wetland restoration and alien control: A challenge for conservation management in South Africa. *South African Journal of Science,* 118(1-2):1-7.

Sil, Â., Rodrigues, A.P., Carvalho-Santos, C., Nunes, J.P., Honrado, J., Alonso, J., Marta-Pedroso, C. & Azevedo, J.C. 2016. Trade-offs and synergies between provisioning and

regulating ecosystem services in a mountain area in Portugal affected by landscape change. *Mountain Research and Development*, 36(4):452-464.

Simpson, S., Brown, G., Peterson, A. & Johnstone, R. 2016. Stakeholder perspectives for coastal ecosystem services and influences on value integration in policy. *Ocean & Coastal Management*, 126:9-21.

Snowball, J. 2005. Art for the masses? Justification for the public support of the arts in developing countries–two arts festivals in South Africa. *Journal of Cultural Economics*, 29(2):107-125.

Spash, C.L. 2000. Ecosystems, contingent valuation and ethics: the case of wetland re-creation. *Ecological economics*, 34(2):195-215.

Spash, C.L. & Hanley, N. 1995. Preferences, information and biodiversity preservation. *Ecological economics*, 12(3):191-208.

Stithou, M. & Scarpa, R. 2012. Collective versus voluntary payment in contingent valuation for the conservation of marine biodiversity: an exploratory study from Zakynthos, Greece. *Ocean & coastal management*, 56:1-9.

Street, D.J., Burgess, L. & Louviere, J.J. 2005. Quick and easy choice sets: constructing optimal and nearly optimal stated choice experiments. *International journal of research in marketing*, 22(4):459-470.

Sundström, A. 2013. Corruption in the commons: why bribery hampers enforcement of environmental regulations in South African fisheries. *International Journal of the Commons*, 7(2).

Swait, J. & Adamowicz, W. 2001. Choice environment, market complexity, and consumer behavior: a theoretical and empirical approach for incorporating decision complexity into models of consumer choice. *Organizational behavior and human decision processes*, 86(2):141-167.

Swaziland Environment Authority. 2014. *Swaziland's Second National Biodiversity Strategy and Action Plan (NBSAP 2).* Mbabane.

Swaziland Tourism Authority. 2010. *The kingdom of Swaziland: a royal experience.*1-15. [Online] Available from.

Swaziland Tourism Authority. 2016. *Swaziland discovery.* [Online] Available from: http://0-dx.doi.org.innopac.up.ac.za/http://thekingdomofswaziland.com/downloads/Swaziland%20Discovery%202016.pdf.

Sy, M.M., Rey-Valette, H., Simier, M., Pasqualini, V., Figuières, C. & De Wit, R. 2018. Identifying consensus on coastal lagoons ecosystem services and conservation priorities for an effective decision making: AQ approach. *Ecological Economics*, 154:1-13.

Taylor, A., Howard, G. & Begg, G. 1995. Developing wetland inventories in Southern Africa: A review. *Vegetatio*, 118:57-79.

Taylor, L.O. 1998. Incentive compatible referenda and the valuation of environmental goods. *Agricultural and Resource Economics Review,* 27(2):132-139.

TEEB 2010. *The Economics of Ecosystems and Biodiversity: ecological and economic foundations.* UNEP/Earthprint.

Teisl, M.F., Boyle, K.J., McCollum, D.W. & Reiling, S.D. 1995. Test-retest reliability of contingent valuation with independent sample pretest and posttest control groups. *American Journal of Agricultural Economics*, 77(3):613-619.

Tengberg, A., Fredholm, S., Eliasson, I., Knez, I., Saltzman, K. & Wetterberg, O. 2012. Cultural ecosystem services provided by landscapes: assessment of heritage values and identity. *Ecosystem Services*, 2:14-26.

Thamaga, K.H., Dube, T. & Shoko, C. 2022a. Advances in satellite remote sensing of the wetland ecosystems in Sub-Saharan Africa. *Geocarto International*, 37(20):5891-5913.

Thamaga, K.H., Dube, T. & Shoko, C. 2022b. Evaluating the impact of land use and land cover change on unprotected wetland ecosystems in the arid-tropical areas of South Africa using the Landsat dataset and support vector machine. *Geocarto International,* 37(25):10344-10365.

The World Bank. 2022. *World Development Indicators*. [Online] Available from: https://databank.worldbank.org/reports.aspx?source=2&series=SP.POP.TOTL.FE.ZS&country=SWZ# [Accessed.

Throsby, D. 2003. Determining the value of cultural goods: How much (or how little) does contingent valuation tell us? *Journal of cultural economics,* 27(3):275-285.

Throsby, D. 2010. *Economics of cultural policy.* United States of America, New York: Cambridge University Press.

Tibesigwa, B., Ntuli, H. & Lokina, R. 2020. Valuing recreational ecosystem services in developing cities: The case of urban parks in Dar es Salaam, Tanzania. *Cities,* 106:102853.

Tilliger, B., Rodríguez-Labajos, B., Bustamante, J.V. & Settele, J. 2015. Disentangling values in the interrelations between cultural ecosystem services and landscape conservation: as case study of the Ifugao rice terraces in the Philippines. *Land,* 4(3):888-913.

Tohmo, T. 2004. Economic value of a local museum: Factors of willingness-to-pay. *The Journal of Socio-Economics,* 33(2):229-240.

Tooth, S. 2018. The geomorphology of wetlands in drylands: Resilience, nonresilience, or…? *Geomorphology,* 305:33-48.

Train, K.E. 2003. *Discrete choice methods with simulation.* Cambridge, United Kingdom: Cambridge University Press.

Train, K.E. 2009. *Discrete choice methods with simulation.* Cambridge university press.

Troy, B., Sarron, C., Fritsch, J.M. & Rollin, D. 2007. Assessment of the impacts of land use changes on the hydrological regime of a small rural catchment in South Africa. *Physics and Chemistry of the Earth, Parts A/B/C,* 32(15-18):984-994.

Turner, K. 1991. Economics and wetland management. *Ambio*:59-63.

Tversky, A. 1972. Elimination by aspects: A theory of choice. *Psycological review*, 79(4):281-299.

UNESCO. 2005. *International flows of selected cultural goods and services, 1994-2003: defining and capturing the flows of global cultural trade.* Montreal, Canada: UNESCO Institute for Statistics.

UNESCO. 2013. *UNESCO Culture for Development Indicators.* Mbabane, Swaziland.

UNESCO Institute for Statistics, 2010. *Global education digest 2010: Comparing education statistics across the world.* UNESCO Institute for Statistics Montreal,, Canada.

Van Vuuren, L. 2014. Mpumalanga wetland rehab partnership a win for ecological infrastructure: ecological infrastructure. *Water Wheel*, 13(4):21-25.

Vélez, J.M.M., García, S.B. & Tenorio, A.E. 2018. Policies in coastal wetlands: Key challenges. *Environmental science & policy*, 88:72-82.

Verhoeven, J.T. & Setter, T.L. 2010. Agricultural use of wetlands: opportunities and limitations. *Annals of botany*, 105(1):155-163.

Vossler, C.A., Doyon, M. & Rondeau, D. 2012. Truth in consequentiality: theory and field evidence on discrete choice experiments. *American Economic Journal: Microeconomics*, 4(4):145-171.

Vossler, C.A. & Watson, S.B. 2013. Understanding the consequences of consequentiality: Testing the validity of stated preferences in the field. *Journal of Economic Behavior & Organization*, 86:137-147.

Watts, S. & Stenner, P. 2005. Doing Q methodology: theory, method and interpretation. *Qualitative research in psychology*, 2(1):67-91.

Watts, S. & Stenner, P. 2012. *Doing Q Methodological Research: Theory, Method and Interpretation.* London: SAGE Publications. [Online] Available from: https://methods.sagepub.com/book/doing-q-methodological-research [Accessed: 2021/12/20].

Wiser, R.H. 2007. Using contingent valuation to explore willingness to pay for renewable energy: a comparison of collective and voluntary payment vehicles. *Ecological economics,* 62(3-4):419-432.

Yarar, N. & Orth, U.R. 2018. Consumer lay theories on healthy nutrition: A Q methodology application in Germany. *Appetite,* 120:145-157.

Zabala, A. 2014. qmethod: A Package to Explore Human Perspectives Using Q Methodology. *The R Journal,* 6(2):163-173.

Zabala, A. & Pascual, U. 2016. Bootstrapping Q Methodology to Improve the Understanding of Human Perspectives. *PLoS One,* 11(2):e0148087.

Appendices

Appendix A: Stakeholder Groups

Table A. 1: Key stakeholder groups in Hawane Dam and Nature Reserve

Sector	Stakeholder Groups
Community	**Adjacent (rural) residents (n = 20)** Households neighboring HDNR and depend on it for their livelihood (grazing, water, farming, fishing etc.). Their claims are legitimate and urgent but often lack power. **Urban residents (n = 26)** Mbabane City dwellers who enjoy piped water from HDRN. Possess legitimate claims, but generally lack the power or urgency to influence claims or situations regarding the resource. **Recreationists (n = 2)** Individuals who visit HDNR for leisure. They have legitimacy but not power or urgency. **Local recreation groups or resorts (n = 2)** Activity-based groups that seek to represent their members who gain specific benefits from HDNR (e.g., recreation, bird viewing, and water). Their claims are legitimate and urgent but often lack power. **Businesses (n = 2)** Stakeholders who extract wetland resources for final goods manufacture. Their claims are legitimate and urgent but often lack power. **Local media (n = 2)** Stakeholders who drive public opinion and politics. Their claims have legitimacy and urgency, but lack power.
Government	**Eswatini Environment Authority (n = 2)** A parastatal that authorizes activities or projects after an Environmental Impact Assessment. Possesses legitimate claims and power, but not always urgency. **Eswatini National Trust Commission (n = 2)** A stakeholder who is an administrative authority that administers key legislation and policy affecting HDNR and other nature reserves. Possesses legitimate claims and power, but not always urgency. **Malolotja Nature Reserve (n = 3)** Stakeholders responsible for managing HDNR. They possess legitimate claims, have power, and but not always urgency. **Ministry of Natural Resources and Energy (n = 2)** Stakeholders who provide a monitoring function through River Basin Authorities. Possess legitimate claims and power, but not always urgency. **Ministry of Tinkhundla Administration (n = 2)** A stakeholder who focuses public administration. They possess legitimate claims and power, but not always urgency. **Ministry of Agriculture (n = 2)** Stakeholders who administer key legislation and policy affecting wetlands. They possess legitimate claims and power, but not always urgency. **Ministry of Tourism and Environmental Affairs (n = 2)** Stakeholders who administer key legislation and policy affecting wetlands, to promote sustainable water use and business tourism. They possess legitimate claims, but no power and urgency.

Research Centre	**Malkerns Research Station (n = 3)** Their output affects the HDNR through information and education. Their claims are legitimate and urgent, but have no power.

Note: The priority different stakeholders would have in wetland management can be described using three power dynamics elements viz. legitimacy, urgency, and power (Mitchell, Agle & Wood, 1997; Simpson, Brown, Peterson & Johnstone, 2016). Following Mitchell *et al.* (1997), legitimacy is a generalized perception that a stakeholder's actions are apt in socially constructed system of beliefs, values, norms, urgency is the extent to which stakeholder claims call for immediate attention, and power refers to a relationship among stakeholders in which one stakeholder can get another stakeholder to do something s/he would not have otherwise done.

Appendix B: Flagged Q-sorts

Table B. 1: Rotated factors and flagged Q-sorts

	Factor 1		Freq1[a]	Factor 2		Freq2 [a]	Factor 3		Freq3 [a]
EEA1	-0.02		0.00	0.81	x	0.99	-0.06		0.01
EEA2	0.09		0.01	0.67	x	0.98	0.00		0.00
ENTC1	0.20		0.06	0.07		0.03	0.35	x	0.69
ENTC2	-0.25		0.01	0.56	x	0.60	0.41		0.26
HH10	-0.02		0.00	0.44	x	0.91	-0.13		0.01
HH11	0.59	x	0.93	0.15		0.00	-0.28		0.05
HH13	0.19		0.01	0.56	x	0.84	0.24		0.06
HH15	0.10		0.00	0.58	x	0.97	-0.14		0.02
HH19	0.57	x	0.86	-0.04		0.01	0.19		0.12
HH2	0.54	x	0.87	-0.09		0.01	0.11		0.10
HH20	-0.09		0.01	0.17		0.04	0.66	x	0.91
HH3	0.33		0.05	0.41	x	0.49	0.16		0.10
HH5	0.49	x	0.69	0.31		0.14	-0.20		0.07
HH6	0.15		0.01	0.47	x	0.48	0.42		0.34
HH7	0.11		0.02	-0.12		0.01	0.70	x	0.93
HH8	0.39		0.21	-0.01		0.02	0.51	x	0.71
HH9	0.32	x	0.48	0.17		0.08	-0.25		0.11
HMB1	-0.07		0.01	0.70	x	0.92	0.28		0.07
HMB10	0.10		0.01	0.55	x	0.97	-0.12		0.02
HMB11	0.51	x	0.83	-0.18		0.01	0.19		0.10
HMB12	0.60	x	0.62	-0.11		0.02	0.41		0.35
HMB14	0.56	x	0.84	-0.11		0.00	-0.45		0.14
HMB15	0.24		0.04	0.08		0.02	0.64	x	0.91
HMB16	0.61	x	0.87	-0.23		0.02	0.14		0.07
HMB17	0.32		0.14	0.34	x	0.43	0.08		0.04
HMB18	0.83	x	0.98	-0.19		0.01	0.10		0.01
HMB19	0.15		0.04	0.13		0.04	0.56	x	0.85
HMB2	0.66	x	0.73	0.28		0.01	0.27		0.05
HMB20	0.47	x	0.80	0.20		0.05	0.00		0.07
HMB21	0.67	x	0.94	-0.06		0.00	-0.30		0.05
HMB22	0.57	x	0.89	-0.09		0.01	0.05		0.08
HMB23	0.63	x	0.94	0.04		0.01	0.05		0.03
HMB24	0.62	x	0.93	0.10		0.01	0.06		0.03
HMB25	0.63	x	0.87	-0.06		0.01	0.27		0.11
HMB3	0.64	x	0.88	0.31		0.03	-0.26		0.04
HMB4	0.60	x	0.67	0.47		0.16	-0.13		0.02
HMB5	0.18		0.02	0.53	x	0.83	0.15		0.06
HMB8	0.49	x	0.69	0.37		0.19	-0.24		0.03
HMB9	0.07		0.01	0.34	x	0.69	0.06		0.02
Media1	0.54	x	0.83	0.16		0.04	0.07		0.08
Media2	0.61	x	0.89	0.18		0.01	0.10		0.03

	Factor 1		Freq1[a]	Factor 2		Freq2 [a]	Factor 3		Freq3 [a]
MNR1	0.08		0.01	0.47	x	0.91	0.10		0.05
MNR2	0.41	x	0.78	-0.11		0.01	-0.14		0.08
MNR3	-0.05		0.01	0.56	x	0.97	0.03		0.01
MoA1	-0.04		0.00	0.75	x	0.98	-0.36		0.01
MoA2	0.49	x	0.81	-0.01		0.02	0.20		0.14
MoT1	0.19		0.04	0.30		0.32	0.33		0.49
MOTEA1	-0.10		0.01	0.61	x	0.87	0.28		0.11
MOTEA2	0.02		0.02	0.24		0.11	0.54	x	0.83
MRS1	0.75	x	0.98	0.09		0.01	-0.08		0.01
MRS2	0.04		0.01	0.66	x	0.98	-0.06		0.01
MRS3	0.19		0.01	0.61	x	0.79	0.27		0.10
Recreat1	0.16		0.04	0.06		0.01	0.35	x	0.65
Resort1	0.53	x	0.86	0.25		0.03	-0.26		0.05
Resort2	0.62	x	0.81	-0.18		0.01	0.30		0.16
WRB2	-0.31		0.02	0.50	x	0.48	0.36		0.22
No Loaded	27			20			8		
Eigenvalues	10.17			7.77			4.87		
Percent Explained	18.16			13.87			8.69		

Freq: Percentage of 3,000 bootstraps where the Q-sort was flagged on this factor

Appendix C: Factors Z-scores

Table C. 1: Factors Z-scores

SID	Statement	Factor score 1	Z-score 1	Factor score 2	Z-score 2	Factor score 3	Z-score 3
1	Purifying water	4	1.518	5	1.931	5	2.311
2	Aquatic habitat	0	-0.074	4	1.429	1	0.697
3	Conservation of threatened plants and animal species	0	-0.047	5	1.502	4	1.736
4	Gradual discharge of stored water (water regulation)	4	1.175	4	1.413	5	1.845
5	Natural flood control	0	0.236	3	1.123	3	1.011
6	Carbon sequestration	0	0.077	3	1.315	-4	-1.228
7	Nutrient cycling and sediment transport	-1	-0.442	2	0.550	-5	-1.571
8	Pollination	-3	-1.081	0	0.172	-4	-1.178
9	Erosion control	2	0.741	1	0.494	2	0.780
10	Regulation of human diseases	-1	-0.200	0	-0.058	-2	-0.765
11	Waste treatment	1	0.383	2	0.583	-2	-0.897
12	Biological control	-2	-0.904	1	0.546	-1	-0.567
13	Air quality maintenance	1	0.359	2	0.812	-2	-0.837
14	Fibre	0	0.098	0	-0.258	-1	-0.680
15	Food	1	0.285	2	0.618	0	-0.271
16	Medicinal plants	1	0.370	4	1.346	0	-0.268
17	Household/municipal water	5	2.627	1	0.487	4	1.748
18	Hydropower	5	1.831	-3	-1.203	-2	-0.730
19	Commercial irrigation	3	1.037	-3	-1.124	-1	-0.513
20	Personal irrigation	3	1.091	-2	-0.707	3	1.049
21	Water for livestock	4	1.303	-1	-0.459	3	1.045
22	Manufacturing and industrial	3	0.963	-4	-1.258	-5	-1.411
23	Mining of soapstone	-2	-0.811	-4	-1.606	-3	-1.105
24	Fighting fires	2	0.629	-1	-0.509	0	-0.158
25	Supporting commercial land-based recreation	-4	-1.170	-2	-0.721	0	-0.398
26	Fishing	2	0.400	-1	-0.480	1	0.129
27	Dam/reservoir hunting	-5	-1.430	-4	-1.217	1	0.187
28	Land-based hunting	-3	-1.111	-5	-2.050	-4	-1.131
29	Dam/reservoir recreation	-2	-0.775	-1	-0.424	-1	-0.583
30	Commercial wetland-based recreation	-1	-0.428	-2	-0.630	0	-0.021
31	Recreation/leisure activities done near wetland	-4	-1.264	-1	-0.296	2	0.843
32	Physically and mentally challenging recreation	-4	-1.273	0	-0.109	-3	-0.897
33	Education management and science	2	0.562	3	1.225	-3	-0.978
34	Knowledge systems	-1	-0.501	0	0.141	1	0.144
35	Swati spiritual values	-5	-1.995	-5	-1.732	2	0.738
36	Swati cultural values	-3	-1.090	-3	-1.044	0	0.080
37	Preserving landscapes	0	-0.009	1	0.386	1	0.265
38	Preserving livelihoods through income generation	1	0.351	1	0.527	4	1.314
39	Inspirational values	-1	-0.511	-2	-0.788	-1	-0.481
40	Aesthetic values	-2	-0.921	0	0.074	2	0.748

Appendix D: Factors composition

Table D. 1: Factor 1 composition

ID	Stakeholder type	Farm Size (hectares, ha)	Gender (0 – male, 1 – female)	HW Times[a]	Cattle (number of cattle)	Loadings F1
HMB18	Household	0	0	0	0	0.83
MRS1	Malkerns Research Station	0	1	0	5	0.75
HMB21	Household	0	1	0	0	0.67
HMB2	Household	0	0	2	0	0.66
HMB3	Household	0	1	0	0	0.64
HMB23	Household	0	1	0	0	0.63
HMB25	Household	0	1	0	0	0.63
HMB24	Household	0	0	0	0	0.62
Resort2	Resort	0.25	0	1	2	0.62
HMB16	Household	0	0	0	0	0.61
Media2	Media	0	0	6	0	0.61
HMB12	Household	0	0	0	0	0.6
HMB4	Household	0	1	20	0	0.6
HH11	Household - farmer	1	0	365	0	0.59
HH19	Household - farmer	2	1	1	22	0.57
HMB22	Household	0	1	0	0	0.57
HMB14	Household	0	0	3	0	0.56
HH2	Household - handcraft	6	1	365	10	0.54
Media1	Media	2	1	4	0	0.54
Resort1	Resort	1	1	365	12	0.53
HMB11	Household	0	1	0	0	0.51
HH5	Household - livestock	5	1	365	60	0.49
HMB8	Household	0	1	5	0	0.49
MoA2	Ministry of Agriculture	0	0	50	0	0.49
HMB20	Household	0	1	0	0	0.47
MNR2	Maloloja Nature Reserve	2	1	365	4	0.41
HH9	Household – farmer	1	1	20	0	0.32

[a] No of times the respondent visited HDNR in the last year (365 corresponds to households living with the HDNR area)

Table D. 2: Factor 2 composition

ID	Stakeholder type	Farm size (hectares, ha)	Gender (0 – male, 1 – female)	HW times[a]	Cattle (number of cattle)	Loadings F2
EEA1	Eswatini Environment Authority	0.5	0	3	9	0.81
MoA1	Ministry of Agriculture	0	1	200	0	0.75
HMB1	Household	0	0	5	0	0.7
EEA2	Eswatini Environment Authority	0	0	6	0	0.67
MRS2	Malkerns Research Station	0	0	15	0	0.66
MRS3	Malkerns Research Station	0	0	12	0	0.61
MOTEA 1	Min. of Tourism and Environmental Af fairs	0	1	1	0	0.61
HH15	Household – farmer	0.5	1	2	0	0.58
MNR3	Maloloja Nature Reserve	2	0	365	0	0.56
HH13	Household - Soapstone user	0.25	0	1	0	0.56
ENTC2	ENTC	0.9	0	365	0	0.56
HMB10	Household 3	0	1	1	0	0.55
HMB5	Household	0	0	0	0	0.53
WRB2	Water expert	0	0	5	0	0.5
MNR1	Maloloja Nature Reserve	2.5	1	3	5	0.47
HH6	Household - farmer	1.5	0	365	6	0.47
HH10	Household - farmer	2	1	365	10	0.44
HH3	Household - fishermen	1	0	365	0	0.41
HMB9	Household	0	0	0	0	0.34
HMB17	Household	0	1	0	0	0.34

[a] No of times the respondent visited HDNR in the last year (365 corresponds to households living with the HDNR area)

Table D. 3: Factor 3 composition

ID	Stakeholder type	Farm Size (hectares, ha)	Gender (0 – male, 1 – female)	HW times[a]	Cattle (number of cattle)	Loadings F3
HH7	Household - farmer	0.5	0	365	0	0.7
HH20	Household - farmer	2	0	1	8	0.66
HMB15	Household	0	1	0	0	0.64
HMB19	Household	0	1	0	0	0.56
MOTEA2	Ministry of Tourism and Environmental Affairs	1.2	0	0	2	0.54
HH8	Household - farmer	2	0	365	0	0.51
ENTC1	ENTC	5	1	1	25	0.35
Recreat1	Recreational user	0.5	1	12	0	0.35

Appendix E: Frameworks for classifying cultural ecosystem services

Table E.1: Framework for classifying cultural ecosystem services

Cultural Ecosystem Service Category	Description	Example
1. Cultural diversity	The diversity of ecosystems is one factor influencing the diversity of cultures.	Sites with particular ecosystems for example wetlands for fishing.
2. Spiritual and religious values	Many religions attach spiritual and religious values to ecosystems or their components.	Sites of spiritual, religious, or other forms of exceptional personal meaning.
3. Knowledge systems (traditional and informal)	Ecosystems influence the types of knowledge systems developed by different cultures.	Sites providing indigenous knowledge through traditional structures.
4. Educational values	Ecosystems and their components and processes provide the basis for both formal and informal education in many societies.	Sites that widen knowledge about plant and animal species.
5. Inspiration	Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture, and advertising.	Sites that stimulates new thoughts, ideas or creative expressions.
6. Aesthetic values	Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, "scenic drives," and the selection of housing locations.	Sites of particular beauty.
7. Social relations	Ecosystems influence the types of social relations that are established in particular cultures. Fishing societies, for example, differ in many respects in their social relations from nomadic herding or agricultural societies.	Sites serving as meeting points with friends.
8. Sense of place	Many people value the "sense of place" that is associated with recognised features of the environment, including aspects of the ecosystem.	Sites that foster a sense of authentic human attachment.
9. Cultural heritage values	Many societies place high value in the maintenance of either historically important landscapes ("cultural landscapes") or culturally significant species.	Sites relevant to local history and culture like museums, archaeological sites, artifacts, cultural heritage villages etc including cultural activities (festivals).
10. Recreational and ecotourism values	People often choose where to spend their leisure time base in part on the characteristics of the natural or cultivated landscapes in a particular area.	Sites used for recreational activities like national parks and game reserves (walking, dog walking, horse riding, swimming, gathering wild fruits, angling, hunting etc).

Source: Adapted from MA (2005); TEEB (2010); Plieninger et al. (2013).

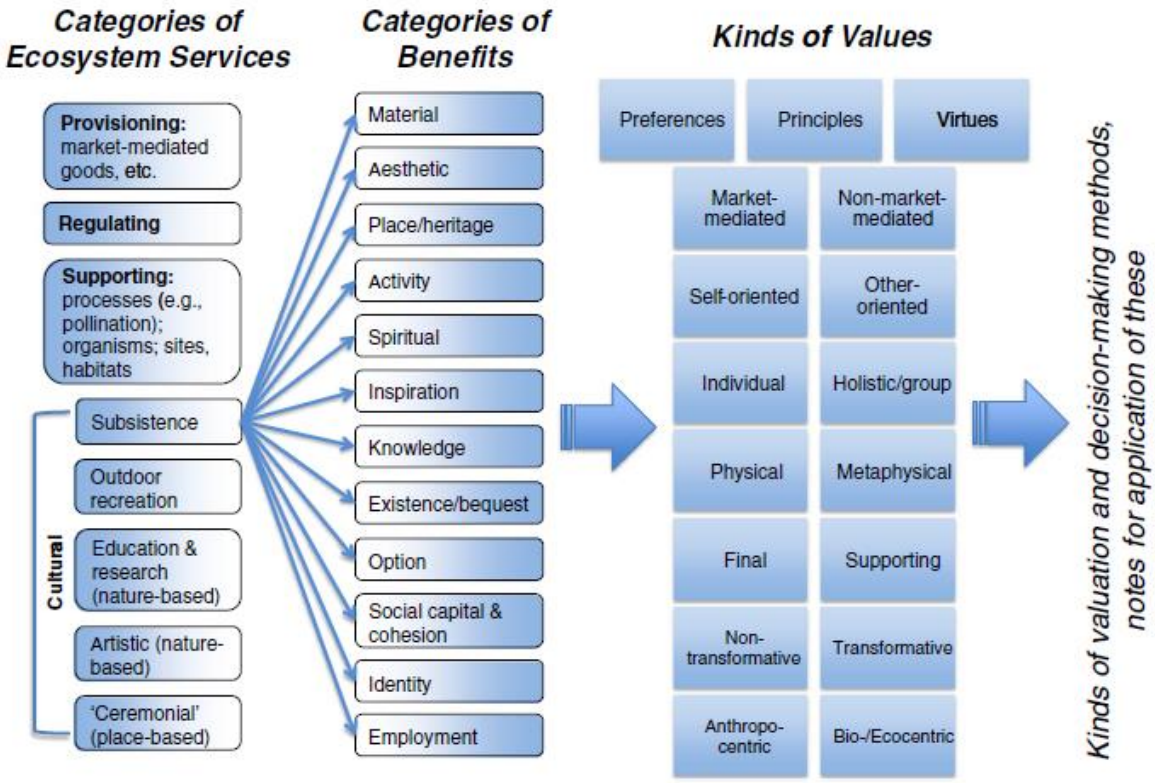

Figure E.1: Framework for classifying cultural ecosystems service - Typology of ecosystem services and values
Source: Chan et al. (2012a).

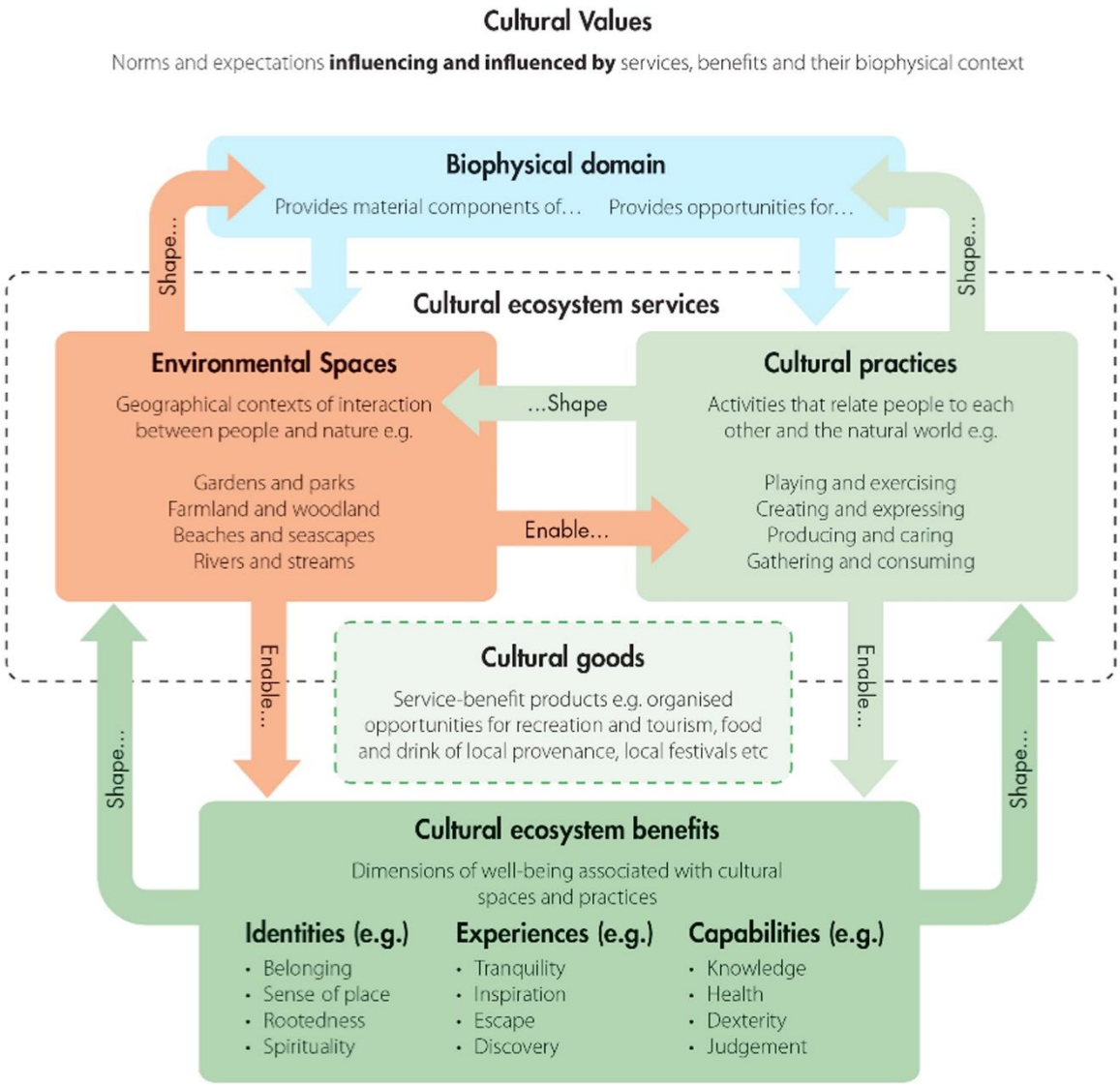

Figure E.2: A framework for cultural ecosystem services
Source: Fish et al. (2016).

Appendix E: Consent for Q methodology survey

Informed consent for participation in an academic research study

Perceptions on wetland ecosystem services in Eswatini using Q-methodology: the case Hawane wetland

Research conducted by:
L.S. Mahlalela (student number: 11335531)
Cell: +27 78 153 7288 (RSA)
+268 7615 3368(SWZ)

Dear respondent

You are kindly invited to participate in an academic research study conducted by Linda Siphiwo Mahlalela in partial fulfillment of the Doctoral (Ph.D.) degree programme from the University of Pretoria, Department of Agricultural Economics, Extension and Rural Development, under the Centre for Environmental Economics and Policy in Africa (CEEPA).

The main purpose of the study is to assess the different perspectives on the benefits from Hawane wetland in order to ensure continuous and secure water supply, habitat for endangered bird species, fish and other raw material benefits to name a few.

Please take note of the following before we commence with the interview:

- This study involves an **anonymous** survey. Your name will not appear on the questionnaire and the answers you give will be treated as strictly **confidential**. You cannot be identified in person based on the answers you give. Your selection as one of the respondents is purely random.
- Your participation in this study is very important to us, we will highly appreciate your sincere response regarding your perception of wetland benefits and suggestions for improvements. That said, you may choose not to participate and you may stop participating at any time without any negative consequences. Please answer questions in the questionnaire as completely and honestly as possible. This should not take more than 30 minutes of your time.
- The result of the study will be used for policy formulation and academic purposes (published in academic journals). We will provide you with a summary of our findings on request.
- Please contact my supervisors, Prof Eric Mungatana (eric.mungatana@up.ac.za), Prof Thomas Lundhede (thlu@ifro.ku.dk) and Dr. Damien Jourdain (damien.jourdain@cirad.fr) for any question or comment regarding this study.
- Please acknowledge that: You understood the information provided above. You give your consent to participate in the study on a voluntary basis.

Participant signature…… **Date**……

Appendix F: Q-methodology questionnaire

A: GENERAL INFORMATION

Date of interview:		Type of stakeholder:			
Name of interviewer:		Starting time:		Ending time:	
Village/Community:					

B: HOUSEHOLD KNOWLEDGE, OPINIONS, PERCEPTIONS, AND ATTITUDES ON HAWANE DAM AND NATURE RESERVE (HAWANE WETLAND)

Hawane Dam and Nature Reserve (Hawane wetland)

Hawane Dam and Nature Reserve (Ramsar site no. 2121, wetland of international importance) is a protected area along the Mbuluzi river which covers the whole Hawane reservoir (which supplies water to the city of Mbabane) and its surroundings. The reservoir is host to a variety of waterbirds, whereas the swamp supports a small but critical population of the endemic and regionally critically endangered plant Swati red hot poker 'licacalatikoshi'. The reserve's main attraction is its wealth of birdlife, and a trail is provided for bird-watching. Bird species include the lanner falcon, Egyptian goose, pied kingfisher 'linombe', white-faced whistling duck and wattled crane. This section seeks to investigate the households' perceptions, and attitudes towards benefits offered by the Hawane Dam and Nature Reserve.

Introduction

The Hawane wetland provides several services and goods such as securing clean water supply, providing habitat for endangered bird species, fish and other animals, providing raw material benefits like fibre for making handicraft products, and allowing for recreating benefits like eco-tourism and boating, we would

like to know how people are ranking these different services. The results of this exercise will be used to select attributes for non-market valuation of the benefits from Hawane wetland so that it would empower the local community to participate more effectively in the conservation and management of Hawane wetland.

1. Where is the Hawane wetland located? ……...…….
2. How many times have you been to the Hawane wetland in the last 12 months? ……...……...
3. What are the benefits you see in maintaining the Hawane wetland? ……..……..
4. Please list the goods that you or your household extract from the Hawane wetland. …..……...…….
5. Please list other services or goods from the Hawane wetland that are important to you. ……...……..

Instruction: *Please read statements in the cards and separate them into three stacks; first stack representing the statements most important to you and your household, second stack those least important and third stack those that are neutral. You may then place them on the respective boxes in the board according to your views or perspectives.*

C: DEBRIEFING QUESTIONS

6. Did you feel that important services that you derive from the Hawane wetland were not mentioned in the list that we provided? Yes [ ] No [ ] *If 'Yes' which are:*

   ……..……
   .....

7. Why did you select the statements [… ...] as most important to you and your household?

   ……..……
   .....
   .....

8. Why did you select the statements [… ...] as least important to you and your household?

……..……

.....

.....

9. Why did you select the statements [… ... … … … … etc] as neutral to you and your household?

……..……

.....

.....

D: HOUSEHOLD FINANCIAL INFORMATION

10. What is your household total monthly expenditure on household needs? E.....

11. What is the total household income per month? E……..

12. **Livestock owned**	13. **Farm size (in ha)**	14. **Land owned (in ha)**	15. **Land tenure**	16. **Assets owned**
Cattle ……	……	……	Title Deed [ ]	Tractor [ ]
Goats ……			Swazi Nation Land [ ]	Car [ ]

E: RESPONDENT INFORMATION

17. **Gender**		18. **Age**	19. **Role in the household**		20. **Education level**		21. **Occupation**	
Male	[0]		Head of household	[1]	No formal education	[1]	Technical/Professional/Managerial-civil service	[1]
Female	[1]	……..	Spouse of the head	[2]	Primary	[2]	Technical/Professional/Managerial-private	[2]
			Child of the head	[3]	High school	[3]	sector	[3]
			Parent of the head	[4]	Tertiary	[4]	Civil servant	[4]
			Other (*specify*)	[5]			Sales/administrator/shop keeper (private)	[5]
			……				Transport	[6]
							Skilled labour private employed	[7]
							Skilled labour self-employed	[8]
							Casual labourer	[9]
							Subsistence farming	[10]
							Ranching	[11]
							Pensioner	[12]
							Handcraft	[13]
							Unemployed	[14]
							Other (*specify*)……..	

Thank you for participating in the survey!

Appendix G: Consent for discrete choice experiment survey

Informed consent for participation in an academic research study

Non-market valuation of cultural ecosystem services in the Kingdom of Eswatini

Research conducted by:
L.S. Mahlalela (student number: 11335531)
Cell: +27 78 153 7288 (RSA)
+268 7615 3368(SWZ)

Dear respondent,

You are kindly invited to participate in an academic research study conducted by Linda Siphiwo Mahlalela in partial fulfilment of the Doctoral (Ph.D.) degree programme from the University of Pretoria, Department of Agricultural Economics, Extension and Rural Development, under the Centre for Environmental Economics and Policy in Africa (CEEPA).

The main purpose of the study is to assess the economic value households attach to the conservation of wetlands mainly to ensure continuous and secure production of reeds so as to preserve the reed dance amongst other benefits.

Please take note of the following before we commence with the interview:

- This study involves an **anonymous** survey. Your name will not appear on the questionnaire and the answers you give will be treated as strictly **confidential**. You cannot be identified in person based on the answers you give. Your selection as one of the respondents is purely random.
- Your participation in this study is very important to us, we will highly appreciate your sincere response regarding your perception of cultural goods and suggestions for improvements. That said, you may choose not to participate and you may stop participating at any time without any negative consequences. Please answer the questions in the questionnaire as completely and honestly as possible. This should not take more than 30 minutes of your time.
- The result of the study will be used for policy formulation and academic purposes (published in academic journals). We will provide you with a summary of our findings on request.
- Please contact my supervisors, Prof Eric Mungatana (eric.mungatana@up.ac.za), Prof Thomas Lundhede (thlu@ifro.ku.dk) and Dr Damien Jourdain (damien.jourdain@cirad.fr) for any question or comment regarding this study.
- Please acknowledge that: You understood the information provided above. You give your consent to participate in the study on a voluntary basis.

Participant signature…… **Date**……..

Appendix H: Discrete choice experiment survey questionnaire – Household tax

A: GENERAL INFORMATION

Date of interview:		Region:		Hhohho [1] Shiselweni [3]		Manzini [2] Lubombo [4]	
Name of interviewer:		Demographic dimension:		Urban [1]		Rural [2]	
Village/Community:		Starting time:		Ending time:		Gender of interviewer:	

B: HOUSEHOLD KNOWLEDGE, OPINIONS, PERCEPTIONS AND ATTITUDES ON REEDS AND THE REED DANCE

I. Reeds and the reed dance

Wetlands in the Kingdom of Eswatini produce important benefits (e.g., fibre for making handicraft products, clay for making pots (tindziwo), dams for spiritual cleansing, reeds for the reed dance, reeds used for building windbreaks (emaguma)) that might be important in preserving and promoting culture and traditions even for future generations. In particular, reeds are used for building and repairing windbreaks (emaguma) around royal residences during the reed dance. This section seeks to investigate the households' knowledge, perceptions, and attitudes towards reeds and the reed dance.

Rate on a scale of 1 (strongly agree) to 5 (strongly disagree) the extent to which you agree or disagree with the following statements regarding the reeds.	**Strongly agree (1)**	**Agree (2)**	**Neutral (3)**	**Disagree (4)**	**Strongly disagree (5)**
1. Reduction in wetland size and in subsequent reduction in the production of reeds negatively affects the ability to host the reed dance					
2. There is a shortage of reeds at Bhamusakhe and Mpisi farm which can be addressed by conservation of wetlands					
3. There is a problem of decreasing wetland size that in turn decreases production of reeds which can be mitigated by conservation of wetlands					
4. During the reed dance, peer education (sharing of health information like HIV/AIDS prevention and control, domestic abuse, abstinence, values and good behaviour) is important shaping health behaviour of maidens					
5. It is important to share indigenous knowledge that instils respect and Swati culture in the maidens, and transfer skills (handicraft skills, sewing, pottery etc) to maidens during the reed dance through entrepreneurship workshops					
6. I enjoy seeing tourists from all over the world at the reed dance					

C: ASSESSMENT OF KNOWLEDGE ON THE REED DANCE (QUIZ)

This section seeks to assess households' knowledge on the reed dance. In each question only **ONE** answer is correct. Please circle the correct one.

Question 1: How often does the reed dance (maidens - imbali) take place in a year? a. Once a year b. Twice a year c. Three times a year d. Do not know	**Question 2: Where does the reed dance take place?** a. Lavumisa b. Mbabane c. Ludzidzini Royal Residence and Mbangweni Royal Residence d. Do not know
Question 3: During the reed dance, young maidens gather from all over the country to honour and pay homage to … a. Her Majesty, the Queen Mother b. Maidens c. Royalty d. Do not know	**Question 4: Reeds in the Kingdom of Eswatini are used for…** a. Building windbreaks (emaguma) (therefore as inputs in the production of the Reed dance), handicraft products and clean water b. Constructing bridges c. Building brick houses d. Do not know
Question 5: How is the reed dance, reeds and wetlands related? a. Reed dance produces reeds for dancing b. Wetlands produce reeds which are used in the reed dance c. There is no relationship d. Do not know	**Question 6: Why is the conservation of wetlands important in relation to the reed dance?** a. Ensure that the reed dance stops b. Ensures the continuous supply of reeds so that the reed dance is preserved for future generations c. Ensures that wetlands are conserved d. Do not know
Question 7: How can the reed dance contribute to development of the Swati nation? a. Slows down climate change b. Prevents land degradation c. Unifies the nation, boost the economy through tourism, empowerment of small business and the girl child d. Do not know	**QUIZ SCORE** $= \frac{.}{7}$

D: PREFERENCES FOR THE REED DANCE (UMHLANGA)

Umhlanga (reed dance) is important in promotion and transmission of culture in the Kingdom of Eswatini. The cultural event depends on traditions and humans but also on the existence of wetlands and rivers. The purpose of the following choice experiment is to understand how you value the reed dance and its preservation for future generations.

Wetlands have, among other factors, decreased in size due to climate change, livestock grazing, extraction of wetland resources which has affected the production of reeds. Currently, only 3% of wetlands are protected in the Kingdom of Eswatini. During the reed dance, maidens previously marched to cut and collect reeds at Mpisi farm and Bhamusakhe wetland. Shortage of reeds in the wetlands at Mpisi farm and Bhamusakhe, has made it necessary for maidens to cut reeds either from their local communities or other identified local wetlands. The current state will further deteriorate the quality and quantity of the wetlands unless there is an intervention. Consequently, the ability to use reeds harvested in the Kingdom of Eswatini in the future is threatened. Wetlands can be conserved by fencing with controlled access and extraction of wetland resources and water balance maintained to increase wetland resilience, and the more areas that are conserved the higher the likelihood that there will be continued supply of reeds in the future. The conservation comes with a cost but if nothing is done in conserving the current wetlands that produce reeds, reeds supply will decrease.

During the preparation for the reed dance, the maidens are given informal education which includes peer education (sharing of health information like HIV/AIDS prevention and control, domestic abuse, values and behaviour), entrepreneurial skills, and traditional and indigenous knowledge. Today, the maiden's receive 12 hours of education but in the future the number of lessons could be changed, as the education comes with a cost.

At the reed dance in 2017 it was estimated that about 2,500 tourists (non-Swatis from outside the Kingdom of Eswatini) attended. This number of tourists is, among other things, the result of advertising efforts made by Eswatini Tourism Authority, and if the amount used for advertising is changed the number of tourists will react accordingly.

A policy to implement an intervention for the reed dance will require funding for the costs of the intervention that supplements the government budget. The government of the Kingdom of Eswatini is planning to do so by increasing/charging an income tax which will be collected by the Eswatini National Trust Commission (ENTC) into a national fund and used for conserving wetlands that supply reeds for the reed dance, increase informal education and tourist presence. All households in the Kingdom of Eswatini are expected to pay this annual charge.

The following presents attributes and attribute levels of the reed dance with the status quo and future scenarios:

	Status quo / Current situation	→	**Future scenario**
Attribute	**Attribute level**		**Attribute level**
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases**		**Conserve 6% of wetlands** and there is relatively high probability that reeds supply **increases** **Conserve 12% of wetlands** and there is high probability that reeds supply **increases**
Informal education	12 hours		8 hours 16 hours
Tourist presence	2500 tourists		1000 5000 7500
Annual household tax (in Emalangeni (E))	E0		E10 E20 E40 E80 E120

Kindly make your choice given the alternatives with different attributes of the reed dance (Umhlanga) presented in the choice cards below.

<u>On the following pages (6-17) you will see 12 choice cards</u>

In each card, we list the attributes related to the reed dance that could be changed and an annual cost to your household for the management required. For each choice card, we kindly ask you to choose the option you prefer given the amount indicated for the changes in the alternatives. You can only choose one option in each choice card, so please pick the one that you prefer. There are no right or wrong answers so please provide your personal answers and choices. The status quo option represents the current situation and there is no additional cost to your household. Every choice in the following choice cards must be treated independently. Results from similar studies have shown that respondents tend to overestimate how much they are willing to pay. We ask you to think carefully about the different alternatives in relation to your household's income. Please note that the additional payment will reduce your spending on other goods and services in your everyday life.

Choice Situation 1: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 
Informal education	12 hours	16 hours	8 hours
Tourist presence	2500 tourists	1000 tourists	5000 tourists
Annual household tax (in Emalangeni (E))	E0 per year	E40 per year	E20 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 2: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	8 hours	16 hours
Tourist presence	2500 tourists	5000 tourists	7500 tourists
Annual household tax (in Emalangeni (E))	E0 per year	E0 per year	E120 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 3: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	16 hours	8 hours
Tourist presence	2500 tourists	7500 tourists	5000 tourists
Annual household tax (in Emalangeni (E))	E0 per year	E120 per year	E80 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 4: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	12 hours	16 hours
Tourist presence	2500 tourists	5000 tourists	2500 tourists
Annual household tax (in Emalangeni (E))	E0 per year	E20 per year	E40 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 5: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	8 hours	12 hours
Tourist presence	2500 tourists	2500 tourists	1000 tourists
Annual household tax (in Emalangeni (E))	E0 per year	E40 per year	E0 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 6: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	8 hours	12 hours
Tourist presence	2500 tourists	2500 tourists	7500 tourists
Annual household tax (in Emalangeni (E))	E0 per year	E0 per year	E120 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 7: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 
Informal education	12 hours	12 hours	16 hours
Tourist presence	2500 tourists	1000 tourists	2500 tourists
Annual household tax (in Emalangeni (E))	E0 per year	E10 per year	E20 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 8: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	8 hours	12 hours
Tourist presence	2500 tourists	7500 tourists	1000 tourists
Annual household tax (in Emalangeni (E))	E0 per year	E20 per year	E10 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 9: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	12 hours	16 hours
Tourist presence	2500 tourists	5000 tourists	2500 tourists
Annual household tax (in Emalangeni (E))	E0 per year	E80 per year	E80 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 10: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 
Informal education	12 hours	16 hours	8 hours
Tourist presence	2500 tourists	7500 tourists	5000 tourists
Annual household tax (in Emalangeni (E))	E0 per year	E120 per year	E10 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 11: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 
Informal education	12 hours	12 hours	8 hours
Tourist presence	2500 tourists	1000 tourists	7500 tourists
Annual household tax (in Emalangeni (E))	E0 per year	E10 per year	E40 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 12: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	16 hours	12 hours
Tourist presence	2500 tourists	2500 tourists	1000 tourists
Annual household tax (in Emalangeni (E))	E0 per year	E80 per year	E0 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

E: DEBRIEFING QUESTIONS

7. Instruction to interviewer: Ask the respondent the following question "If in the above choice situations in section D you always chose the status quo alternative (current situation), please indicate which, if any, of the statements listed below closely match your choice, *select the most important reason*". *Tick only one*. Otherwise go to Q8.

Umhlanga (reed dance) does not mean anything to me	[ ]
I already pay enough taxes, the government should pay for the conservation of wetlands supplying reeds for the reed dance	[ ]
I do not think it is important to fund conservation of wetlands supplying reeds for the reed dance	[ ]
I would like to contribute to the conservation of wetlands supplying reeds for the reed dance contribution fund but I cannot afford	[ ]
I did not trust the collecting fund	[ ]
Other (specify)……	[ ]

8. When making your choice please indicate how often you paid attention to each attribute.

	Always	**Sometimes**	**Never**
Informal education	[ ]	[ ]	[ ]
Tourist presence	[ ]	[ ]	[ ]
Wetland conservation	[ ]	[ ]	[ ]
Additional annual cost to your household	[ ]	[ ]	[ ]

9. Why did you always consider the attribute(s) in Q8? Please tick all that apply.

Reasons	**Yes**	**No**
I did not understand the other attributes		
There was no information about the other attributes		
Where possible I always chose a lot of tourists		
Where possible I always chose 'conserve wetlands..'		

Where possible I always chose not to pay anything (E0)		
Where possible I always chose high conservation and more tourists at a reasonable cost		
Where possible I always chose high conservation and more informal education hours at a reasonable cost		
Other (specify) ……..		

F: HOUSEHOLD FINANCIAL INFORMATION

10. What is your total monthly expenditure on household needs? E.....
11. What is the total household income per month? E…….
12. What is the maximum amount of money your household can contribute annually towards the production and maintenance or preservation of reed dance compared to the current price structure (with a maximum of E120) presented before the choice tasks? E…….

G: SUGGESTIONS FOR IMPROVEMENTS IN THE SUPPLY AND DISTRIBUTION OF CULTURAL GOODS

13. For my household, preservation of the reed dance secures... (tick all that apply)

Knowledge systems	[ ]	Heritage	[ ]	Inspiration	[ ]	Social relations	[ ]
Sense of belonging	[ ]	Identity	[ ]	Social cohesion	[ ]	Networking	[ ]

14. To what extent do you agree with the following statement with (1 – strongly agree to 5 – strongly disagree)?

"The results of this study will influence public and cultural policies in the Kingdom of Eswatini."

Strongly agree	[1]	Agree	[2]	Neutral	[3]
Disagree	[4]	Strongly disagree	[5]		

15. Have you attended the reed dance before? Yes [ ] No [ ] *(IF 'Yes' go Q16, otherwise go to Q17)*

16. How many times have you attended the reed dance? …… times

17. Do you intend to attend the reed dance in future? Yes [ ] No [ ] *(IF 'No' why?)*

……

18. For my household, conservation of wetlands is essential for production of cultural benefits... (*tick all that apply*)

Recreation (swimming, boating, fishing, etc) [ ] Ecotourism [ ] Aesthetic (beauty) [ ]

Tick 'Yes' or 'No' on the following statements regarding payment vehicles	**Yes (1)**	**No (0)**
19. Do you or anyone in your household pay income tax?		
20. Have you or anyone in your household ever made a donation or contribution?		
21. Have you or anyone in your household paid higher prices for groceries in order to support a project (community project, school project, orphanage project etc)?		

H: RESPONDENT INFORMATION

22. **Gender**	23. **Age**	24. **Role in the household**	25. **Education level**	26. **Occupation**
Male [0]		Head of household [1]	No formal education [1]	Technical/Professional/Managerial-civil service [1]
Female [1]	……...	Spouse of the head [2]	Adult education [2]	Technical/Professional/Managerial-private sector [2]
		Child of the head [3]	Primary [3]	Civil servant [3]
		Parent of the head [4]	High school [4]	Sales/administrator (private) [4]
	(If range, choose the middle)	Other (*specify*) [5]	Tertiary [5]	Transport [5]
		……		Skilled labour private employed [6]
		…		Skilled labour self employed [7]
				Casual labourer [8]
				Pensioner [9]
				Unemployed [10]
				Other [11]
				(*specify*)……..

27. Do you have a suggestion on improvements in the production and distribution of the reed dance?

.....

.....

I: SURVEYOR'S OBSERVATIONS AND DEBRIEFING

28. Was the respondent a Swati? Yes [ ] No [ ] *(IF 'No' state ethnicity ……..)*

29. In your own opinion, did the interviewee understand all the questions? Please rank the answers based on the level of understanding in the following table.

Level of understanding	**Rank**
Very well understood	
Well understood	
Understood	
Not understood	
Not well understood	
Not at all understood	

30. Were there any questions that the interviewee found hard to answer because the options given to choose from did not cover his/her opinion or how he/she felt? If so, please describe them. Yes [ ] No [ ] *(IF 'Yes' please describe them)*

…….....

31. How would you rate the reliability of the responses given by this interviewee? Please rank the reliability in the following table.

Level of understanding	**Rank**
Very reliable	
Quite reliable	
Reliable	
Not quite reliable	
Not reliable	
Not at all reliable	

32. Provide reasons for your response to reliability data question above.

……..……

.....

Thank you for participating in the survey!

Appendix I: Discrete choice experiment survey questionnaire – Contribution

A: GENERAL INFORMATION

Date of interview:		Region:		Hhohho [1] Shiselweni [3]		Manzini [2] Lubombo [4]	
Name of interviewer:		Demographic dimension:		Urban [1]		Rural [2]	
Village/Community:		Starting time:		Ending time:		Gender of interviewer:	

B: HOUSEHOLD KNOWLEDGE, OPINIONS, PERCEPTIONS AND ATTITUDES ON REEDS AND THE REED DANCE

II. Reeds and the reed dance

Wetlands in the Kingdom of Eswatini produce important benefits (e.g., fibre for making handicraft products, clay for making pots (tindziwo), dams for spiritual cleansing, reeds for the reed dance, reeds used for building windbreaks (emaguma)) that might be important in preserving and promoting culture and traditions even for future generations. In particular, reeds are used for building and repairing windbreaks (emaguma) around royal residences during the reed dance. This section seeks to investigate the households' knowledge, perceptions, and attitudes towards reeds and the reed dance.

Rate on a scale of 1 (strongly agree) to 5 (strongly disagree) the extent to which you agree or disagree with the following statements regarding the reeds.	**Strongly agree (1)**	**Agree (2)**	**Neutral (3)**	**Disagree (4)**	**Strongly disagree (5)**
1. Reduction in wetland size and in subsequent reduction in the production of reeds negatively affects the ability to host the reed dance					
2. There is a shortage of reeds at Bhamusakhe and Mpisi farm which can be addressed by conservation of wetlands					
3. There is a problem of decreasing wetland size that in turn decreases production of reeds which can be mitigated by conservation of wetlands					
4. During the reed dance, peer education (sharing of health information like HIV/AIDS prevention and control, domestic abuse, abstinence, values and good behaviour) is important shaping health behaviour of maidens					
5. It is important to share indigenous knowledge that instils respect and Swati culture in the maidens, and transfer skills (handicraft skills, sewing, pottery etc) to maidens during the reed dance through entrepreneurship workshops					
6. I enjoy seeing tourists from all over the world at the reed dance					

C: ASSESSMENT OF KNOWLEDGE ON THE REED DANCE (QUIZ)

This section seeks to assess households' knowledge on the reed dance. In each question only **ONE** answer is correct. Please circle the correct one.

Question 1: How often does the reed dance (maidens - imbali) take place in a year? a. Once a year b. Twice a year c. Three times a year d. Do not know	**Question 2: Where does the reed dance take place?** a. Lavumisa b. Mbabane c. Ludzidzini Royal Residence and Mbangweni Royal Residence d. Do not know
Question 3: During the reed dance, young maidens gather from all over the country to honour and pay homage to … a. Her Majesty, the Queen Mother b. Maidens c. Royalty d. Do not know	**Question 4: Reeds in the Kingdom of Eswatini are used for…** a. Building windbreaks (emaguma) (therefore as inputs in the production of the Reed dance), handicraft products and clean water b. Constructing bridges c. Building brick houses d. Do not know
Question 5: How is the reed dance, reeds and wetlands related? a. Reed dance produces reeds for dancing b. Wetlands produce reeds which are used in the reed dance c. There is no relationship d. Do not know	**Question 6: Why is the conservation of wetlands important in relation to the reed dance?** a. Ensure that the reed dance stops b. Ensures the continuous supply of reeds so that the reed dance is preserved for future generations c. Ensures that wetlands are conserved d. Do not know
Question 7: How can the reed dance contribute to development of the Swati nation? a. Slows down climate change b. Prevents land degradation c. Unifies the nation, boost the economy through tourism, empowerment of small business and the girl child d. Do not know	**QUIZ SCORE** $= \frac{.}{7}$

D: PREFERENCES FOR THE REED DANCE (UMHLANGA)

Umhlanga (reed dance) is important in promotion and transmission of culture in the Kingdom of Eswatini. The cultural event depends on traditions and humans but also on the existence of wetlands and rivers. The purpose of the following choice experiment is to understand how you value the reed dance and its preservation for future generations.

Wetlands have, among other factors, decreased in size due to climate change, livestock grazing, extraction of wetland resources which has affected the production of reeds. Currently, only 3% of wetlands are protected in the Kingdom of Eswatini. During the reed dance, maidens previously marched to cut and collect reeds at Mpisi farm and Bhamusakhe wetland. Shortage of reeds in the wetlands at Mpisi farm and Bhamusakhe, has made it necessary for maidens to cut reeds either from their local communities or other identified local wetlands. The current state will further deteriorate the quality and quantity of the wetlands unless there is an intervention. Consequently, the ability to use reeds harvested in the Kingdom of Eswatini in the future is threatened. Wetlands can be conserved by fencing with controlled access and extraction of wetland resources and water balance maintained to increase wetland resilience, and the more areas that are conserved the higher the likelihood that there will be continued supply of reeds in the future. The conservation comes with a cost but if nothing is done in conserving the current wetlands that produce reeds, reeds supply will decrease.

During the preparation for the reed dance, the maidens are given informal education which includes peer education (sharing of health information like HIV/AIDS prevention and control, domestic abuse, values and behaviour), entrepreneurial skills, and traditional and indigenous knowledge. Today, the maiden's receive 12 hours of education but in the future the number of lessons could be changed, as the education comes with a cost.

At the reed dance in 2017 it was estimated that about 2,500 tourists (non-Swatis from outside the Kingdom of Eswatini) attended. This number of tourists is, among other things, the result of advertising efforts made by Eswatini Tourism Authority, and if the amount used for advertising is changed the number of tourists will react accordingly.

A policy to implement an intervention for the reed dance will require funding for the costs of the intervention that supplements the government budget. The government of the Kingdom of Eswatini is planning to do so through voluntary donations/contributions which will be collected by the Eswatini National Trust Commission (ENTC) into a national fund and used for conserving wetlands that supply reeds for the reed dance, increase informal education and tourist presence. All households in the Kingdom of Eswatini are expected to make a contribution annually.

The following presents attributes and attribute levels of the reed dance with the status quo and future scenarios:

	Status quo / Current situation	→	**Future scenario**
Attribute	**Attribute level**		**Attribute level**
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases**		**Conserve 6% of wetlands** and there is relatively high probability that reeds supply **increases** **Conserve 12% of wetlands** and there is high probability that reeds supply **increases**
Informal education	12 hours		8 hours 16 hours
Tourist presence	2500 tourists		1000 5000 7500
Annual household contribution (in Emalangeni (E))	E0		E10 E20 E40 E80 E120

Kindly make your choice given the alternatives with different attributes of the reed dance (Umhlanga) presented in the choice cards below.

<u>On the following pages (6-17) you will see 12 choice cards</u>

In each card, we list the attributes related to the reed dance that could be changed and an annual cost to your household for the management required. For each choice card, we kindly ask you to choose the option you prefer given the amount indicated for the changes in the alternatives. You can only choose one option in each choice card, so please pick the one that you prefer. There are no right or wrong answers so please provide your personal answers and choices. The status quo option represents the current situation and there is no additional cost to your household. Every choice in the following choice cards must be treated independently. Results from similar studies have shown that respondents tend to overestimate how much they are willing to pay. We ask you to think carefully about the different alternatives in relation to your household's income. Please note that the additional payment will reduce your spending on other goods and services in your everyday life.

Choice Situation 1: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 
Informal education	12 hours	16 hours	8 hours
Tourist presence	2500 tourists	1000 tourists	5000 tourists
Annual household contribution (in Emalangeni (E))	E0 per year	E40 per year	E20 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 2: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	8 hours	16 hours
Tourist presence	2500 tourists	5000 tourists	7500 tourists
Annual household contribution (in Emalangeni (E))	E0 per year	E0 per year	E120 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 3: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	16 hours	8 hours
Tourist presence	2500 tourists	7500 tourists	5000 tourists
Annual household contribution (in Emalangeni (E))	E0 per year	E120 per year	E80 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 4: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	12 hours	16 hours
Tourist presence	2500 tourists	5000 tourists	2500 tourists
Annual household contribution (in Emalangeni (E))	E0 per year	E20 per year	E40 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 5: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	8 hours	12 hours
Tourist presence	2500 tourists	2500 tourists	1000 tourists
Annual household contribution (in Emalangeni (E))	E0 per year	E40 per year	E0 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 6: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	8 hours	12 hours
Tourist presence	2500 tourists	2500 tourists	7500 tourists
Annual household contribution (in Emalangeni (E))	E0 per year	E0 per year	E120 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 7: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 
Informal education	12 hours	12 hours	16 hours
Tourist presence	2500 tourists	1000 tourists	2500 tourists
Annual household contribution (in Emalangeni (E))	E0 per year	E10 per year	E20 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 8: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	8 hours	12 hours
Tourist presence	2500 tourists	7500 tourists	1000 tourists
Annual household contribution (in Emalangeni (E))	E0 per year	E20 per year	E10 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 9: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	12 hours	16 hours
Tourist presence	2500 tourists	5000 tourists	2500 tourists
Annual household contribution (in Emalangeni (E))	E0 per year	E80 per year	E80 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 10: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 
Informal education	12 hours	16 hours	8 hours
Tourist presence	2500 tourists	7500 tourists	5000 tourists
Annual household contribution (in Emalangeni (E))	E0 per year	E120 per year	E10 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 11: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 
Informal education	12 hours	12 hours	8 hours
Tourist presence	2500 tourists	1000 tourists	7500 tourists
Annual household contribution (in Emalangeni (E))	E0 per year	E10 per year	E40 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 12: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	16 hours	12 hours
Tourist presence	2500 tourists	2500 tourists	1000 tourists
Annual household contribution (in Emalangeni (E))	E0 per year	E80 per year	E0 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

E: DEBRIEFING QUESTIONS

7. Instruction to interviewer: Ask the respondent the following question "If in the above choice situations in section D you always chose the status quo alternative (current situation), please indicate which, if any, of the statements listed below closely match your choice, *select the most important reason*". *Tick only one*. Otherwise go to Q8.

Umhlanga (reed dance) does not mean anything to me	[ ]
I already make enough donations/contributions, the government should pay for the conservation of wetlands supplying reeds for the reed dance	[ ]
I do not think it is important to fund conservation of wetlands supplying reeds for the reed dance	[ ]
I would like to contribute to the conservation of wetlands supplying reeds for the reed dance contribution fund but I cannot afford	[ ]
I did not trust the collecting fund	[ ]
I think we should all pay taxes instead, in order to prevent other households from enjoying the benefits from conserving wetlands and preserving the reed dance without paying for them	[ ]
Other (specify)……	[ ]

8. When making your choice please indicate how often you paid attention to each attribute.

	Always	**Sometimes**	**Never**
Informal education	[ ]	[ ]	[ ]
Tourist presence	[ ]	[ ]	[ ]
Wetland conservation	[ ]	[ ]	[ ]
Additional annual cost to your household	[ ]	[ ]	[ ]

9. Why did you always consider the attribute(s) in Q8? Please tick all that apply.

Reasons	**Yes**	**No**
I did not understand the other attributes		
There was no information about the other attributes		

Where possible I always chose a lot of tourists		
Where possible I always chose 'conserve wetlands..'		
Where possible I always chose not to pay anything (E0)		
Where possible I always chose high conservation and more tourists at a reasonable cost		
Where possible I always chose high conservation and more informal education hours at a reasonable cost		
Other (specify) ……		

F: HOUSEHOLD FINANCIAL INFORMATION

10. What is your total monthly expenditure on household needs? E.....
11. What is the total household income per month? E…….
12. What is the maximum amount of money your household can contribute annually towards the production and maintenance or preservation of reed dance compared to the current price structure (with a maximum of E120) presented before the choice tasks? E…….

G: SUGGESTIONS FOR IMPROVEMENTS IN THE SUPPLY AND DISTRIBUTION OF CULTURAL GOODS

13. For my household, preservation of the reed dance secures... (tick all that apply)

Knowledge systems	[ ]	Heritage	[ ]	Inspiration	[ ]	Social relations	[ ]
Sense of belonging	[ ]	Identity	[ ]	Social cohesion	[ ]	Networking	[ ]

14. To what extent do you agree with the following statement with (1 – strongly agree to 5 – strongly disagree)?
"The results of this study will influence public and cultural policies in the Kingdom of Eswatini."

Strongly agree	[1]	Agree	[2]	Neutral	[3]
Disagree	[4]	Strongly disagree	[5]		

15. Have you attended the reed dance before? Yes [ ] No [ ] *(IF 'Yes' go Q16, otherwise go to Q17)*

16. How many times have you attended the reed dance? …… times

17. Do you intend to attend the reed dance in future? Yes [ ] No [ ] *(IF 'No' why?)*

……

……

18. For my household, conservation of wetlands is essential for production of cultural benefits... (*tick all that apply*)

Recreation (swimming, boating, fishing, etc) [ ] Ecotourism [ ] Aesthetic (beauty) [ ]

Tick 'Yes' or 'No' on the following statements regarding payment vehicles	**Yes (1)**	**No (0)**
19. Do you or anyone in your household pay income tax?		
20. Have you or anyone in your household ever made a donation or contribution?		
21. Have you or anyone in your household paid higher prices for groceries in order to support a project (community project, school project, orphanage project etc)?		

H: RESPONDENT INFORMATION

22. **Gender**	23. **Age**	24. **Role in the household**	25. **Education level**	26. **Occupation**
Male [0]		Head of household [1]	No formal education [1]	Technical/Professional/Managerial-civil service [1]
Female [1]	……...	Spouse of the head [2]	Adult education [2]	Technical/Professional/Managerial-private sector [2]
		Child of the head [3]	Primary [3]	Civil servant [3]
		Parent of the head [4]	High school [4]	Sales/administrator (private) [4]
	(If range, choose the middle)	Other (*specify*) [5]	Tertiary [5]	Transport [5]
		……		Skilled labour private employed [6]
		…		Skilled labour self employed [7]
				Casual labourer [8]
				Pensioner [9]
				Unemployed [10]
				Other [11]
				(*specify*)……...

27. Do you have a suggestion on improvements in the production and distribution of the reed dance?

.....

.....

I: SURVEYOR'S OBSERVATIONS AND DEBRIEFING

28. Was the respondent a Swati? Yes [ ] No [ ] *(IF 'No' state ethnicity ……..)*

29. In your own opinion, did the interviewee understand all the questions? Please rank the answers based on the level of understanding in the following table.

Level of understanding	**Rank**
Very well understood	
Well understood	
Understood	
Not understood	
Not well understood	
Not at all understood	

30. Were there any questions that the interviewee found hard to answer because the options given to choose from did not cover his/her opinion or how he/she felt? If so, please describe them. Yes [ ] No [ ] *(IF 'Yes' please describe them)*

……

31. How would you rate the reliability of the responses given by this interviewee? Please rank the reliability in the following table.

Level of understanding	**Rank**
Very reliable	
Quite reliable	
Reliable	
Not quite reliable	
Not reliable	
Not at all reliable	

32. Provide reasons for your response to reliability data question above.

……...……

……...……

Thank you for participating in the survey!

Appendix J: Discrete choice experiment survey questionnaire – Subsidy

A: GENERAL INFORMATION

Date of interview:		Region:		Hhohho [1] Shiselweni [3]		Manzini [2] Lubombo [4]	
Name of interviewer:		Demographic dimension:		Urban [1]		Rural [2]	
Village/Community:		Starting time:		Ending time:		Gender of interviewer:	

B: HOUSEHOLD KNOWLEDGE, OPINIONS, PERCEPTIONS AND ATTITUDES ON REEDS AND THE REED DANCE

III. Reeds and the reed dance

Wetlands in the Kingdom of Eswatini produce important benefits (e.g., fibre for making handicraft products, clay for making pots (tindziwo), dams for spiritual cleansing, reeds for the reed dance, reeds used for building windbreaks (emaguma)) that might be important in preserving and promoting culture and traditions even for future generations. In particular, reeds are used for building and repairing windbreaks (emaguma) around royal residences during the reed dance. This section seeks to investigate the households' knowledge, perceptions, and attitudes towards reeds and the reed dance.

Rate on a scale of 1 (strongly agree) to 5 (strongly disagree) the extent to which you agree or disagree with the following statements regarding the reeds.	**Strongly agree (1)**	**Agree (2)**	**Neutral (3)**	**Disagree (4)**	**Strongly disagree (5)**
1. Reduction in wetland size and in subsequent reduction in the production of reeds negatively affects the ability to host the reed dance					
2. There is a shortage of reeds at Bhamusakhe and Mpisi farm which can be addressed by conservation of wetlands					
3. There is a problem of decreasing wetland size that in turn decreases production of reeds which can be mitigated by conservation of wetlands					
4. During the reed dance, peer education (sharing of health information like HIV/AIDS prevention and control, domestic abuse, abstinence, values and good behaviour) is important shaping health behaviour of maidens					
5. It is important to share indigenous knowledge that instils respect and Swati culture in the maidens, and transfer skills (handicraft skills, sewing, pottery etc) to maidens during the reed dance through entrepreneurship workshops					
6. I enjoy seeing tourists from all over the world at the reed dance					

C: ASSESSMENT OF KNOWLEDGE ON THE REED DANCE (QUIZ)

This section seeks to assess households' knowledge on the reed dance. In each question only **ONE** answer is correct. Please circle the correct one.

Question 1: How often does the reed dance (maidens - imbali) take place in a year? a. Once a year b. Twice a year c. Three times a year d. Do not know	**Question 2: Where does the reed dance take place?** a. Lavumisa b. Mbabane c. Ludzidzini Royal Residence and Mbangweni Royal Residence d. Do not know
Question 3: During the reed dance, young maidens gather from all over the country to honour and pay homage to … a. Her Majesty, the Queen Mother b. Maidens c. Royalty d. Do not know	**Question 4: Reeds in the Kingdom of Eswatini are used for…** a. Building windbreaks (emaguma) (therefore as inputs in the production of the Reed dance), handicraft products and clean water b. Constructing bridges c. Building brick houses d. Do not know
Question 5: How is the reed dance, reeds and wetlands related? a. Reed dance produces reeds for dancing b. Wetlands produce reeds which are used in the reed dance c. There is no relationship d. Do not know	**Question 6: Why is the conservation of wetlands important in relation to the reed dance?** a. Ensure that the reed dance stops b. Ensures the continuous supply of reeds so that the reed dance is preserved for future generations c. Ensures that wetlands are conserved d. Do not know
Question 7: How can the reed dance contribute to development of the Swati nation? a. Slows down climate change b. Prevents land degradation c. Unifies the nation, boost the economy through tourism, empowerment of small business and the girl child d. Do not know	**QUIZ SCORE** $= \frac{.}{7}$

D: PREFERENCES FOR THE REED DANCE (UMHLANGA)

Umhlanga (reed dance) is important in promotion and transmission of culture in the Kingdom of Eswatini. The cultural event depends on traditions and humans but also on the existence of wetlands and rivers. The purpose of the following choice experiment is to understand how you value the reed dance and its preservation for future generations.

Wetlands have, among other factors, decreased in size due to climate change, livestock grazing, extraction of wetland resources which has affected the production of reeds. Currently, only 3% of wetlands are protected in the Kingdom of Eswatini. During the reed dance, maidens previously marched to cut and collect reeds at Mpisi farm and Bhamusakhe wetland. Shortage of reeds in the wetlands at Mpisi farm and Bhamusakhe, has made it necessary for maidens to cut reeds either from their local communities or other identified local wetlands. The current state will further deteriorate the quality and quantity of the wetlands unless there is an intervention. Consequently, the ability to use reeds harvested in the Kingdom of Eswatini in the future is threatened. Wetlands can be conserved by fencing with controlled access and extraction of wetland resources and water balance maintained to increase wetland resilience, and the more areas that are conserved the higher the likelihood that there will be continued supply of reeds in the future. The conservation comes with a cost but if nothing is done in conserving the current wetlands that produce reeds, reeds supply will decrease.

During the preparation for the reed dance, the maidens are given informal education which includes peer education (sharing of health information like HIV/AIDS prevention and control, domestic abuse, values and behaviour), entrepreneurial skills, and traditional and indigenous knowledge. Today, the maiden's receive 12 hours of education but in the future the number of lessons could be changed, as the education comes with a cost.

At the reed dance in 2017 it was estimated that about 2,500 tourists (non-Swatis from outside the Kingdom of Eswatini) attended. This number of tourists is, among other things, the result of advertising efforts made by Eswatini Tourism Authority, and if the amount used for advertising is changed the number of tourists will react accordingly.

A policy to implement an intervention for the reed dance will require funding for the costs of the intervention that supplements the government budget. The government of the Kingdom of Eswatini is planning to do so through annual price increase on household goods (lowering the current subsidies for groceries such as flour, sugar, maize meal and fuel enjoyed by you and other households). In other words, these goods will become more expensive for you to buy. The money from an annual price increase on household goods (subsidies) will be collected by the Eswatini National Trust Commission (ENTC) into a national fund and used for conserving wetlands that supply reeds for the reed dance, increase informal education and tourist presence. All households in the Kingdom of Eswatini are expected to pay this annual charge.

The following presents attributes and attribute levels of the reed dance with the status quo and future scenarios:

	Status quo / Current situation	→	**Future scenario**
Attribute	**Attribute level**		**Attribute level**
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases**		**Conserve 6% of wetlands** and there is relatively high probability that reeds supply **increases** **Conserve 12% of wetlands** and there is high probability that reeds supply **increases**
Informal education	12 hours		8 hours 16 hours
Tourist presence	2500 tourists		1000 5000 7500
Annual increase on household goods (in Emalangeni (E))	E0		E10 E20 E40 E80 E120

Kindly make your choice given the alternatives with different attributes of the reed dance (Umhlanga) presented in the choice cards below.

<u>On the following pages (6-17) you will see 12 choice cards</u>

In each card, we list the attributes related to the reed dance that could be changed and an annual cost to your household for the management required. For each choice card, we kindly ask you to choose the option you prefer given the amount indicated for the changes in the alternatives. You can only choose one option in each choice card, so please pick the one that you prefer. There are no right or wrong answers so please provide your personal answers and choices. The status quo option represents the current situation and there is no additional cost to your household. Every choice in the following choice cards must be treated independently. Results from similar studies have shown that respondents tend to overestimate how much they are willing to pay. We ask you to think carefully about the different alternatives in relation to your household's income. Please note that the additional payment will reduce your spending on other goods and services in your everyday life.

Choice Situation 1: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 
Informal education	12 hours	16 hours	8 hours
Tourist presence	2500 tourists	1000 tourists	5000 tourists
Annual increase on household goods (in Emalangeni (E))	E0 per year	E40 per year	E20 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 2: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	8 hours	16 hours
Tourist presence	2500 tourists	5000 tourists	7500 tourists
Annual increase on household goods (in Emalangeni (E))	E0 per year	E0 per year	E120 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 3: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	16 hours	8 hours
Tourist presence	2500 tourists	7500 tourists	5000 tourists
Annual increase on household goods (in Emalangeni (E))	E0 per year	E120 per year	E80 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 4: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	12 hours	16 hours
Tourist presence	2500 tourists	5000 tourists	2500 tourists
Annual increase on household goods (in Emalangeni (E))	E0 per year	E20 per year	E40 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 5: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	8 hours	12 hours
Tourist presence	2500 tourists	2500 tourists	1000 tourists
Annual increase on household goods (in Emalangeni (E))	E0 per year	E40 per year	E0 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 6: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	8 hours	12 hours
Tourist presence	2500 tourists	2500 tourists	7500 tourists
Annual increase on household goods (in Emalangeni (E))	E0 per year	E0 per year	E120 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 7: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 
Informal education	12 hours	12 hours	16 hours
Tourist presence	2500 tourists	1000 tourists	2500 tourists
Annual increase on household goods (in Emalangeni (E))	E0 per year	E10 per year	E20 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 8: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	8 hours	12 hours
Tourist presence	2500 tourists	7500 tourists	1000 tourists
Annual increase on household goods (in Emalangeni (E))	E0 per year	E20 per year	E10 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 9: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	12 hours	16 hours
Tourist presence	2500 tourists	5000 tourists	2500 tourists
Annual increase on household goods (in Emalangeni (E))	E0 per year	E80 per year	E80 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 10: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 
Informal education	12 hours	16 hours	8 hours
Tourist presence	2500 tourists	7500 tourists	5000 tourists
Annual increase on household goods (in Emalangeni (E))	E0 per year	E120 per year	E10 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 11: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 
Informal education	12 hours	12 hours	8 hours
Tourist presence	2500 tourists	1000 tourists	7500 tourists
Annual increase on household goods (in Emalangeni (E))	E0 per year	E10 per year	E40 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

Choice Situation 12: Which **ONE** of the following alternatives would you choose?

Attribute	Status Quo	Alternative 1	Alternative 2
Wetland conservation	**Continue with the conserved 3% of wetlands** and there is high probability that reeds supply **decreases** 	**Conserve 12% of wetlands** and there is high probability that reeds supply **increases** 	**Conserve 6% of wetlands** and there is high probability that reeds supply **increases** 
Informal education	12 hours	16 hours	12 hours
Tourist presence	2500 tourists	2500 tourists	1000 tourists
Annual increase on household goods (in Emalangeni (E))	E0 per year	E80 per year	E0 per year
Which alternative do you prefer? (tick only one)	☐	☐	☐

E: DEBRIEFING QUESTIONS

7. Instruction to interviewer: Ask the respondent the following question "If in the above choice situations in section D you always chose the status quo alternative (current situation), please indicate which, if any, of the statements listed below closely match your choice, *select the most important reason*". *Tick only one*. Otherwise go to Q8.

Umhlanga (reed dance) does not mean anything to me	[ ]
I already spend enough on household goods, the government should pay for the conservation of wetlands supplying reeds for the reed dance	[ ]
I do not think it is important to fund conservation of wetlands supplying reeds for the reed dance	[ ]
I would like to contribute to the conservation of wetlands supplying reeds for the reed dance contribution fund but I cannot afford	[ ]
I did not trust the collecting fund	[ ]
I think we should all pay taxes instead, in order to prevent other households from enjoying the benefits from conserving wetlands and preserving the reed dance without paying for them	[ ]
Other (specify)……	[ ]

8. When making your choice please indicate how often you paid attention to each attribute.

	Always	**Sometimes**	**Never**
Informal education	[ ]	[ ]	[ ]
Tourist presence	[ ]	[ ]	[ ]
Wetland conservation	[ ]	[ ]	[ ]
Additional annual cost to your household	[ ]	[ ]	[ ]

9. Why did you always consider the attribute(s) in Q8? Please tick all that apply.

Reasons	**Yes**	**No**
I did not understand the other attributes		
There was no information about the other attributes		

Where possible I always chose a lot of tourists		
Where possible I always chose 'conserve wetlands..'		
Where possible I always chose not to pay anything (E0)		
Where possible I always chose high conservation and more tourists at a reasonable cost		
Where possible I always chose high conservation and more informal education hours at a reasonable cost		
Other (specify) ……		

F: HOUSEHOLD FINANCIAL INFORMATION

10. What is your total monthly expenditure on household needs? E.....
11. What is the total household income per month? E…….
12. What is the maximum amount of money your household can contribute annually towards the production and maintenance or preservation of reed dance compared to the current price structure (with a maximum of E120) presented before the choice tasks? E…….

G: SUGGESTIONS FOR IMPROVEMENTS IN THE SUPPLY AND DISTRIBUTION OF CULTURAL GOODS

13. For my household, preservation of the reed dance secures... (tick all that apply)

Knowledge systems	[ ]	Heritage	[ ]	Inspiration	[ ]	Social relations	[ ]
Sense of belonging	[ ]	Identity	[ ]	Social cohesion	[ ]	Networking	[ ]

14. To what extent do you agree with the following statement with (1 – strongly agree to 5 – strongly disagree)?
"The results of this study will influence public and cultural policies in the Kingdom of Eswatini."

Strongly agree	[1]	Agree	[2]	Neutral	[3]
Disagree	[4]	Strongly disagree	[5]		

15. Have you attended the reed dance before? Yes [ ] No [ ] *(IF 'Yes' go Q16, otherwise go to Q17)*

16. How many times have you attended the reed dance? …… times

17. Do you intend to attend the reed dance in future? Yes [ ] No [ ] *(IF 'No' why?)*

……

……

18. For my household, conservation of wetlands is essential for production of cultural benefits... (*tick all that apply*)

Recreation (swimming, boating, fishing, etc) [ ] Ecotourism [ ] Aesthetic (beauty) [ ]

Tick 'Yes' or 'No' on the following statements regarding payment vehicles	**Yes (1)**	**No (0)**
19. Do you or anyone in your household pay income tax?		
20. Have you or anyone in your household ever made a donation or contribution?		
21. Have you or anyone in your household paid higher prices for groceries in order to support a project (community project, school project, orphanage project etc)?		

H: RESPONDENT INFORMATION

22. **Gender**	23. **Age**	24. **Role in the household**	25. **Education level**	26. **Occupation**
Male [0]		Head of household [1]	No formal education [1]	Technical/Professional/Managerial-civil service [1]
Female [1]	……...	Spouse of the head [2]	Adult education [2]	Technical/Professional/Managerial-private sector [2]
		Child of the head [3]	Primary [3]	Civil servant [3]
		Parent of the head [4]	High school [4]	Sales/administrator (private) [4]
	(If range, choose the middle)	Other (*specify*) [5]	Tertiary [5]	Transport [5]
		……		Skilled labour private employed [6]
		…		Skilled labour self employed [7]
				Casual labourer [8]
				Pensioner [9]
				Unemployed [10]
				Other [11]
				(*specify*)……...

27. Do you have a suggestion on improvements in the production and distribution of the reed dance?

.....

.....

I: SURVEYOR'S OBSERVATIONS AND DEBRIEFING

28. Was the respondent a Swati? Yes [ ] No [ ] *(IF 'No' state ethnicity ……..)*

29. In your own opinion, did the interviewee understand all the questions? Please rank the answers based on the level of understanding in the following table.

Level of understanding	**Rank**
Very well understood	
Well understood	
Understood	
Not understood	
Not well understood	
Not at all understood	

30. Were there any questions that the interviewee found hard to answer because the options given to choose from did not cover his/her opinion or how he/she felt? If so,. please describe them. Yes [ ] No [ ] *(IF 'Yes' please describe them)*

…….....

31. How would you rate the reliability of the responses given by this interviewee? Please rank the reliability in the following table.

Level of understanding	**Rank**
Very reliable	
Quite reliable	
Reliable	
Not quite reliable	
Not reliable	
Not at all reliable	

32. Provide reasons for your response to reliability data question above.

……...……

……...……

Thank you for participating in the survey!