Language and Nature in South Arabia:

Ethnographic description of traditional practices of Dhofar and al-Mahra

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I confirm that the work submitted is my own and that appropriate credit has been given where reference has been made to the work of others.

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ABSTRACT

This thesis examines the biocultural (linguistic, cultural, and biological) diversity of Dhofar, Oman and al-Mahra, Yemen through the lens of resilience theory and adaptive management. This approach contrasts with conservationism which resists the disturbances and the changes that come with them. Instead, resilience is built into systems, such as biocultural diversity, by managing the adaptations these systems make in response to inevitable disturbances. The biocultural diversity in Dhofar is facing unprecedented disturbances through rapid socioeconomic change, increased wealth, and increased human and livestock populations. This research examines traditional institutions and evaluates their strength, describes the link between the language and ecosystem, and investigates disruptions and current adaptations in light of how these can be managed to encourage resilience and sustainability.

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Abbreviations

Transcription abbreviations:

- 1: first person
- 2: second person
- 3: third person
- :: : elongation
- ADJ: Adjective
- DESC: descriptor
- DIM: diminutive
- DO: direct object
- DU: dual
- F: feminine
- FUT: future
- GEN: genitive particle
- IMPERF: imperfect
- INTRANS.: intransitive
- M: masculine
- N: noun
- NEG: negation particle
- o's: one's
- PART: participle
- PERF: perfect
- PL: plural
- SG: singular
- so.: someone
- st.: something
- us.: usually

Abbreviations in the text:

- CPR: Common pool resource
- DEAMSA: Documentation and Ethnolinguistic Analysis of Modern South Arabian
- DOB: Date of birth
- ELAR: Endangered Languages Archive
- ICH: Intangible cultural heritage
- ICN: International Code of Nomenclature for algae, fungi, and plants
- IUCN: International Union for Conservation of Nature
- JSS: *Journal of Semitic Studies*
- LE: Linguistic ethnography
- MSAL: Modern South Arabian languages
- OED: Oxford English Dictionary

- POWO: Plants of the World Online
- RBGE: Royal Botanic Garden Edinburgh
- UNESCO: United Nations Educational, Scientific and Cultural Organization
- WWF: World Wide Fund for Nature

Data is presented in one of three languages other than English: Arabic, Mehri, or Śḥerēt. The default language, when not English, is Mehri. Language is marked as follows:

- (M) = Mehri
- (Ś) = Śḥerēt
- (A) = Arabic

Speakers

Speakers quoted in this research are listed below by their code and region their dialect originates from. Speaker codes follow the Documentation and Ethnolinguistic Analysis of Modern South Arabian languages project (DEAMSA - Eades & Morris, 2016; Morris, 2016a, 2016b; Watson & Morris, 2016a, 2016b) with the first letter representing the speaker's primary language: M for Mehri and J for Śḥerēt (also known as Jibbāli) and numbers assigned as they joined DEAMSA. The information given for speakers below includes the general location the speaker originates from. Mehri dialects tend to diversify along tribal lines rather than geography, but most of the speakers are old enough that they were born and learned language in their traditional tribal lands, so location is a good proxy for tribal affiliation and a little more anonymous. All these participants were part of the DEAMSA or Community Documentation of Biocultural Diversity in the Eastern Yemeni Province of al-Mahra, Yemen projects except M100 and J200. There are significantly more men than women, largely because men are much more willing to be recorded.

M100 female, 20s, southern Saudi Arabia

M026 male, 50, central dialect of Śḥerēt and central Dhofar dialect of Mehri

J001 male, 40, central dialect of Śḥerēt and central Dhofar dialect of Mehri

M001 male, 30s, central Dhofar dialect of Mehri

M003 male, 30s, central Dhofar dialect of Mehri

M004 male, 80s, central Dhofar dialect of Mehri

M010 female, 60s, central Dhofar dialect of Mehri

M018 male, 80s, central Dhofar dialect of Mehri

M019 male, 40, central Dhofar dialect of Mehri

M021 male, 30s, central Dhofar dialect of Mehri

M017 male, 60s, Dhofar mountains dialect of Mehri

M043 male, 60s, Dhofar mountains dialect of Mehri

M044, male, 60s, southeastern Dhofar dialect of Mehri

M066 male, 70s, east Yemen, Mahriyyōt

J020 male, mid 40s, speaker of eastern dialect of Śḥerēt

J116 male, late 20s, speaker of central dialect of Śḥerēt

J004 female, 50s, speaker of central dialect of Śḥerēt

J200 male, 50s, central Dhofar dialect of Śḥerēt

YMGh031 male, 40s, Yemeni dialect of Mehri

1 Introduction

This thesis is born of a love of diversity. In a global climate of mass extinction in both biodiversity and languages, this thesis seeks to encourage greater resilience within an area of diversity in Southern Arabia. By learning and sharing part of the place-based epistemology, I hope to increase its prestige and value both on a local scale and on a global scale.

This research situates the place-based language and culture of Dhofar (Oman) and al-Mahra (Yemen) in our wider understanding of humanity's interaction with the world. This is done through an examination of natural resource governance institutions; describing the links between the language and culture to the ecosystem; and analysing the disruptions to the various diversities of the region and working to mitigate them.

1.1 Motivation

Dhofar and al-Mahra are situated on the southern shores of the Arabian Peninsula and are characterised by a region of cloud forest with many endemic plant and animal species (Ghazanfar, 1998; Watson, Boom, et al., in press), and four indigenous languages (Simeone-Senelle, 2011). These languages, Mehri, Śḥerɛ̄t (also known as Jibbāli), Hobyōt, and Baṭḥari, comprise, with Soḳoṭri and Ḥarsūsi, the Modern South Arabian languages (MSAL) (see Figure 1). All six languages are classified as endangered to varying degrees, meaning that children of MSAL speakers are not using their parents' language because they are separated from the domains the language developed in (Watson & Al-Mahri, 2023). Other families are currently or have already switched to Arabic usage. None of the MSAL were written until the 21st century, so their history is entirely oral. If the languages fall out of use, the history and place-based knowledge of the region will also disappear.

At the same time, the ecosystems have come under significant pressure over the past 50 years. As the region modernised, human and livestock populations have grown significantly (Ball et al., 2020). Lifestyles have shifted from nomadic or semi-nomadic to largely sedentary in a matter of two or three decades; automobiles, healthcare, formal education, and water infrastructure were all rapidly introduced (Risse, 2019). Already in the 1980s there was a

notable decline in the plants that had traditionally sustained the population of the region, and wildlife species such as the wolves and the Arabian leopard (Miller & Morris, 1988; Watson, Boom, et al., in press).

These declines in language use, traditional lifestyles, and ecological health are not disconnected phenomena; the disruptions to one often also affect the other and as one declines, it affects the others. For example, urbanisation is a disruption to linguistic diversity: as more people speaking different languages interact, there is a need for a mutually comprehensible language; at the same time, urbanisation removes people from their traditional land, thereby disrupting cultural practices; and urbanisation disrupts ecosystems with increased number of buildings and greater infrastructure (Pretty et al., 2009). And as language use declines and local vocabulary falls out of use, strategies for sustainable use of ecosystems also disappear, and as the ecosystem declines, the language and activities once associated with it also disappear.

The tandem decline of ecological health and linguistic-cultural diversity in Southern Arabia is a pattern that has been noted around the world: since 1970, 30% of plant and animal species have gone extinct and population sizes have shrunk by 60% globally (WWF, 2018); at the same time, some linguists predict that 50% of languages will fall out of use by the end of the 21st century (Krauss, 1992). Research has found that similar factors are affecting both global linguistic diversity and biological diversity (Amano et al., 2014; Dunn, 2017; Gorenflo et al., 2012; Pretty et al., 2009; Sutherland, 2003). In addition, areas of high biological diversity also tend to have high linguistic diversity (Loh & Harmon, 2005, 2014; Mace & Pagel, 1995; Moore et al., 2002; Nettle, 1998). This common pattern, where high linguistic diversity tends to exist in regions of high biodiversity, along with the shared factors affecting linguistic, cultural, and biological diversities has led to the concept of biocultural diversity, short for "biological, cultural, *and linguistic* diversity" (Maffi, 2007, p. 269; emphasis original).

Researchers of biocultural diversity have called for "detailed case studies of the links between the environment and language, cultural beliefs, knowledge, and practices at regional and local levels." (Maffi, 2007, p. 270). Dhofar fits within the global pattern of

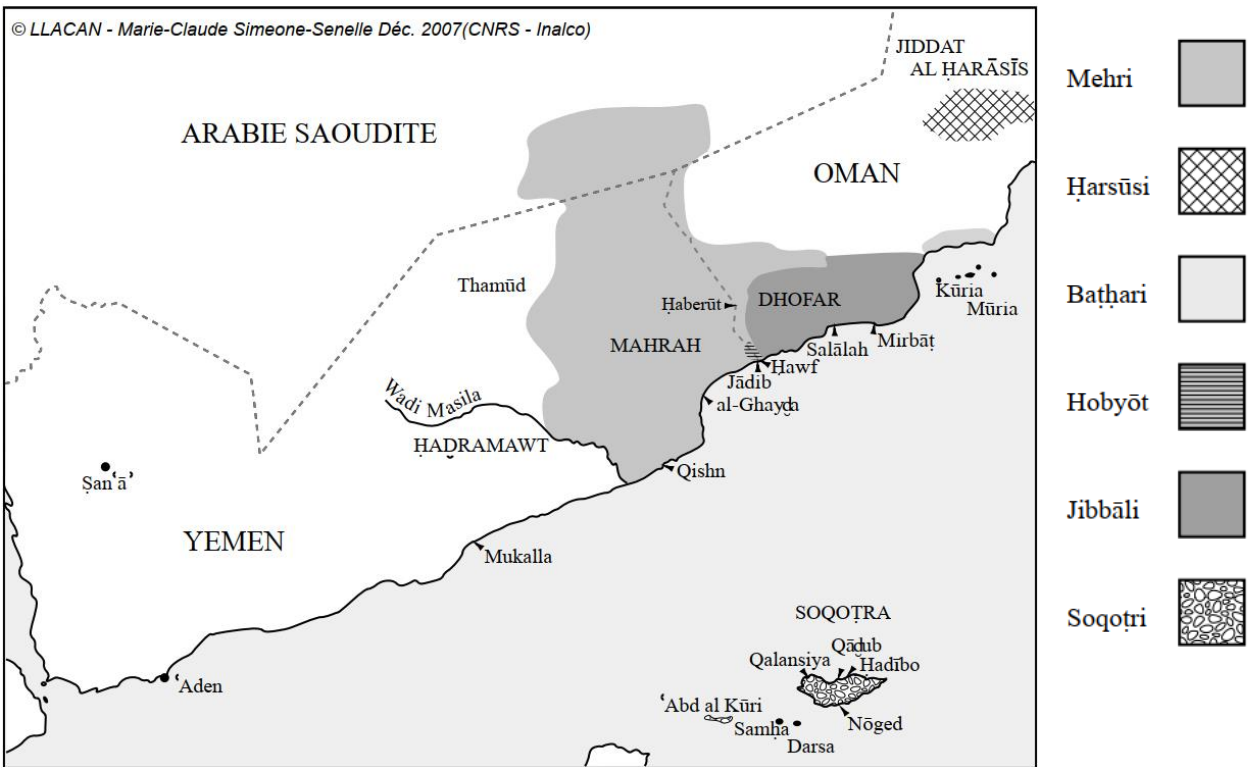

Figure 1 Map of Modern South Arabian languages (Simeone-Senelle, 2011, p. 1078)

overlapping diversities with several endemic species and languages and so is a logical location for biocultural research. However, it is also somewhat unique in that the languages and traditional lifestyles have not yet been entirely lost – when they were younger, the elders of the language community functioned entirely within the traditional governance structures and subsistence livestock herding practices of the past. As compared with many moribund or sleeping languages and cultures in North America with less than 10 fluent speakers (Krauss, 1992), the estimated 100,000 native Mehri speakers , even if they are aging and using the language less than their forebears, provide a key opportunity to record and revitalise the language and culture before they disappear.

1.2 Background

This section describes the social and historical background of Dhofar and al-Mahra in general and the Mahra tribe more specifically outlining the Mahra social structure and historical events that have shaped the current situation in Dhofar. Following this, I discuss the current situation in Dhofar in relation to the biocultural diversity of the region. Lastly

there is a description of Mehri and Śḥerēt and some of the features that distinguish them from one another.

1.2.1 Social Context

Social structure in Dhofar was very stable leading up to the Dhofar War (1965-1975). This section describes the nomadic characteristic of the lifestyles in the region, gender norms, tribal structures, and traditional land use and boundaries.

1.2.1.1 Nomadism

Prior to 1970 in Oman[1], the Mahra tribe were nomadic livestock herders in the regions north of the Dhofar Mountains. They inhabited caves when they were available, otherwise life was lived outdoors, sometimes sheltering under trees or sunshades. Typically, families would move together in groups of 3-5 nuclear family units, combining their herds of camels and herds of goats for pasture and night shelter (Janzen, 1986). In Mehri this relationship is referred to as *xəlayṭ* 'person you mix your animals with.' These traveling groups were often, but not always, blood relatives and also often, but not always, of the same tribal affiliation (Janzen, 1986). These groups were not static and would change from time to time (Janzen, 1986). Camp sites were changed every few weeks, moving around ten kilometres per move and grazing livestock within a kilometre or two of the campsite (Janzen, 1986).

Water was always a concern. When rain was spotted, people would track its location and move to it as fast as possible for the fresh pasture that would spring up following the rain. Without the sighting of rain, family groups usually moved on a north-south axis along wadi bottoms where the most vegetation can be found and thereby avoiding the regions of sharp gravel between wadis (Janzen, 1986). There are several other sources of water found in the regions the Mahra inhabited traditionally, though all of them depend on the shifting rainfall patterns. 5.2.2.2 will give examples of vocabulary for the various types of rainfall in Mehri

[1] The history of the Mahra tribe in Yemen is a bit different. I do not address it here because most of the consultants in this research are from Dhofar.

and 5.3.3 will describe several water sources and explain some of the vocabulary related to them.

1.2.1.2 Gender

Gendered divisions were, and still are, common. Mahra women oversaw cooking, caring for children, caring for goats (including milking)[2], and making household items such as mats, baskets, milk bowls, etc. (see 4.1.3.1 for further discussion of women in Dhofari society). Men were responsible for caring for the camel herds (including milking) and any heavy manual labour such as loading goods onto camels. At the same time, there were tasks that were generally not done by Mahra tribe members such as agriculture (Janzen, 1986). One consultant for this research had an uncle who had been offered arable land on the coastal plain but turned it down in disdain because 'farming is slaves' work.' That land is exceptionally valuable today. Other work relegated to lower social levels included mucking out animal enclosures, catching and cleaning fish, and fetching water (Janzen, 1986). On the other hand, not all Mahra families or traveling groups owned slaves in which case this work was done by members of the household. Slavery was officially abolished in Dhofar in 1968 by the Front (the organisation of the insurgents in the Dhofar War see 1.2.2 below) and in 1970 by Sultan Qaboos (Wilson, 2023).

1.2.1.3 Tribal structure

Social strata defined traditional Dhofari society until the 1970s, and even today it has not been completely changed or erased (Wilson, 2023). Historically, there were three powerful tribes: the Mahra, the Qara, and the Bayt Kathir. These tribes were the main political forces (Tabook, 1997) in the region and their members were the only people allowed to bear arms (Janzen, 1986). The Mahra controlled much of the *nagd* 'central desert region' as well as some of the *gbēl* 'mountains' on the east and west of the Dhofar range (Tabook, 1997). The Qara mainly controlled the mountains and speak Śḥerēt; many also speak Mehri (Tabook, 1997). Bayt Kathir traditionally controlled the Salalah plain and regions north of the Dhofar Mountains. They have a unique dialect of Arabic. These three tribal groups did not regularly

[2] As opposed to the Śḥeri women, who do not milk goats.

intermarry. Even today, marrying across tribal boundaries is somewhat uncommon; my Mahra contact in Saudi Arabia is expected to marry at least within the Mahra tribe, if not within her smaller sub-tribe group. However, another consultant from the Mahra tribe married a Beit Kathir woman in the last ten years, so cross-tribal marriages are not unheard of. The tribal land arrangements meant that while cross-linguistic trade was a regular occurrence, most of life was experienced within one's own tribal group (and therefore linguistic group). Today, these linguistic boundaries are still quite apparent. Children acquire their parents' dialect of Mehri rather than a broader, more urban dialect of Mehri as would be expected as families settle into urban environments.

The other tribes and people of the region all fell into a hierarchy below these three tribes and were historically known as *daʕif* 'weak' (A) (Peterson, 2004). Today it is strongly frowned upon to use such a pejorative term, and in my fieldwork I have not heard this term used. However, the distinction is still reportedly a lived reality for members of these groups (Wilson, 2023).

The Śḥeri people, the original speakers of Śḥerēt (a MSAL; see 1.2.4 below), were (and still are) not organised by tribe but by geographic location. They are often reported to be the original inhabitants of the region (Tabook, 1997). At some point prior to the seventeenth century, they were protected/dominated by the Qara tribe who adopted the Śḥerēt language (Peterson, 2004; Tabook, 1997). Other Dhofari tribes include the Baṭaḥira and Ḥarsasiis tribes which traditionally inhabited the eastern regions of Dhofar into the Rub al-Khali (the Empty Quarter). Their languages are reportedly related to Mehri, and some traditions claim that the Mahra dispossessed them of their land in antiquity (Peterson, 2004). Both tribes are considerably smaller than the Mahra. Baṭḥari, the language of the Baṭaḥira, is classified as moribund with less than 20 speakers (Fabio Gasparini, p.c. 2018) and Ḥarsusi, the language of the Ḥarsasiis tribe, has only a few thousand speakers and is classified as endangered (Hammal al Balushi, p.c. 2023).

At the very bottom of the Dhofari social ladder were the African slaves and the Bahhara, "an indeterminate group distinct in race from the Africans" (Peterson, 2004, p. 266). These two groups made up a disproportionate number of the hard-core Marxist leadership of the

insurrectionists in the Dhofar War (Peterson, 2004). This is understandable since they had the most to gain from throwing off the oppressive leadership of the Omani sultans and restructuring of the social order.

1.2.1.4 Land use

Dhofar has three distinct geographical regions: the *nagd* (M) region of arid plateau that slopes into the sand desert, the mountains called *gbēl* (M), and the coastal plain called *gərbīb* (M) (for further discussion on landscape terminology, see 5.3.1). Each region had a unique economy which was symbiotically connected with the other two. People on the *nagd* produced salt, palm fronds, and frankincense; people in the *gbēl* produced butter, leather, latex (used for sealing cracked pottery and removing unwanted body hair), cereals, wood, and some frankincense (though of inferior quality to that from the *nagd*); and people on the *gərbīb* produced fish for human and livestock consumption and had access to shipping lanes and imported goods (Tabook, 1997, p. 3). The trade interactions between the groups of each of these areas supported the population for generations and the products from each region improved life in the others. Despite this interconnectedness, each location and tribal group maintained their unique identity and linguistic heritage, possibly because of the importance of tribal heritage to one's identity.

The Mahra largely lived in the *nagd* and the far east and far west of the Dhofar Mountain range. In the *nagd*, tribes had control of different regions, usually on a north-south axis. Tribal lands were defended through force, though, according to Tabook (1997), violence ending in killing was rare. Strict boundaries were not generally practiced; the important thing was the water sources within the tribal lands (M003). In addition, there were areas with frankincense trees and some oases with date palms that were also controlled by tribe (Janzen, 1986).

Historically, land in Dhofar was only as valuable as the water sources and grazing it provided, particularly in the mountains, plateaus, and deserts to the north. Among the Mahra, land boundaries were not as important as among the more sedentary inhabitants of the south-facing mountains and coastal plains. In settlements such as Salalah and Taqah, land was deeded, bought, and sold. The nomadic Mahra tribes to the north did not practice

this amongst themselves or in contact with the other tribes in the region (Yahya al Mahri, p.c. 2021). Among the Mahra, land was controlled by strength. If your tribe was large and able to take control of a water source, then that was done. If your tribe shrank again for whatever reason, and you were unable to maintain control over that water source, another tribe would take over. However, there were always agreements and truces between tribes allowing access and use of pastureland and water sources. These were negotiated for a variety of reasons including mutual benefit and as peace agreements, water resources were expected to be shared except in times of extreme need or shortage (for further discussion of this see 4.2.2). To prevent someone or their livestock from accessing water you had control over was very shameful (Yahya al Mahri, p.c. 2021).

The social structure of the Mahra tribes has adapted to modern life with tribal affiliation still having an impact on governance and social interaction. However, the lifestyle has been dramatically altered in the past fifty years. These changes are discussed below in 1.2.3.

1.2.2 Historical Context

Historically, the region including modern-day Dhofar, Oman and al-Mahra, Yemen was fairly isolated with the Rub al-Khali (the Empty Quarter) to the east and north and the Hadramout region of modern-day Yemen to the west. The region was also unified across today's international border between Yemen and Oman. That boundary was not enforced until oil exploration began in the 20th century. This isolation from both neighbouring cultures and the wider world means that written information about the region is "more or less non-existent" (Tabook, 1997, p. xxiv). The following historical background is drawn from some of the few written sources that are available.

Dhofar and al-Mahra's history is intrinsically linked with the empire of modern-day northern Oman. The following section begins with the Dhofari and al-Mahra context and then describes the rise of the Omani empire and its impact on Dhofar and al-Mahra. Following the division of Dhofar and al-Mahra into their current arrangement, sources on the al-Mahra side are even scarcer than those about Dhofar.

Historically, Dhofar's wealth was built around the frankincense trade of antiquity. The peak of its power, influence, and wealth was between 400 BCE and 500 CE when many religions around the Mediterranean, Arabian Gulf and Persian influenced-areas used frankincense in their worship rituals (Seland, 2014). It is reported that in Roman marketplaces, frankincense was sold at par with gold by weight (Miller & Morris, 1988). The trade tapered off into the second millennium CE as trade routes shifted and demand varied. However, it was not until the 1960s when the Dhofar War broke out that the trade stopped entirely (Janzen, 1983; Peterson, 2004).

As the frankincense trade slowed in the early centuries CE, the Omani empire in the north was gaining power through naval prowess and the African slave trade. The Omani empire, historically ruled alternately from Muscat and Nizwa in modern-day Oman, grew in strength and influence, eventually spreading from the Gwadar coast in Pakistan and occasionally including Kuwait and Bahrain in the north and controlled seas south to Zanzibar and Mombassa (Halliday, 1979). Oman's naval power declined sharply when Europeans first began traversing the Cape of Good Hope in the 1600s (Halliday, 1979). For a brief period, the Portuguese controlled Muscat, and significant portions of the Arabian Gulf. The Dhofari population, however, successfully repelled their conquest (Halliday, 1979). In 1650, the British followed and opposed the Portuguese. With British support, the Omani Sultans of the Al Bu Said dynasty successfully reconquered Muscat and expelled the Portuguese (Halliday, 1979). This began an enduring history of the British sustaining the ruling family of Muscat which has continued even into the twenty-first century.

The Omani empire declined rapidly in the 19th century. The suppression and end of the African slave trade in the 1850s and the opening of the Suez Canal in 1869 were two major blows to Omani influence in the area. Halliday wrote: "In a twenty-year period, between the 1850s and 1870s, the population of Muscat fell from 55,000 to 8,000." (Halliday, 1979, p. 281) In addition, the amount of trade through the Muscat harbour fell by 75% from the 1830s to 1874-5 and the population largely reverted to a near-subsistence economy (Halliday, 1979). This economic state continued until oil was discovered in the 1960s.

For Dhofar, this economic downturn of the Muscat-governed regions in the mid-19th century coincided with Muscat's decision to take control of Dhofar. This was met with varying degrees of resistance from varying numbers of tribal leaders in Dhofar through the 19th and 20th centuries up to and including the Dhofar War beginning in the 1960s (Halliday, 1979).

In the 1930s and 1940s, the question of which government – Aden (present-day Yemen) or Muscat (present-day Oman) – controlled the regions of al-Mahra and Dhofar arose as the British wished to prospect for oil in the region. The lengthy process of determining where the borders should lie was documented through East India Trading Company correspondence (East India Company, 26 March 1930-27 July 1947). Ultimately, the borders were drawn where they lie today, with Aden controlling al-Mahra and Muscat controlling Dhofar.

Sultan Said bin Taimur ascended the Omani throne in Muscat in 1932 (Halliday, 1979) and was involved in the border negotiations with Aden. By this time, Dhofar was already a ‘dependency’ of the Omani empire, meaning Dhofar was under Muscat’s control. It was taxed separately and received different development funding from the rest of the country, which caused consistent resistance from the Dhofari population, though not unified or concerted resistance (Halliday, 1979).

Sultan Said bin Taimur married two Dhofari women from the Ma'shani tribe and spent the last twelve years of his reign in Salalah (Peterson, 2004). He was later described by Halliday as "one of the nastiest rulers the world has seen for a long time… Said’s regime prevented Omanis from leaving the country; discouraged education and health services, and kept from the population a whole series of objects, including medicines, radios, spectacles, trousers, cigarettes and books." (Halliday, 1979, p. 287) Peterson reported that this repression led many Dhofari men to seek work outside of the Sultanate in other Gulf states and more widely into Europe (Peterson, 2004). This migration was one of the causes for the unrest in the Dhofar region - the rest of the world was enjoying the benefits of modern travel, healthcare and globalised trade while Dhofaris starved due to lack of these (Peterson, 2004). Halliday also wrote of the horrors such as torture chambers, enslaved women, and arsenals

of weapons found within the royal palace after the 1970 coup and of the British government and army's complicity in these events (Halliday, 1979). Without British support, the Al Bu Said dynasty would not have survived past the eighteenth century (Halliday, 1979; Wilson, 2023).

Conflict erupted in 1965 when revolutionaries attacked a government convoy, though violence attributed to this revolution dates back as far back as 1963 (Peterson, 2004). The main goal of the insurrection was the removal of colonial control of the region and an increase in access to modernisation (Halliday, 1979, p. 366). The revolutionaries organised into the Popular Front for the Liberation of Occupied Arabian Gulf, hereafter ‘the Front’. This organisation had a few iterations, and its name shifted every few years. ‘The Front’ is a simple way of referring to the revolutionaries without lengthy discussions of their policies and changing leadership reflected in the changing name.

The Front controlled all of Dhofar except Salalah by 1970 (Halliday, 1979). At this time, the British decided that Sultan Said bin Taimur could not bring stability to the region and so they, with Said's son, deposed him and Sultan Qaboos bin Said ascended the Omani throne (Halliday, 1979). Sultan Qaboos' mother was from the Dhofari Ma’shani tribe, giving him slightly more legitimacy in Dhofar than any other Omani governor up to this point. The Front continued to resist Qaboos for another five years following the coup. Qaboos responded with significant military campaigns supported by the British, Iranian and Jordanian governments (Halliday, 1979). These campaigns included land mines, significant bombing of livestock and residences, and food blockades, all of which were devastating for an already impoverished population (Wilson, 2023). However, following the 1970 coup, once the Omani military gained control of a region they immediately began building wells, health clinics, schools, and mosques (Janzen, 1986).

For the Mahra, the war had significant impact on their ability to trade for food. As the insurrection grew, unlike previous uprisings, it drew support from many strata of society including the Mahra, though they are not viewed as the primary instigators of the conflict (Peterson, 2004). By the 1970s, the main fighting was along the Salalah-Thamrit road and the western Oman-Yemen border. Both of these regions have been tribal lands of the

Mahra and Bait Kathir (Janzen, 1986). Following 1968, the Front swung far left, embracing the Marxist movement and receiving support from the recently independent People's Democratic Republic of Yemen (PDRY). The most radically Marxist leadership of the Front reportedly came from the Bahhara people who, until the war, were at the bottom of the social ladder (Peterson, 2004) (see 1.2.1). While the Front was widely supported and Dhofaris were uniting across tribal boundaries for the first time in history, their policies were not universally accepted. For example, the Front pushed egalitarianism quite strongly but some Dhofari families insisted "'in my family we did not let women become fighters'" (Wilson, 2023, p. 89). However, the effects of the war and the changes brought at its completion were universally felt (Peterson, 2004).

Both sides of the conflict consider themselves victors – both the revolutionaries (p.c. with several consultants 2018 and 2021) and the government (Wilson, 2023). The Dhofaris won the modernisation and access to resources and outside trade that they desired, and the government ended the rebellion and integrated the entire region of Dhofar into the larger Omani state. Dhofar has maintained some self-governance as well, preserving aspects of its autonomy and achieving a partial victory over colonial influences. Dhofari consultants tell of fighters realising in the 1970s that communism would prevent them from practicing Islam, resulting in increased defections to the Sultan's army which they attribute to hastening the war's conclusion. At the same time, however, historians note the desperate hunger and poverty that many Dhofaris faced (Halliday, 1979; Wilson, 2023). The region was already impoverished prior to the war due to heavy taxation, barely sufficient resources, and restricted access to trade with the outside world; when the Omani army instated food blockades and bombing campaigns, the situation went from bad to starvation very quickly (Halliday, 1979). Wilson (2023) argued that defection was a legitimate survival strategy for many Dhofaris. However, the insurrection aimed to remove colonial control, improve development, modernise systems and increase contact with the outside world, and most of these goals were achieved. Full anti-colonial independence was not fully realised but was also not a complete failure - the Omani state has allowed certain tribal governance systems to remain, for example, blood money debts are set locally while the rest of Oman follows Muscat's governance in this area.

The Omani government was heavily invested in stabilizing the region. Following the end of the Dhofar War, transport infrastructure, mosques, schools, and water wells were quickly built (Janzen, 1983). Food was delivered across the region along with building supplies (Janzen, 1983). During the war, 40% of the total Omani budget was spent on Dhofar (Wilson, 2023). Following the war, the proportion of the budget spent on Dhofar did not diminish even though only 10-25% of the country's population lived in Dhofar (Peterson, 2004). However, Wilson (2023) pointed out that if the British, Iranians, and Jordanians had not supported Qaboos militarily, he would not have been able to afford the projects he instigated, both military and development. Nonetheless, the Dhofari people's needs were taken seriously.

This modernisation had significant impact on the livelihoods of Dhofaris, especially those who were traditionally nomadic (Janzen, 1986). Mahra clans who lived outside of the mountains were fully nomadic, even into the 1980s. These families felt the economic changes very suddenly. The motivation for a nomadic lifestyle had been to find water and food for humans and livestock; once those could be found in one location, the movement was unnecessary. Today, camel herds still roam as they once did, but they are now tracked by GPS and hired herdsmen care for them. Families live in settlements where health care is available and children attend school.

In part, this rapid modernisation was possible because of the oil revenues that began impacting Oman in the 1960s-1970s. According to Halliday (1979), the Omani budget was under £2 million per year until 1967 when oil revenue began. Revenues in 1967 were £8 million/year and by 1970 went up to £44 million/year. However, this money was put into Swiss bank accounts by Sultan Said bin Taimur. One of the deciding events for the British to support a coup was a bombing attack nearby one of the oil fields in the north of Oman in June 1970. This attack is attributed to allies of the insurrectionists in Dhofar. Less than one month after the attack, Qaboos ascended the Omani throne. By 1971 over half of the oil revenue was expended on counter-revolutionary fighting in Dhofar. The energy crisis of 1974 helped to further boost revenues (Wilson, 2023) and modernisation projects were proposed and executed at lightning speed across Dhofar (Janzen, 1986).

Dhofar has a long history of resisting colonisation, including repelling the Portuguese incursion in the 1600s and the Omani conquest in the 1800s (Halliday, 1979). What sets the Dhofar War apart from earlier struggles is the unity Dhofaris presented against the Omani state - the Front sought, imperfectly, to supersede tribal affiliations in part because of the ways tribal politics had been manipulated throughout history in conquest attempts in the region (Wilson, 2023). Qaboos' heritage on his mother's side helped bridge this gap (Peterson, 2004), but a lingering distrust of the British and a greater willingness to bring up grievances with the Omani state than Omanis of the north have been sustained in Dhofar even to today. There is a sense that, since the modernisation goals of the rebellion were met, the state government continues to be tolerated.

1.2.3 Current disruptions

Given the historical and social background of Dhofar and the Mahra people, this section discusses the disruptions to the traditions of the region. These are framed in terms of language, culture, and ecosystem - each disruption affects each of these elements.

Some authors, for example, Pretty et al. (2009), described socioeconomic changes and modernisation as 'threats' to biocultural diversity (linguistic, cultural and biological diversity). This research does not frame these changes as 'threats' because the changes have greatly improved the standard of living for both humans and livestock in the region, so treating them as threats to be removed or worked against is more complex than Pretty et al. (2009) convey. Instead, following Titon (2016) and Allen et al. (2014), these changes are discussed as disruptions which trigger adaptation with in the languages, cultures, and ecosystems. Those adaptations can then be intentionally managed to encourage resilience within the affected systems. The best people to do this management are people within the systems who are concerned about the changes (see 6.3).

Loosely following Pretty et al. (2009), the disruptions to Dhofari biocultural diversity are grouped below as follows:

1. formalised land rights and nation building
2. urbanisation and transport expansion
3. food systems and healthcare

4. formal education
5. ecological disturbances

1.2.3.1 Formalised land rights and nation building

The disruptions to biocultural diversity due to formalised land rights and nation building include cultural and linguistic shift and assimilation as well as ecological decline (Pretty et al., 2009). Formalised land rights and state building are intrinsically linked in Dhofari history; as the Omani state claimed and enforced unity between Dhofar and Oman over the past 150 years, formalised land rights were actively enforced, especially following the Dhofar War (Janzen, 1983; Janzen, 2000). In 1974 the Sultan nationalised all tribal land, effectively ending the traditional land arrangement north of the mountains, where tribes controlled water sources by force (Janzen, 2000). Strict rules from the national government on armed conflict meant exclusion of neighbours from traditional tribal lands became very nearly impossible (Peterson, 2004). However, it is reported both in the literature (Janzen, 2000) and among Dhofaris today that the old tribal boundaries are still well-remembered and even inform the current administrative regions.

As tribal boundaries became unenforceable, people had freer access to areas they once were excluded from, meaning that greater cultural mixing did occur. While Dhofar has maintained a unique cultural identity, distinct from their neighbours in northern Oman, there has been some cultural shift and assimilation within the region as well. This can perhaps be most clearly seen in the process of some Modern South Arabian languages (MSAL) with lower-perceived prestige being abandoned for higher-prestige MSAL (Watson & Al-Mahri, 2023).

In addition to land governance and cultural assimilation, state building has also impacted traditional cultural practices in Dhofar. As the government won control of land in the 1970s, the land was rapidly developed to the benefit of the people (Halliday, 1979); first by building wells and other infrastructure then, later, by introducing schools, healthcare, and other government services (Chatty, 1987, 2022; Halliday, 1979; Risse, 2019). Having these resources available in one location removed much of the need for the nomadic lifestyle traditionally adopted by the Mahra (Janzen, 1983). This shift meant that the needs that the land historically met - grazing for livestock and sustaining human life - were satisfied

through other means such as water infrastructure, imported foods, and health care. This, in turn, has removed the people from regular interaction with the local ecosystem on which their language and culture are based.

Ecologically, this shift has had significant negative impact through loss of traditional management practices, such as exclusion from access to pasture land and water sources. In the past, tribes were able to control who had access to the pasture land and thereby preventing over-grazing. In addition, the increased water infrastructure impacted the water table and ground water availability very quickly (Janzen, 1983) putting further stress on already over-grazed pastures.

The nation building of the past 150 years and the formalisation of land rights have meant that the vast majority of the Dhofari population now live sedentary lifestyles. Traditional land boundaries are unenforceable and greater linguistic and cultural interaction have resulted from these changes. Ecological decline is also evidenced as traditional management of access to local resources has been removed making over-grazing a greater possibility than in the past.

1.2.3.2 Urbanisation and road network expansion

In Dhofar, urbanisation and transport network expansion have been closely linked with state building, as the state gained control in the region urban centres and road networks were rapidly developed. Pretty et al. (2009) predicted that urbanisation would lead to habitat destruction, which is already evident in Dhofar. Growing cities have led to a significant loss in forest cover, for example (Galletti et al., 2016). As Pretty et al. (2009) also predicted, urbanisation is responsible for a disconnect from the local ecosystem: as families transition from nomadic or semi-nomadic lifestyles into towns and cities, children have become increasingly detached from the local ecosystem.

Transportation networks also impact the local ecosystem through habitat destruction and increased pollution (Pretty et al., 2009). However, vehicular pollution is not a significant source of air pollution in Dhofar today (Albusaidi, 2019). This could change soon, though,

and I believe considering the impact of increased automotive traffic should be included in any sustainability planning.

The impact on cultural and linguistic diversity from transport network expansion and urbanisation, similar to state building, tends to be assimilation or hybridisation into the more dominant culture or language (Pretty et al., 2009). However, there is also evidence of cultural resilience. Nomadic cultural norms are still very much present in the towns and cities where formerly nomadic families now live. For example, the assumption that there will be men traveling through at any given time, that there is a need for appropriate space to host them, and that this will happen frequently means that houses are built specifically with spaces that allow families to accommodate these travellers within cultural modesty standards.

1.2.3.3 Food systems and healthcare

Food systems and healthcare are other areas of society that have changed dramatically over the past 50 years in Dhofar. Historically, local food sources were barely sufficient to support the population (Miller & Morris, 1988). Vegetation depended on irregular rains and was the basis for all aspects of life - food, building shelters, livestock care and husbandry, medicines, hygiene, etc. When the rains were not sufficient, hunger was inevitable. There is extensive vocabulary in Mehri to do with rains and thirst (see 5.2.2.2). Modernisation of these food systems, mostly through importing foods that cannot grow in Dhofar and a small amount of increased farming in the region, has greatly improved food stability and quality of life. Additionally, wells and (more recently) desalination plants have met the water needs of the region, lessening the dependence on the monsoon rains.

In a similar way, healthcare was dependent on locally available resources. There are many plants that have medicinal uses in the region, but again, when the vegetation was insufficient, health outcomes suffered. The modernisation of healthcare in Oman has made tremendous improvements to quality and length of life. For example, infant mortality rates fell by 99.24% from 1972 to 2008 (Alshishtawy, 2010; Oman, 2021).

However, modernised healthcare and food systems have a detrimental impact on biocultural diversity (Pretty et al., 2009). As new resources become available, reliance on the local ecosystem decreases. This can reduce pressure on the species can also induce the loss of the traditional knowledge and the devaluing of the local ecosystem (Pretty et al., 2009). There is evidence that language loss and the resulting local knowledge loss is a bigger threat than ecological damage and species loss to medicinal plant use in the Amazon, Papua New Guinea, and North America because the medicinal knowledge is so localised (Cámara-Leret & Bascompte, 2021).

When a language goes dormant and the local knowledge is no longer passed on to new generations, the language can be revitalised, but the knowledge is much more difficult to reconstruct. When this knowledge loss is paired with ecological decline, the loss is even more profound. Today, we have very little documentation about the flora of Dhofar. The plants are known, but they are known by speakers of the local languages who learned about them from their parents as the knowledge was needed. Today, that transmission has been profoundly upset by the modernisation of healthcare and globalisation of food systems, because the need for the knowledge is no longer linked to survival. It is entirely possible to live in Dhofar and never need to rely on local resources for food or medicine, therefore the knowledge is not being passed on and is liable to be lost within the next generation or two (see 6.2).

1.2.3.4 Formal education

Formalised education is a disruption to traditional knowledges and languages (Pretty et al., 2009). However, simply eradicating education will not revitalise languages, cultures, or ecosystems. The languages and cultures of Dhofar are adapting to the disruption of formal education but these adaptations are diminishing the use of the language and cultural knowledge. Formal education can be adapted to support the revitalisation of languages, cultures, and ecosystems but this management will require intentional intervention.

Formal education was introduced in Dhofar in the 1970s and 80s and was made compulsory in May 2023 (Oman, 2023). It is conducted in Arabic, with the aim of preparing students to function in Omani society as adults. This is leading to significantly decreased linguistic

proficiency in the MSAL and a disconnect in communication between the younger generations and their parents and grandparents. Pretty et al. (2009) explained that this disconnect leads to changes in the mechanisms of knowledge transmission which, if not balanced, will result in the loss of that knowledge. When the traditional knowledge disappears, cultural identity is diminished, local resources are devalued, and traditional stories and worldviews are lost (Pretty et al., 2009). This can be clearly seen among the Mahra today. Younger generations who have grown up removed from the local ecosystem have significantly lower ecological knowledge and lower linguistic proficiency in their mother tongues. One consultant, M010, said to me and Professor Watson while we were on fieldwork, “The only reason my children know about the plants is because you [Professor Watson] have taught them!” M010 is one of the most knowledgeable and consistent collaborators in the DEAMSA project and the fieldwork done for this research. Her children also help but consistently ask for information from M010. This quote also shows the impact of the research on the younger generation – according to M010 her children would not have learned about the plants if outside researchers had not been asking questions about them.

1.2.3.5 Ecological disturbances

The final disruption discussed here is the ecological shifts that have occurred due to the socioeconomic changes of the region. Janzen (1986) reported that in the past, the nomadic lifestyle of Dhofari inhabitants mitigated the problem of over-grazing by moving herds and households before the pasture was completely depleted. And in Janzen (2000) he wrote that population sizes had been limited by resource availability and lack of medical and veterinary services, which again mitigated the problem of over-grazing.

As wealth and stability grew for the human population, much of that wealth was translated into livestock. “Over the 30-year period from 1982 to 2012, the cattle, camel, and goat populations in Dhofar increased by at least 257%, 170% and 96% respectively (Spalton 2020)” (as quoted in Ball et al., 2020, p. 2). Peterson (2004) reported that the growing livestock herds have led to less and less opportunity for fodder plants to seed themselves following the *xarf* (monsoon) season so more and more fodder was imported. This imported fodder, in turn, has introduced invasive species such as *Parthenium hysterophorus* (Said Baquir, p.c. 2022) which is not eaten by anything in Dhofar, spreads rapidly, and causes

allergic reactions in humans. When on fieldwork in November 2021, the mountains should have been brown by the time I was there, but many of the areas were still quite green with this inedible weed that irritates human skin and airways. Ghazanfar (1998) also reported that unpalatable plants have spread in areas previously used for grazing because over-grazing depleted the fodder plants. This change further reduced the availability of local fodder, increasing reliance on imported feed.

Besides livestock feed, this ecological damage is also affecting the flora and fauna that were important for everyday life in other areas. For example, frankincense trees are overgrazed and are not reaching maturity; some of the trees traditionally used for building and firewood can no longer be found in the mountains due to over-harvesting (J004, p.c. 2021). This is in part due to the changes in socioeconomic status and rapid modernisation of the region discussed above; as the need to depend on these species for survival diminished, so did the practices that protected them from over exploitation. Another example is the invasive species *Prosopis juliflora*. These trees do not have traditional uses or local names in Dhofar; the Arabic name is a borrowing from the English 'mesquite'. These trees were introduced as landscaping trees and quickly spread to many areas of the *gerbib*. They are prolific in the region, but few people know what they are called (even in Arabic) or how they can be used (see 6.1.1.2). This is further evidence of the decline in connection with the ecosystem - these trees are making a significant, visible difference in the ecology of the *gerbib* but that change is not salient in people's lived experiences.

These ecological changes are also both causing and reflected in the decline in language and culture. As the traditional management strategies are no longer taught to younger generations, exploitation is not prevented as it had been in the past. As dependence on local resources for survival has diminished, so has the language and knowledge transmission around the ecology (Watson et al., 2019); many younger speakers of Mehri are fluent but be unable to discuss plants or landscapes because they have never needed to know about them (Fatimah al Mahri, p.c. 2024).

Ecological decline in Dhofar is compounded by language loss, which is both a cause and an effect of these changes – as local knowledge is transmitted less and less, the language is

used in fewer domains; and as the ecosystem declines and species disappear, the associated vocabulary also vanishes. The place-based language and knowledge hold keys to sustainable existence within the ecosystem. Chapter 6 of this thesis will explore adaptations already present in Dhofari cultures and propose strategies to strengthen the resilience of the region's biocultural diversity.

1.2.4 Linguistic Context

Mehri is one of the Modern South Arabian languages (MSAL), a group of languages spoken across the southern region of the Arabian Peninsula. The other languages in this group are: Soḳoṭri, spoken on the Soqotran archipelago off the shore of southern Yemen; Śḥerēt (also known as Jibbāli), spoken in the mountains of Dhofar; Ḥarsūsi, spoken in the region east of the Dhofar mountains; Hobyōt, spoken near the southern border between Yemen and Oman; and Baṭḥari, spoken the eastern region of the Dhofar mountains (see Figure 1). No official census information exists for numbers of speakers, but Watson and al-Mahri (2023) give these estimates:

> Mehri - approximately 200,000 members of the Mahra tribe, unknown how many speak Mehri; Simeone-Senelle (2011) estimated 100,000 speakers
>
> Soḳoṭri - approximately 100,000 speakers (Kogan & Bulakh, 2019)
>
> Śḥerēt - approximately 30,000-50,000 speakers of various tribal affiliations and non-tribal regions in the Dhofar mountains.
>
> Ḥarsūsi - approximately 2,000 speakers
>
> Hobyōt - approximately 1,000 speakers
>
> Baṭḥari - less than 20 speakers

Traditionally, Mehri was spoken mainly in modern-day southeastern Yemen with some speakers in western Oman and southern Saudi Arabia. Population shift has occurred in each modern state due to political and economic changes, both internally and externally - diaspora communities are now found in many of the major cities in the Gulf (such as Kuwait City, Kuwait and Dammam, Saudi Arabia). Mehri has relatively high prestige among other

MSAL speaking groups and some reports state that the less-prestigious languages are losing speakers to the more-prestigious languages (Watson & Al-Mahri, 2023).

Mehri is not a dialect of Arabic, nor is it mutually intelligible across the other Modern South Arabian languages. There is and has been significant bi- and multi-lingualism among Mehri speakers with Arabic and other MSALs (Morris, 2007). This multi-lingualism is due first to contact and second to education and government services being provided in Arabic. When a speaker of Mehri does not interact with speakers of Śḥerēt, they cannot understand Śḥerēt (M100). This is a pattern found elsewhere in the world. For example, in the Netherlands, residents of the eastern regions, closer to the German border, can often communicate with Germans from the western regions of Germany but not with those from further east. Mutual intelligibility in these situations is due to sustained contact. The traditional economic situation of Dhofar, discussed above (1.2.1 and 1.2.2), meant that there was a constant interaction between the groups of the various languages, but also that not every individual of the group interacted with others. The languages maintained their distinctions, even in this inter-connected society, I believe due to the impartation of identity the language and dialect spoken provides.

Though there is no agreed definition of the difference between a dialect and a language, most Mahra contend that Mehri is a language, not a dialect. This research operates on that assumption. For further discussion and evidence of this claim within the linguistic literature, see, for example, Bittner (1909a).

The Mehri language has been described by several researchers over the past 130 years (see 2.3.2). This thesis follows the methodology and grammatical descriptions published by Professor Watson, including Watson (2012) and Watson et al. (2020).

1.2.4.1 Semitic language characteristics

MSALs are part of the Semitic language family. This language family includes Arabic, Hebrew, and the Ethio-Semitic language group, among others. Mehri shares features with each of these languages and language groups. The following section describes some of the

characteristics found in the Semitic language family and how Mehri exhibits these characteristics.

Nonconcatenative morphology – root and pattern

Nonconcatenative morphology is a word-building strategy in which inflection and word derivation is achieved by modifying a word rather than adding affixes. In English, a nonconcatenative plural inflection is found in some Germanic-based words such as goose (singular) ~ geese (plural). In this example the quality of the vowel changes to indicate 'plural' rather than the usual addition of the suffix -s as in most other nouns ex. dog (singular) ~ dogs (plural). Semitic languages' words are nearly always derived with nonconcatenative morphological processes. They are built from a root of (usually) three consonants which appear in the same order with different vowels or extra consonants added to create words. The root itself often carries semantic content, but roots are never used in spoken language without being derived into a word.

Roots often derive words with shared semantics, which gives insight into how the language might be encoded in the minds of speakers. For example, the root k-t-b in Mehri occurs in at least five different words (all taken from Johnstone (1987, p. 217) and following his transcription):

kətūb 'to write'
šəktūb 'to have so. write a charm'
škētəb 'to correspond with so.'
kətōb 'book'
kōtəb 'clerk'

Each arrangement of vowels and extra consonants is called a 'pattern', and, like roots, patterns can carry some linguistic information such as word-type or derived verbal form. In the example above, *kətūb* can be described as coming from the root k-t-b and the pattern $C_1əC_2ūC_3$ where C_1 = k; C_2 = t; C_3 = b. This pattern: $C_1əC_2ūC_3$ is one that is found more broadly in Mehri for the base form of many verbs.

Dictionaries of Semitic languages are usually organised by root. To find *kətūb* in a dictionary, one would first need to recognise that the root is k-t-b and then find that root between k-š-f and k-t-f in the *Mehri Lexicon.*

Several roots are shared across many Semitic languages, such as the example above which is realised as *kutub* 'he wrote' in Arabic and *ktev* 'he wrote' in Hebrew[3]. This is a result of having descended from a common linguistic ancestor. Not all roots are common, and not all languages have the same subset of roots. However, this feature of this language family means that it is sometimes possible to look up a Mehri word's root in an Arabic-English dictionary and get a sense of what the word might mean in Mehri and vice-versa (though Arabic-English dictionaries are far more advanced and complete than Mehri-English dictionaries). This strategy was employed occasionally in this research.

Phonological triads

A second notable feature of Semitic languages is the triad system of the phonology. Whereas many languages around the world have pairs of sounds: /t/ and /d/ for example, where the place of articulation is the same, but the voicing is different, many Semitic languages have triads of sounds: /t/ /d/ and /ṭ/. The third consonant in that set is called 'emphatic' and its realisation in pronunciation varies across languages and dialects. In Arabic, emphatic sounds are often pharyngealized and cause nearby vowels to be pronounced further back. For example, the minimal pair *kalb* 'dog' and *ḳalb* 'heart' where the vowel in 'dog' is closer to a /æ/ sound whereas in 'heart' the vowel is /ɑ/ or even /ɔ/. In Mehri, emphatics can be pronounced as ejective, which is a feature also found in many Ethio-Semitic languages. They also have effects on the surrounding vowels, with Mehreyyet (eastern dialect) using diphthongs in the context of emphatics. See Watson (2012) for greater depth of this phenomenon in Mehri.

Consonantally, Mehri has a set of sibilants that Arabic does not. They are pronounced laterally, meaning the opening of the mouth is at the side, similar to making a /l/ sound but only out of one side of the mouth. It is transcribed here as plain: /ś/ and emphatic: /ṣ́/. The emphatic is often realised as an affricate, sometimes as an ejective. These phonemes are possibly relics from older Semitic language varieties, there are some Arabic dialects that

[3] Some Hebrew consonants become fricatives in certain contexts, so the root is still written k-t-b in Hebrew

retain these sibilants in the South West of Saudi Arabia, bordering regions of Yemen, and the Hadramout of Yemen (Watson, 2011; Watson & Al-Azraqi, 2011).

1.2.4.2 Dialects of Mehri

There are many dialects of Mehri ranging from central Dhofar west toward the Hadramout of Yemen and north to the southern reaches of Saudi Arabia. Unlike many dialectal variation patterns, dialects of Mehri are not geographically defined, they are defined by tribal affiliation. This is still true, even 50 years after sedentarisation was implemented and heavily encouraged by the Omani state, and even though two generations have been born into the new areal arrangement of families and tribes.

Some dialectal differences are described in Watson (2012) and al-Qumairi et al. (2024). One of the most salient is the ḏ ~ d and ṯ ~ t contrast - Western dialects have lost this contrast whereas Eastern dialects have not. Another salient difference is that Eastern dialects vocalize /l/ in many contexts. However, this east-west dichotomy is not universal. /ʕ/ is lost in almost all dialects except a few Yemeni varieties. Xarxir (in Saudi Arabia) was home to (at least) two distinct dialect groups, one which had lost the interdental - alveolar contrast and one which had not (Munira al-Azraqi, p.c. 2023). Neither group resides in Xarxir any longer, but the distinction is still found in families that have migrated from there.

There is also dialectal variation in vocabulary. The Mehri Lexicon gives many words which have synonymous meanings but does not comment on their usages. When working with Mehri speakers from different dialect groups, speakers sometimes understand the word choice but would choose a different synonym and sometimes struggle to understand unfamiliar words. The more Western dialects have also lost the diminutive markers. My consultant from this dialect group sometimes understands diminutive but describes them as 'old' words and sometimes struggles to understand these forms. Further research is needed to fully describe the variation between dialects of Mehri.

1.2.4.3 Mehri and Śḥerēt

As mentioned above, Mehri is not generally mutually intelligible with other MSALs (though some speakers report Ḥarsūsi is mutually intelligible with Mehri). However, there are many

speakers who are competent in more than one MSAL as well as in Arabic. The two MSALs most drawn upon for this thesis are Mehri and Śḥerēt. Because these two languages are primarily oral, any written presentation of them has the potential to impact the codification of them and their use in the future. Please note that the transcriptions given here are not intended to represent a standardisation, instead they are meant as examples of the language in use.

The sections below outline a few differences between these two languages.

Consonantal inventories

Both Mehri and Śḥerēt have a larger consonantal inventory than either English or Arabic. As mentioned above, Semitic languages tend to have triads of phonemes with the same place of articulation: voiced, voiceless, and emphatic. Both Mehri and Śḥerēt follow this pattern. While in Arabic, emphatics are often pharyngealized, in Mehri and Śḥerēt they are sometimes realised with ejective phonation.

The sibilant inventory is quite a bit larger in both languages. Both languages have a lateral fricative pair (mentioned above) which are pronounced on one side of the mouth and are transcribed /ś/ and /ṣ́/ following Watson (2012) and Watson et al. (2020).

In addition to the lateral fricatives, Śḥerēt also has a set of sibilants which include a rounding of the lips: /s̃/, /z̃/ and /ṣ̃/. These are pronounced slightly further forward in the mouth than /š/ (the sound in the English word shoe) and with rounded lips (Bellem & Watson, 2017). Śḥerēt also has pre-aspirated sonorants (nasals, lateral and rhotic) which neither Mehri nor Arabic share. These are transcribed with a superscript ‘h’ as in: /^{h}n/. Below are the complete consonant inventories for Mehri (Table 1) and Śḥerēt (Table 2).

Mehri consonants:

	Phonation	labial	dental	alveolar	pal-alveolar	palatal	velar	uvular	pharyngeal	glottal
PLOSIVE	voiceless			t			k			
	voiced	b		d			g			ʔ[4]
	emphatic			ṭ			ḳ			
FRICATIVE	voiceless	f	ṯ	s	š			x	ʕ	
	voiced		ḏ	z	ž			ġ	ḥ	h
	emphatic		ṯ̣	ṣ	ṣ̌					
LATERAL	voiceless				ś					
	voiced			l						
	emphatic				ṣ́					
nasal		m		n						
rhotic				r (ṛ)						
glide		w				y				

Table 1 Mehri phonemes (adapted from Watson et al., 2020, p. 6)

[4] Most commonly an allophone of /ʕ/.

Śḥerēt consonants:

	phonation	labial	dental	alveolar	pal-alveolar	alveo-palatal	velar	uvular	pharyngeal	glottal
PLOSIVE	voiceless			t			k			
	voiced	b		d			g			
	emphatic			ṭ			ḳ			
FRICATIVE	voiceless	f	t̲	s	š	š̃		x	ʕ	ʔ
	voiced		d̲	z		ž̃		ġ	ḥ	h
	emphatic		ṭ̲	ṣ		ṣ̃				
LATERAL	voiceless			ʰl	ś					
	voiced			l	ź					
	emphatic				ṣ́					
NASAL	voiceless	ʰm	ʰn							
	voiced	m	n							
RHOTIC	voiceless	ʰr								
	voiced	r								
glide		*w				y				

Table 2 Śḥerēt phonemes (adapted from Watson et al., 2024, p. 5)

Vowel inventories

Mehri has six long vowels: /ā/ /ī/ /ū/ /ē/ /ɛ̄/ and /ō/, seven short vowels: /a/ /i/ /ə/ /o/ /u/ /e/ and /ɛ/ as well as diphthongs /ay/ and /aw/ (Watson, 2012; Watson et al., 2020). It also has some vowel variation across dialects: my Mahriyyōt (Western dialect) consultant does not use diphthongs in the context of emphatics, but my Mehreyyet (Eastern dialect) consultants do. As mentioned above (1.2.4.2), some Eastern dialects also vocalise /l/ when it follows a vowel, creating a long vowel in the place of a vowel-/l/ sequence.

The Śḥerēt vowel inventory is larger than Mehri's, and includes: /i/ /e/ /ɛ/ /a/ /ɔ/ /o/ /u/ /ə/ (Johnstone, 1981, p. xv). In addition, there are more phonological rules shaping the length and quality of vowels in Śḥerēt than in Mehri. Brewster (2021) gives three processes affecting vowels:

1. Bilabial elision intervocalically - /b/ /m/ and /w/ are deleted when between two vowels; Watson & Al-Kathiri (2022) add /y/ to this, classing these elided consonants as an 'unnatural class' because 'y' is not included in the classification of bilabial consonants.
2. Vocalisation of prevocalic glides - /w/ and /y/ are deleted and a long vowel created when there is a vowel following either of these phonemes
3. Liquid-vowel metathesis - /l/ /r/ switch places with any vowel they precede (Brewster, 2021, p. 39)

In addition, vowels can be nasalised in Śḥerēt, which is not a process found in Mehri (the exception being the Mehri word for 'where', *ḥõh,* with a nasalised /o/; Johnstone (1987) claimed this is the only word in Mehri with a nasalised vowel (p. 10)).

Stress assignment

Lastly, stress in Mehri is assigned in a fairly transparent manner: the right most heavy syllable receives stress, while vowels in light syllables are reduced to /ə/. There are exceptions, however, where a heavy syllable earlier in the word may take stress instead (Watson, 2012). Stress assignment in Śḥerēt is far from transparent. Some researchers suggest that a tonal system is found in Śḥerēt (Brewster, 2021) which is completely absent in Mehri. Indeed, Professor Watson tells of learning a new word in Śḥerēt with a high tone on one of the syllables and asking her consultant if saying it without the tone would have the same meaning. The answer was no, the tone is obligatory (Janet Watson, p.c. 2024). As a phonologist, even with years of practice I still struggle to label stress in Śḥerēt recordings. For a more detailed description of stress assignment in Śḥerēt, see Brewster (2021).

1.3 Thesis outline

This thesis seeks to contribute to the resilience of the biocultural diversity of Dhofar and al-Mahra by exploring the links between the endangered language, culture, and ecosystems. Chapter 2 reviews the literature used to build this biocultural diversity description of the region and link it to other biocultural analyses. Chapter 3 describes the methods used to explore and analyse the language and culture and their link to the ecosystem. Chapter 4 explores the traditional governance structures and relationships of the Mahra tribes, comparing them with characteristics of other long-lasting governance institutions. The Mahra governance institutions were shaped by the scarcity of water and pasture and have

been significantly disrupted by factors such as urbanisation in the past fifty years. These institutions have allowed humans to live in the region sustainably for millennia. The health of these institutions is therefore closely linked to the sustainability of the resources. Chapter 5 describes some aspects of how the language and ecosystems are linked by examining vocabulary and semantic extensions of words to do with the ecology, climate, landscape, and activities connected to each of those. This vocabulary has likewise been disrupted by urbanisation as the population settles into towns and cities and is increasingly removed from the ecosystem. Chapter 6 examines the factors that are impacting the diversities present in Dhofar, how the language and culture have adapted, and suggests some ways the disruptions can be mitigated. Chapter 7 states limitations and provides conclusions from the findings of this research.

2 Literature Review

This thesis builds on previous documentation and incorporates various social science theories. This chapter offers background information on the development of these topics and concepts, as well as the key publications referenced in the subsequent research chapters. The review begins with the overarching theory of biocultural diversity (2.1) and then discusses institutions 2.2), language and nature (2.3), and resilience theory (2.4).

2.1 Biocultural diversity literature

Biocultural diversity postulates that language, culture, and ecosystems are inextricably linked (Maffi, 2007, p. 268). The implication of this theory is that sustainability of the various diversities in these areas is also inextricably linked (ex. Maffi, 2005; Maffi, 2007; Pretty et al., 2009). The label 'biocultural diversity' arose from the International Society of Ethnobiology in 1988 (Maffi, 2007, p. 268), but the link can be found in other fields of research as well. For example, Douglass North suggests the link between ecology, culture and language in his institutional economic framework (North, 1997). He did not explore ways in which that link works, only how the link shapes human culture and economic development.

According to Maffi (2005), the field of biocultural diversity is primarily concerned with four avenues of investigation: 1- the global distribution of linguistic and biological diversity and how languages, cultures and ecosystems are linked; 2- common threats to biocultural diversities; 3- revitalisation and sustainability of biocultural diversity; and 4- the human rights implications of sustainability programmes (p. 600). The following sections discuss the literature and previous work done in each of these four areas.

2.1.1 Global distribution of and links between linguistic and biological diversity

The relationship between linguistic diversity and biological diversity has been studied on both regional and global scales. Research shows that regions with high biodiversity also tend to have high linguistic diversity, whether examined locally or worldwide.

Nettle (1998) built an argument for global linguistic diversity patterns based on ecosystems. He demonstrated that language diversity is higher in lower latitudes, low in areas of low

biodiversity such as deserts, and high where equatorial forests tend to grow. This is then linked to linguistic diversity. Nettle argues that when a people group can support themselves reliably throughout the year, interaction with others is less necessary and languages fragment. When trade is essential for survival, people must interact with a wider network leading to more widespread singular language use.

Loh & Harmon (2005) provided an early attempt to quantify global biocultural diversity by comparing the number of species with the number of languages and balancing the result by incorporating human population and country land area. They found three areas where biocultural diversity is highest: the Amazon Basin, Central Africa, and Indomalaysia/Melanesia. This shows that linguistic and biological diversities do statistically correlate. In 2014 they published a much more comprehensive report on the shared evolutionary path and impacting factors on biological diversity and cultural diversity (which they measure by linguistic diversity). They point out that the global trend is one of decline in both linguistic and biological diversities, but that regionally these trends are more diverse.

Gorenflo et al. (2012) investigated biodiversity hotspots – areas of high endemism and a loss of at least 70% of the natural habitat. They mapped linguistic diversity over biological hotspots and found that globally, biodiversity and linguistic diversity tend to be high in the same regions, with statistical significance. They argued that this should inspire conservation strategies that include both indigenous languages and the biodiversity found in these hotspots. More recently, Connolly et al. (2023) reproduced the results of Gorenflo et al. (2012) with more complete biodiversity data and found that the patterns reported in Gorenflo et al. hold. Linguistic diversity tends to pattern with biological diversity on a global scale.

Given the global distribution of linguistic diversity, we now turn to regional studies of this phenomenon. Mace & Pagel (1995) calculated the number of languages spoken prior to European conquest at every second line of latitude in North America. When corrected for the narrower landmass to the south, they found that linguistic diversity increases toward the equator and languages' ranges increase nearer the poles. They also found that linguistic diversity was greater in areas of greater habitat diversity than in areas of lower habitat

diversity, independent of latitude. So again, linguistic diversity statistically correlates with biological diversity.

In Sub-Saharan Africa, Moore et al. (2002) found that environmental factors can account for 71% of species diversity and 36% of linguistic diversity especially pointing to availability of water and stability of food sources. This paper showed that linguistic and biological diversities are encouraged by similar factors. They claimed that linking culture and language with ecological studies can give insight into how human cultures affect ecosystems and how ecosystems affect human cultures.

One of the common factors leading to this global distribution of linguistic and biological diversity is similar evolutionary processes and actors. Loh & Harmon (2014) demonstrated that linguistic variation and change leads to dialect formation in a similar process to genetic variation and change which leads to speciation. The evolutionary processes can be geographical isolation in both languages and species (Loh & Harmon, 2014) or through self-sufficiency and lack of need for interaction again in both languages and species (Henson et al., 2021). This mechanism is not well-understood and does not account well for the linguistic situation in Dhofar where linguistic diversity has been sustained despite the inter-dependence of the various linguistic groups living in the region.

Critics of using evolutionary theory to describe language risk have argued that languages are not biological entities and that they cannot be subjected to the same types of criteria for endangerment as flora or fauna species can be (see for ex., Pennycook, 2010). There are valid points to this argument: languages are not like animal species in that they are not independent of the human community which uses them. However, languages are also not entirely cultural entities. Languages lie between culture and ecosystem, being affected by and affecting them (Maffi, 2018; North, 1997). There is scope for discussing languages in relation to their adaptations to outside forces, and how those forces affect the culture and ecosystems the languages are situated within.

2.1.2 Common threats to biocultural diversity

As a result of the evolutionary links between linguistic and biological diversities, some research has focused on the shared factors affecting these diversities. Sutherland (2003) examined several factors that are known to affect animal species and tested their effect on linguistic diversity. This paper drew out commonalities between language loss and species loss using the International Union for Conservation of Nature (IUCN) Red List criteria for endangerment. Sutherland concluded that, though language diversity and mammal and bird species diversity overlap geographically, the extinction factors do not. This conclusion comes from the fact that human population density is highly correlated with bird and mammal extinction rates, but not with rate of language extinction. However, Amano et al. (2014) explained that two of the drivers of language extinction risk are small population size and rapidly declining numbers of speakers. When these factors are considered for bird populations, they could be triggered by human encroachment – when applied to languages these factors are often triggered by linguistic competition with a dominant, larger language. So, though Sutherland did not find correlation between linguistic and bird and mammal extinction, Amano et al. gave the possibility that these declines could be due to similar drivers, just with a wider interpretation. Bird and mammal populations compete with humans, endangered languages compete with larger, more dominant languages. The competition is the common driver.

Common threats to biocultural diversity have also been explored at length in Pretty et al. (2009) who provided a comprehensive list of threats and what their impact is on cultural and biological diversities. This paper drew on data from the Americas, so the claims do not necessarily apply globally. The threats presented by Pretty et al. are overwhelmingly modernisation changes. For example, the modernisation of healthcare affects biological diversity because it shifts the value of local medicinal plants and can lead to their devaluing and ultimate decline; it affects cultural diversity because ecological knowledge, closely related to cultural identity, is devalued leading to loss of cultural identity. Another example is nation building where centralised authorities are set up and bring dominant language and belief systems at the same time. Nation building disrupts cultural diversity by enforcing the dominant language and/or a new belief system and disrupts biological diversity by enforcing

new regimes of resource management and importation of goods. The paper called for greater recognition of the connection between linguistic, cultural, and ecological diversities at governmental levels of policy making.

Cámara-Leret & Bascompte (2021) showed that language loss can lead to loss of traditional ecological knowledge even when the ecosystem is not declining as quickly as the local language. They looked at the medicinal plants and traditional knowledge in three areas of high linguistic and biological diversity: North America, northwest Amazonia, and New Guinea. They found that in all three regions, though the languages were geographically near one another, 70% of the medicinal knowledge was held in only one language. They also found that this knowledge is much more likely to be associated with endangered languages than with endangered plant species. They conclude that this loss of knowledge impoverishes both humanity's ability to develop new or better medicinal and food sources and the understanding of the relationships that keep ecosystems healthy.

2.1.3 Revitalisation and sustainability of biocultural diversity

Once the decline and factors affecting that decline have been understood, the question arises as to how to mitigate these changes. Gavin et al. (2015) recommended working toward biocultural sustainability through the lens of institutions as defined by Douglass North (discussed in 2.2). The authors applied resilience theory (further discussed in 2.4) as a holistic approach encompassing biodiversity and linguistic and cultural diversity. They set out eight principles to be used in building biocultural sustainability programmes. They are:

1. Acknowledge that conservation can have multiple objectives and stakeholders.
2. Recognise the importance of intergenerational planning and institutions for long-term adaptive governance.
3. Recognise that culture is dynamic, and this dynamism shapes resource use and conservation.
4. Tailor interventions to the social-ecological context.
5. Devise and draw upon novel, diverse, and nested institutional frameworks.
6. Prioritize the importance of partnership and relation building for conservation outcomes.
7. Incorporate the distinct rights and responsibilities of all parties.
8. Respect and incorporate different worldviews and knowledge systems into conservation planning.
   (Gavin et al., 2015, p. 141)

These principles draw upon the design principles for long-lasting common pool resource management institutions developed by Elinor Ostrom, discussed below in 2.2. Gavin et al. (2015) went on to describe how these principles can be implemented within conservation programmes and the types of challenges they expect to face in the effort to include cultural and linguistic diversities. They were also intentional in pointing out that there is not one solution to preserving all of the world's diversity, but that local institutional frameworks need to be included and valued in any sustainability programme.

2.1.4 Human rights in biocultural links

Human rights in relation to the connection between languages, cultures and ecosystems can narrowly be viewed as linguistic rights. UNESCO supported the 1996 meeting for the Universal Declaration of Linguistic Rights in Barcelona where the declaration was signed by several non-government organisations and linguistic rights activists. This declaration sets out comprehensive rights for language groups including the right to use and teach their language(s) in private and public and the right to manage their own resources for the maintenance and continuation of their language(s) (UNESCO, 1996). This declaration has never been adopted by UNESCO. The UNESCO Convention for Cultural Diversity, 2001, explicitly includes encouraging linguistic diversity both in schools and online (UNESCO, 2001, p. 64). But in 2003, UNESCO held the Convention for the Safeguarding of Intangible Cultural Heritage which does not include linguistic diversity as an element of intangible cultural heritage (ICH). In 2019, UNESCO declared the International Year of Indigenous Languages and an action plan for a Decade of Indigenous Languages from 2022-2032 (UNESCO, 2021). This declaration still falls short of the linguistic rights set out in the Universal Declaration of Linguistic Rights but does acknowledge the value and importance of linguistic diversity.

Human rights in relation to biocultural diversity can also be viewed as Indigenous rights. Indigenous rights researchers and activists often criticise the UN’s strategies for conservation, arguing that decolonisation is a greater priority than sustainable development. Child (1993) criticised UNESCO and other conservation governing bodies because they write and enforce sustainability policies without any connection to the local people and their needs. His paper demonstrated how indigenous landholders in Zimbabwe

have been able to re-establish control over their local natural resources due to the Communal Areas Management Programme for Indigenous Resources. In this programme, villages were equipped with the authority to exploit the local wildlife for tourist recreation, both by offering safari camping options and with a limited number of hunting licenses. Child argues that by making wildlife more valuable alive than dead and offering indigenous groups a path toward economic sustainability through the resources around them, conservation will fall into place.

Chatty's 2003 paper came out of an international conference at the Dana Nature Reserve in Jordan where a manifesto was drawn up regarding mobile peoples and conservation. The Dana Declaration (Unnamed, 2003) set out five conservation principles which signatories committed to promoting in conservation practices:

1. Rights and empowerment
2. Trust and respect
3. Different knowledge systems
4. Adaptive management
5. Collaborative management

Chatty, a signatory of the Declaration, argued that mobile people groups are both highly adapted at managing their traditional homelands sustainably and consistently invisible to sustainability programmes. She argued that multidisciplinary work, including both natural and social sciences, is needed to understand and balance the needs of both mobile peoples and conservation of the world's resources.

In the same issue of the *Nomadic Peoples* journal, Colchester (2003) described the colonial roots of conservation programmes in the 19th and 20th centuries when many of these programmes removed human populations from regions deemed in need of conservation. He described the consequences of forced migration for cultures of the displaced peoples – the consequence has almost always been death. He furthered the argument that indigenous human rights must be incorporated in conservation programmes, including land rights.

In a similar vein, Titon (2016) argued that sustainable development is "a new form of Western colonialism" because it sacrifices traditional knowledge and ways of being for

economic growth; and that growth is usually to the benefit of the developers rather than those who are being developed (p. 170) (further discussed in 2.4.2).

More recent work has focused more broadly on decolonisation. Richardson et al. (2023) presented three case studies of urgencies in the field of folklore. The first two discussed aging and forced migration and their impacts on folklore. The third study explored decolonisation as practice rather than theory. This study gave examples of how an Indigenous culture in the northern United States is growing in vitality as community members live the culture rather than simply learn about it. The biodiversity of the region is much higher than in non-indigenous controlled areas nearby (p. 192). Educational outcomes increased dramatically when traditional knowledge and practice were incorporated into the curriculum (p. 195). These examples demonstrate some of the benefits decolonisation, as opposed to sustainable development, has had by incorporating adaptive management into disrupted systems of biodiversity and education.

2.1.5 Conclusion

While southern Arabia does not qualify as a biodiversity hotspot, the relative biodiversity in Dhofar and al-Mahra is notably higher than in the surrounding regions. The same is true in terms of linguistic diversity – whereas much of the Arabian Peninsula is home to Arabic speakers, Dhofar and al-Mahra are home to four endemic Modern South Arabian Languages (MSAL); the fifth and sixth are spoken in Jiddat al-Ḥarsasiis in central Oman, and the Soqotran archipelago of Yemen. In addition, rapid socioeconomic change since the 1980s has caused disruption to the ecosystems and cultures. Many of the threats to biocultural diversity mentioned in Pretty et al. are affecting Dhofar today (Boom, 2022). This thesis seeks to address the challenge posed in the biocultural diversity literature of more localised analyses of the links between languages, cultures, and ecosystems.

The remainder of this chapter discusses the theoretical lenses through which biocultural diversity is viewed, described, and analysed through the rest of this thesis.

2.2 Institutions literature

This section outlines the evolution of the ideas underpinning institutions and how they are connected to the link between language, culture, and ecosystems.

The concept of 'institutions' was first used in relation to economics in Hamilton (1919) where Hamilton argued that institutional economics is the best way to describe human economic behaviour. In this paper, Hamilton did not give a concise definition for 'institution' but appeared to assume that an institution is a structure within an economy such as the wage system. The economic theory of institutions continued to develop and change through the 20th century, but the focus of my research is on the connection between institutions and their impact on the ecosystem. This shift from economic behaviour to a broader sense of interaction extending to the local ecosystem was not published until the 1990s.

In his 1991 paper, 'Institutions', Douglass North gave a more concise definition of what an institution is, which he further explored in his 1993 Nobel Prize lecture where he says, "Institutions are the humanly devised constraints that structure human interaction." (§II) Institutions incentivise behaviour and shape the direction, health, and longevity of economies and, therefore, institutions shape and impact the environment and *vice versa* (North, 1991).

Concurrently, Ostrom (1990) explored human interaction with the environment through investigating a specific type of institution – those which govern common pool resources (CPRs). CPRs are resources that can be used up and are difficult to exclude users from, for example, common grazing land or forests. Traditionally these have been a subset of natural resources. More recently they have expanded to include communal services such as firefighting or roads.

Ostrom's work focused on the characteristics of institutions that successfully manage long-term solutions which allowed the use of the CPRs but also ensured their continuation into the future; in other words – sustainable resource management. The characteristics of successful CPR management institutions as described by Ostrom are:

1. Clear boundaries

2. Rules appropriate to local conditions
3. Adaptable rules
4. Self-monitoring
5. Graduated sanctions
6. Low-cost conflict resolution
7. Minimal interference from outside authorities
8. Nested structures (Hess & Ostrom, 2007; Ostrom, 1990)

These principles can be used to consider the resilience of current institutions and identify areas requiring strengthening. Other researchers who have explored this avenue include Morrow & Hull (1996) and Gautam & Shivakoti (2005) in the context of forest CPRs, Sarker & Itoh (2001) in the context of communal irrigation systems, Yandle (2003) in the context of fisheries, and Quinn et al. (2007) in the context of common grazing land in semi-arid regions.

The work by Quinn et al. (2007) is particularly applicable to this research because they investigated whether these eight principles are found in institutional frameworks in semi-arid conditions with traditionally semi-nomadic people in Tanzania. Through semi-structured interviews and regional meetings, they built an understanding of the governance institutions and then analysed the strength of the institutions in relation to each of Ostrom's eight principles. Their main question was whether institutions of nomadic cultures manifest the same characteristics of long-lasting institutions found in non-nomadic societies. They found that Ostrom's principles do describe the management institutions in the Tanzanian environment. They conclude that, though the eight principles are useful for analysing the strength of institutional structures, applying the principles as models for change could restrict access to the CPRs and flexibility in the institutions, leading to reduced ability to adapt to changes.

Anthropologists have also adopted the concept of institution into their research. As with institutional economics, the definition of what constitutes an institution varies from author to author. Douglas (1986) wrote that institutions are deeply engrained in the human mind and socially conditioned. She built on the work of Emile Durkheim, who wrote that "classifications, logical operations, and guiding metaphors are given to the individual by society" (p.10), but Durkheim was heavily criticised for claiming a social basis for classification, logical operations, and guiding metaphors and did not develop it further. She also compared Durkheim with the work of Fleck, who wrote "'cognition is the most social-

conditioned activity of man'"(Fleck, 1979, p. 42). From this basis, Douglas built a theory of institutional functioning and its effect on society. Her definition of institution begins with it simply being a 'convention' like North. However, she expands the idea to include legitimacy - there must be some motivation to adhere to the convention, and for Douglas that is legitimacy. Therefore, her definition of an institution is a 'legitimized social grouping.' (p. 46) This contrasts with North's definition as 'humanly devised constraints that structure human interaction.' (North, 1997, §II) Douglas' definition for institution is closer to North's definition for organizations: "Organizations are made up of groups of individuals bound together by some common purpose to achieve certain objectives." (North, 1997, §III) This is also true of Khattri & Pandey (2023) who used the word 'institution' to describe the social roles of king, monk, village chief, and household. According to North's definition of institution, important cultural elements such as the concept of 'individual' and the honour/shame dichotomy in morality could also be considered institutions. However, most other literature does not take such a theoretical approach to the idea of an institution, so these are treated slightly separately from governance institutions in the research that follows.

Mahra governance institutions have not been widely described in the literature. This is at least in part because colonising powers are believed to have exploited that type of information in the past to their own benefit, a situation inferred from M003's interviews on institutions, so the Mahra do not disseminate the information freely. The institutions are largely based on tribal affiliations, but even information about tribal structures of the Mahra is not easily found. Tabook (1997) listed divisions and names of Mahra tribes and some aspects of their interactions with the Śḥerēt speakers of the mountains; Janzen (2000) described the ecological decline of the Dhofar Mountains and gave some information about tribal boundaries; Liebhaber (2018) gave a list of tribes and their homelands but carefully noted that tribal affiliations and links shift regularly and that the information shared was current in 2010 but probably would not remain stable. Otherwise, tribal structure among the Mahra is not published knowledge. Chapter 4 analyses some aspects of the institutional framework of the Mahra through the lens of Ostrom's eight design principles. These

principles, found in diverse long-lasting institutional frameworks, are applied in determining the relative health of other institutional frameworks in other settings.

2.3 Language and nature literature

One of the main concerns of biocultural research is understanding the links between language, culture, and ecosystem. This section discusses the literature on understanding these links. The first is ecolinguistics methodology, which is deemed unsuitable for this research; the second is linguistic ethnography; the third is the impact of language on cognition.

2.3.1 Ecolinguistics

A common linguistic methodology used to describe and analyse the link between languages and ecosystems is ecolinguistics. Ecolinguistics is a critical discourse analysis method developed by Arran Stibbe whereby a researcher critically examines discourse to determine the impact that discourse has on the ecosystem. Discourses are evaluated based on the author's idea of what is an "ideal society" (Stibbe, 2013, p. 5). This is accomplished by distilling which stories are being put forward as true and valuable within the discourse and comparing them to the ecological philosophy, or 'ecosophy', of the researcher (Stibbe, 2017). This research does not include ecolinguistics analysis for several reasons. First, the type of discourse that is analysed in this methodology is not available in Mehri today. There are stories and beliefs that shape the culture and the ways the people interact with the environment, but they are not documented or published in the way these are in other parts of the world. This research focused on gathering narratives, histories and place-based knowledge which is not suitable for this type of analysis.

Second, there are some potential objections to this method which are described as follows. First, the concept of 'ecologically friendly' has been weaponised against Indigenous cultures, such as the Inuit of northern Canada. In 2009, the EU enforced a ban on the import and sale of seal products on the recommendation of ecology activists such as Greenpeace (European Union, 2016). This ban negatively impacted already struggling communities and erased one of the only income options for the Inuit (Arnaquq-Baril, 2016). There have since been

concessions by the EU allowing certain areas to trade in seal products, if their sale can be proven to benefit Inuit or other indigenous communities; however, this was not implemented until 2016 (European Union, 2016). This is an example of a philosophy of ecological friendliness (from Greenpeace and others) that heavily impacted an already vulnerable population (the Inuit) that had sustainably managed their local ecosystem for centuries.

Second, the personal philosophy of ecolinguistic analysis should be based on "a set of values concerning oppression, exploitation and inequality" (Stibbe, 2013, p. 5). In the societies the present research focuses upon, there is oppression and exploitation but what is interpreted as oppression and exploitation is different than Western sensibilities expect. For example, in a story told to me relating to governance institutions, there were two men, one with a thirsty camel and another in control of a water source. The men argued about whether the camel should be allowed to drink, which ended in the camel's owner killing the man who was trying to refuse access to his water. In the Mahra perspective, the camel owner is seen as justified in this case (the one who killed the other man) because denying someone access to water is seen as an unacceptably shameful act.

And third, the application of ecolinguistics outside of one's own culture is colonial. As Richardson et al. put it, "decolonization is most generally about sovereignty" including environmental and land sovereignty (2023, p. 191). As an outsider arriving in Oman and analysing discourse based on my understanding, I would dismiss the local knowledge and impose my own instead. Because of these critiques, I will not be applying ecolinguistic methods in Oman.

2.3.2 Linguistic ethnography

An alternative approach to exploring the link between language and ecosystems is linguistic ethnography (LE). LE is not intrinsically concerned with ecology, but its holistic approach to researching language lends itself to a broad application, including the language-ecosystem link as discussed following the description of how LE is implemented.

LE is a combination of linguistic and anthropological methodologies that investigate language and culture to research social questions (Tusting, 2020). It is distinct from linguistic anthropology in that LE developed in the UK from the traditions of interactional sociolinguistics, literacy studies, critical discourse analysis, language and learning research, and applied linguistics for language teaching (Rampton et al., 2004) as opposed to linguistic anthropology which was developed in the United States and draws on the work of Sapir and Whorf (Tusting, 2020). These two fields are very similar, but the current work descends directly from ethnolinguistic work conducted in Dhofar and al-Mahra. The development of research in this region is discussed further below.

There is still much discussion in the literature as to how LE should be classified – whether it qualifies as a field of research or as a methodological approach (Tusting, 2020). In this project, I use it as justification for investigating language and culture through the lens of each other – language through culture and culture through language. Taken together, the linguistic and anthropological methodologies provide a coherent strategy for exploring social issues through language use and culture (Tusting, 2020). This research explores the social interaction between humans and their local environment through the lens of their language and culture.

LE is intrinsically collaborative (Budach, 2020). It rests on the relationship between the researcher and her expert consultants and naturally lends itself to partnerships outside of the academy. This requires adaptation and flexibility on both sides of the partnership. However, the payoff can be powerful outputs, often giving a voice to communities traditionally outside academia and deeper insight into human societies and impact to those inside academia.

LE work has evolved in the southern Arabian region over the past two centuries drawing on work done in linguistics and ethnography. These two strands of research were gradually brought together in the early 21st century. Some previous research involved colonial goals, especially through the 20th century when much of Western interest in exploring the region was driven by demand for oil. The documentation of this exploration and the political negotiations between the governments in Muscat and Aden are available through the

British Library and the Qatari National Library (East India Company, 26 March 1930-27 July 1947). Before this geographical and political exploration, a linguistic and anthropological expedition from Austria documented some of the languages of the region at the turn of the 20th century. The outputs from this expedition include Müller (1902) which provided a number of texts in Mehri and Soqotri with Arabic and German translations of the texts which were recorded between December 1898 and January 1899. Jahn (1902) also produced several texts in Mehri with the addition of a dictionary. He went on to publish a grammar of Mehri in 1905, even including some dialectal variation descriptions (Jahn, 1905). Bittner (1909b) gave an overview of the morphology of Mehri in the context of Arabic and Ethiosemitic languages.

Following the Austrian expedition, no further linguistic research from the Yemeni side of the Mahra's range occurred until 1983 when a team of French researchers were dispatched (Lonnet, 1985). In his 1985 report, Lonnet gave an update on the research he and Simeone-Senelle conducted in Qishn, Yemen in 1983. In it, he stated that they interacted with people who only spoke Mehri and immigrants into al-Mahra who had attained fluency in Mehri. The necessity of Arabic appears to only have been implemented in mandated military service at this point. The rest of the article claimed to give the first report of Hobyot to Western audiences. A little later on, Lonnet & Simeone-Senelle (1987) described the Mahra medicinal chants for treating stomach ailments and snake bites, situating them within the culture, the Mehri language, and the wider Semitic family of languages. This theme of situating Mehri within the Semitic family was revisited in Lonnet (1993) where he argued that the MSAL should be considered their own languages, not dialects of Arabic, and gave an outline of the phonology and morphology of Mehri, Śḥerɛ̄t, Hobyōt and Soqotri.

Simeone-Senelle has also published extensively on the linguistic features and dialectology of Mehri and other MSALs independently of Lonnet, though their early fieldwork was conducted together. Simeone-Senelle (2010) gave a detailed description of some dialectal variation across Mehri speakers with examples of phonological, morphological, vocabulary and oral literature variations. Simeone-Senelle (2011) gave a description of each of the MSALs, their geographical location and some cultural background. A further French-led research project examining the linguistic structure of the MSALs ran from 2013-2016 with a

special issue of *Brill's Journal of Afroasiatic Languages and Linguistics* published in 2017 (Bendjaballah & Ségéral, 2017).

Also, from the Yemeni side of the Mahra territory, Samuel Liebhaber has recorded, published, and analysed the oral poetry of the Mahra. His digital exhibit, published by Stanford University Press, 'When Melodies Gather' holds recordings, annotated transcriptions, and translations of many Mehri poems (Liebhaber, 2018); Liebhaber (2011) is a printed collection on Mehri poetry. He has also published analyses of this oral poetry in the light of both ancient Nabaṭi poetry in Liebhaber (2015) and Arabic poetry in Liebhaber (2010). More recently, his co-authored contribution to *Language and Nature in Southern and Eastern Arabia* highlighted the strong connection between the ecosystem in the Mahra land and their poetry (al-Barami et al., 2023).

On the Oman side, the Modern South Arabian languages were investigated and documented by T.M. Johnstone from the 1960s-1980s. His work, while still largely focused on linguistic description, also included some cultural information and description. His most impactful work in terms of the current research are his lexicons of Mehri (Johnstone, 1987) and Jibbāli (Śḥerēt) (Johnstone, 1981). Sadly, Johnstone passed away before the *Mehri Lexicon* was published, so it was published posthumously by G. Rex Smith. Harry Stroomer published Mehri and Ḥarsūsi (another MSAL) texts from Johnstone's fieldwork in 1999 and 2004 respectively. Johnstone's recordings and fieldwork data were further analysed by Aaron Rubin who published a descriptive grammar of Mehri in 2010 and an updated grammar in 2018 (Rubin, 2010, 2018).

In addition, there are numerous articles out of universities in Arabia published in Arabic about these languages, many listed in the *Bibliography of the Modern South Arabian languages* (Watson & Morris, 2024). Unfortunately, these publications can be difficult to access outside of the region and without a strong knowledge of Arabic.

At the turn of the 21st century, and directly impacting the current research, Alexander Sima documented language and cultural data from al-Mahra but tragically lost his life in a car accident in Yemen in 2004. His collection of texts was published posthumously in 2009 (Sima, 2009). Further documentation projects followed this as Professor Janet Watson

continued Sima's work. The DEAMSA project (Eades & Morris, 2016; Morris, 2016a, 2016b; Watson & Morris, 2016a, 2016b), Community Documentation of Biocultural Diversity in the Eastern Yemeni Province of al-Mahra, Yemen (al-Qumairi & Watson, 2018), and follow-up fieldwork have focused on documenting local knowledge and languages in response to declining linguistic proficiency and traditional knowledge. Knowledgeable speakers of local languages were, and continue to be, recorded describing aspects of traditional life in their local languages. Topics include vocabulary lists, stories about memorable events, information about landscapes, wind types, camel culture, local plants, etc. The data collected are housed at the Endangered Language Archive (ELAR – https://www.elararchive.org/). Collaborative research has continued in both Dhofar and al-Mahra, and the archives are updated regularly with new material.

Out of these documentation projects, numerous journal articles and book contributions have been published. For example, Wilson et al. (2022) explored the link between gesture and the ecological knowledge held by MSAL speakers in Dhofar by analysing gestures in videos from ELAR. The gestures used by MSAL speakers give insight into the way they conceptualise time, space, plants and animals. Boom et al. (2024) drew on archived recordings and first-hand accounts about traditional dwellings and described the shift from nomadic and semi-nomadic lifestyles among Śḥerēt and Mehri speakers in Dhofar. Watson, Boom, et al. (in press) described aspects of the links between the language and the ecosystem, discussing topics such as naming for quantification in telling time, dry measures and livestock herd sizes, drawing again on ELAR audio and video recordings. Watson et al. (2024) described traditional building practices and resources in the Dhofar mountains drawing on three texts from ELAR.

Aside from specifically ELAR-focused work, discussion of the link between language and ecosystem in Dhofar and al-Mahra can also be found in recent LE literature. Watson & al-Mahri (2016) described the cost that the loss of connection between people and the ecosystem has on language by demonstrating how non-literal utterances are heavily dependent on the ecosystem. When the link is lost, the meanings of metaphors, similes and metonymy is also lost – a significant loss for languages that are not extensively written down. They expanded this discussion in their 2017 paper where they described more

comprehensively how ecological loss and loss of connection to the ecosystems has led, and continues to lead, to language attrition in Dhofar and al-Mahra. Watson & Al-Mahri (2023) described the ongoing public involvement with the language revitalisation efforts for which the ELAR material is being collected. They discussed the ongoing projects such as community training and partnership with local academics in Oman, Saudi Arabia, and Qatar.

Recent work on poetry is also shedding light on the link between language and ecosystems. al-Barami et al. (2023) described the ecological imagery, specifically winds, at the centre of MSAL oral art. They highlighted how climate change affects these expressions with an eye to the future where the winds so central to the imagery may or may not blow. In a similar vein, al-Qumairi et al. (2024) discussed the connection between children's rhymes in Mehri and ecological knowledge – how the declining use of children's rhymes is a reflection of, and contributor to, the decline in environmental knowledge. The paper gave suggestions for revitalising the use of children's rhymes to help revitalise and sustain the language, ecological knowledge, and adult poetry into the future.

In addition to LE and linguistic studies, there have also been significant contributions through ethnographic descriptions. Miranda Morris conducted anthropological fieldwork from the 1970s onward in various locations in Southern Arabia. Her book with Anthony Miller on the botany of Dhofar (1988) is a seminal work on the plants of the region and their traditional uses. Morris conducted decades of research among the various tribes and language groups of Southern Arabia. Her experience and insight into the culture and local knowledge of the various tribes, languages, and areas of Southern Arabia is unparalleled.

Another anthropological work on the Southern Arabian region is Salim Tabook's PhD thesis (1997) which described the tribal structures and folklore of Dhofar. Born in Dhofar but raised in England, Tabook offers a semi-autobiographical perspective. His thesis is one of the only, if not the only, ethnography written on Dhofar culture by a Dhofari in English. It covered various topics including the economic structure, birth, marriage, death, and traditional beliefs. Focusing primarily on Śḥerēt-speaking groups, he interspersed explanations of other people groups, including the Mahra. Notably, his research was conducted shortly after the Dhofar War (1965-1975), so participants in his research had

lived nomadic or semi-nomadic lifestyles before Sultan Qaboos' reforms and regional development.

Marielle Risse, who has lived and worked in Salalah since 2005, provided an additional ethnographic description of the mountain-dwellers of Dhofar (Risse, 2019). Her research is conducted in English either with English-speaking Dhofaris or through an interpreter. Her research is also more removed from the traditional lifestyles of Dhofaris than Tabook's because she started her research about 20 years after his was published. Nonetheless, taking those elements into account, her depictions of daily life and some of the cultural reasoning behind the practices she describes compliment the descriptions Tabook gives. It is also one of the only other English-language ethnographies of the mountain-dwelling people of Dhofar. The Mahra are not widely included in the book, but the people described have been neighbours of the Mahra for hundreds, if not thousands, of years.

Kamala Russell's unpublished PhD dissertation (2021) covered moderation and agency expressed in human interaction in a homestead in the Dhofar mountains. She described daily life within this homestead and how concealment is built into every aspect of daily life. Russell lived within a family unit and acquired fluency in Śḥerɛ̄t over her time in Dhofar. Her ethnography described the gendered experience of concealment in the context of Dhofar and how it is used to practice and teach Islam both at home and in the public sphere.

Dawn Chatty worked among another of the MSAL-speaking tribes who inhabit the region to the east of the Mahra called the Ḥarsasiis. Their language is called Ḥarsūsi and around 5000 speakers remain today (Hammal al Balushi, p.c. 2024). At the request of the Omani government, Chatty worked on building social infrastructure for the Bedouin tribes of central Oman from 1978-1994 (Chatty, 2022). She has built and published a website documenting her time in Oman (Chatty, 2010-2024) and since 1994 has been working on other human rights projects protecting traditional nomadic lifestyles (Chatty, 2003, 2007, 2022).

Another outsider description of a nearby culture was written by Paul Dresch. Dresch (1989) described the tribes of Yemen, to the west of al-Mahra. This book was written about traditions and culture with a special focus on tribal relations and interactions. Significantly,

Dresch explained the concepts of honour and shame among the Yemeni tribes and the many strategies employed to protect honour. This discussion has helped with understanding how Dhofari tribes function with very similar institutions set up for the maintenance of a person's, family's, or tribe's honour. Dresch also described how the tribes of Yemen idealised the tribesmen who lived east of Marib – these would be either the nomadic Mahra or their neighbours.

Altorki & Cole (1989) is an ethnographic description of a culture that does not directly neighbour the Mahra but arose in a similar ecology. This book described the traditions of 'Unayzah, an oasis city in north-central Saudi Arabia. This city's agricultural output sustained both the sedentary and nomadic population as well as a wide-spread trading network which reached from Kuwait and Jubail in the east to Makkah and Egypt in the west. The timeframe, like Tabook, describes pre-industrialised livelihoods and societal structure. This book gives a description of how the discovery of oil and the establishment of the Saudi state changed lives within the towns and villages of the Nejd (central desert areas of Saudi Arabia).

These ethnographies all describe cultures that are important to understanding the Mahra, including the societal changes that transformed the Arabian Peninsula in the 20th century.

2.3.3 Language and cognition

One of the ways this thesis explores the biocultural links in Dhofar is through the way the Mehri language categorises the landscape and climate (see Chapter 5). This analysis depends on the connection between language and thought. This topic has long been an area of interest for linguists, philosophers, anthropologists, and psychologists (Boroditsky, 2001). In the history of linguistic theory, the idea developed from the work of Sapir and his student Whorf who explored the possibility of language determining thought. The strong Sapir-Whorf hypothesis, asserting that human perception and understanding of the world are heavily impacted by language (Whorf, 1940), was debunked in the mid-twentieth century and is not relevant to the current work. A weaker version of the hypothesis, stating that the language one speaks influences categorisation and some aspects of conceptualisation, underpins much work on the link between language and culture.

Empirical work testing this weaker Sapir-Whorf hypothesis first explored colour classification on the assumption that since colour is a gradient, languages should vary widely in how they delineate boundaries between colours in order to label them. However, Berlin & Kay (1969) found significant and consistent typological consistencies across languages in how colours were delineated and labelled. It was later shown by Kay & McDaniel (1978) that colour perception in humans is physiological, meaning that perception shapes language rather than language shaping perception. A year later, Lucy & Shweder (1979) reproduced two significant colour-naming and memory tests from the earlier literature and concluded that colour perception does not negate the Sapir-Whorf hypothesis. Their argument is that Whorf gave a hierarchy of influences on perception, including a level of cultural categories, which allowed researchers to account for the typological consistency of colour naming cross-linguistically while also depending on the linguistic element of the basic colour names.

More recent research has tested the hypothesis using other domains of language such as conception of time and causality. Boroditsky (2001) showed that Mandarin speakers conceptualise time on a vertical axis while English speakers do so on a horizontal axis. This difference can be overcome, however, by training English speakers to think on a vertical axis instead. She demonstrated that while language does affect thought, it does not determine thought and that the effect language has on the way we think can be overcome fairly simply. Fausey et al. (2010) showed that speakers of different languages remembered different things about shared events, possibly due to the way in which their language encodes events or causality. This, and other, recent literature suggests that language and cognition are connected but not deterministically so.

Another area in which the Sapir-Whorf hypothesis is explored is in the link between language and landscape. In a special issue of the journal *Language Sciences*, several authors explored cross-linguistic categorisation practices to do with landscape. In the introduction, Burenhult & Levinson (2008) gave the motivation for the special issue in two parts. First, every human inhabits a landscape and, though landscapes are largely continuous surfaces, they are still divided into categories and sub-categories which vary across languages. Second, way-finding strategies have been shown to be linguistically determined – some languages depend on egocentric wayfinding (ex. turn left, to your right), and others depend

on non-egocentric directions such as north, south, east, west. They mentioned that some languages do not have words for 'left' and 'right,' and so use different strategies for describing position or paths. One of the main findings in the papers of this special issue is that even concepts such as 'mountain' and 'cliff' are not universal.

The other papers in this special issue are largely descriptive, from a wide range of languages. For example, O'Meara & Bohnemeyer (2008) described how the Seri language of Sonora, Mexico uses compound descriptive terms broadly in the language. More specifically, place names always include one of these four: ground, stone, fresh water, or seawater along with another term to build the place name. Cablitz (2008) gave examples from Marquesan, an East Polynesian language which has 52 grammaticalized body parts as place names, moving the words from the 'what' category to the 'where' category. O'Connor & Kroefges (2008) examined another Mexican language, Chontal, and described how the words for the basic elements of 'water' and 'earth' give an element of agency to the item described. These words do not appear in place names, however; place names use generic words for landscape features along with descriptors of flora, fauna, or activities associated with the place. O'Connor & Kroefges also pointed out that as the people's connection to the land weakens, their spirituality is also diminished as places and spirits are closely linked in Chontal. As can be seen from just these three examples, universals are hard to define in how languages label or categorise landscapes. However, landscape categorisation does give insight into the conceptualisation of space held by the speakers of a language and perhaps universal patterns will be evident with more investigation of cross-linguistic landscape categorisation. This is explored further in Chapter 5.

2.4 Resilience and adaptive management literature

The final area of literature and previous work relevant to this research is sustainability and resilience. This section discusses the shift from conservationism to resilience and the work that has been done in Dhofar around biodiversity monitoring and conservation.

2.4.1 Conservationism

Biodiversity conservation is usually implemented through conservation areas set apart to exclude human interaction or exploitation of a region and its more-than-human inhabitants. These conservation areas, then, might be surveyed for the number of species present (see for ex., Ghazanfar, 1998; Raffaelli et al., 2008) and/or have photography traps set for particular species (see for ex., Spalton et al., 2006). Conservation is measured through repeated or long-term monitoring of biodiversity. These strategies extend beyond biological diversity to protectionism of languages and cultures as well, for example, with UNESCO designating some cultural practices as 'world masterpieces' encouraging host countries to protect those practices (Titon, 2016).

There are heavy criticisms of conservationism. One comes out of conservation efforts that have been imposed in sub-Saharan Africa by colonial powers as described by Brian Child and discussed in 2.1.4.

Another criticism of conservationism comes from the idea of 'virgin landscapes' that are untouched by human beings and should be either reverted to or protected. Most of the ecosystems of the world today have been shaped by human presence directly or indirectly (Pretty et al., 2009). Even areas traditionally thought to be 'pristine' wildernesses have recently been shown to have been impacted by human populations for thousands of years: for example, the Amazon rainforest (Lombardo et al., 2020). This is a problem for the conservationist programme because it obfuscates the goal of the conservation. In addition, human impact goes back millennia. For example, in the sheep-grazing areas of the English Lake District people have been raising sheep for upward of 5000 years (Rebanks, 2015). Without a goal for each conservation programme to aspire to, conservation is nonsensical.

2.4.2 Resilience

Due to the failure of many conservation programmes, ecologists started exploring alternative solutions for sustainability, which led to the development of the theory of resilience. The seminal paper on this topic is Holling (1973). Holling described 'domains of attraction', states of relative stability, which systems will shift in and out of when they face

major disruptions and gives many examples from ecosystems around the world. He argued that focusing conservation efforts on equilibrium does not guarantee continued existence and availability of the natural resources at stake. In light of this, he suggested focusing instead on resilience, "a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations" (p. 14).

Walters (1986) took this idea of shifting focus from keeping ecosystems the same to managing their adaptations to disturbances and extended it to the development of ecosystem management policies. He argued for a move away from the rigidity of scientific problem solving and embracing creative, collaborative problem solving in which everyone's needs are considered. He revisited this collaborative problem solving in his 1997 paper where he explained, with considerable pessimism, the reasons for the failure of this to take root in the scientific and bureaucratic policy-making processes (Walters, 1997). He mainly attributed the failure to self-interested parties that refuse to take risks on creative and experimental solutions.

In 2004, the concept was extended again to include social aspects in a paper by Walker et al. In this paper, the authors returned to the concept introduced in Holling (1973) of 'domains of attraction'. Walker et al. argued that resilience in social-ecological systems is measured by examining four things: how much a system can be changed before it shifts to a new domain of attraction, how easily a system can be changed, how close a system is to moving to a new domain of attraction, and which outside forces such as politics, invasions, market shifts, etc. are acting on the system (Walker et al., 2004, pp. 4-5). They argued again that adaptive management and governance are the best way forward in sustaining these systems, though they contend that current governance structures are actively blocking adaptive strategies.

Gavin et al. (2015) applied the concepts of resilience theory to biocultural diversity. This paper is discussed in 2.1.3.

Jeff Todd Titon extended the idea of resilience and interconnectedness found in ecological literature and applied it to ethnomusicology. In Titon (2009a), he wrote that music cultures should be viewed in a similar way to ecosystems in that they are interconnected with their

environment, both social and physical. He pushed against the tendency in conservation practices to isolate and stagnate cultural practices and instead argued for a dynamic and evolving approach to sustainability. In Allen et al. (2014), Titon and his collaborators further developed this approach and labelled it 'ecomusicology' where the health of biological, cultural and musical diversity are intrinsically linked; this is very similar to the concept of biocultural diversity (see 2.1). This paper also championed collaborative work between academics, musicians, and communities to address ecological challenges, in a comparable way to the collaborative nature of the research conducted for this thesis. In Titon (2016) he described how flexibility in musical cultures allows them to adapt to disturbances, drawing on the concept of adaptive management from ecological sustainability Walters (1986). In this paper, Titon advocated approaches to music culture sustainability that move away from fossilising practices and holding masterpieces as epitomes of success. Instead, he proposes managing the ways adaptations present themselves in any system that faces disruption. The focus of his work is music cultures, but this is also applicable to culture in a broader sense, as discussed further in Chapter 6. In Allen & Titon (2019) Titon and Allen argued that traditional, local knowledge which emphasises interconnectedness and cooperation is important for ecological sustainability. They tied this interconnectedness to musicology through 'sound ecology' where the sounds of the natural world facilitate connection between human and non-human worlds. This interconnectedness of human cultures and their natural ecosystems is one of the bases for the research presented here.

Richardson et al. (2023) (discussed in 2.1.4) also employed resilience theory to their discussion of urgencies in the field of folklore. The paper described how researchers in a variety of fields within folklore are working to build resilience into their respective projects.

Many concepts from within resilience theory have been translated into cultural and biocultural sustainability conversations, as seen in Walker et al. (2004), Gavin et al. (2015), Titon (2009b, 2016) and Richardson et al. (2023). However, these concepts are still lacking in the sustainability discourse within Dhofar. This is discussed in the following section.

2.4.3 Previous work on ecological sustainability in Dhofar

The ecology of the Dhofar Mountains has been a topic of interest due to the unique climate and relative isolation from the rest of the Arabian Peninsula. The biodiversity of the mountains and plateaus has been threatened by human activity such as urbanisation and increased livestock herds (Ball et al., 2020).

Ghazanfar (1998) reported that Dhofar is the most floristically diverse area of Oman with approximately 72% of Omani flora species found in Dhofar (p. 288). A survey of the Khor Rori region, northeast of Salalah, was carried out in the early 2000s and published as a list of flora species and their locations by Raffaelli et al. (2008). This descriptive paper documented the state of the flora in the early 21st century. Galletti et al. (2016) analysed satellite imagery from 1988-2013 looking at vegetation changes in that period. Their conclusions were that the changes in cloud-forest cover are complicated, with some regions increasing in vegetation and others decreasing. They suggest further investigation into this phenomenon.

In addition to these surveys, more detailed studies have been published which describe the uses and local names of the flora. Miller & Morris (1988) is a key resource on this topic as is Ghazanfar's extensive work on the plants of the Middle East. These researchers have been and continue to be proponents of better conservation practices in the Dhofar region.

Spalton has worked on the fauna diversity for decades describing conservation efforts and reintroduction of some of the large mammals such as oryx and the Arabian leopard (see for ex., Spalton et al., 2006; Spalton et al., 1999). Moore is a specialist on the shark species of Oman (Moore et al., 2012) and acted as consultant for other publications from this PhD tenure (ex., al-Qumairi et al., 2024; Watson et al., 2024) as well as contributing to two chapters in the volume *Harvesting the Sea along the Southern Arabian Seaboard* (Watson, Morris, et al., in press). Compared to research conducted in other regions, such as the UK, there is limited quantitative data on the health and abundance of species in Dhofar.

Strategies for sustaining resilience have been worked out in several North American settings (Richardson et al., 2023), and in theory for biocultural systems (Gavin et al., 2015), but this has not yet been applied in the Southern Arabian context. Chapter 6 of this thesis describes

factors affecting biocultural diversity in Dhofar and gives suggestions for how adaptive management could be employed.

2.5 Conclusion

The goal of this thesis is to encourage greater resilience of the biocultural diversity of Dhofar and al-Mahra by exploring the links between the language, culture, and ecosystem.

The Mahra governance institutions are not well-documented. This research will extend the published information about these institutions and, based on Ostrom's eight design principles, analyse their resilience in Chapter 4.

The link between the ecosystem and the language and culture of Dhofar and al-Mahra is valuable to understand how the human population has sustainably interacted with their environment in the past. This link will be explored through ecological vocabulary, semantic extensions, and seasonal activities in Chapter 5.

The biocultural diversity of Dhofar and al-Mahra has been significantly impacted over the past 50 years, but little attention has been paid to the adaptations developing around this impact. Chapter 6 will examine the factors affecting the biocultural diversity in light of resilience theory and adaptive management strategies and gives suggestions to strengthen the biocultural resilience.

The next chapter will describe the methods used to accomplish these goals.

3 Methodology

This thesis provides one step toward strengthening the resilience of the biocultural systems of Southern Arabia by exploring and describing the link between endangered languages, cultures, and ecosystems. Three questions are investigated:

1. How do traditional Mahra governance institutions conform to the patterns found in long-lived governance institutions elsewhere?
2. How has the ecosystem shaped the language and culture of the Mahra?
3. How have the Mahra adapted to the disruptions to the biocultural systems and how can those adaptations be managed to increase the resilience of those systems?

These questions are explored with the long-term aim of continued collaboration with community members to connect the indigenous knowledge of the Mahra to ongoing modernisation of the region.

Methods for data collection and analysis were ethnographic in character with adaptation for travel limits imposed during the COVID-19 pandemic. By late-2021, travel restrictions eased enough to allow for one month of fieldwork in Salalah, Oman in November. Further data was gathered during fieldwork in Dammam, Saudi Arabia from June 2022-May 2023. Because travel was restricted during the first eighteen months of this project, data was also collected online. Online interviews became possible when the Omani government lifted online video calling restrictions in 2020 but are still restricted in Saudi Arabia.

While on fieldwork in Oman, I travelled to various ecological regions in Dhofar (see Figure 2) and photographed as many plants as I could find. When in Salalah, I visited family homes and conducted group interviews with knowledgeable speakers and their families about the photographs. I also participated in aspects of daily life including eating meals together, helping with childcare, shopping, and visiting other family members. While on fieldwork in Saudi Arabia, I translated archived videos, documented dialectal variation within Mehri, and began developing e-books for children with a view to increase the perceived value and use of the language, thereby strengthening its resilience. Online work included interviews with

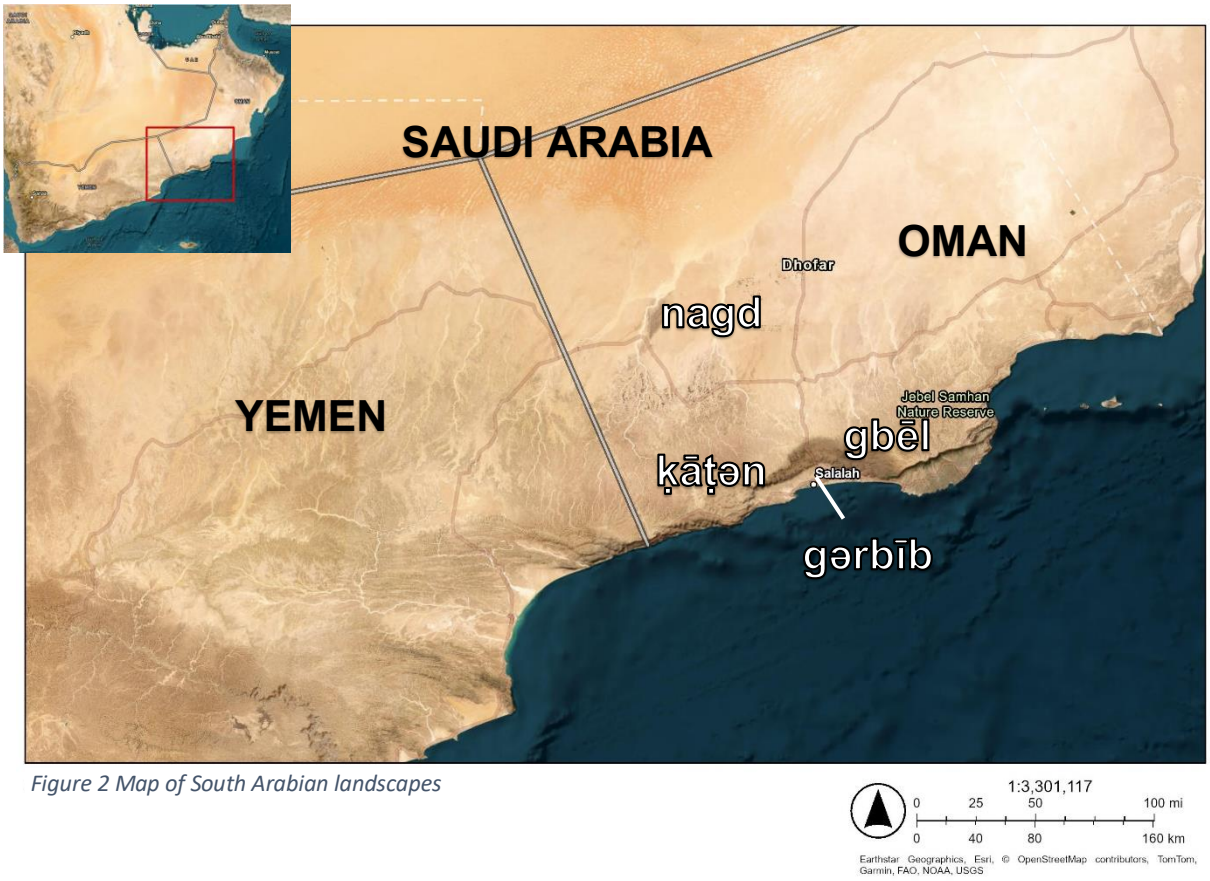

Figure 2 Map of South Arabian landscapes

individuals and collaborations on conference presentations, book chapters, journal articles, and e-resources.

Secondary data was drawn from the DEAMSA project (Eades & Morris, 2016; Morris, 2016a, 2016b; Watson & Morris, 2016a, 2016b) and the Community Documentation of Biocultural Diversity in the Eastern Yemeni Province of al-Mahra, Yemen project (al-Qumairi & Watson, 2018) both hosted at the Endangered Languages Archive (ELAR https://www.elararchive.org/). These recordings were transcribed and translated into English, and sometimes Arabic, either prior to the research beginning or in partnership with native speakers during the project. The transcribed and translated texts were coded and sorted using NVivo, a mixed-methods data analysis computer programme. Coding is discussed further in 3.4.3.

3.1 Rationale

This section describes my positionality, core values, interpretation of the concept of 'indigenous', and a reflexive method called action research method.

3.1.1 Positionality

The suitability of methodologies for investigating institutions, exploring linguistic and ecological links, and analysing disruptions to biocultural systems was determined in part by my position as a researcher in Dhofar.

While I was in Dhofar, I did not fit within the community accountability structure through tribal or family membership. Thus, from a Dhofari point of view, I was an outsider: someone without connections and investment within the community. It was riskier to work and associate with me than if I were an insider, someone with family and community responsibilities and investments. This was mitigated in part by my introduction to the community in person and through previous online collaboration during COVID, both facilitated by Professor Watson who is an adopted insider.

As an outsider, I can function outside of local social constructs. However, to build relationships and trust with my hosts, I chose to follow several local social conventions. I relied on my relationships within the community and the advice of Professor Watson to continually assess my presence and actions.

One of the social constructs that I was less bound to than women in the community is the restriction on mixed gender groups outside of my household. For example, when I visited families, I met with both the men and the women of the household rather than just the women. Another example is that our male hosts would take me and Professor Watson on excursions to see local plants. This freedom accelerated my research and broadened its scope.

However, being a woman within the Dhofari context meant letting go of some of the agency and choice I am entitled to in my home culture. The way that I dressed reflects this shift. In Dhofar, I chose to cover my head and wear the traditional house-clothing (called *xəlayḳ*) when in other people's homes. When outside people's homes, I kept my head covered, but wore long, loose-fitting skirts and tops.

Another way my agency shifted was that my hosts expected to be involved in things that I assume are personal. For example, while in Salalah I developed a minor infection which

needed antibiotics. One of my hosts was very upset that I went to the hospital on my own, not letting him know that I was unwell or asking for accompaniment to the hospital. My initial reaction to this was to assume that he wanted control over my movements. I think, now, though, that there was also an element of his honour being at stake – if anything was seriously wrong with my health or went wrong in the process of finding care, his good standing in the community was at stake because a good host ensures the wellbeing of his guests. This tracking of my movements continued for the month I was in the region; if I didn't go to visit his family in the evenings, I usually heard about it through another contact or Professor Watson – he wondered if I was still ok.

A second aspect that makes me an outsider is my Christian faith, which contrasts to the local expression of Islam. In Dhofar, Christianity is often seen with a certain amount of suspicion and expectation of missionary activity. Religion is often a topic of conversation and I have had many people tell me that they will pray that I will become a Muslim one day. Usually this is done with good intentions – they want good things for me and in their view that comes from following Islam. In my experience, Omanis have been very tolerant of my presence, even when I do not convert to Islam when they suggest it to me, and I am deeply honoured by their trust and hospitality despite the 'otherness' I bring.

A third aspect of my outsider status is meta-language. The Dhofari community is almost entirely bi- or multi-lingual, so choosing one language to conduct research in was never a consideration. My own language skills developed over the course of the research, but I still rely heavily on being able to function in English. This research was done either in partnership with locals who speak English and translate or through recordings in MSAL later translated into Arabic and English. Some interactions, especially in people's homes in Salalah, used a mixture of Arabic and Mehri. In line with this, outputs have been published in several languages. Some were in English, especially academia-focused outputs such as journal articles and conference papers. Others were in Arabic, such as an e-book on traditional skincare; and others were in Mehri, such as a photo montage with a recording about landscapes in Mehri. Most interviews were conducted in English with some Arabic or MSAL, and the survey was mostly conducted in Arabic. In general, the intended audience

and my consultants determined the meta-language, but my limited proficiency in Arabic and MSAL was a determining factor in both choice of methodology and consultant.

A final example of my outsider position is the ability to take the knowledge I gain and publish it outside of Dhofar where it will be largely inaccessible to Dhofaris. Again, this has been mitigated to an extent by Professor Watson's longstanding collaboration with Dhofaris and her efforts in involving Dhofaris in research dissemination and in the production of educational materials. This is something I have tried to emulate in my own work.

My position within this community was that of an outsider, however the Dhofaris treated me with incredible grace and hospitality. My influence and connections outside of Dhofar meant that my honour was not tied to the region's wellbeing, making it risky for Dhofaris to work with me and teach me about their way of life. I continue to strive to honour the gift they each gave me by giving back at every opportunity.

3.1.2 Core Values

My identity and my values shape the implementation of methodology. As a white, Canadian, Christian researcher, it is important that I acknowledge and resist the colonial history of my people, my religion, and some of the research that has gone before mine. I hold two core values in resistance to these colonial attitudes.

The first is that I believe fundamentally that every human being is intrinsically and uniquely valuable. Any methodology that leads to the exploitation of human beings is unacceptable. This has meant constant re-evaluation of methods of approaching and collaborating with consultants. It has also meant that my own goals sometimes came second to honouring the people I worked with.

The second core value lies in the nature of knowledge. According to Richardson et al. (2023), epistemological sovereignty is part of decolonising research. To me, epistemological sovereignty is the freedom to know the way the world works and how one fits into it from one's cultural basis. It is the freedom to consider other worldviews, learn other perspectives, stretch one's understanding of the world, and crucially, accept or reject other ways of knowing and being.

Colonial agendas do not allow this freedom. Colonial powers arrive with religious agendas, commercial aspirations, and/or superiority complexes that dismiss, ignore, belittle and exploit the people and ecosystems they encounter (Smith, 1999). The expansion of western colonial powers in the 18th and 19th centuries also expanded European epistemology across the globe. This epistemology carries assumptions about the way the world should be divided (plant vs animal vs mineral; living vs not living; related, but distinct species), time (moves forward linearly, counted by a clock and calendar), geographical orientation (either egocentric: right vs left; or geocentric: north, south, east, west), etc. (Smith, 1999). These assumptions are not often challenged within Western academia, but they are not universal. For example, the Mahra categorise things in the world differently including a spiritual element which shapes their worldview and actions (Miller & Morris, 1988; Tabook, 1997); time is divided by the height of the sun, which remains largely stable throughout the year (Wilson et al., 2022) with the addition of the Islamic calendar shaping life-rhythms (Russell, 2021); geographical orientation is defined by upstream and downstream which vary depending on the point of reference, i.e., which side of the escarpment mountains one is on.

Some examples of the difference between my epistemology and that of the Mahra are as follows. When in Salalah, I know that Gibgat is a town in the mountains roughly north, and further north and a little to the west of Gibgat is Rabkut. The families I work with are closely linked to these two towns. However, the Mahra know that Gibgat is upstream of Salalah, but Rabkut is downstream from Gibgat. This is because Gibgat is close to the pinnacle of the escarpment. I know that the sun, sky, and plants are yellow, blue, and green respectively. The Mahra know that *ḥə-yawm* 'the sun', *háytəm* 'sky' and *śəgərēt* 'plants' are all *ḥśawr* and if more description is needed, then expressions such as *ḥśawr* like the sun, *ḥśawr* like the sky or *ḥśawr* like the plants could be used for clarification. On the other hand, when I look at a camel, I may describe it as light brown, brown or nearly black. The Mahra have at least nine words for camel colours:

āfərūt 'bay'
ḥazmayyət 'black'
ūbənīt 'white'
həśrīt 'between white and bay'

mlaḥt ‘peppered’
žūdayyət ‘bright white’
səḥwīw ‘fawn-coloured’
ḥūḳāḳ ‘dark bay’
ṣəḥmēm ‘dark brown’ (Boom et al., 2021)

These are largely different from the words used for describing goat colours. The lexical density in colour words to do with describing camels and goats in Mehri and to do with describing sun, sky and plants in English are examples of how the two languages categorise the world differently.

In addition to decolonisation, epistemological sovereignty is central to resilient biocultural diversity. Increasingly, published research points to the centrality of local knowledge (epistemology) in local sustainability efforts (Dunn, 2017; Gadgil et al., 1993; Gavin et al., 2015). This 'discovery' by Western academia is not new for the indigenous peoples whose traditional knowledge has sustained human populations for millennia. However, in Dhofar, the younger generation have transitioned from nomadic or semi-nomadic lifestyles to sedentarised, digitised and globalised lifestyles and are not learning the traditional knowledge. This thesis strives to bridge the gap between the indigenous knowledge of the Mahra and Western knowledge, which has greatly increased the standard of living and health outcomes for the Dhofari people. My long-term aim beyond this thesis is to collaborate with community members to attempt to build resilience into the biocultural systems of the region by integrating Western and traditional forms of knowledge (epistemologies). This thesis provides one step toward greater resilience in these systems because it describes and analyses the local institutional framework, the local language’s links to the environment, and current disruptions to the biocultural systems.

3.1.3 A note on the use of the word ‘indigenous’

Indigenous, in its general sense, means “born or originating in a particular place” but carries a secondary sense of doing so prior to the arrival of (European) settlers or colonizers (OED, 2023). The secondary sense often, but not always, carries a capital initial: Indigenous.

In this work, I use the word with a lower-case first letter in the general sense of the word – originating from a particular place. In this sense, Germans are indigenous to Germany, the

Mahra are indigenous to modern-day Dhofar, al-Mahra and southern Saudi Arabia. This can also be used in terms of languages and cultures – the German language and culture is indigenous to Germany and Mehri language and culture is indigenous to Dhofar, al-Mahra and southern Saudi Arabia. Indigenous languages and cultures carry adaptations that are a result of the region they are indigenous to (this is further explored in Chapter 5). When links to the indigenous region are loosened or lost, those adaptations are in danger of being lost as well. I occasionally use the term Indigenous (with a capital 'I') to refer to the original tribes who lived in North America prior to European colonisation.

There are times when the term Indigenous is used as a delineation between Western, industrialised cultures/people/languages and non-Western cultures/people/languages with unhelpful assumptions and attitudes. This delineation is problematic because it turns the conversation away from agency in adaptation and toward categories. In the literature and research attitudes, discriminatory sentiments can still be found, such as: that group is Indigenous and cannot benefit from modernisation without losing their cultural identity; that Indigenous language must be preserved in its pure form, free from external influences; and that Indigenous knowledge is irrelevant in this context so we should adhere to the "real" methods.

This discussion of indigenous/Indigenous is not to dismiss the damage done through the oppressive processes of colonisation that have led to the erasure of identities. This is also not to block or reverse modernisation. The goal is to move away from the Indigenous versus non-Indigenous debate and to consideration of building resilience and meaningful adaptations. Western thought and science are treated as one way of knowing and doing in this research, Mahra thought and science are treated as another way of knowing and doing that is different, not better or worse.

3.1.4 Action research method

Once I had selected and implemented research methods that conformed to my core values and were suitable within my position in Dhofar, I continued to re-evaluate them using the action research method: a cyclical method for analysing and immediately improving outputs or methods (Moura et al., 2019). Using this method, the researcher makes changes to their

approach and monitors the effects of that change. They then either implement those changes more broadly or investigate the impact further before extending the implementation. In Dhofar, a researcher who is not reflecting on what is going well and what is not could find themselves alone and without consultants (Risse, 2019). For example, Tabook found that his consultants would get bored and wish to take a break and then not return to the recording session: "the pretext usually being that that [sic] they had remembered something urgent that they had to do" (Tabook, 1997, p. xxvii) and so he adjusted his methodology accordingly by asking questions about topics he knew his consultants were interested in, or offering short breaks during recording sessions.

In contrast, when research consultants are comfortable correcting and directing the discussion, far richer understandings of the topics being explored are possible. For example, when interviewing M003 about institutions in Dhofar, he would often hear my question and take time to first explain something more fundamental in Dhofari society than the subject of the question. He recognised and addressed the underlying cultural and theoretic assumptions behind the questions. This helped my understanding of the institutions tremendously and gave deeper understanding of the answers to the interview questions.

3.2 Ethics

As this research focused on human experience and interaction with the ecosystem, several ethical issues arose including institutional approval, informing participants of the goals of the research, gaining their consent, and storing data securely.

Institutional ethics approval for this research was granted September 2021 by the University of Leeds Arts, Humanities and Cultures Faculty Research Ethics Committee, approval number: FAHC 21-008 (see Appendix 5).

Participants were informed of the reasons for the research, how their data was stored, how to contact me or Professor Watson to withdraw their participation, and what type of outputs were planned. The participant information sheets were available in Arabic and English. Once that information was shared, participants were given a consent form on which they indicated which activities they were willing to participate in and whether photographs

of them or recordings of their voice or person could later be shared. Illiterate participants gave their consent verbally, as did online interview participants. Appendix 6 includes the participant information sheet and Appendix 7 includes the consent form presented to participants prior to collaborating.

Care was taken in the interview process, both in person and online, to mitigate any sensitive topics and allow participants to direct the topic of conversation or leave uncomfortable questions unanswered. Children were automatically excluded from the online survey, and they did not participate in interviews online or in person. Personal information and consent forms were stored on an encrypted drive and the University's file system, separately from recordings and field notes. Anonymisation of participants was carried out prior to coding and analysis of the recorded data.

3.3 Data collection

3.3.1 Participant recruitment

Research participants are central to ethnographic research and so, to investigate institutions, explore language links with the environment and understand disruptions to the biocultural systems, I developed relationships with knowledgeable speakers of the local languages and their families.

Many anthropological methods for finding consultants involve arriving and settling into a chosen community (Papen, 2020). This has proven effective in many circumstances and a careful description of many cultures has been published for Western audiences because of such methods (see for ex., Risse, 2019; Russell, 2021). However, this method has been criticised due to the power imbalance between researcher and those being researched (Smith, 1999). There are strategies and attitudes that help mitigate this power imbalance and the researchers mentioned above take these into consideration.

One of those mitigating strategies is having an introduction into a community; as discussed above, this is one of the ways I was able to enter the Dhofari community. Professor Watson introduced me to three families, and each family also introduced me to more of their friends

and family members in and around Salalah. The initial introduction led to further invitations, which is a second mitigating strategy for entering a community.

I received an invitation either deeper into the community in Dhofar or to partner with Mahra in other areas a few times during this research project. There is still an imbalance of influence – I still hold more influence in communities and institutions outside of the Mahra sphere of influence, and my Mahra contacts are gatekeepers for the wider Mahra community. This presents something of a risk to the community I work with (see 3.1.1): I could take the information and leave, I could misrepresent the information to my wider spheres, etc. However, when others, such as members of the Mahra tribe, initiate the conversation, perhaps by inviting collaboration, they have greater agency to direct the research in ways that interest them. This collaborative dynamic can sometimes develop over time. For example, I have a consultant in Saudi Arabia, M100, who began working with me on translating videos. As we translated information, she grew increasingly interested in the topics. Then we submitted an abstract to give a presentation about her use of Mehri as a member of a minority people and she grew increasingly enthusiastic about telling her story. Following that, she decided she wanted to write children's books in Mehri, like the one published by al-Mahri et al. (2023). While the work we are doing together is not strictly research, it is developing new resources in Mehri for Mehri speakers and has developed into something my consultant is starting to take a lead in.

3.3.2 Data gathering techniques

Data was gathered on a fieldtrip through Dhofar, Oman over four weeks in November 2021 and Dammam, Saudi Arabia from June 2022-May 2023, as well as through online collaborations and WhatsApp conversations.

Methodologies from social science disciplines such as institutional economics, resilience and adaptive management, linguistic ethnography, and biocultural diversity theories were considered. All these research foci involve exploring human interactions and their impact on various aspects of their environment, often by either directly asking the people involved or by observing them in their environment. This section discusses these methods.

3.3.2.1 In-person interviews

For this research, in-person interviews with knowledgeable Mehri, Śḥerēt, and Hobyōt speakers were conducted using photos taken on outings (for information on photography, see: 3.3.2.4) in PowerPoint presentations and the interview audio was recorded with permission. The PowerPoint files were later used for reference. Bringing the photos to the consultants allowed for greater control over the conversation and less wind interference in the audio recording. This approach also allowed women to stay at home and, sometimes, the possibility for other family members to help. However, in taking this approach, the spontaneity that comes with being outside was lost. Some consultants struggled to identify plants because of poor photo quality or lack of context. In addition, taking the photos to consultants often involved taking valuable digital equipment into the range of small children, and sometimes having family around distracted from the interview process.

An alternative to presenting photos to the consultant was taking the consultant to the site where the plants were growing and documenting the information shared on-site. This approach was utilized effectively during the 2021 field trip. Conducting interviews outside the city with consultants offered the advantage of spontaneous conversations, facilitated plant identification within their natural context, allowed observations of the consultant in a different setting, and provided flexibility in conversation topics. However, drawbacks to this method included potential distortion in recorded sound due to wind, general reluctance from women to be recorded, constraints on the consultant's availability to leave home, and a requirement for physical capability that some older consultants lacked.

3.3.2.2 Online interviews

Interviews were also conducted online through video calls. Online video call technology was blocked in Oman until the pandemic of 2020, so this was a fairly new method in the region. Interviews were recorded when consent was given, but most participants did not want their interviews made available for other researchers, so the recordings remain private. Online interviews allowed consultants to choose where to be during the interview process and for some flexibility in terms of their work schedule and family commitments. Younger participants with greater technological skills were more comfortable with this method than

their elders, so the pool of participants was smaller for online work than in-person. Also, technology is notoriously unstable and many factors on both ends of these interviews influenced the flow of conversation.

Meta-language is something I considered in my online work (and more broadly – see 3.1.1). Many younger Dhofaris have an amount of English, and I have some Arabic and Mehri, so we were often able to communicate with one another. However, there were times when that was more difficult, for example when discussing the hierarchies within the tribal structure, translating words from Mehri or Arabic into English was complicated by lack of equivalent concepts and difficulty in making the information request clear. Also, delays in the internet connection made conversations online difficult when only using one language, and when functioning in two or three languages these difficulties were compounded. Having a recording to refer to later helped with these interruptions, as did keeping notes through the interview.

3.3.2.3 Online survey

Surveys are valuable because they give comparable data across participants. A survey was used in this research to measure people's attitudes toward ecological issues, their botanical knowledge, and to gauge interest in further collaboration.

I chose to use an online survey because a survey could be set up and then require little monitoring of the data collection while it ran, and because it had the potential to gather a lot of data. It also allowed me to filter respondents, if necessary. For example, by asking for a respondent's age group, children could be filtered out immediately.

With the benefits of flexibility and minimal monitoring needed, there were also some shortcomings to this method. The survey required hours to build and test, including considering and justifying which information needed to be gathered for meaningful results. Additionally, it was very difficult to judge whether online survey respondents answered honestly as compared with an in-person interview where I could monitor body language and tone of voice. The online survey was also restricted to people who have access to the internet and are literate, which reduces the pool of potential respondents.

A significant limitation to the online survey in this research was a small number of respondents and their lack of diversity. Eight participants were included in the data, seven of whom were men. This small number and limited diversity are due a few factors: first, personal opinions are only shared with personal contacts, so asking people to fill out and share an online survey is not always the best method to gather data. However, I believe that it was a good complementary method alongside interviews and participant observation. Second, Dhofari women are especially reluctant to express opinions or personal experience, which helps explain why only one participant was a woman. These limitations were mitigated by including participant observation and interview data collected during fieldwork and online collaborations.

The survey was run online instead of in-person due to travel restrictions. The proposed project included a second fieldwork trip to Dhofar, but this was not possible during the project.

Data produced was compiled using the NVivo programme and analysed to determine where resilience is evidenced and where it requires further strengthening. Chapter 6 discusses this analysis and provides future recommendations.

3.3.2.4 Photography

Photography was primarily used to document plant species found during fieldwork and to stimulate discussion and interviews (discussed above in 3.3.2.1). One of the main activities carried out with consultants in Dhofar was traveling to various landscapes and photographing the plants. This provided opportunities for information to be shared about the ecosystem, it provided reason to travel to regions with diverse ecologies, and it involved both younger speakers and their elders, fostering cross-generation communication about topics that are not often discussed.

The still cameras used were a Samsung A705FN phone, Sony DSC-HX350 still camera and Sony HDR-PJ410 video recorder.

Four regions of Dhofar were visited on several occasions – the mountains, *śḥayr* (M), both north of Salalah and west toward the Yemeni border, the plains north of the mountains,

ḳāṭən (M), the increasingly dry regions north of the plains and the gravel desert, *sayḥ* (M), and the coastal plain around Salalah, *gərbīb* (M). Both sides of the mountains were visited – the sea-flowing wadis and the desert-flowing wadis (see Figure 2).

In each of these regions, photographs were taken of as many plants as we could find. At least three photos were taken of each type of plant:

1. A close up of the leaves, stems, flowers, fruit, seeds, etc.
2. A panned photo of the whole plant
3. A further panned photo of the plant in context

The photographs were sorted by date and location and then used in interviews to ask about their local names and how they have been used in the past. Since the focus of the research was not biodiversity mapping, the photography was not as systematic as would be needed for a biodiversity survey. Instead, the photography was executed in locations the consultants knew well.

The metadata was recorded for each photograph and collected into a spreadsheet. Also, the photographs were catalogued based on the research trip and local names. The data management structure applied to these files can be found in Appendix 4. The photographs and metadata will be uploaded to the DEAMSA project on ELAR found at the following URLs: https://www.elararchive.org/dk0307 for Mehri data and: https://www.elararchive.org/dk0308 for Śḥerēt data.

3.3.2.5 Video and audio recording

Another important step in data gathering is recording either video or audio. Video recordings were one of the richest sources of data because they include the language in context as well as the person's bearing, tone of voice, body language, etc. Audio recordings were more acceptable to the women who participated in the research. Recordings were transcribed and coded using ELAN (https://archive.mpi.nl/tla/elan), a linguistic transcription programme, and NVivo, a mixed-methods data analysis programme. Coding of this data is explained in 3.4.3.

I made my own recordings in the field using a Sony HDR-PJ410 video camera and an Olympus LS-11 digital voice recorder. The future use of recordings depends on the participants' wishes. Many women in Dhofar did not want their voices shared with people not present during the interview, especially other men, so those recordings are kept for personal use only. Other consultants were happy to have their voice and knowledge shared with others. Those recordings will be archived and made available online through the ELAR archive.

In addition to my own recordings, I also used previously recorded data held at ELAR. These recordings gave insight into linguistic and cultural understandings and assumed knowledge. They often required consultation with at least one other knowledgeable speaker to interpret accurately. For example, in a recording in which participants discuss how they would shelter from wind in the past, one participant mentions a plant called *awṭayb* in Mehri, stating that it was used in building shelters. However, according to my audio recordings, *awṭayb* is a small, grass-like plant *Crotalaria aegyptiaca* (see Figure 3). Professor Watson consulted

Figure 3 awṭayb in Rabkut

another Mehri speaker who explained that the plant was used to block gaps between larger plants in wind shelters. This was assumed knowledge in the first recording about wind shelters and only by triangulating the information could a full understanding of the original recording be reached.

3.3.2.6 Participant observation

Participant observation is, simply put, being present and paying attention (Papen, 2020). A researcher is a participant in the social phenomenon being studied and an observer of that social phenomenon (Campos et al., 2019). Holding the participant and observer identities in tension is important and a discussion of a researcher's positionality is necessary. My positionality is discussed in 3.1.1.

In this research, field observations shaped my understanding of the culture. This included observations about how individuals interact in their homes and how they prepare for interactions outside of their homes; who holds the knowledge about the ecosystems and who is interested in learning about it; hospitality and the types of things that my hosts expected me to communicate with them. The participation included traveling together to visit relatives in other towns with stops for photographing plants along the way, listening to stories about raising children and how the land has changed recently, entertaining small children and eating meals with the family. And keeping a field journal to remember the things that I saw, thought, and experienced.

My field journals grew with my research. The content of what I recorded and how I recorded it developed over the course of the project. I have drawn on these journals for insights and future research possibilities. They also hold many stories that I have used as topics for conversation with consultants giving further insight into the culture. This collaborative process helps me to understand the experiences from their perspective giving me further insight into my own positionality and their culture.

3.3.2.7 Expert consultants

Lastly, other researchers with expertise in one of the areas of research were consulted. Shahina Ghazanfar at Royal Botanic Gardens, Kew is an expert in the flora of the Middle East

and has assisted in connecting Western botanic names with local names of plants. Likewise, Miranda Morris has assisted in understanding the historical cultural context of the Mahra. She spent many years living among the people of Southern Arabia during the socioeconomic shifts of the 1970s and 1980s. Her expertise in the languages and culture helped clarify points that were opaque even after consulting multiple Dhofari colleagues.

3.4 Data analysis

The data, sourced from ELAR and gathered personally, was analysed using several methods including case studies, triangulation, transcription, coding, and discourse analysis. These methods are used in the fields of institutional economics, resilience and adaptive management, linguistic ethnography, and biocultural diversity analysis. The following sections describe these methods and how they were implemented in this research.

3.4.1 Case studies

A case study begins with an observation or a question, and data is collected related to it; that data is then narrated in a report as a description or comparison (Moura et al., 2019). Participant observation data can be used to help build a case study. Alternatively, more focused data gathering methods can be employed such as semi-structured interviews or Q methodology.

In this thesis, case studies are included in each of Chapters 4-6, though Chapter 6 includes a more in-depth case study of the impact disturbances are having on the biocultural diversity of the region.

3.4.2 Triangulation

Triangulation is cross-checking. All the data were triangulated at least once, often many times. Sources include ethnographies from Dhofar (see for ex., Chatty, 1987; Risse, 2019; Russell, 2021; Tabook, 1997), near-culture ethnographies (see for ex., Altorki & Cole, 1989; Dresch, 1989), consultants from a variety of areas within Dhofar, Yemen and Saudi Arabia, expert consultants, and near-culture contacts (e.g., from other Arab backgrounds). The term

‘near-culture’ is used here to describe a culture that shares some common elements such as religious background, ecological situation, and/or social structure.

Near-cultures to the Mahra include other societies that are largely structured by tribe, have Islamic roots, and/or have developed in a similar ecological setting, that is, mainly arid. This is not a scientific measurement; it is a subjective judgement acknowledging some common elements found between some cultures and not in others. For example, Mahra tribal culture has far more in common with that of the Śḥerɛ̄t speakers in the Dhofar mountains, or Arabic-speaking tribes to the north and west than with urban British culture.

Triangulation often leads to deeper insights beyond simply checking accuracy or comprehension. Almost every time some element in the data was checked, I learned about other aspects of the language, culture, or ecosystem.

Triangulation helped ensure that the data was not skewed by heavy reliance on one or two consultants. Saying ‘no’ to a question can be viewed as shameful, so some consultants may be reluctant to say, ‘I don’t know the answer to your question’ and might make something up on the spot. In fact, M026, one of my consultants in Salalah, introduced me to an expert in the local botany, Ahmed. When asked about a particular plant, Ahmed told us that he did not know it and M026 said, ‘He’s a good man because when he doesn’t know the plant he says so.’

Similarly, M003 pointed out that one or two consultants could have ulterior motivation to skew cultural information, for example for prestige. In his interviews, he carefully anonymised all his stories and repeatedly suggested I ask other members of the Mahra tribe for similar stories. By asking more than one consultant from different tribes about these issues, I built a more widely accepted picture of the biocultural links.

3.4.3 Transcribing and coding qualitative data

Another tool used for data analysis was transcription. Field notes and journals were typed on a word processor. Audio and video recordings were transcribed in the ELAN programme either with Roman letters and diacritics or in Arabic script. They were then translated into English and Arabic. Translation into Arabic supports working with consultants with lower

English proficiency and makes the information available to those with limited proficiency in MSAL. The resulting files were checked with native speakers. Many archived files had already been transcribed and translated and a few were transcribed and translated in the process of the research.

The transcription files were then imported into NVivo. NVivo allows users to code sections or words in a text and then collate all the labelled text into a summary. Codes can also be nested into broader topics or concepts and analysed from a wider point of view.

Texts from ELAR and from Professor Watson that are transcribed in Mehri or Śḥerēt and translated were imported from ELAN into NVivo. Once in NVivo each text was coded for:

- Speaker – Each speaker code was linked to the following information: age, gender, tribe, location. This information was gathered from Watson's metadata. In the archived material examined here, there are 16 Mehri speakers and 5 Śḥerēt speakers. The language of each speaker is in their speaker code – J for Śḥerēt (also known as Jibbāli) and M for Mehri. The speaker codes follow those used for the DEAMSA project (see Speakers).
- Vocabulary in Mehri and Śḥerēt – Each vocabulary item is categorised under one of the languages. Below the language level, I created broad categories of topics. These codes are used for linguistic analysis and discourse analysis in Chapter 5.
    - Colours
    - Fish
    - Food
    - Insects
    - Livestock
    - Material culture – includes cultural artefacts that were made and tools used
    - Place names – includes words for water, landscapes, and toponyms as sub-topics
    - Plants – includes words for plant parts such as roots, leaves, etc. in a sub-topic
    - Tribal structure – vocabulary words related to governance including tribe and sub-tribe names
    - Verbs – verbs that link with other vocabulary topics.
    - Weather words
    - Wild animals
    - Codes that do not fit into any of the broader categories
- Literary devices – this heading includes interesting expressions and word-usage including:
    - Reduplication
    - Elongation
    - Story

        - Hypothetical ‘if I did… then this would happen’
        - Historical ‘one day this thing happened’
    - Do you see/hear me
    - It turned out – *śef*
    - In the past/nowadays – included to compare factual information and attitudes about the two timeframes
- Institutions
    - Ostrom’s 8 principles – coded for each
        - [clearly defined] Boundaries
        - Rules [suitable for] local needs
        - Modifiable rules
        - Respect from external authorities
        - Self-monitoring
        - Graduated sanctions
        - [low-cost] Conflict resolution
        - Nested structure
    - Resilience characteristics – coded for each characteristic but they are less well-defined than the principles of healthy institutions and it is harder to find examples within existing texts.
    - Mahra traditions
        - Family
        - Elder care
        - Generosity
        - Hierarchy
        - Honour
        - Islam vs tribal law
        - Marriage
        - Neighbours
        - *ṣūrəḥ ḍə-Mahra* [roughly translated ‘laws of the Mahra’]
        - Trade
        - Women

While coding, a journal was kept including future research topic possibilities and questions to investigate as well as observations about the data. These form the backbone for the analysis of the coded material.

This data is rich in connections and information, but it does not lend itself to word frequency counts and percentages. This is because most of it is in both MSAL and English and the MSAL transcriptions are not always consistent. For example, the same word is sometimes transcribed with a schwa and other times with an /a/. This leads NVivo to count them as separate words. Also, translation is not literal, so a word could be translated

differently depending on the translator or the context. This means that English count words, which should have less spelling variation, also do not give clear insights into the data.

This data also requires constant triangulation and consultation. There are times when it brings up more questions than answers and the assumed knowledge can be quite high, especially in recordings done by local researchers rather than outside researchers. I used a journal to track the questions and answers related to the recordings.

3.4.4 Discourse/linguistic analysis

I analysed interview recordings and archived data using linguistic methodologies. This included analysing the lexical semantics (vocabulary meaning), morphology (word-building processes) and discourse. Semantic and morphological analysis were done by exploring patterns that bear cultural significance – for example, related words linked to activities and landscape. Literary devices, idioms and stories, or 'discourse' all give evidence for how the world is viewed through the lens of the culture.

3.5 Linguistic and botanic conventions

In this section, I discuss definitions and nomenclature conventions which are important for the presentation of data and analysis in the rest of the thesis. Data presented in later chapters include quotes from archived recordings, definitions of words or groups of words, poems, and botanic nomenclature. The information presented here gives information on how the data are presented.

3.5.1 Language notation

This thesis follows the *Journal of Semitic Studies* (JSS) guide for transcription of non-English words into Roman script (https://static.primary.prod.gcms.the-infra.com/static/site/jss/document/journal-of-semitic-studies-style-sheet-2023.pdf?node=8468cea1f21de9ac1a5d see especially p. 7). Since the languages discussed here have some phonemes not found in Arabic, some of the consonant transcriptions are not found in the JSS StyleGuide. The transcription and description of those consonants are discussed below.

3.5.1.1 Transcription notation

Throughout this thesis I use *Journal of Semitic Studies* notation rather than IPA. This is mostly because the source texts use this notation but also because the transcriptions are not meant to make claims about the acoustic qualities of the phonemes beyond the broad categorisations in the tables above. These acoustic qualities vary according to tribe and geographic location and the purpose of this research was not to describe allophony in the languages. When IPA is given, it is in square brackets.

When the Mehri is within the paragraph structure, for example, "*rīyēḥ*, pl *rīḥayn* means 'hot or very hot wind' with a relentless and exhausting connotation" (from 5.2.2.1 ex. 8) then every effort has been made to be consistent in spelling; any omissions or inconsistencies are mine. When Mehri is given in a tabbed paragraph with a morpheme-by-morpheme gloss, the spelling matches the source of the quote. For example:

1. *yəkūn* *līham* *arīyēḥ* *ḥābū* *nhūran* *mən* *k-sōbaḥ*
   be.IMPERF.3.M.SG to.3.M.PL hot.wind people daily from in-morning
   attā: *ġasā:rawwan* [5]
   until evening
   'people have hot winds from the morning until the early evening'

Sources for the quotation are given in footnotes following the Mehri/Śḥerēt line in the example. This is to maintain readability. The sources are often recording names from ELAR, such as 20161114_MehriRabkut_M019_winds. This string can be entered into the search bar in ELAR to access the recording. Other quotes are taken from Johnstone (1987) and are cited with their page reference in the footnote as well.

3.5.1.1 Some notes on transcription

Some phonemes are transcribed differently by different researchers. In Johnstone (1987), Sima (2009), and Rubin (2010, 2018) /ś/ is represented as /ź/ because it often carries some voicing. In this thesis, when the data is taken from Johnstone it is referenced and his spelling

[5] 20161114_MehriRabkut_M019_winds

is maintained. If I have checked the pronunciation of the word in question with another Mehri speaker, I use /ṣ́/ instead of /ź/.

In addition, emphatic interdentals vary in transcription from one author to another. Professor Watson transcribes this sound with a voiceless place of articulation: /ṯ/ but both Miller & Morris (1988) and Johnstone (1981, 1987) transcribe it with voicing: /ḏ/. I follow the source of the data, maintaining /ḏ/ when quoting Johnstone and Morris, and Watson's transcription when transcribing data myself.

3.5.1.2 Translation

Meta-language is discussed in 3.1.1. As stated there, I have limited proficiency in Mehri and Arabic and very limited proficiency in Śḥerēt. The research was conducted largely in English or through English-speaking interpreters. Translations were built from the resources already mentioned: *Mehri Lexicon*, *Jibbāli Lexicon*, and *Hans Wehr Arabic-English Dictionary*, as well as *Təghamk Āfyət* (Watson et al., 2020) and in consultation with native speakers.

Translations given in single quotes: ‘ ’ are loose translations meant to provide an English reader a close sense of what is meant by the Mehri word/s; some liberty is taken to provide a smooth reading, but meaning is inevitably shifted or lost in translation. One example of this loss is in the *Mehri Lexicon's* presentation of verbs. As with many Semitic-English dictionaries, the *Mehri Lexicon* (Johnstone, 1987) gives Mehri verbs in the 3.M.SG perfect

(see Abbreviations) form but translates them to English using the infinitive form even though there is no infinitive verbal form in Mehri. The 3.M.SG perfect verbal form is typically used in Semitic descriptions as the base-form of a verb because it has no concatenative inflection and the vowels are fairly predictable. When directly quoting the *Mehri Lexicon*, I retain the infinitive translation; in morpheme-by-morpheme glosses, I always gloss the aspect and person-gender-number inflection rather than giving the infinitive form in English.

Translations in tabbed paragraphs (as given above in example 1) are glossed morpheme by morpheme using Leipzig glossing conventions with the following notations to indicate morpheme boundaries when possible:

.	delimit morphemes that are non-concatenated, ex. *yḥaym* means 'they m. want'; a glossed translation would be: want.IMPERF.3.M.PL
/	signal a pause in a recording, the speaker paused at this point in their discourse
ALL CAPS	used for morphemes linked to inflection, aspect, voice, case, and word type which are non-concatenative ex. *yḥaym* want.IMPERF.3.M.SG
-	used for boundaries of concatenative morphemes, ex. *l-ḥəḳ* to-up. Some morphemes have a concatenative and non-concatenative component; for example, the inflection for third person, masculine, plural in the imperfect aspect includes both the prefix *y(ə)-* and an internal vowel shift. These are marked with ALL CAPS abbreviations

Table 3 Gloss notation

3.5.2 Botanic nomenclature

Botanic nomenclature is italicised and given in the format of *Genus species*, with the genus name capitalised, for example *Aloe dhufarensis*. This nomenclature is standardised (Turland et al., 2018) and therefore accessible in most Western scientific settings. If an English speaker took a botanic name from this thesis and entered it into a search engine, they could be confident of finding at least some information on the plant online. This is less certain with plants that have severely limited range, for example plants that only grow in a small area of Dhofar. However, indigenous plant names are far less likely to produce information in an internet search, especially non-English indigenous plant names.

Western botanic nomenclature changes over time. Until recently, scientific nomenclature was based on phenotype (how a plant grows) as opposed to genotype. Phenotype is somewhat dependent on location. For example, the same type of plant might look quite different when growing in a sheltered location than on an exposed cliff face (see Figure 35, Figure 36, and Figure 37). Therefore, some plants that were categorised together before

have been divided into new categories following genetic testing, and some plants that were previously categorised separately have recently been grouped together. Plants of the World Online (POWO – https://powo.science.kew.org/) provides lists of synonyms and the accepted nomenclature, however, usage does not always follow scientific naming. In this thesis, if the currently accepted nomenclature for a plant is different than the one used by Dhofaris, it is given in a footnote in the first instance. Thereafter naming follows Dhofari usage.

There are some botanic names which have been borrowed into common usage in English, for example, aloe. When 'aloe' is used to generally refer to the aloe genus, it is not italicised. For example, "I have a few aloes growing in my garden." However, when discussing plants in context, aloe is the genus and the species name will follow: "*Aloe dufarensis*, *ṭayf* (M) can be found in higher areas of the escarpment whereas *Aloe inermis*, *sēḳəl* (Ś and M) is found in more sheltered areas in the wadis."

Botanic names of the Dhofar plants were found using several online and printed resources. One was Shahina Ghazanfar's personal list of vernacular names linked with the Latin names. Her transcription of vernacular names lacks some phonemic contrasts. For example, there is no distinction between the Śḥerēt /ś/ or /š/ and there are no diacritics indicating fricatives, so the contrast between /ṯ/ and /th/, for example, is lost. When there was a reasonable amount of certainty that the vernacular name in Ghazanfar's data matched the one recorded during my fieldwork, a Google image search was conducted to verify.

I also consulted Ghazanfar's *Handbook of Arabian Medicinal Plants* (1994) which includes some drawings of plants and information about their medicinal uses. This book had some information that I was unable to find elsewhere, but its geographical scope is wider than mine, so while it is an excellent resource for identifying plants in the Middle East and their uses, only a subset is found in Dhofar. In addition, I consulted Ghazanfar's *Annotated catalogue of the vascular plants of Oman and their vernacular names* (1992) where again, transcription lacks some contrasts found in the source languages. Also, this book reports Arabic, Dhofari Arabic, Ḥarsūsi, and Śḥerēt vernacular names but not Mehri. Often the Ḥarsūsi or Śḥerēt names are similar to the Mehri, allowing for identification, but not always.

Plants of Dhofar (Miller & Morris, 1988) is an invaluable resource. It has extensive lists of plants found in the region until the 1980s with Śḥerēt names connected with Latin names. In addition, it holds vast amounts of information about the medicinally and economically important plants in the past. This book was used extensively in identifying plants found during the fieldtrip of 2021. Having the Śḥerēt names, Latin nomenclature and drawings of the plants made cross checking much easier. One drawback was that the book focuses on the escarpment mountains and Śḥerēt names rather than the plants found further north and Mehri names. However, many of the desert plants in Dhofar are found in higher altitude in the mountains, so are included anyway.

Online, I consulted JSTOR (https://www.jstor.org/) which holds the digitised records of several Botanic Gardens around the world. This collection is sortable by location, so the sources were filtered for Oman and each entry was checked for mention of Dhofar or southern Oman.

Once a Latin botanic name was found, I conducted a Google image search, a Flikr search (https://www.flickr.com/), and a POWO search of the Latin botanic name. Nearly all the plants found in Dhofar during my fieldwork are documented somewhere online. I compared photos found in various places on the web to the photos taken on the field. I made a note of identifications that were less certain, but many connections were clear.

Even with all the tools and websites, there are still some plants that are very hard to identify. Grasses are difficult to distinguish, especially when photographed while not in bloom. Also, photos shared online tend to be of flowers or fruit, rarely only of the foliage of a plant. This sometimes complicated identifying the plants from the field because my photos were taken in November when not many plants are flowering. Another difficulty is that the phenotype of a type of plant can vary significantly depending on its growing conditions. Lastly, plants with limited range are difficult to find online. For example, *Ormocarpum*

dhofarense[6] is nearly impossible to find online and two of my three main Dhofari consultants do not know it because it only grows in a narrow area of the Dhofar Mountains.

3.6 Conclusion

This chapter has described the methodologies used in this research. They were selected based on my positionality, my core values, cultural considerations specific to the region of Dhofar, as well as the scope of a PhD dissertation. The subsequent chapters use these foundational methods to elicit insight into different aspects of the biocultural diversity related to traditional institutions, linguistic analysis and building resilience.

[6] *Zygocarpum dhofarense*

4 Institutional frameworks in Dhofar [7]

This chapter extends the published information about Mahra governance institutions and analyses their resilience based on Ostrom's eight design principles. Ostrom (1990) describes eight characteristics of long-lasting CPR governance institutions. She presents her arguments in case studies examining institutions that have perpetuated for between one hundred and over one thousand years. These institutions developed in the Philippines, Spain, Japan, and the Swiss Alps – all different from one another and very different from Dhofari cultures. The CPRs examined in Ostrom and other literature include forests (Gautam & Shivakoti, 2005; Morrow & Hull, 1996; Ostrom, 1990), fisheries (Yandle, 2003), communal irrigation systems (water management) (Ostrom, 1990; Sarker & Itoh, 2001), and grazing land (Ostrom, 1990; Quinn et al., 2007) (see 2.2) – all local ecological resources which can be depleted if abused.

As discussed in 2.2, there is a scarcity of information published in English on Dhofari tribal structure in the current literature. This appears to be intentional on the Mahras' part; when proposing the interviews, some of my consultants said, 'when someone asks about tribes we say, "What are the British looking for this time?"' This question likely arises from the desire of Petroleum Concessions Limited to prospect for oil in the current-day Dhofar region. The Commonwealth Office correspondence on this issue has been digitised by the Qatar National Library (East India Company, 26 March 1930-27 July 1947) where discussions on influencing the "local Beduin" come up frequently in the context of which governing power in the region can provide security for the geological survey team. In this context, 'exerting influence' over the local tribes mainly meant getting the tribes to agree to the British government's wishes without much consideration for the tribes' autonomy or needs.

The information presented here is from a series of semi-structured interviews conducted with two knowledgeable Dhofari men who are involved in their respective tribes' governance. Both men are well known to Professor Watson and have participated in the

[7] This chapter was possible because of Yahya al-Mahri's willingness to be interviewed on the topic of tribal governance and his detailed review of the information presented here.

DEAMSA project and other documentation work in the past. Their descriptions corroborated each other which gives greater confidence in the accuracy of their individual reports.

The interviews were conducted over Zoom during the COVID lockdowns. They were recorded with permission but without permission to be made public, so the transcripts will not be published. Both interviewees expressed concern over the topics we discussed and implied that in the past, this type of information has been manipulated by foreign governments looking to benefit themselves at the expense of the Dhofari people. Every effort has been made to maintain a high level of anonymity in the examples given because of the political nature of the information shared. Most of the information has been triangulated with secondary sources and consultants from other areas and tribes.

This chapter comprises three sections. 4.1 gives background information about institutional economics, common pool resources (CPRs see 2.2), and important Dhofari cultural concepts to aid in understanding the institutions that have developed in Dhofar. 4.2 describes the eight principles Ostrom found in long-lived institutional frameworks. Each principle is also compared with institutions found in Dhofar and resilience factors are discussed. 4.3 contains a brief discussion and conclusions.

In this chapter I use the words ‘rule’ and ‘law’ interchangeably. The *ṣūrəḥ ḏə-mahra* ‘Mahra law/rules’ are not codified, or written down, in the way laws are codified, for example, in Canada, but are no less binding. However, the term ‘law’ often infers codification and a lack of flexibility or adaptability. In reality, the institutions described below are somewhere in between a codified, binding, and unchanging ‘law’ and a generally more flexible and interpretable ‘rule’.

4.1 Background and motivation

This section gives some background into the concepts found in institutional economics and the culture of Dhofar. These are important for understanding the ways in which Ostrom’s principles are exhibited in Dhofar. 4.1.1 describes how institutional economics links economic theory with biocultural diversity and resilience theory. These three concepts are then applied to each of the principles in the following section. 4.1.2 explains the importance

of CPRs and how the concept is used in this chapter. 4.1.3 describes some major elements of Dhofari culture: the treatment and societal position of women, the honour/shame cultural view as opposed to right/wrong, and lastly the orientation toward one's family and tribe. These concepts are the basis on which the analysis of the principles is built in 4.2.

4.1.1 Institutional economics

According to North (1997), institutions are the rules, taboos, expectations and assumptions that govern the way humans interact with each other and with the environment around them. This does not exclude the more common use of the word 'institution' meaning school, hospital, organized religion, etc. but extends the definition to include unwritten rules. It is important that an institution can be unwritten because the cultures being dealt with in this thesis are traditionally oral societies and written history is only recently a possibility. Other authors use a narrower definition of institution, for example Ostrom (1990) examines only governance institutions.

An institutional framework is the collection of institutions which work together and structure human interactions. Culture can be approached as an institutional framework which gives structure to the world and how it functions for the people within that culture. Institutions are shaped by the humans that function within them, their belief systems, and by the physical environment in which they exist (North, 1997).

This co-evolution between human beings, the structures of their interactions, and the physical environment is similar to the one described in biocultural diversity literature where language, cultures and ecosystems co-evolve (Maffi, 2018) and are affected by the same disruptions (Pretty et al., 2009). This interconnected character of these elements means that understanding each will help with understanding the impact they have on the others and understanding the other's situation as well. For example, knowing that urbanisation has affected language use as people move into closer vicinity of people speaking other languages, and that urbanisation has a negative effect on the ecosystem by destroying habitats, one could then investigate how urbanisation affects the institutions of the people who have moved from the land to a city or village. Information about impact on the

institutions can be applied to managing adaptations to the disruption so that resilience can be built into the institutions as well as the languages and ecosystem.

Resilience can be intentionally built into systems by assuming that disruptions are inevitable, and that the system will adapt to those disruptions (Walters, 1986). Managing the adaptation can then help the system both evolve and maintain its identity (Titon, 2016). One example can be found in language revitalisation processes where extending an endangered language to new domains of use helps make the revitalisation sustainable (Stone & Anonby, 2019). A new domain of use for a language is a topic or area of life that had developed recently. Often, speakers of minority or endangered languages receive words from dominant languages to use in those new situations; by extending the endangered language to these new domains instead of borrowing, the language will have more places it is used in and, consequently, its vitality will be strengthened. Similarly, traditional knowledge needs to be extended and applied to new domains before the knowledge is lost. For traditional knowledge to be managed sustainably, intentional adaptations to existing institutions will be needed.

As such, this chapter examines the traditional ways resources were managed through the lens of Ostrom's eight design principles for CPR-governing institutions. The ways in which these principles are engendered in the traditional governance institutions will give insight into how to adapt current and disappearing institutions so that they can continue to work toward sustainability, provide cultural continuity, and strengthen the identity of the people who live within these systems.

4.1.2 Common Pool Resources (CPRs)

Common Pool Resources (CPRs) are resources held in common, used by a group of people, can be depleted through use, that is, they are subtractable, and are difficult to exclude people from. Some examples of CPRs include forests, clean air, and fish stocks. Elinor Ostrom spent decades working through descriptions of institutions that govern CPRs (Ostrom, 1990). She distilled eight characteristics shared by the most long-lived and successful institutions. These characteristics are called 'design principles' in her writing, but design principles in the sense that they are foundational, abstract characteristics, not

requirements imposed on the institutions or on the people within the institutions from outside.

An example of a CPR that has been managed by traditional institutions in the past in Dhofar is water sources. Water sources were relatively scarce and were continual points of contention across the region. There was a constant struggle to find enough water for human and livestock populations until water infrastructure was built following the Dhofar War. Because of this, water sources and the conflicts surrounding them are good examples of CPR management and the governance institutions surrounding that process.

This chapter discusses each of Ostrom's eight principles and how they are demonstrated in traditional Mahra governance of water and conflict resolution. All eight principles have been present within these institutions; however, recent changes have, to varying degrees, disrupted these institutions. This chapter also examines some of these disruptions.

4.1.3 Important cultural concepts and understandings / Informal Mahra institutions

This section outlines a few cultural concepts that are important for understanding the governance institutions in Dhofar. According to North (1997), these could be considered institutions since they shape the way humans interact with each other and their environment. In the institutional analysis that follows, however, I will only examine governance institutions. Future work will examine a broader range of institutions in the region.

The cultural considerations discussed here are based on interview information and field observations. I examine the role of women, the honour/shame context contrasted with right/wrong, and the concept of the individual in different arenas. I hope that by introducing a few basic cultural assumptions, the institutional framework will be more highly regarded when considering sustainability goals.

4.1.3.1 Role of women

In Dhofar, women's rights is a contentious topic and receives defensive responses when probed directly. This section aims to shed light on the ways in which women are treated and the role they play within the society. The aim is not to argue that feminism is good and Islamic or tribal structure bad or vice versa. Both deal with discrimination against women and do so differently. Obviously, neither system is perfect. In describing the culture around gender differences, I hope to move the conversation away from 'liberating' Muslim women and build deeper understanding and appreciation for the diversity of human experience.

The idea that men and women should be treated the same is not present in this and neighbouring cultures. Men and women fulfil different functions in every aspect of society. A woman is represented at all levels of tribal governance by her male relatives, first her father, and later in life her husband or brother. Women do not have a voice in the tribal meetings and are not directly included in debating or deciding matters of tribal law, though Naumkin reports they "exert a strong influence" on tribal discussions (Naumkin, 1995, p. 100). In the West, this is often seen as exclusionary and discriminatory. In this context, however, it is seen as a matter of honour. A man's reputation, his honour, is dependent on the well-being of the women under his protection whether they are daughters, sisters, wives, etc. Therefore, decisions made to the detriment of a woman's well-being are counterproductive for the man.

In contrast to many neighbouring cultures, for example other regions of Oman (Omar al-Kindi, p.c. 2021), women in Dhofar have the autonomy to leave their husbands and return to their own family. When a woman does this, her return is celebrated with the slaughter of a camel – a tremendous show of honour. She is welcomed back and the man she left, or was left by, loses his standing among her brothers. It is shameful for a man to divorce or be divorced by a woman.

Another aspect of women's rights that comes up is the concept of honour killing. This is not practiced among the Dhofari population. This is not to imply that no woman is ever murdered but killing a woman because she is seen to have brought great dishonour to the family or tribe is not practiced.

Lastly, according to Islamic law, *šariʕa* (A), a man is obligated to provide for his female dependents. All of a woman's needs are met – food, shelter, clothing, etc. by her male relatives, either her father, her husband, her brothers, or her uncles or male cousins (generally in that order). Yahya al-Mahri describes this as "being in a safe place and relationship, stable finances" and contrasts this against freedom women in the West often fight for: to dress as they please. This is a fundamentally different approach to gender interactions than those of the West, and of course some women prefer one or another of these systems, but both have their strengths and benefits. This element of gender interactions is not unique to Dhofar, neighbouring cultures in northern Oman and Saudi Arabia also require the men to provide financially for their needs. However, in those societies women have far less autonomy to leave unhappy marriages than Dhofari women do.

4.1.3.2 Honour/shame

Much has been written about the concept of honour and shame (see for ex., Dresch, 1989) and how it differs from concepts of right and wrong. In a right versus wrong mindset, doing bad brings punishment. In cultures which function instead on honour/shame, actions either bring honour or shame but the honour/shame comes from the perceptions others have of that action. This means that stealing is deterred in right/wrong societies by threat of punishment and in honour/shame societies by threat of ostracism. The concept of the difference between honour/shame and right/wrong was first described by anthropologist Ruth Benedict in her 1946 wartime book on Japanese culture (Benedict, 1946).

This basic understanding of how to view the world and the people in it has enormous ramifications for governance and laws. On the surface, the difference might look subjective (honour/shame) versus objective (right/wrong). However, especially when describing institutions as rules, taboos, expectations and assumptions that govern the way humans interact with each other and with the environment around them (North, 1997), the difference becomes much more pronounced. In the framework of right/wrong, a rule is something that is followed for its rightness. Benedict frames it in terms of fighting wars: European aggression is based on "the eternal righteousness of its cause" and draws "strength from reservoirs of hatred or moral indignation" therefore making changes in

policy or goal quite difficult (1946, p. 173). She contrasts this with Japanese thinking – the Japanese are quite able to abandon a course of action with no apparent ethical problem. She gives the example of a British man who was murdered in Satsuma in 1862. The British launched an attack on the Kagoshima port. Rather than fighting back, the Japanese extended an offer of friendship, built a trade agreement, and established a college to teach British science and learning. Her explanation for this behaviour was that the Japanese were not concerned with the rightness or wrongness of their actions. They sought honour and if their current strategy for gaining that (repelling bombardment attacks from the British Navy) was not working, they would change strategies without hesitation.

In Dhofar, actions either bring *šaraf* (A) 'honour' or *ʕayb* (A) 'shame'. Dresch writes extensively on the concept of *ʕayb* in the tribes from further west in Yemen than the Mahra live. He concludes that there is not a concise way of translating this concept into English but settles for 'disgrace' in the end. He also points out the lack of wrong-ness in actions, that *ʕayb* is "always purely external" (Dresch, 1989, p. 40). It is also described by Dresch as an action, one can commit *ʕayb* or have *ʕayb* inflicted on oneself. *ʕayb* is also connected to a failure to fulfil one's duties in hospitality or in caring for one's dependents. This is a description of the Yemeni tribes, so some of these applications may not extend to the Mahra.

In Mehri, underlying /ʕ/ is often realised as [ʔ] and so this word is realised as *ʔāyb* 'disgrace, shame' (Johnstone, 1987, p. 37). It also means 'breaking of an oath' in Mehri, and in Śḥerɛ̄t it is translated as 'to shame, embarrass' (Johnstone, 1987, p. 37). *ʔāyb* is used in Mehri-speaking households to get toddlers to behave gently or with calm and in tribal discussions to describe behaviour that is not honourable. Too much *ʔāyb* leads to ostracization. This is discussed below under Principle 4.

4.1.3.3 Family ~ tribe orientation

Another notable difference that impacts human interaction is in the understanding of 'individual' among the Mahra. In a Western context 'individual' tends to mean every person, or every person old enough to participate (say, by voting). In Dhofari culture, 'individual' is more like 'representative of one's dependents' which could be the husband, father, or

oldest brother in a family. That individual carries the voice of every one of his dependents and is expected to represent them in a way that meets their needs. If he does not, women have the right to return to their family if their husband is not behaving correctly. If it is their father or brother, they have less autonomy but are well capable of making life difficult if their concerns are not taken seriously.

4.2 Ostrom's eight principles

With those cultural bases, I now turn to the eight principles that Elinor Ostrom distilled from examining long-lasting institutions that govern CPRs. Her book, *Governing the commons: The evolution of institutions for collective action*, analyses four such CPR-governing institutions, but includes others that are not used as case studies. Each of these four institutional structures has lasted for at least one hundred years, some for over one thousand. Ostrom found that the longevity of the institutions was not due to shared rules governing the individual CPRs examined, but rather to underlying principles that shaped the institutions.

These eight principles are important because they describe successful institutional frameworks. The institutional frameworks in Dhofar have faced unprecedented disruption in recent years. By examining the institutions that existed in the past, we can compare them to these principles. The institutions examined here that demonstrated longevity in Dhofar encompass water access and conflict resolution. These institutions have been disrupted by recent socioeconomic shifts that began, particularly inland, in the 1970s. Understanding the historic institutions that sustained the CPRs in the region will help to strengthen institutions to meet the current biocultural situation.

By recognising how these principles manifested in the past, adaptations can be directed in the present. The knowledge will allow the governing community to make informed choices in structuring these institutions as new resources come available. Just because a way of, for example, setting boundaries worked in the past does not necessarily mean it will work today. However, knowing how it was done in the past allows for a starting point in choosing how to implement boundaries in the present.

The following eight sub-sections describe each principle and its importance to CPR governance. Following that is a description of how these principles are or were manifested in Mahra institutions in the past. Then, for many of the principles, I discuss disruptions the institutions are currently facing, or have recently faced, and possible strategies to build resilience in them again. Table 4 summarises the principles from Ostrom (1990) and how they are demonstrated within Dhofari governance institutions.

SECTION	PRINCIPLE	DHOFARI EXAMPLE
4.2.1	Clear boundaries	Tribal affiliation and interactions
4.2.2	Rules appropriate to local conditions	Rules about refusing to give others access to water sources
4.2.3	Adaptable rules	Tribal councils and debates
4.2.4	Self-monitoring	Honour within society
4.2.5	Graduated sanctions	Provisions for broken peace agreements
4.2.6	Low-cost conflict resolution	Access to several adjudicators and judges at each level of governance
4.2.7	Minimal interference from outside powers	Ongoing autonomy and application of tribal law
4.2.8	Nested structure	Multiple layers of governance with representation from lower layers

Table 4 CPR governance principles with Dhofari examples

4.2.1 Principle 1: Boundaries

The first principle shared by long-lasting CPR-governing institutions is clear boundaries delineating who has the right to draw from the CPR and what the boundaries around the CPR are (Ostrom, 1990). Without these definitions, no one knows who is managing what and for whom (Ostrom, 1990).

In Dhofar, the boundaries around who has the right of access and extraction are along tribal and familial lines. Ancestry is enormously important in Dhofar and many of my consultants can trace their lineage through 18 generations or more. The delineation of exactly where someone fits within a tribe, which are often but not always linked to ancestry, is known. Within the tribal structure there are sub-tribes and sub-sub-tribes, depending on the scale one is looking at.

The smallest unit is the nuclear family, though that often includes the patriarch and up to 4 generations of his offspring. In Salalah, many families live in large low-rise buildings with their siblings and parents if they are alive. Children are highly valued and large families are quite common, so a 'nuclear' family of three or four generations could easily be over 50 people.

Within a family, there is a spokesperson, the father or eldest son, who represents that family in the larger family or clan. From there, the units increase, and representation continues – one from each sub-tribe represents that group at the next higher level of organisation. Each level of the tribe has representatives from the lower level who have a voice in debates and decisions made that affect that level. While an individual is a member of the tribe, and each individual is allowed to be present at meetings to discuss decisions or debate conflict, some individuals have higher standing than others. Tribal and familial boundaries are nearly but not always the same, there is provision for joining a tribe other than the one you were born into.

Besides the family structure built into the tribal network, some families have additional inherited expertise or functions within the tribe. There are *sheikh*[8] (A) families where leaders of that level of the subdivision come from. There are families who are arbitrators and interpreters of tribal law. There are families who are famous for their negotiating skills. There are famous fighters. And there is the 'father' of the tribe. Each of these has a

[8] Following the *JSS* transcription this would be *šeyḵ*, however, it is a fairly commonly used word from Arabic in English, so I will leave it with its typical Anglicised spelling of *sheikh* here and elsewhere.

particular function within the wider structure and some are discussed further under other principles.

So, the immediate family is one boundary, and each level of organisation above this is a boundary. Each boundary contains different types of relationships and responsibilities, but the boundaries are quite clear.

Boundaries must also be clear around the resource being governed by the institution (Ostrom, 1990). In Dhofar, there are traditionally three types of governance based on location. In the old cities, such as Salalah, there are long-standing governmental bodies that moderate land claims with written records going back hundreds of years. This includes water ways and access to the water sources.

In the mountains surrounding Salalah, the people were traditionally fairly sedentary. The fertile land of the mountains was governed by the tribal laws of landownership and regularly fought over (Tabook, 1997). There were areas that were held in common, such as grazing areas and forests kept clear of livestock to produce good wood for buildings (Tabook, 1997; Watson et al., 2024). Further investigation into how these CPRs were managed is a future direction for research.

This thesis focuses on the Mahra tribes who functioned outside of this institutional arrangement. In the plateau and desert north of the mountains, the most important resources were springs. Control of the springs was determined by the strength and size of one's tribe.

These boundaries were disrupted by a decree in 1974, which nationalised all tribal lands (Janzen, 2000). This decree helped to end the Dhofar War but also meant that people were no longer able to defend the land they had traditionally used or lived on. This led to an influx of livestock herds in the pastureland and cloud forests of the mountains. My Dhofari consultants tell me that even though the boundaries are no longer protected, every tribe remembers where their lands were. There are some maps in existence (cf. Janzen, 2000; Tabook, 1997), but the ones I have seen have disclaimers associated with them due to the political nature of the information.

Tribal boundaries might be volatile information, but the knowledge of the tribes' lands and the livestock they were able to sustain, the types of trees and edible plants that were available within their lands, the places pasture was likely to be found, and the rhythms of movement that maintained sustainable use of the land is held within tribal groups. This knowledge is not needed for the same issues that required its development in the past; livestock can now be supported by imported fodder allowing for sedentary lifestyles in towns; the availability of running water means that knowing where to find rain-fed water sources is not critical knowledge anymore. However, this information can be used for new sustainability questions such as how much livestock can be sustainably managed in which areas and how to allocate space for urban development by considering areas that are key to local ecosystems.

4.2.2 Principle 2: Rules appropriate to local conditions

The second principle in Ostrom's findings is that the rules governing access to a CPR are appropriate for the availability of the resource and the work required to access that resource, that is, there are appropriate restrictions on how much each user can remove and on the ways users can remove units of the shared resource.

For the Mahra in Dhofar, water resource governance institutions were flexible in this way. In general, tribal governance oversaw water resources. The tribe had the authority to restrict access to that water if they chose; the Mehri word for this is *ḥkūr*. However, choosing to do this is very shameful and can lead to armed conflict. It is only permissible in circumstances where sharing the water would deprive your own livestock. There is a Mehri story of a man who brought his very thirsty camel to another man's spring. The man who controlled the spring said, 'You may not let your camel drink here.' The camel owner told him 'If you touch my camel, I will kill you.' And he did kill the man for trying to prevent the camel from drinking. The understanding of this story is that the camel's owner was justified in defending his camel's right to drink and the man attempting to exclude the camel from his spring was being disrespectful.

Something that the Mahra consider in assigning justification in this story is whether the man who wanted to prevent the camel from drinking would have sufficient resources to care for

his own livestock if he shared with this camel. If he was going to be short and his own livestock would go without, he would be justified in preventing the camel from drinking his water. If he had no such worry, the man who killed him is justified in his reaction. Evidently there is room for interpretation in these rules which Ostrom allows for in her principles. In desperate times, she argues, flexibility is to the benefit of the community because desperate people who feel trapped begin to resent rules that keep them trapped and are less likely to continue in their compliance.

And so, in the very concepts of the law – such as *ḥkūr*, which is usually shameful but not always, and in the ways the laws are applied – through discussion and debate, with appeal processes readily available (see 4.2.6), the traditional institution around water resources is flexible enough to deal with changeable resource availability. If there is not enough of the resource, monopolising that resource is acceptable; however, when the monopolisation is done without reasonable cause, monopolising is shameful, and a justifiable response is armed conflict.

This institution around water rights has been made obsolete by improving access to water through wells and infrastructure supporting indoor plumbing. This change is not one that needs to be removed: running water has greatly improved standard of living. The flexibility in times of scarcity is still an important principle that must be considered in adapting to new circumstances and building institutions around those circumstances.

Today, access to politically valuable land is a point of contention. The tribes along the Yemeni-Omani border have been involved in territorial disputes over the past few years, particularly concerning border crossings. These conflicts unfold in a manner reminiscent of water claim cases in the past. Access might be denied, but where the shame should be laid in the conflict is a matter of debate. This demonstrates laws being adapted to new circumstances while maintaining the underlying principle of keeping rules appropriate and flexible enough to adapt to the availability of the resource.

4.2.3 Principle 3: Adaptable rules

The third principle is that the people who are affected by the rules are also able to participate in changing them. One of the most significant challenges institutional governance faces is enforcing compliance to the laws/rules. One way to address this challenge is to allow individuals to have a say in how the institutions are modified. If circumstances or values shift and the institutional framework fails to adapt, people will stop conforming to the institutions because the benefits they can reap either disappear or end up in someone else's control.

The adaptation of Mahra rules is generally done through discussion and debate. An example of rules changing comes out of one tribe's tradition of collecting an amount of money from each member and giving the collection to a recently bereaved family. Generosity is honourable; it demonstrates that your family is stable and wealthy enough that you can contribute to another family's well-being. However, the inverse then is also true – receiving help is not honourable and demonstrates one's weakness and inability to provide. This bereavement gift is tradition, not law, but one tribe was faced with the problem that wealthy families would refuse the bereavement gift – they recognised that there were others in the community who could use the money more than they could so would not accept the gift. This is honourable, but it led to all families refusing the gift, whether they had the means to support themselves or not. So, the tribe came together to discuss how to deal with this problem. It was decided that accepting the gift would be mandatory. That requirement demonstrates participatory changes to laws governing the people.

4.2.4 Principle 4: Self-monitoring

The fourth principle states that there must be appropriate amounts of accountability within the institution. Ostrom describes the self-monitoring as a simple solution to the problem of 'slackers' or people who opt out of compliance, either by taking more than their agreed upon share of the CPR or by not participating in the upkeep of that CPR. One of the factors she says plays into this is the idea of being found to be a trustworthy person. If one is caught in violation of the rules, then one's trustworthiness declines and others are less willing to cooperate with that person. In a culture like Dhofar's, this could be catastrophic.

In Dhofari culture, appearance is very important, and the community watches each other very carefully. A person's honour, his/her reputation, determines their standing, their power, and their ability to influence the course of events to their advantage. If a person has low standing, their access to an arbitrator who will work for their benefit is lowered. Trading and marriage prospects are also dependent on a person's honour/reputation. In general, life can be unbearably difficult if one's honour/reputation are badly damaged; in the past, this could be the difference between life and death. There are stories of *sheikh*s killing male members of their own tribe because of the dishonour they had brought not only on themselves but on their entire tribe[9]. In less extreme cases, a person of low honour might struggle to find spouses for his children, might have trade deals pass him by, or might have settlements negotiated that do not meet his needs. A person's honour depends on how he or she[10] is perceived in the community. If a man acts honourably, gives generously, extends hospitality and protection graciously, then his honour will be high within the community. But if he acts outside of those expectations then the community will know this, remember, and treat him accordingly. Ultimately, the entire community is accountable.

A tribe can also gain or lose honour depending on how they treat their neighbours. There is a story of a tribe whose *sheikh* intentionally picked a fight with the *bər aley muḳaddəm*, the person who interprets the tribal law in appeals, so that this *sheikh* would not need to go to the *bər aley muḳaddəm* when someone had a dispute with him. This is seen as dishonourable and the whole tribe was affected by that dishonour.

This principle is still powerful in Dhofari culture today. It is impossible to exist within Salalah and not be known. Trade agreements and marriage opportunities are still dependent on one's honour. Hospitality and generosity are still important within the society and a person, either Dhofari or outsider, who does not behave accordingly is quietly excluded. This might seem lenient or even not worth mentioning, but being excluded is costly, again, with trade and marriages, but also in receiving important information, having a say in how adaptations

[9] This, significantly, applies to male members of the tribe, not female. The female members are under their male guardian's authority and would not be subject to this type of punishment from the *sheikh*.
[10] Women are held to different social conventions conferring honour than men are. Further research is needed in this area

and applications of local laws are shaped, etc. Losing these opportunities is significant even today.

4.2.5 Principle 5: Graduated sanctions

The fifth principle states that the first offence receives a light penalty but repeat offences receive increasing penalties. Graduated sanctions are an essential element in institutional longevity because imposing strict penalties on first-time offenders could cause resentment and refusal to conform to the institutions in the future. It can be very difficult to sustain an institution's health and longevity if individuals begin breaking from it (Ostrom, 1990).

This principle is evidenced in the Dhofari structure of shame versus honour. A person's behaviour can either bring shame or honour, and the sanctions are graduated. If a person consistently behaves shamefully, they can ultimately be exiled from the tribe or, as already discussed, be killed to erase the shame.

Graduated sanctions can also be seen in the procedure for making peace after a conflict. When there is conflict, the *marjaʕ* 'arbitrator' will first hear the dispute and interpret the tribal law. *ṣulḥ* 'a period of 2 or 3 months after the initial conflict in which the two sides must not interact,' will be enforced. This can sometimes be extended to longer periods. The *marjaʕ* will decide where the *ʕayb* 'shame' lies in the dispute and reparations will be negotiated. After reparations are made, an initial contract called *mət̲t̲əniyət* is drawn up. This contract will stipulate the consequences for re-opening the conflict following reparations. If that contract is broken, which infrequently happens, a second, stronger contract is negotiated called *mət̲t̲əmənet* in which the consequences often include the killing of members of the offending tribe.

These agreements and contracts are drawn up in the tribal governance meetings. First the issue is debated to determine if the actions of one or the other could be justified or accidental; they are also examined to see whether the conflict is the reopening of another, previously settled conflict. Once that has been agreed on, reparations will be negotiated. Often the reparations are in kind, but substitutions of money are also common. The reparation amount will depend on the issues mentioned above – whether the actions were

accidental or justifiable, if the conflict breaks other reparation agreements, etc. The reparations and peace agreement are enforced by outside tribes – those not involved in the conflict. Crucially, the sanctions are graduated, the first reparation agreement brings justice, if that is broken, further punitive measures are taken to enforce the peace.

4.2.6 Principle 6: Low-cost conflict resolution

The sixth principle is that conflict resolution is easily accessible and occurs rapidly between both officials and people who have access rights. If there is a disagreement between two people of different rank, the conflict resolution must be accessible to them as well as when the conflict is between two people of the same rank. Ostrom writes that although conflict-resolution mechanisms on their own do not guarantee longevity in an institutional framework, their absence does nearly guarantee the collapse of the system (Ostrom, 1990).

This principle is evidenced in Dhofar throughout the traditional governing structure. At the smallest level – the family – the father or the eldest brother settles disputes. As one moves higher in the level of tribal affiliation, first the tribe's *ḥayb* 'father' will step in; if that fails the *marjaʕ* is next. Failing that, or if someone disagrees with the *marjaʕ*'s decision, then *bər aley muḳaddəm* will be consulted. These leaders are described as tribal leaders by Naumkin (1995). Because the tribal structure is so layered, there are representatives and legal experts at multiple levels. One can also choose which *marjaʕ* to appeal to, whether one closely linked to one's own tribe or another.

A tribe member can also take their *sheikh, ḥayb* or *marjaʕ* to another *marjaʕ* or to *bər aley muḳaddəm.* This is normally done if someone disagrees with a judgement made by the *sheikh, ḥayb* or *marjaʕ*, though if there is other conflict between people of different ranks these will also be mediated by a *marjaʕ* or by *bər aley muḳaddəm*. As discussed above (see 4.2.4), there was a *sheikh* who picked fights with *bər aley muḳaddəm* so that other disputes could not be arbitrated by *bər aley muḳaddəm*, leaving this *sheikh*'s opponents without recourse when conflicts arose. This tactic was described to me as playing with the rules and very shameful; actions that would not have been tolerated in the past when the tribal laws were the only way of governing. Because there are higher powers in the state governments

today, this kind of manipulation is possible. The situation is more stable again because the *sheikh* in question is no longer in power.

The governance institutions of the Mahra in Dhofar have traditionally included accessible conflict resolution pathways. These pathways have been weakened, however, by some leaders manipulating circumstances to usurp the usual ways of seeking resolution. This example demonstrates the vulnerability of these institutions. However, the consensus, outside of this one *sheikh*, is that the people are generally happy to function within the set-out conflict resolution pathways.

4.2.7 Principle 7: Minimal interference from outside powers

The seventh principle states that the creation and management of institutions should receive minimal interference from external authorities – the rules and traditions around use of a resource must be allowed to function with little or no interference. This principle is important because if someone wanted to subvert the rules around access to the CPR and if they could appeal to an external authority to get around said rules, the power of those rules would be greatly diminished. Ostrom reports that several of the institutions she examined that failed lacked this principle.

Until the mid-1900s, the Mahra and other tribes in the region did not have political interference so their institutions developed independently. In the first half of the 20th century, Dhofar and al-Mahra was largely autonomous and unified. When the British wanted to know who would oversee oil exploration in the area, the idea of a boundary came into question (East India Company, 26 March 1930-27 July 1947). The British had diplomatic ties to both Aden to the west and Muscat to the east, but none in the central region between these two cities. Ultimately the boundary ended up where it is today because the British pushed Aden and Muscat to draw a line (East India Company, 26 March 1930-27 July 1947).

In the middle of the 20th century, the Dhofar war and civil wars in Yemen were being fought, which had major impact on the region and a significant amount of disruption on traditional

land ownership and boundaries. However, once the war was settled in Dhofar, the institutions were adjusted, and a certain level of continuity was maintained.

Following the Dhofar War, the region modernised at a very rapid pace and the once-scarce resources were no longer a source of contention. As families moved into towns and cities, running water became the norm and the springs were no longer fought over. In addition, as part of the end of the war, the Sultan of Oman declared all the not-deeded land to be common land (Janzen, 2000). This dismantled traditional land-claims almost entirely and the tribes that once maintained boundaries began mixing more regularly, especially in Salalah and other bigger towns. That is not to say that all tribal distinctions were erased – people still operate within the tribal structure today – just that traditional land boundaries were effectively removed. People still remember where they were, though, and as you travel away from the big cities the tribal law holds more firmly.

So, despite all the interest in the region and the unrest through the middle of the 20th century, the institutions have been maintained to a point. Today, tribal law is followed for a certain sub-set of crimes, some fines are set by tribal agreement rather than following the central government's fine structure, and disputes are still moderated by the traditional hierarchy. The cause of the disputes has shifted away from water and pastureland toward political standing, but their arbitration and settlements are still based on tribal law in the region. Particularly in al-Mahra, Yemen this is true as the political influence of the central government is diminished due to the ongoing conflict.

4.2.8 Principle 8: Nested structure

The eighth principle states that nested structure of governance is needed. It is an addendum in Ostrom's work and has the caveat that it only applies to larger institutions. The governance structure of Dhofar is nested by nature. Disputes are debated and contracts negotiated at the level at which the dispute took place. There is a clear appeals process and a person's place within the structure is well defined by the community.

4.3 Discussion

Each of Ostrom's eight principles can be found in Mahra governance institutions. By examining these institutions in the light of other long-lived institutions, we can see that their longevity can be predicted by the same principles. This demonstrates that Ostrom's principles can account for different cultural settings and assumptions – even though the institutions she examined were from cultures that differ greatly from those of Dhofar, the principles are still evidenced.

Many of the institutions in Dhofar have been significantly impacted by recent societal changes. These disruptions have led to adaptations in the institutions, some leading to cultural and ecological sustainability such as maintaining community accountability for proper behaviour. Others such as political independence have had to adapt to a new reality. Perhaps the largest disruption to the water CPR governing institutions is the decrease in value of the CPR itself. This change does not negate the value of the institutions, however, and continuity of cultural identity can be encouraged through intentionally shaping adaptations in the institutions. This is further discussed in 6.4.

Intentional adaptations can easily become colonial – an outside 'expert' dictating changes or programmes. Adaptations must be designed and applied from within the community. Sometimes having an outside perspective helps clarify the institutions that are already present and recognise what is being lost (Joranson, 2008). This has already begun in Dhofar through the documentation work and ongoing collaborations that the current research has grown out of. Further work is needed on other CPRs such as frankincense harvesting, forest management in the mountains, and pasture access throughout the mountains and plateau.

This chapter has described the ways in which Ostrom's eight design principles for long-lasting governance institutions are manifested in some of the Dhofari Mahra institutional framework. These principles underpin sustainable resource management institutions which have existed for hundreds of years. As this is, to my knowledge, the only analysis of these institutions it is a contribution to the field of institutional economics, expanding our understanding of how and where Ostrom's eight principles are in evidence. The description of the tribal governance structure is also an expansion of published information, though

carefully anonymised. Further research is needed in a wider Mahra tribal context, for other resources traditionally managed, and in the al-Mahra region in Yemen which has had different factors affecting the institutions.

5 Place-based language and culture

Chapter 4 discussed the institutional framework of resource governance among Mahra tribes of Central Dhofar, describing the characteristics they share with other long-lasting CPR governing institutions around the world. In this chapter I describe some of the ways in which the ecosystem has shaped the Mahra language and culture. Section 5.1 describes the types of data presented in this chapter and the sources of that data. Section 5.2 describes semantic and metaphoric extensions in spatial language and language related to the weather. Section 5.3 describes categorisation in Mehri by exploring vocabulary for landscape, soils, and water sources. Section 5.4 describes the climate's impact on the culture and language by describing the climate and resulting seasonal activities and gives examples of plants that have been important for livestock. Section 5.5 gives conclusions.

5.1 Data

Linguistic data analysed here was both primary data, from fieldwork – both participant observation and recording – and secondary data. The main secondary sources were ELAR texts (Watson & Morris, 2016a, 2016b), *Təghamk Āfyət* (Watson et al., 2020), *Mehri Lexicon* (Johnstone, 1987), *Jibbāli Lexicon* (Johnstone, 1981), *A Comparative Glossary across the Modern South Arabian Language Family* (from here on *Comparative Glossary*) (Morris et al., 2019), and other Arabic sources such as Wehr's *A dictionary of modern written Arabic* (1979) and personal correspondence with Arabic speakers.

Cultural data analysed for this research was also both primary and secondary. Primary data was gathered during fieldwork and ongoing relationships. Secondary data was gathered through ethnographies such as Tabook (1997), Risse (2019), Russell (2021), Chatty (1987, 2003, 2010-2024, 2022) and ELAR texts (Watson & Morris, 2016a, 2016b).

When language examples are given, some are given as vocabulary in italics in the text, for example, *məḥlīḳ*, pl *məḥlōḳ* 'rock pool'. When the example is taken from a specific source, such as the *Mehri Lexicon*, that is indicated with a reference following the word and definition, for example, *xōrəb* 'to spoil, damage' (Johnstone, 1987, pp. 445-446) indicates that the word *xōrəb* is taken from Johnstone (1987) and follows his transcription system.

When the vocabulary is not followed by a reference, the transcription was checked by Professor Watson and/or Mehri consultants for accuracy; any inconsistencies or errors are my own.

Other examples are given as tabbed paragraphs and morpheme-by-morpheme glosses built from native speaker consultation, the Lexicons, *Təghamk Āfyət*, and the *Comparative Glossary*. The example sentences are usually taken from ELAR recordings. To help with readability, the citations for these paragraphs are given in footnotes as the name of the file the quote was taken from. These file names can be searched on the ELAR website, and most are openly accessible or available with an ELAR account. In these examples, transcription follows the source and is not always consistent.

Mehri demonstrates a connection to place through these elements: semantic extensions discussed in 5.2; categorisation discussed in 5.3; and climate and culture discussed in 5.4. Occasional examples taken from Śḥerēt are also given.

5.2 Semantics and metaphoric extensions

The Mahra have lived north of the Dhofar Mountains for centuries, if not millennia, and their language reflects this location through vocabulary and semantic extensions. Often, place-based knowledge is not overt, but passed along through shared extensions and creative use of semantics. These extensions are shaped by the culture of the speakers (Evans, 2010b) which in turn shapes the speakers' interaction with the local environment (North, 1997).

This section explores some of the specialised vocabulary in Mehri for spatial reference and weather. Semantic relationships between words related by root (see 3.5.1.11.2.4.1) demonstrate the conceptualisation of the local ecosystem held by speakers of Mehri. Semantic extensions could encompass every aspect of the language but, for the sake of space, this chapter focuses on vocabulary that are themselves linked to the environment.

5.2.1 Spatial reference

Spatial reference is a topic of considerable interest to linguists as languages and cultures vary in how they describe space (Evans, 2010a). Relative spatial reference terms include 'right' and 'left' and are relative to the speaker or listener. Absolute referencing uses cardinal directions such as 'north' or 'upstream'.

For the inhabitants of southern Arabia, one way in which directions have traditionally been given is in terms of the direction of flowing water – upstream or downstream. The geographic setting for the language means that 'upstream' is to the south when on the north side of the mountains which is reflected in Mehri; however, in Śḥerēt, 'upstream' is usually to the north because this language is mainly spoken on the south side of the mountains. Using 'upstream' and 'downstream' requires knowledge of the location being referenced both in relation to oneself and in relation to the *gbēl* 'mountains'.

The importance of 'upstream' and 'downstream' directions is an indication of the centrality of the need to find water sources. Permanent or semi-permanent water sources such as *fōḳa*, pl *fḳawwa* 'water pool' found in caves (5.3.3.4), or *məḥlīḳ*, pl *məḥlōḳ* 'rock pool' in deep gullies in the mountains (5.3.3.6), tend to be found at the head of *ūday* 'wadis'. These water sources are dependent on the rains, some are seasonal, others remain as a water source year-round. Sometimes they will fill up following a cyclone and remain for several years following. In 2021, during fieldwork, there were water holes and flowing water at the bottom of *ūday* in the *gbēl* which had been filled during the cyclone of 2018 and were still sources of water over three years later.

The Mehri word for 'upstream' is *l-ḥəḳ* (sometimes *lḥaḳ*). It is a compound word including the preposition *li-* and the word *ḥəḳ* literally meaning 'to-up'. *ḥaḳḳ* or *ḥaḳli* is used as the word for 'up' in the western dialect Mahriyyōt (Morris et al., 2019, p. 32; Fatimah al-Mahri, p.c. 2023), in Mehreyyet (an eastern dialect, spoken in Dhofar), the word *aġawf* is used for 'up'.

In the following example, M018 describes how people migrated to be closer to water sources. The stories that he tells in this text occurred in 1959 when a major cyclone made

landfall on the Salalah plain. Here is *l-ḥəḳ* in context (refer to Abbreviations for transcription abbreviations):

2. *həbrōkən* *tā:::* *k-ṣōbəḥ* *wə-gəhmā*
knelt.PERF.3.M.PL until in-the.morning and-tomorrow
həlḥōḳən[11] ***lḥəḳ***[12]
gathered.camels.PERF.3.M.SG **upstream**
'we knelt [that is, camped] until the morning and the next day we moved upstream'

This use of *l-ḥəḳ* demonstrates that even with the changes in wayfinding in recent years with the introduction of automobiles and global systems of spatial reference using relative terms instead of absolute terms (Watson & Wilson, 2017), location is still described as upstream or downstream in this recording from 2013.

According to the *Mehri Lexicon, l-ḥəḳ* does not have related words or extended meaning. However, Mahriyyōt speakers use the word *ḥəḳlī* 'up' which suggests the root for *l-ḥəḳ* in Mehreyyet historically dropped a root-final /l/ which was preserved in Mahriyyōt. Further evidence from Śḥerēt supports this cf. (*d-*)*ḥáḳέl* 'north' (Johnstone, 1981, p. 108; 1987, p. 175). Note that where Śḥerēt is spoken, upstream is generally to the north – 'north' and 'up' are linked because the mountains lie to the north. Root-deletion of /l/ is a characteristic of the eastern dialects of Mehri, such as the one spoken in this recording (see 1.2.4.2).

The Mehri word for 'downstream' is *ūmṣāʔ* from *l-mṣā*. In Mehreyyet there is a separate root which is x-ṭ-r giving the word *xōṭər* 'down'. In Mahriyyōt, the word for down is *mṣaʕ* (Morris et al., 2019, p. 32; Fatimah al-Mahri, p.c. 2023). In Mehreyyet the words *xōṭər* and *ūmṣaʔ* can be used as synonyms in some contexts. For example:

[11] From the root l-ḥ-ḳ meaning 'to round up, collect together (camels)' (Johnstone, 1987, p. 253), not to be confused with *l-ḥəḳ* 'upstream' – the roots are unrelated.
[12] 20131018_MehriRabkut_M018_headingforwaterstory_20200622

3. *wə-šərḥawm* ***ūmṣā*** *nagd* *šərḥawm* *bātī*
and-had.rain.3.M.PL **downstream** Nagd had.rain.3.M.PL region/house.of
ftaxayt [13]
Ftaxayt
'and downstream they had had rains in the Nagd they had had rains in the region of Ftaxayt'

Ftaxayt is a village about 130km north northeast of Salalah. In this location, downstream is to the north, toward the desert. Compare the use of *ūmṣā?* to the use of *xōṭər* in the following example:

4. *w-ūḳōt* *ərḥəmēt* ***xōṭər*** ***xōṭər*** ***xōṭər*** *mən* *hāl* *əśḥayr*
and-came.3.M.SG rain **down** **down** **down** from in the.mountains
xōṭər [14]
down
'and rain came downstream downstream. Downstream from the mountains'

In this example, *xōṭər* is used in a very similar context to *ūmṣā?* in the first example. These were taken from the same speaker at different points in one recording, both *xōṭər* and *ūmṣa?* are describing the direction where rain was found – downstream from the storyteller's position. In the first example, the word following *ūmṣa?* is *nagd* 'desert' while *xōṭər* is followed by a prepositional phrase *mən hāl əśḥayr* 'from in the mountains'. It is possible that there are nuances to the use of *xōṭər* versus *ūmṣa?* but the data available does not give enough evidence to make claims. More data is needed to determine whether these words are interchangeable.

'Up' and 'down' also have emotional connotations in Mehri, with 'up' relating to being happier and 'down' relating to danger. Historically, the Mahra were nomadic camel herders with some using raiding tactics to help with survival. Higher ground is almost always strategically better when planning a raid and when defending from raids. However, water is almost always found *xōṭər*, downward, making moving down a necessity. Down and danger are linked through the root x-ṭ-r from which derives *xōṭər* 'down' and 'to endanger'

[13] 20131018_MehriRabkut_M018_headingforwaterstory_20200622
[14] 20131018_MehriRabkut_M018_headingforwaterstory_20200622

(Johnstone, 1987, p. 453). These semantic extensions of ‘up’ and ‘down’ are directly linked to the local geography and cultural practices.

Beyond ‘upstream’ and ‘downstream’, the Mahra also have a word for ‘sunset’ *mārīb* and one for ‘sunrise’ *mśəḳayṣ* as in:

5.	*w-ərīyēḥ*	*yəkūn*	*mən*	*mṣā /*	*wə-ykūn*
	and-hot.wind	be.IMPERF.3.M.SG	from	downstream /	and-be.IMPERF.3.M.SG
	mən	***mśəḳayṣ*** [15]			
	from	**sunrise**			
	‘winds known as *rīyēḥ* come from downstream and from the sunrise’				

Both *mśəḳayṣ* and *mārīb* are very infrequent in the ELAR texts, suggesting *lḥəḳ* / *aġawf* and *umṣaʔ* / *xōṭər* are more useful in describing a location than *mśəḳayṣ* and *mārīb*. Possibly, this is due to where most of the speakers of the examined ELAR texts are from. Most texts were recorded in the central Dhofar dialect of Mehri. Perhaps Mahra who live further west or north would use *mārīb* and *mśəḳayṣ* more often because they are less closely linked to the mountains and trade there. Further investigation is needed on this point.

5.2.2 Weather

Weather affects human experience in general, but a nomadic people experience weather far more consistently than people who are settled and enjoy permanent shelters. There are a tremendous number of words to do with wind and rain in Mehri, and these are obviously closely linked to the environment in which Mehri has developed. This section provides examples of the vocabulary for wind and rain and gives semantic extensions through related words and poetry.

5.2.2.1 Wind

Wind is extremely important to the Mahra. Watson records 31 names for different winds in Mehri relating to the strength, temperature, direction, time of day and season of the wind (Janet Watson, p.c. 2023). The poetry and vocabulary of winds give a glimpse into how much

[15] 20161114_MehriRabkut_M019_winds

wind affected people in their daily lives. The ELAR texts examined here include many examples of the vocabulary, poetry is discussed in the next sub-section.

hzēz, pl *hzawzət* 'wind' (Morris et al., 2019, p. 22)

hzēz, pl *hzawzət* is translated 'wind' in the ELAR texts and the glossary (Morris et al., 2019, p. 22) but the *Mehri Lexicon* gives 'strong wind' (p. 163). Other words in the *Mehri Lexicon* with this root include *həzz* (given as *həz* in Johnstone) 'to shake; (wind) to blow', *háttəz* 'to be shaken; (person) to be scared into inactivity', and *šəhzōz* 'to persist in opposing, in enmity toward'.

In the ELAR texts, there is evidence for both the simple 'wind' translation and the more nuanced 'strong wind' translation.

6. *hēh wə-hēh* ***həzēz*** *mən* *boh* *xərūb* [16]
   if **wind** from here *xərūb*
   'when it is wind from here [it is called] *xrūb*'

This example describes a type of wind using the word *hzēz* to mean simply 'wind' and then elaborating the description of that wind with *mən boh xərūb* 'from here [it is called] *xərūb*.' In other places, though, *hzēz* is used to describe destructive winds from a cyclone.

7. *yəṯūbər* *hərmayt* *əṭyēḳ* *w-əryēṣ .../* *əlyōmah*
   break.IMPERF.3.M.SG trees *Ficus vasta* and-*ryēṣ .../* these
   tkūn *bə-śḥayr /* *yənōka* ***həzayz***
   be.IMPERF.3.F.SG in-mountains come.IMPERF.3.M.SG **wind**
   ḏə-yṯūbər *əlyakmah* [17]
   GEN-break.IMPERF.3.M.SG those
   'it brought down trees *Ficus vasta* and *ryēṣ*... they are in the mountains; wind came that brought those down'

Ficus vasta are some of the tallest and broadest trees that grow in the Dhofar Mountains. They were highly prized in the past for the shade they offered livestock and for their fruit, so settlements were either built around these trees or the tree would be transplanted to the settlement (Miller & Morris, 1988, p. 208). A wind that knocked down such a tree was very

[16] 20131018_MehriRabkut_M018_headingforwaterstory_20200622
[17] 20131018_MehriRabkut_M018_headingforwaterstory_20200622

strong indeed. These examples demonstrate that either the simple ‘wind’ translation or the ‘strong wind’ translation works for *hzēz* and context determines how the word is interpreted.

rīyēḥ, pl *rīḥayn* ‘hot or very hot wind’

rīyēḥ, pl *rīḥayn* means ‘hot or very hot wind’ with a relentless and exhausting connotation as in:

8.	*yəkūn*	*līhəm*	***arīyēḥ***	*ḥābū*	*nhūrən*	*mən*	*k-sōbəḥ*
	be.IMPERF.3.M.SG	to.3.M.PL	**hot.wind**	people	daily	from	in-morning
	attā:	*ġasā:rawwən* [18]					
	until	evening					
	‘people have hot winds from the morning until the early evening’						

This word for wind is used in the context of the wind that preceded the major cyclone of 1959:

9.	*wə-nūka*	***rīyēḥ***	*ḏakm*	*hamak*	*u-mən ṯār*	*nhōri*
	and-come.PERF.3.M.SG	**hot.wind**	that	do.you.hear	and-after	day.DU
	ṯrayt	*nūka*	*āṣf* [19]			
	two	come.PERF.3.M.SG	storm			
	‘and that [hot] wind came, do you hear, and two days later a storm came’					

Related words to *rīyēḥ* include *rawḥ* ‘spirit’ which is a common Semitic word, as in *rūḥ* ‘spirit, breath of life’ in Arabic (Wehr, 1979, p. 423); as well as *aryīḥ* ‘to give so. relief, a rest’ and *həryēḥ* ‘to make (l-) so. happy, laugh’ (Johnstone, 1987, p. 333). Given the oppressive nature of the *rīyēḥ* it is somewhat surprising that *aryīḥ* means ‘to give so. relief’. I propose the link is to do with the rains that sometimes follow the *rīyēḥ* as in the example above about the storm coming and the following example as well:

[18] 20161114_MehriRabkut_M019_winds
[19] 20131018_MehriRabkut_M018_headingforwaterstory_20200622

10.	*tōli*	*nūka*	***rīyēḥ***	*ḏakməh*	***rīyēḥ***	*ḏakmah*
	then	come.PEFR.3.M.SG	**hot.wind**	that	**hot.wind**	that
	śafḥ		*mənwōt* [20]			
	turned.out.to.be.3.M.SG		raincloud			

'then that wind came, that wind, and it turned out to be rain'

xərūb pl *xərbīn* 'hot wind during *ḳayṭ*'

Another hot wind which comes in *ḳayṭ* 'the hot season' (5.4.1.4) is called *xərūb* pl *xərbīn* in Mehri. The *Mehri Lexicon* reports that these winds come out of the east or west (p.446); the *Comparative Glossary* says they come from any direction (p. 20). They are dry winds and sometimes carry dust. When they come with dust, they are called *xrūb əttōrəb*. This descriptor, *əttōrəb*, could be related to the verb *trūb* 'to use a little earth or sand for purification before prayer, if water unavailable' (Watson et al., 2020, p. 316). Another word related to *xərūb* include *xōrəb* 'to spoil, damage' (Johnstone, 1987, pp. 445-446) – heat spoils things, especially food, so another way *xərūb* could be translated is 'hot, spoiling wind'.

blēt, pl *bīlaytən* 'cold wind from the desert'

The winter wind is called *blēt*, pl *bīlaytən* in Mehri. It is cold and comes from the desert:

11.	*wə-mən*	*nagd*	***əbəlēt*** [21]
	and-from	*nagd*	**the-winter.wind**

'and the winter wind comes from the *nagd*'

These winds require shelter.

12.	*bāṣ́*	*əmūri*	*gōna*	***blēt*** [22]
	some	wind.shelters	shelter [from]	**winter.wind**

'some wind shelters protect from the winter wind'

This compares with winds at other times of the year which either do not require people to shelter from them or come from a different direction, so wind shelters were built differently

[20] 20131018_MehriRabkut_M018_headingforwaterstory_20200622
[21] 20131018_MehriRabkut_M018_headingforwaterstory_20200622
[22] 20140613_MehriRabkut_M021_windshelters

for those winds. Today, people live in houses and no longer build these types of shelters and the effects of the wind on daily life are greatly reduced.

When *blēt* is very cold it gets a descriptor *šmamyət*, which is not in the *Mehri Lexicon*, *Jibbāli Lexicon*, or *Təghamk Āfyət*, but when asked to explain it M001 says:

13. *hām / k-śśētū tnūka blēt / wə-tkūn*
if / in-winter come.IMPERF.3.F.SG winter.wind / and-be.IMPERF.3.F.SG
ḥəbūr / hām ḥəbūr wīyən wīyən / yʔamrəm / ***bəlēt šmamyət*** [23]
cold / if cold very very / call.IMPERF.3.M.PL ***bəlēt šmamyət***
'And if a wind off the desert comes, in the winter the desert wind comes, and it'll be cold. If it is really cold they call it *bəlēt šmamyət.*'

And M019 gives a similar explanation in another recording:

14. *w-ablēt yəʔamrəm* ***bəlēt šəmamyət***[24] *hām sēh ḥəbūr wīyən* [25]
and-winter.winds call.3.M.PL ***bəlēt šəmamyət*** if she cold very
'and the winter winds are called *bəlēt šəmamyat* if they are very cold'

These winds can come from any direction other than the sea, but they are always very cold.

Related words include *bloh* (given as *bəlō* in Johnstone) 'to trouble; interrupt', *bátli* 'to interfere' and *bəlwēt* or *bəlyēt* 'catastrophe, disaster' (Johnstone, 1987, p. 49). From these words, the connotation of *blēt* includes disruption and bother. This could be because these winds require people to take shelter as compared with other types of wind that do not – they disrupt otherwise stable living arrangements.

mdīt 'sea wind'

In the ELAR texts there is one other wind word that is mentioned, but it does not have related words in the dictionary. However, it is used extensively in Mehri poetry where it symbolises goodness, sweetness, and beauty. This is the sea wind, *mdīt*.

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[23] 20161109_MehriRabkut_M001_windtypes
[24] This is the same word as *šmamyət* above, in some contexts and some speakers 'intrusive' vowels are inserted within a consonant cluster without changing the meaning of the word (Watson et al., 2020, p. 29)
[25] 20161114_MehriRabkut_M019_winds

This wind comes from upstream for the Mahra who traditionally lived north of the mountains:

15. ***mdīt*** */* *tkūn* *mən* ***lḥəḳ*** */* *wə-tkūn* *ḳāṣəm* [26]
sea.wind / be.IMPERF.3.F.SG from **upstream** / and-be.IMPERF.3.F.SG cold
'the sea wind comes from the south and is cool'

And it comes during the hot period:

16. *wə-mākinīma* ***mdīt*** *əmdīt* *ḥall* *ḏ-**aḳayṭ*** [27]
and-but **sea.wind** the.sea.wind season of-**hot.period**
'but the sea winds, the sea winds come in the hot period'

It is also characterised as a relief from the hot winds that blow all day:

17. *yəkūn* *līhəm* *ərīyēḥ* *ḥābū* *nhūrən* *mən* *k-sōbaḥ*
be.IMPERF.3.M.SG to.3.M.PL hot.wind people daily from in-morning
attā: *ġasā:rawwən* *txōf* ***əmdīt*** */*
until evening spend.the.evening.PERF.3.M.SG **the.sea.wind** /
klūt *əmdīt* *wə-yfərḥəm* *bīs* *wīyən* [28]
come.PERF.3S.F the.sea.wind and-be.happy.IMPERF.3.M.PL in.it.F.SG very
'people have hot winds from the morning until the early evening [then] the sea wind comes in, the sea wind comes back and they love it'

Though this word does not have any relatives through its root, it does take many descriptors, which is unusual in the language. These descriptors sometimes add a lot of depth to the word, for example:

mdīt ***hzaymət*** 'sea wind in evening that leaves one feeling cold and lonely' (Janet Watson, p.c. 2023).

When this word was explained by M019, he said:

[26] 20161114_MehriRabkut_M019_winds
[27] 20161114_MehriRabkut_M019_winds
[28] 20161114_MehriRabkut_M019_winds

18. *sōbər* *əmdīt* *ḳwayyət* *ḳwayyət* *ḳwayyət* *wə-mġōrən* *məṭṭawr*
always the.sea.wind strong strong strong and-then sometimes
tkūn / *hām* *əmnēdəm* *waḥśih* *walā: /* *tʔōmər*
be.IMPERF.3.M.SG / if someone alone or / say.IMPERF.2.M.SG
mdīt həzaymət *tkūn* *əmdīt* *ḥəbūr* *wīyən*
mdīt həzaymət be.IMPERF.3.F.SG sea.wind cold very
wə-tkūn *ḏə-firḥak* *bīs* *lā* *mdīt* [29]
and-be.IMPERF.3.F.SG of-be.happy.PERF.2.M.SG in.it.F NEG sea.wind
'the whole time the sea wind is really strong and then sometimes when someone is on their own or, you say *mdīt həzaymət* the sea wind is very cold and you no longer delight in it'

This example shows the poetic meaning of *mdīt hzaymət* – a cold, lonely feeling, brought on by a cold and very strong sea wind. *hzaymət* is not found in *Təghamk Āfyət* or the *Mehri Lexicon*.

Other descriptors for *mdīt* that are also negative in connotation are *mdīt zəfzīf* 'sea wind that blows things around', *mdīt zġayf* 'very blowy sea wind', and *mdīt zəġzēġ* 'cold sea wind' (Janet Watson, p.c. 2023). When asked what *mdīt zəfzīf* means, M019 answered:

19. *yəxah* *mdīt* *wīyən* [30]
mean.IMPERF.3.M.SG sea.wind very
'it means a lot of sea wind' or 'it means much sea wind'

For *mdīt zġayf*, there is no example in the ELAR texts examined here, but the word *zġayf* is related to *zəġāf* 'to sing' (Johnstone, 1987, p. 465). With that knowledge, *mdīt zġayf* could be a wind that makes singing sounds, or a wind that makes one want to sing.

Another descriptor added to *mdīt* is *tərməyūt* which also is not in *Təghamk Āfyət* or the *Mehri Lexicon*. The description of this wind is 'sea wind that comes at the end of *xarf* or beginning of *ṣayrəb* which is cool and helps relieve the camels of the biting flies' (Janet Watson, p.c. 2023). This wind is welcomed and enjoyed. This idea of welcoming and enjoying the *mdīt* is also found in Mehri poetry, further discussed below.

[29] 20161114_MehriRabkut_M019_winds
[30] 20161114_MehriRabkut_M019_winds

Wind direction

Another way winds are linked to the environment is through the direction they come from. In the West, we tend to describe winds according to their cardinal directions. In Mehri, they are described as coming from *lḥaḳ* ‘upstream’ or *umṣaʔ* ‘downstream’. For example, a cool wind that comes from downstream, i.e., the desert, during the hot period is called *ġrayr* (Janet Watson, p.c. 2023).

In Mehri, *mdīt* comes from upstream:

20.	***mdīt*** */*	*tkūn*	*mən*	***lḥaḳ*** */*	*wə-tkūn*
	sea.wind /	be.IMPERF.3.F.SG	from	**upstream** /	and-be.IMPERF.3.F.SG
	ḳāṣəm [31]				
	cold				

‘the sea wind comes from upstream and is cool’

The only place in Dhofar where this could be true is north of the escarpment mountains. When one is south of the escarpment, the water flows the other direction, and the wind would come from downstream.

As compared with *mdīt*, the *rīyēḥ* comes from downstream:

21.	*w-ərīyēḥ*	*yəkūn*	*mən*	***mṣā*** */*	*wə-ykūn*
	and-hot.wind	be.IMPERF.3.M.SG	from	**downstream** /	and-be.IMPERF.3.M.SG
	mən	*mśəḳayṣ* [32]			
	from	sunrise			

‘winds known as *rīyēḥ* come from downstream and from the sunrise’

In the *Mehri Lexicon* and in the ELAR texts, *mṣaʔ* is sometimes translated as ‘north’ as a synonym for ‘downstream’ and likewise, *lḥak* as ‘south’. While this can make the meaning more accessible to English speakers, this translation is problematic because while north of the Dhofar Mountains, the connection between *mṣaʔ* and 'north’ works, anywhere else the connection does not. This demonstrates how meaning in a language can be intimately linked to location.

[31] 20161114_MehriRabkut_M019_winds
[32] 20161114_MehriRabkut_M019_winds

The recent changes in climate have upset these weather patterns. The winds are changing – for example, storms are coming more frequently and rains no longer blow as far inland as they did in the past, thus, younger generations do not experience them as their elders did (al-Barami et al., 2023). With so much meaning and knowledge enveloped in this vocabulary, the loss or change in weather patterns will precipitate the loss of this knowledge.

Poetry – wind

Wind features strongly in Mehri poetry and songs. Liebhaber's digital exhibit 'When Melodies Gather: Oral art of the Mahra' documents many Mehri poems from across the region the Mahra inhabit. A quick exploration of the documented poetry gives lines such as:

22. *ǧwāher hōnet we-**mdīt** //* *w-līn tḳaźfen elhēb* [33]
    'Ǧwāher is a fragrant breeze and the **south wind** // that extinguishes our burning'

In this poem, a young girl, Ǧwāher, is described as the cool sea breeze – a wind that is welcomed and delighted in. In this poem, she is wooed by a wealthy man because of her beauty like the beauty of the sea breeze.

In another poem the opening line includes *mdīt* again:

23. *hey bīš **emdīt** //* *akkaws ḏ-aġrīr*
    Welcome to you, **Sea breeze** // the gentle wind that comes from the southwest
    nekśīt fwōd // *w-šīs henśīr* [34]
    It stirs my heart // and with it, I am glad

Here is the *mdīt* being welcomed, described as gentle and making the poet glad.

Below is another example of poetry including wind imagery but *rīḥayn* instead of *mdīt*:

24. *ṭār ḳāten w-ṭarbūt //* *hel mǧawrī ḏ-**rīḥeyn** //*
    'Atop the peak of Ṭarbūt // at the place of the paths of the winds //
    wet ġmūzem w-klūb [35]
    when they blow furiously and are joined together

[33] http://whenmelodiesgather.supdigital.org/wmg/advice-for-wher
[34] http://whenmelodiesgather.supdigital.org/wmg/yearning-for-baklt
[35] http://whenmelodiesgather.supdigital.org/wmg/atop-the-peak-of-arbt

This poem's theme is not gentleness and love as in the first examples, but turmoil and loss. By the end of the poem all has been set to rights again, but the strong wind imagery at the beginning sets the scene for the story that follows.

5.2.2.2 Rain

The *Mehri Lexicon* reports five separate words related to rain as a verb, a further five verbs to do with either moving toward or away from rains, two verbs to do with predicting the rain and six nouns closely linked to rain, ex. types of rain or vegetation following rain.

By far the most common rain word in the ELAR texts is *rəḥmēt* from the root r-ḥ-m. This is a Semitic root directly related to God's mercy and provision and used as a name for God as in *a-rəḥmōn* 'God' (Johnstone, 1987, p. 322) and *ar-raḥīm* 'the Merciful (i.e., God)' in Arabic (Wehr, 1979, p. 384). Other words derived in Mehri from this root include *rəḥaym* 'beautiful M.SG' and *rəḥām* 'to be kind to someone' (Johnstone, 1987, pp. 321-322).

Another root used frequently in the archived recordings is l-s-w which only carries the meaning of 'to rain'. This root has three related words in the *Mehri Lexicon*: *əwsū* 'to rain', *šəwsū* 'to be rained upon' and *məwsē* 'rain, n.' (p. 256). Two of these appear in the recordings, *tlays* the imperfect form or *əwsū* and *mūsē* 'rain'.

The difference in usage between *rəḥmēt* and *mūsē* does not appear to be dialectal because M018 uses both words. They appear to be synonyms – both are used to describe gentle rains and destructive rains, rain that is nearby and rain that is far away or hypothetical, rain on its own and rain with wind. *mūsē* is used exclusively when describing when a plant grows by one speaker, M066, but another, YMGh031 (from the Community Documentation of Biocultural Diversity in the Eastern Yemeni Province of al-Mahra, Yemen recordings) uses *rəḥmēt* in the same context. This suggests these words are interchangeable.

Other 'to rain' verbs found in the *Mehri Lexicon* include: *argədēt* '(rain) to fall gently' (p. 318), *səbūl* '(rain) to pour down' (p. 338), and *ṭəś* 'to rain (light showers)' (p. 412). These categorisations of rain action types demonstrates that each of these had a different impact on the lives of the people in the region.

Semantic and metaphoric extensions on the concepts of rain are also extensive. One already mentioned is the connection to God's mercy and provision. Another example is found in one of the words for 'to have a premonition,' *šənēbi* in Mehri which has a cognate in Śḥerēt, *šənbé* (Johnstone, 1987, p. 278) meaning 'to scan the skies to forecast rain.' These words are derived from the root for prophet: n-b-y. In Mehri, there is also a root n-w-y giving *šənwō* 'to search the sky to see where expected rain might fall' or *šənēwi* 'to search the sky for signs of rain' and in Śḥerēt *šənbé* 'to have a premonition' (Johnstone, 1987, p. 307). These roots may be historically connected: according to Watson & Al-Kathiri (2022), /b/ in Śḥerēt often corresponds with Mehri /w/. The ability to predict where rain would fall or to be able to follow it by watching the skies was one of great importance in the past. The link to prophecy is transparent in predicting the future.

Rain and the resulting pasture were coveted and carefully protected. In one recording about heading for water, the family insisted on moving to where the rains were reported. This family's needs were being met in the current pasture, but they wanted to go where the fresh rains had fallen. Another example is found in a quoted saying in the *Mehri Lexicon* for the word *'xnīn* "to say little about something, speak deprecatingly, neither in praise nor in blame". *xnīn arḥəmēt* "he didn't speak much of the rain (because he wanted the resultant pasture for himself)"' (p. 444-445). The context used to explain the word *xnīn* is the understood implication that the rain was unpredictable and often insufficient, so being discreet about it falling or the pasture it produced worked to one's advantage.

Lastly, when looking at or for *mənwōt* 'rainclouds', among the Mahra it was important to point only with a hooked finger rather than a fully extended finger (Wilson et al., 2022). This has been explained several ways by Mehri speakers. Some say pointing directly at the sky is offensive to God who lives in the heavens and provides the rains, others say pointing at a raincloud could make it either go somewhere else or disappear, others say by hooking the finger the person encourages the raincloud to come to their location. All these explanations link, again, to the uncertainty about rain and resultant pasture availability.

The link between rains and pasture is inextricable. The most used word for rain in the ELAR recordings is *rəḥmēt*, which can also mean 'vegetation springing up after rain' and this

synonymous meaning is extended to the diminutive form as well: *rəḥmānōt* ‘spot of rain, inadequate vegetation’ (Johnstone, 1987, p. 321). Here is an example with *rəḥmēt* meaning pasture instead of rain:

25. *hām* *šīsən* ***rḥəmēt*** *w-aḳā* *bih* ***rəḥmēt***[36] *u-bih*
if has.3.F.PL **pasture** and-the.ground with.3.M **rain** and-with.3.M
fəlūl / *wə-bih* *u-bih* *maray /* *tiṭḥānən*[37]
grass / and-with.3.M and-with.3.M pasture / do.such-and-such.IMPERF.3.F.PL
‘if there is good **pasture** and the ground has had **rain** and it has fresh grass and pasture they do such-and-such’

In the following example, the word could mean either ‘pasture’ or ‘rain’:

26. *wə-tā* *wiṣlən* ***ərḥəmēt*** *kūsən* ***ərḥəmēt***
and-until arrive.PERF.1.PL **the.rain/pasture** find.PERF.1.PL **the.rain/pasture**
l-sēh *mēkən* *lā*[38]
to-it.F much NEG
‘until we reached the place where [rain had fallen]/[there was pasture] we found there [hadn't been much rain]/[wasn’t much pasture]’

This can also be demonstrated by the example above relating to *xnīn*. In the quote, the person speaking deprecatingly spoke of the *rəḥmēt* – Johnstone translated it as ‘rain’ and included the pasture as an implied meaning, but because *rəḥmēt* means both the rain and the pasture, *xnīn arḥəmēt* ‘he didn’t speak much of the rain (because he wanted the resultant pasture for himself)’ could also mean ‘he didn’t speak much of the rain-and-pasture (because he wanted it for himself)’.

Rain is connected to prayer through at least two roots (see 1.2.4.1 for explanation about roots). The word *sōbəl* from s-b-l means both ‘to pray with the hands at the sides and not folded in front’ and ‘(rain) to pour down’ (Johnstone, 1987, p. 339). Additionally, the root r-ḥ-m the word *arōḥəm* means ‘to urge to prayer and recite pious sayings (us. on Friday or in Ramadhan) for about five minutes before the ‘adhān [call to prayer]’ and from the same root comes *rəḥmēt* ‘rain’ (Johnstone, 1987, p. 321). This connection could stem from rains being provided by God, whether Allah of Islam worshipped today, or the pre-Islamic gods

[36] rəḥmēt and rḥəmēt are not different words here, just slightly different pronunciation.
[37] 20141103_MehriDhahbun_M017_goatmilk_20160718
[38] 20131018_MehriRabkut_M018_headingforwaterstory_20200622

worshipped in much earlier times. It also reflects the lack of control held over the rains; they require prayer because they are not guaranteed from one year to the next.

Rain is also linked to trouble in Mehri. It requires caution and causes fear. I have been told stories while visiting *ūday* and mountains about the dangers of *wōdi* beds when the rains come, as entire families are sometimes swept away. An example from the *Mehri Lexicon* about the fear floods caused is found as context for the word *hāgōl* 'to make so. hurry':

27.	*śēni*	*ɛməwsē*	*wə-yəṣ*	*mən*	*ɛḏhīb*
	see.PERF.3.M.SG	the.rain	and-fear.PERF.3.M.SG	from	the.flood
	*wə-**hāgəlɛ́y***		*nnawḥ* [39]		
	and-**rush.**PERF.3.M.SG.DO-1SG		help.1.PL.DO-3S		
	'he saw the rain and was afraid of flooding, and made me hurry (for us) to help him'				

This reflects the fear and urgency felt at the onset of rains – the help the person is looking for is more urgent because of the oncoming rain. Another verb, *ʔaṭáwf* meaning 'to make off quickly' is used in the context of fleeing because of rain:

28.	*hēs*	*ənkōt*	*ɛməwsē*	*ḥābū*	***ʔaṭáwf***
	when	came.PERF.3.F.SG	the.rain	people	**make.off.quickly**.PERF.3.M.PL
	b-ɛm-olhəm		*hɛ̄mkənīn* [40]		
	with-flocks.GEN.3.M.PL		to.rain.shelter		
	'when the rains came the people **took off** their flocks **quickly** to safe places'				

ʔaṭáwf also carries meanings of panic or stampede. The unpredictable rains could require quick decisions and actions.

Another interesting word in that example is *məknīn* which is a shelter specifically from the rain. When talking about taking shelter from other elements such as the sun, wind, or cold, other words are used. Johnstone roughly translated it in the above example as 'safe places.' However, the entry for this word in the *Mehri Lexicon* is 'strong roof to keep out the rain, good shelter' (p. 211) meaning a closer translation might be 'When the rains came, people quickly took off with their livestock to a rain shelter'.

[39] (Johnstone, 1987, p. 16)
[40] (Johnstone, 1987, p. 34)

Sometimes shelters start to leak. The Mehri word for leaking rain is *xlūl* as in *abáyt xəllūt* ‘the house let in water’ (Johnstone, 1987, p. 439). It is close to the word for ‘lavatory’ *xəllēt*. Leaking shelters are no good, and for the Mahra there is an added element of uncleanness in the connection with lavatories.

Livestock require shelter from the rains as well. Camels especially need to be shielded from rains as they are not adept at traveling over wet ground and vegetation. A fall is catastrophic for a camel, even today, so they are moved from the mountains for the *xarf* season (transhumance is discussed further in 5.4.2.3).

There is a verb for livestock dying of exposure (as opposed to falling due to slippery ground), *hərźā* (Johnstone, 1987, p. 336), the sentence given for context is:

29. *hām* *əwsūt,* ***məhərźáwtən*** [41]
if rain.PERF.3.M.SG PART.**animals.die.of.exposure**.1.PL.FUT
‘if it rains we shall have (animals) die of exposure’

In the mountains, Śḥerēt speakers built permanent shelters for their animals called *dáḳəf*, pl *díʂáf* (Ś) (Watson et al., 2024). The Mahra did not build such structures. Shelter for humans and animals was typically found in caves, *ʂayge?* (M).

There are also several verbs that have to do with leading livestock to water or where pasture has sprung because of recent rains. These are discussed in 5.4.2.3 below.

And then, at the end of *xarf*, the rains stop. The semantic connection of the rain stopping is to weakness and decreased health, particularly in livestock. The word *wəṭyō* means ‘(animals) in poor condition; (rain) slackening, little not much’ (Johnstone, 1987, p. 433). For the Mahra, unhealthy livestock led to hunger because other reliable food sources were scarce, especially in the late *ḳayṭ* ‘hot season’ (5.4.1.4) and early *xarf* seasons before the rains had had any effect on the edible flora.

[41] (Johnstone, 1987, p. 336)

Another root with meanings linked to rain stopping is ḳ-ṭ-ʔ (Johnstone, 1987, pp. 243-244). This root derives several verbs to do with being cut off from water:

> *ḳáṭṭa* – to be cut, discontinued; (rain) to stop; to be cut off in the desert without food or drink
> *ənḳáyṭa* – to be cut; to be thirsty
> *əḳtōṭa* – to be extremely thirsty, hungry, cut off in the desert without food or drink
> *šəḳṭā* (*mən*) – to be depressed because it does not seem likely that one will get what one needs; to think one is going to die of thirst. Also, to be left in an isolated place; (married woman) to have a strip of scalp removed at the front for cosmetic purposes
> *məḳṭāt* – waterless desert

Thirst and being cut or cut off are connected in the words *káṭṭa* and *ənḳáyṭa*. This could be because blood loss can lead to thirst. The verbs *əḳtōṭa* and *šəḳṭā* link extreme thirst with depression and being cut off in the desert. These verbs are also a reflection of the ecological and geographical location of Mehri. The cosmetic procedure of *šəḳṭā* is described by Tabook as also practiced among the Śḥerēt speakers of the mountains. It was a very dangerous procedure and often resulted in death (Tabook, 1997). It is possibly related through the notion of 'cutting' found within this root. Finally, *məḳṭāt*, 'waterless desert' according to Johnstone, could be translated as a noun-of-place: 'a place of extreme thirst, hunger, isolation'. A noun-of-place is a common nominal derivation within Arabic where one finds, for example, *maktaba* 'library' or 'a place of *kutub* [books]' and *maṭbax* 'kitchen' or 'a place of *ṭabx* [cooking]' and *madrasa* 'school' or 'a place of *dirāsa* [studying]' etc.

The extensive vocabulary and survival strategies surrounding the notion of rain demonstrates the central importance of rain in this geographical context. The unpredictability of the rains is also clearly reflected in the vocabulary and semantic extensions. Some concepts are expressed succinctly in one word that other languages perhaps have no need of, for example: *šəḳṭā* (*mən*) 'to be depressed because it does not seem likely that one will get what one needs; to think one is going to die of thirst' (Johnstone, 1987, p. 244) These words are part of the language because of the geographical and ecological context the language developed within.

Poetry – rain

Like winds, rain is included in Mahra poetry, though less frequently. In the following example, rainclouds and the resulting *yərḥōm* 'rain.IMPERF.3.M.SG' is compared to the beauty of a woman:

30.	*awle rwāḳāt //*	*wet āymel ḥğīr*
	Or like dark rain clouds //	that produce rain without storms
	***yerḥōm** arūź //*	*w-lew ḏe-hwīr* [42]
	And drench the gardens //	once stricken by drought.

Poetry often features wishes for rain and euphemisms for it instead of directly using the vocabulary for rain. For example:

31.	*tē*	*meyt*	*ḏ-šeḳfūl* [43]
	until	time	of-plenty

'Until the time that the rain falls abundantly'

This translation works in the context of the whole poem, but the literal translation does not include rain vocabulary. It is an interesting extension of 'rain falls abundantly' from *meyt ḏ-šeḳfūl* 'time of plenty' (Liebhaber, 2018) given the connotations of danger and needing shelter that rain also carries.

Children's rhymes also make use of the theme of rain, though more often as a topic for teaching than as metaphors. For example:

32. *yā sūbaḥ yā sūbaḥ*
    Let's go swimming!
    ḥəmoh də-ḥād lɛ
    The water doesn't belong to anyone.
    ḥəmoh də-bāl jōd
    Water belongs to God,
    bāl jōd yəḥōm aṭɛ[44]
    God needs worship.

[42] http://whenmelodiesgather.supdigital.org/wmg/yearning-for-baklt
[43] http://whenmelodiesgather.supdigital.org/wmg/homesick-in-hyderabad
[44] (al-Qumairi et al., 2024, p. 7)

This rhyme teaches that water is common property and links it with God's provision. The phrase used for God here is *bāl jōd* which literally means 'master of generosity.'

Another example of a children's rhyme that has the theme of rain is the following rhyme:

33. *marḥab būk //* *sayl bə-sayl*
    You are welcome // flood upon flood,
    marḥab būk // *bə-ġayṭar nəxīl*
    You are welcome // twister of palms,
    marḥab būk // *bə-jīzər ātōm*
    You are welcome // slaughterer of irrigation channels,
    marḥab būk // *bə-hīdəm byūt*[45]
    You are welcome // destroyer of houses.

This rhyme describes the flood's power and danger in hopes of warding off that danger by ironically welcoming the flood (al-Qumairi et al., 2024).

The theme of rain in poetry evidences its importance and salience within the culture. This importance comes from the location Mehri developed within where the climate is unpredictable and scarcity, particularly of rain, was a common experience.

5.2.3 Conclusion

Mehri developed in a particular ecological and climatic context which has shaped the way in which concepts such as wayfinding and up and down are understood and extended. Wayfinding provides insight into the ontology of space and relationships within the region; the Mahra are constantly aware of their position in relation to the flow of water, whether there is water present or not. In addition, weather vocabulary and the semantic extensions of those vocabulary also carry a dual connotation: wind and rain are known for their power and potential destruction but also linked to the goodness of God and his mercy.

5.3 Categorisation

The way that humans categorise the world and the role of language in that process has been investigated on many different fronts including colour, time, causality, body parts and

[45] (al-Qumairi et al., 2024, p. 6)

landscape (see 2.3.3). This section explores the categories of landscape terms, soil types, and water sources in Mehri. These categories depend on both the physical characteristics and the activities associated with each.

The following section begins with a discussion of landscape vocabulary, 5.3.1, which has recently been identified as a fruitful topic to explore given that all speakers are situated within landscapes and not much work has been done on landscape terminology in the past (Burenhult & Levinson, 2008). 5.3.2 discusses soil type categorisation, and 5.3.3 discusses water sources.

5.3.1 Landscapes

This section describes the categorisation of the Dhofar – al-Mahra landscape. Cross-linguistic work on the vocabulary of landscapes has found that landscape categorisation is often based on cultural variables rather than the physiology of the landscape (Burenhult & Levinson, 2008). Burenhult & Levinson (2008) describe several ways in which languages have been shown to derive landscape terms from other domains of language such as “body parts, animals, plants, objects, people, proper names, properties, and activities” (p. 146). Mehri landscape terms tend to be unique words without obvious links to other domains, though related words are presented here when possible.

The Dhofar – al-Mahra landscape is made up of several distinct regions: the Salalah plain near the coast, the monsoon-affected mountains, the mountains that are not affected by the monsoon winds, and the plateau beyond the mountains that transitions into the desert. From the coast to the sand desert the distance is 200-250km. Traditionally the Mahra have also lived in the sand desert to the north and into the southern edges of what is now Saudi Arabia, though most of the DEAMSA recordings are from tribes in Central Dhofar and along the coast. That sand desert is the southern edge of the Empty Quarter which extends about another 1000km to the north. These regions are labelled in Figure 2.

The varied landscape had significant impact on the livelihoods of the inhabitants and so an extensive vocabulary developed describing different features within each landscape region. This section is divided into subsections for each of the regions from the *gərbīb* ‘coast’, *gbēl*

'mountains', *ḳāṭən* 'plateau', and *nagd* 'desert'. These divisions are representative of the divisions found in the ELAR texts and in conversation with consultants. In addition to these subsections, there are two other categories of landscape which span two or more of these regions. These categories are *wōdi* 'dry riverbed' and *ṣ́īgɛʔ* 'caves'.

wōdi, pl *ūday* has been categorised separately from the other regions because there is extensive vocabulary linked to the different sizes, connections, areas, and features found within and around the *ūday*. The descriptions of *ūday* in comparison with other landscape regions, especially the *ḳāṭən*, demonstrates that the *ūday* make up their own landscape region in the language. In addition, *ṣ́īgɛʔ* are categorised separately. This is less because of the boundaries found in the language and more because they are found across several areas, so categorising them into, for example, 'mountains,' would not give a clear description of their uses and location.

5.3.1.1 gərbīb 'coastal plain'

At the very south of Dhofar there is a plain hemmed in by the mountains to the north, east and west and the Indian Ocean to the south called the *gərbīb*. The *gərbīb* was once heavily forested, though settlements have also been there for millennia (Seland, 2014). This area was traditionally controlled by some of the Kathiri tribes (Tabook, 1997), however, in 1974 all tribal land was nationalised, so the traditional tribal boundaries were no longer enforced (Janzen, 2000). The land in the settlements was often deeded, even in the more distant past, so the nationalisation affected this land less significantly than further north where deeding was not practiced. The Kathiri tribes are not Mahra; they speak a dialect of Arabic. As such, the Mahra have very few words to describe this landscape – there is a word for shore: *ḥayḳ* and a word for sea: *rawrəm*. There are also *məsyōl*, 'flood paths' where runoff from the mountains crosses the *gərbīb*, however, *məsyōl* can also be found in other landscape areas.

5.3.1.2 gbēl 'mountains'

The Mahra have many words to describe the landforms encountered in the mountains. Embedded in those words are the hardships faced in traversing the mountains. The escarpment mountains are north of the *gərbīb* 'coastal plain,' and along the seashore elsewhere. The highest peaks are about 2000m above sea level and the altitude change is

very steep. The south-facing slopes are affected by the monsoon winds that blow inland every year from mid-June to mid-September. The monsoon-affected mountains are called *śḥayr* in Mehri. The monsoon season is called *xarf* and it is discussed further in 5.4.1.1.

The mountains to the north of the *śḥayr* are much drier. They do not receive rain and mist to the same extent as the southern slopes, but water does flow north through the valleys of these mountains due to the *xarf*. These mountains, and mountains in general, are called *gbēl* in Mehreyyet and *jbēl* in Marhiyyōt. The Mahra tribes have controlled the northern mountain areas in the past, and so have an extensive set of vocabulary dealing with steep slopes and paths navigating between them.

śəgrīt 'mountain pass'

From the root ś-g-r (Johnstone, 1987, p. 374) from which the simple verb *śəgūr* is derived with the meaning 'to ask for a travelling companion on some difficult enterprise (hoping thereby for postponement or cancellation).' The response to such a request could be *śátgər* 'to go with so. one likes or respects against o's best interest.' This root highlights the difficulty faced in traversing the mountains and a word that is uniquely necessary in this type of cultural and ecological setting.

During fieldwork in 2021, one of the families I was working with took us to the desert from Salalah to look at plants. As we drove downhill out of the mountains, over back roads, we came to a *śəgrīt* M010 told us that her family used to traverse when her children were young. The pass was still quite steep with many hairpin turns for cars to descend in relative safety. She told us that it has been much improved in the past few years. She had come one time with the car, and she made her 10- or 12-year-old son (now an adult) drive the car down while she walked down with the other children because it was so dangerous for driving. Once the car was safely at the bottom of the incline the family got back in and continued their journey.

Another example of the difficulty of traveling through the mountains, even today, come from the stories repeatedly told on the highway down the mountains back into Salalah. These stories are of the lorries and other vehicles that have gone over the edge of the cliffs

in the steep descent. There is quite a bit of heavy vehicle traffic on these roads because of the port in Salalah. The remarkable stories, the ones that are told repeatedly, are the ones in which the people involved survived. The dangers of these roads have decreased recently, but the mountain passes are still difficult to navigate.

mayər 'steep; rough, broken ground' (Johnstone, 1987, p. 260)

This word is used in context of herding goats.

34. *wə-ḥārawn* *tū… tūtəlīfən* *lūk /* *bərk* ***əmayər***
and-goats befriend.IMPERF.2F.PL to.2M / in **steep.places**
wə-tnayś *bīsən* *ərḥəmēt* [46]
and-take.IMPERF.2.SG with.3.F.PL the.rain/pasture
'and goats are your companions in **steep places** and you take them to where rain has fallen/ there is pasture'

Since the landscape includes a lot of *mayər*, camels and goats are good animals to raise because they can cope with this type of ground, as compared with cows which cannot.

hədḥayd 'ridge between two valleys, gullies' (Watson et al., 2020, p. 219)

M026 tells a story of when he was in primary school in the 1980s and had acquired a car which he used to drive himself and his siblings to and from school. The schoolteacher at the time took advantage of this and insisted that M026 drive him to and from school as well. M026 was unhappy with this arrangement and one day drove as fast as he possibly could along the *hədḥayd* with cliffs on either side. After this incident, the schoolteacher never demanded a ride again. Today, M026 tells stories of cars that disappeared off the edge of these ridges and can still point out where they stopped at the bottom of the steep slope.

ġdū 'path between two hills' (Watson et al., 2020, p. 219); 'crack, depression on a mountain' (Johnstone, 1987, p. 133)

Other words from the ġ-d-v[47] root in the *Mehri Lexicon* have to do with forgetting and a curse *ġədéw* 'go!; perish!' (p. 133). Tabook reports that areas which were often dark, such

[46] 20141103_MehriDhahbun_M017_goatmilk_2016071
[47] *Mehri Lexicon* uses 'v' to represent a vowel within a root without specifying whether the vowel is 'w' or 'y'.

as deep valleys, were often reported to be guarded by *jinn* which could be the connection between the meaning of 'path' or 'crack' and the curse.

śēṣər 'gully'; *śáṣṣər* 'to be cracked' (Johnstone, 1987, p. 386)

These landforms are dangerous for livestock, as demonstrated by this context sentence from the *Mehri Lexicon*:

35. *hām ḳəbáźkəm ḥəlákəməh, amkōn ḏɛ́kəməh bəš*
If herd.PERF.2.M.PL there, place that with.DO-2.F.SG
śəṣōwər, *wə-hām həwúh ɛmōl bərk* ***śēṣər*** *l-ād*
gullies/cracks and-if fall.3.M.SG livestock in **crack** NEG-still
irūfaʔ laʔ! [48]
climb.3.M.SG NEG
'if you take your stock there, (look out because) that place is full of **crevices** and if the beasts fall down a **crevice** they won't get out again!'

This is still true today – these gullies can cause falls for camels and cattle alike. And veterinary services available cannot perform major surgery on injured camels. If a camel were to fall into a gully and break a bone, the only course of action would be to slaughter her.

ṣayk 'steep-sided valley' (Watson et al., 2020, p. 219)

M026 tells stories about the Dhofari rebels using these valleys and the caves that are also found in the mountains during the Dhofar War, 1965-1975. He also tells a story about his grandfather who was killed and left in one of the valleys. The witnesses of the murder and subsequent cover-up were threatened so remained silent for years after the event.

5.3.1.3 ḳāṭən 'plateau'

The next landscape region to the north of the mountains is called *ḳāṭən* in Mehri. The root ḳ-ṭ-n in the *Mehri Lexicon* has to do with being thin. M100, who grew up in Saudi Arabia away from these landscapes, hears 'thin' when she comes across *ḳāṭən* in the archived recordings. The *ḳāṭən* is referenced as being a place people go 'up' to, even though it is physically lower than the mountains which is usually the frame of reference. I suggest this is in contrast to

[48] (Johnstone, 1987, p. 386)

the *ūday* that cut through the *ḳāṭən* and demonstrates a mental boundary between *ḳāṭən* and *wōdi*. Therefore, *ūday* are treated as their own landscape region below.

The *ḳāṭən* region is characterised by speakers as a plain, but there are many words to describe more specific types of plains which I will discuss in this section as well. Once one has moved out of the mountains to the north in Dhofar, the landscape is fairly flat with some hills and *wōdi* valleys. The landscape becomes increasingly more desert-like the further north one travels.

kərmaym 'hills'

Across the *ḳāṭən* there are hills that are smaller than the mountains to the south. These are called *kərmaym* in Mehri. In the *Mehri Lexicon* there are no other related words, but there is a close root: k-r-m (as compared to k-r-m-m for *kərmaym*). This root is linked to generosity *kərōmət* and being grateful *škarūm*. The semantic link is not immediately obvious which may be why Johnstone presented them as separate roots.

M001 describes the hills in the *ḳāṭən* as 'not very many':

36. *yʔamrəm* *hēh* *aḳāṭən* *ḥəlakmah* *dəbdōb* *wə-**kərmōm*** *bāṣ́ […]*
call.IMPERF.3.M.PL it.M the.*ḳāṭən* there plains and-**hills** some [...]
hōba *wīyən* *lā* [49]
that.is.to.say many NEG
'they call it the *ḳāṭən* there there are plains and some hills, but not very many'

Hills can also be found on the *gərbīb*:

37. *wə-bih* ***kərəmmawtən*** *wə-msīyɛ̄lawtən /* *məsyūl* [50]
and-with.M.SG **hills.DIM** and-flood.path.PL.DIM / flood.paths
'and there are small hills and small flood paths, flood paths'

As compared with the *ḳāṭən* hills, the hills found on the *gərbīb* are notably smaller. The feminine plural diminutive pattern adds the suffix *-awtən* to the word (Watson et al., 2020, p. 260). Not all Mehri dialects have maintained the diminutive construction; my consultant

[49] 20161009_MehriRabkut_M001_topography_seatodesert_20161114
[50] 20161009_MehriRabkut_M001_topography_seatodesert_20161114

from the Oman-Yemen border area struggled to understand the diminutives in the texts we worked on together. She described diminutive words as being 'old'.

mḥaskēt

Another area with hills, called *mḥaskēt*, is also found in or near the *ḳāṭən*. These hills are described as conical hills between the mountains and the desert (Watson et al., 2020, p. 307), though translation varies quite a bit across the archived texts from 'the plateau' to 'a line of conical hills'.

38. *wə-thaḳṣawmən* *maṭṭawr* *bə-**mḥask***
and-spend.the.hot.part.of.the.day.IMPERF.3.F.PL sometimes in-**mḥask**
wə-kəlaynī *mən* *yəṣṣayt* *ḏ-aḏəbbēt*
and-early.evening from escape?.IMPERF.3.M.PL GEN-the.flies
wə-kəlaynī *trafən* ***aḳāṭən*** [51]
and-early.evening go.up.1.PL **the.*ḳāṭən***
'they spend the hot part of the day on **the plateau** [the *mḥaskēt*] and in the early evening to get away from the flies they go up to the **central plateau** [the *ḳāṭən*]'

From this example it appears that the *ḳāṭən* and the *mḥaskēt* are distinct because there is movement between then, but both are translated as 'plateau'.

39. *wət* *ḳfidk* *hōbak* *twōlī* *nagd* *tkūsa /*
when go.down.PERF.2.M.SG [?].2.M.SG toward *nagd* find.IMPERF.2.M.SG /
amḥask *mḥaskēt* *tkūn* *bīs* -- *tkūn* *mān* *gəbēl*
the.*mḥask* *mḥaskēt* be.3.M.SG in.it.F -- be.IMPERF.3.M.SG from mountain
wə-mān *nagd* [52]
and-from *nagd*
'When you have gone down towards the desert you find **a line of conical hills** the *mḥaskēt* the *mḥaskēt* has -- is between the mountains and the desert'

In this example, *mḥaskēt* is translated 'line of conical hills' however in the example above, the *mḥaskēt* is lower than the *ḳāṭən*. *mḥaskēt* could be a region within the *ḳāṭən* or a region between the *ḳāṭən* and the *nagd*.

[51] 20140612_MehriRabkut_M021_movingtopasture_Arabic_English_20160708
[52] 20161009_MehriRabkut_M001_topography_seatodesert_20161114

> *gərdīś*, pl. *gərdōś* ‘compacted hard (desert) surface’ (Johnstone, 1987, p. 124)

Another type of plain is *gərdīś*, pl *gərdōś*. The *Mehri Lexicon* defines this word as ‘compacted hard (desert) surface’ as compared with a dusty place (p. 124) but there are no other words linked to this root.

> *dəbdīb* ‘flat area, wide plain above hills and beyond the *wōdi*’ (Watson et al., 2020, p. 293)

dəbdīb is a place where people would move to after the monsoon finished.

40.	*ḥāwēl*	*ḏ-aṣayrəb*	*ḥāwəlay /*	*ṣarbay*	*ḥāwəlay /*
	beginning	GEN-post.monsoon.period	first.M /	post.monsoon.season	first.M /
	yəhrafəm	***ədəbdōb***			
	move.up.3.M.PL	**the.*dəbdīb*.PL**			

‘at the beginning of the post-monsoon period, the beginning of the post-monsoon period they move up to the ***dəbdōb***’

Plains are important areas because they are less dangerous to travel than the mountains and provide space for rest. The different types of plains discussed are not widely found in the archive data examined here; further investigation is necessary to better understand their individual meanings.

5.3.1.4 nagd ‘desert’

Beyond the *ḳāṭən* comes the *nagd* or *badyət*. Both words are translated as ‘desert’ in the archived material, though *nagd* is much more frequently used. An example of each in context:

41.	*wə-sēt*	*tinūka*	***badyət***	*ykūn*	*ḥarr* [53]
	and-when	come.IMPERF.3.F.SG	**desert**	be.IMPERF.3.M.SG	hot

‘and sometimes it [rain] comes to the **desert** it [the desert] will be hot’

42.	*w-**anagd***	*ykūn*	*bih*	*əmdīt*
	and-the.**desert**	be.IMPERF.3.M.SG	with.DO.3.M.SG	sea.winds
	w-āṣār [54]			

[53] 20161107_MehriHawf_M066_seasons_stars_20161120
[54] 20161114_MehriRabkut_M019_winds

and-storm.winds
'and the **desert** has sea winds and stormy winds'

There are verbs to do with travelling or arriving in the *nagd*: *həngūd* 'to go to the Nagd[55], and *šəngūd* 'to be in Nagd, get to Nagd' (Johnstone, 1987, p. 286).

43.	*ḥād*	*yəhrōfa*	*aḳaṭən*	*w-aḥād*
	one	go.up.IMPERF.3.M.SG	the-ḳāṭən	and-one
	yhəngūd [56]			
	go.to.the.nagd.IMPERF.3.M.SG			
	'some go up to the central plateau and some **go to the desert**'			

However, *badyət* does not have similar verbs.

Təghamk Āfyət specifies that *nagd* is a gravel desert (p. 219), but the *Mehri Lexicon* does not. There is a separate term for gravel desert: *sayḥ* (p. 311). This root has an emphatic /ṣ/ in the *Mehri Lexicon* however, this is incorrect - the /s/ is not emphatic, and is related to words for shouting such as *aṣyīḥ* 'to shout' and shadows shortening *ṣəyūḥ* (p. 369). There is also a word for sand desert, *rəmlēt* which means 'sand' as well (Johnstone, 1987, p. 327; Watson et al., 2020, p. 219). *rəmlēt* is typically found north of the *sayḥ*. The distinction between sand and gravel deserts is an important one as the food sources for livestock vary, with some plants growing in one region but not the other. There is extensive vocabulary to do with the dust, sand and stone types found in the deserts, discussed in 5.3.2.

5.3.1.5 wōdi 'wadi; dry watercourse'

wōdi, pl *ūday* is an important element of landscape among the Mahra. Outside of the *śḥayr*, most *ūday* are dry for most of the year but can still be sources of water. Especially at the heads of *ūday*, ground water can sometimes be found within 2m of the surface (see 5.3.3.1). North of the *gbēl*, plants grow on the wadi beds, indicating that they can access enough water there, and providing browse for livestock and sometimes food for humans as well.

Some plants are used as sign for water. For example, *āṯɪb* (Ś) is a tree that only grows near water, though generally in the *śḥayr* (see Figure 4 for a small photo). A *nagd* plant used as

[55] Johnstone transcribes nagd as negd. I replaced his transcription here for consistency.
[56] 20140612_MehriRabkut_M021_movingtopasture_Arabic_English_20160708

an indicator of the presence of water is called *ḥarṭōt* and tentatively identified as *Ephedra milleri* (see Figure 5). For desert dwellers this knowledge is critical.

Figure 4 āṯɪb (Ś) in Dirbat

Figure 5 ḥarṭōt in Wadi Gzayl

I classify *ūday* as a separate landscape region because the language surrounding them suggests they are held in contrast to the surrounding landscape whether that is the *gbēl*, *ḳāṭən*, or *nagd*. First, as mentioned in the discussion about directions, people often talk about 'going up' to the *ḳāṭən* even though it is lower elevation than the escarpment mountains.

44. *ədəbdōb* *aġawf /* *b-aḳāṭən* [57]
the-dabdōb up / on-the.ḳāṭən
'the dəbdōb are up on the central plateau'

In this example, describing the *ḳāṭən* as 'up' must be relative to something, something that is not the mountains and equally not the desert because this speaker is discussing movements from central Dhofar. That leaves *ūday* and the valleys and *agēʔ* 'gullies' they make through the landscape.

Another example:

[57] 20140612_MehriRabkut_M021_movingtopasture_Arabic_English_20160708

45. *yəśxawalīl* ***b-aḳāṭən*** */* *wə-ykūn* *šīhəm* *məkənīn*
stay.IMPERF.3.M.PL ***on-ḳāṭən*** */* *and-be.3.M.SG* *with.3.M.PL* *shelter*
mən *ḥabūr* *warx /* *īṯroh* *m-bād* *warxī* *ṯroh*
with cold month / two after month.DU two
yərdawd *yəḳfīd* ***agēʔ*** [58]
return.IMPERF.3.M.PL go.down.IMPERF.3.M.PL **gullies**
'they stay on the **central plateau**, and they have shelter from the cold for a month, or two and after two months they go back down to the **gullies**'

Here, M021 is describing the movements of the people in various seasons. People would move from the gullies, *agēʔ*, in the *ḳāṭən*, back up to the plain when it was cold during the winter. He contrasts the gullies with the *ḳāṭən*; the gullies are not included in the term *ḳāṭən*.

46. *rəddən* *ū-boh* ***aġawf*** *aḳāṭən* [59]
return.PERF.2.PL here **up** the.*ḳāṭən*
'we came back up here up to the plain'

In this example, M018 describes moving back 'up' to the plain following an attempt to follow some rumoured rains.

The second reason for classifying *ūday* as their own landscape is the amount of vocabulary specifically linked to them:

ḳəfḳayf, pl. *ḳəfḳōf* 'wall at head of wadi m.' (Watson et al., 2020, p. 219)

This word does not appear in the *Mehri Lexicon* or in the archived texts examined here. As discussed in 5.3.3.1, the Mahra would drop large rocks onto the ground at the head of wadis to determine whether they could dig a 'waterscrape'.

ḳəzzūt, pl. *ḳīwēz* 'overhang in wadi wall f.' (Watson et al., 2020, p. 219)

Overhangs were often used as shelter. There are separate, unrelated words for overhangs in other areas of the landscape, such as *rəḳab,* pl *rḳawwab* which are found in the *nagd*. This word is not found in the *Mehri Lexicon* or the archived material.

[58] 20140612_MehriRabkut_M021_movingtopasture_Arabic_English_20160708
[59] 20131018_MehriRabkut_M018_headingforwaterstory_20200622

gəḥrīr, pl. *gəḥrōr* ‘wadi bottom m.’ (Watson et al., 2020, p. 219)

This word does not appear in the *Mehri Lexicon*, nor in the archived texts examined here. That there is a separate word for the bottom of a wadi suggests this area is salient in some way possibly in part due to the dangers of flash flooding on wadi bottoms. There are stories of entire families being swept away in flash floods while they were staying in a *gəḥrīr*.

məsyōl, pl. *msaylət* ‘streambed; watercourse m.’ (Watson et al., 2020, p. 219)

In the archived texts, these water ways are described as part of the *gərbīb* but the definitions in both *Təghamk Āfyət* and the *Mehri Lexicon* suggest they are not limited to the *gərbīb.* In my experience these are normally dry. Further investigation is needed to determine how these are different than *gəḥrīr*.

gūt, pl. *gīwɛʔ* ‘narrow, often deep valley that sometimes has water in it’ (Johnstone, 1987, p. 126; Watson et al., 2020, pp. 219, 296)

This word has many translations in the archive and no related words in the *Mehri Lexicon*. Sometimes it is translated as ‘deep depression’:

47.	*lākin*	*tkaysah*	*wēṭa*	*akṯēr*	*[…]*	*wə-bīh*
	but	find.IMPERF.2.F.SG.DO-M.SG	flat	more	[…]	and-in.DO-M.SG
	gīwē	*ṭawrən* [60]				
	deep depressions	also				
	‘but you find it [the *ḳāṭən*] flat mainly and it has **deep depressions** too’					

In other texts it is translated as ‘gullies’:

48.	*ḥābū*	*yhəngīd /*	*ād*	*yhiḳfīd*
	people	move.to.the.desert.IMPERF.3.M.PL /	still	go.down.IMPERF.3.M.PL
	agēʔ	*lā* [61]		
	gullies	NEG		
	‘people move to the desert; they don't go to **the gullies’**			

And in the ‘heading for water’ story, when asked ‘where did you get water from?’ M018 answers *əgūt* which is translated as ‘large deep pool’:

[60] 20161009_MehriRabkut_M001_topography_seatodesert_20161114
[61] 20140612_MehriRabkut_M021_movingtopasture_Arabic_English_20160708

49. *lā* *lā* *ḥəmoh* *ḥəmoh* ***əgūt*** [62]
NEG NEG water water **large.deep.pool**
'no, no there was **a large deep pool'**

M018 goes on to explain that there was water in that *gūt* for most of the year. *Təghamk Āfyət* gives the definition for *gūt* as 'small narrow branch from wadi' and 'small wadi in mountains' (p. 219 and 269); however, M001 says they are found in the *ḳāṭən* in example 47 above.

> *nēḥər*, pl. *nīḥār* 'narrow wadi branch off main wadi m.' (Watson et al., 2020, p. 219)

This word is found in the archives in connection with the *śḥayr* and good grazing at the end of the *xarf* season.

50. *xarfāy* *əmtallī* *wə-yḳabśəm* *mən* *ḥəlakmah*
*xarf.*DESC the.end and-graze.IMPERF.3.M.PL from there
ənīḥār [63]
the-**wadi.branch**
'the end of the monsoon period and from there they graze [livestock] in the wadis'

This root is linked to funeral feasts where animals were slaughtered both in honour of the person who died and to help feed the mourners who would often travel to participate (Tabook, 1997). The semantic link between a *wōdi* branch and funeral feasts is unclear.

> *ġīrīt* pl. *ġyartən* 'flat place suitable for sleeping'

ġīrīt pl *ġyartən* is a flat space on the *ḳāṭən* where people could build wind shelters when needed or just use for sleeping when wind shelters are not needed[64]. The *ġyartən* are also the preferred habitat of the plant *məṭəkēt* which camels eat and smells nice[65]. *Təghamk Āfyet* says these plains are normally above the head of a *wōdi* – so quite high in elevation (p. 297).

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[62] 20131018_MehriRabkut_M018_headingforwaterstory_20200622
[63] 20140612_MehriRabkut_M021_movingtopasture_Arabic_English_20160708
[64] 20140613_MehriRabkut_M021_windshelter
[65] 20140613_MehriRabkut_M021_plantscamelseat_20161025 and M010

gēḥi ‘a plain above the *wōdi*’ (Watson et al., 2020, p. 219)

gēḥi is related to gathering: *gátḥi* ‘to gather, intrans.’ and *šəgēḥi* ‘to have a disagreement with so.’ (Johnstone, 1987, p. 118). These semantic connections demonstrate two things: first, that gathering and flat places are linked, and second, that gathering is linked to disagreement. For a discussion on Mahra conflict resolution, see 4.2.6.

5.3.1.6 śīgɛʔ ‘cave; pen’

The final landscape category is *śayga*, pl *śīgɛʔ* ‘cave; pen’ which is a category apart from the other regions because there are caves in the *gbēl,* the *ḳāṭən*, the *sayḥ* and the *ūday*. In Ḥarsūsi, the cognate word means ‘house, home’ (Johnstone, 1987, p. 474).

There are several types of caves and overhangs that have been used to shelter people and animals.

rəḳab, pl. *rḳawwəb* ‘rocky overhang’

In the archived material, the word *rəḳab*, pl *rḳawwəb* means ‘rocky overhang’ which were walled off and used as winter shelters:

51.	***ərḳawwəb***	*yḥafrəm*	*tēhəm*	*yāmīl*
	the-**rocky.overhangs**	dig.IMPERF.3.M.PL	DO.3.M.PL	make.3.M.PL
	yəgədrəm	*līhəm*	*ḥall*	*ś-śētū* [66]
	build.a.wall.IMPERF.3.M.PL	to.it.M.PL	season	GEN-winter
	‘for **overhangs** they dig them and make a wall for them in the winter’			

These overhangs were used to shelter goats and, if large enough, humans as well.

dəxśīr, pl. *dəxśōr* ‘narrow, deep hole’

Another type of cave, *dəxśīr*, pl *dəxśōr* can also be translated ‘lair’ or ‘borehole’, suggesting a narrow but deep hole. The *Mehri Lexicon* also states that this word can refer to a hole in, but not through, an object (Johnstone, 1987, p. 77).

[66] 20140613_MehriRabkut_M021_windshelter

dəḥlīl, pl. *dəḥlōl* ‘small, narrow cave’

Lastly, *dəḥlīl*, pl *dəḥlōl* is also a small and narrow cave with the *Mehri Lexicon* reporting that it can refer to a lair for snakes and foxes in Śḥehret (p. 67). It is used in context in the *Mehri Lexicon* in connection to a pool of water:

52. *ta* *kōsa* *fōḳa* *bərk* ***dəḥlēl*** *əwkōb* *bərk*
until find.PERF.3.M.SG rain.pool in **small.cave** enter.PERF.3.M.SG in
adəḥlēl *wə-təḳ* *tā* *rēwi* [67]
the.small.cave and-drink.PERF.3.M.SG until satisfy.thirst.PERF.3.M.SG
'then when he found a pool of water in **the cave**, he went into **the cave** and drank till his thirst was slaked'

Having the wider context of the word gives a different mental picture to the thirsty man’s experience. If he were then to go to describe where he had found this water source to his family, knowing the difference between *dəḥlīl* and *śīgɛʔ* would be important.

5.3.1.7 Śḥerēt landscape vocabulary[68]

In contrast to the details of the *gbēl*, *ḳāṭən* and *ūday* in Mehri, Śḥerēt in the archived texts has a different subset of specific landscape vocabulary. The Śḥerēt data is less comprehensive as the focus of my research was on Mehri, but even in the small selection of Śḥerēt texts the landscape words used are different than the Mehri words.

Where Mehri has many words for plains around *ūday* and the *ḳāṭən*, Śḥerēt has words for the scrublands in the mountains and areas of the coastal plain. For example,

53. *yibġid* ***ɛśorḥ*** *ɛ-šɛh de-ḥotarf ʕar ūśēt ḏ-o tīlojš ūśēt lo her ol-ʕod yixorab herum* [69]
‘they go to the **woods** that they keep the livestock out of so that they don't destroy the trees’

ɛśorḥ (Ś) ‘wooded area’ appears to be a section of the *śḥayr* specifically protected from browsing livestock to ensure that there were enough building materials. The word *ɛśorḥ* (Ś) is related to spreading as in *śéraḥ* (Ś) ‘(bushes, trees) to spread out on the ground; (animals)

[67] (Johnstone, 1987, p. 91)
[68] Building morpheme-by-morpheme translations in Śḥerēt is significantly more complicated than doing so in Mehri, so morpheme-by-morpheme translations are not included here.
[69] 20131212_Shehret_J020_buildingstret

to spread out too much, scatter too far' and losing or being lost: *eśríḥ* (Ś) 'to lose (an animal)' and *śɛrḥún* (Ś) 'lost, strayed' (Johnstone, 1981, p. 255). This link could be because if an animal is in the *ɛśorḥ* it has strayed too far, so *ɛśorḥ* is something like 'the straying place'.

Another Śḥerēt word that is not shared in Mehri (according to the Lexicons) is for 'lower plains', *ēdaʕn*, such as those between Salalah and the mountains (Johnstone, 1981, p. 33). Mehri does not distinguish the landscapes on the coastal plain because Mehri speakers did not regularly inhabit that region until the 1980s. Śḥerēt speakers have lived in this region for millennia. This lower plain is contrasted with *ṣarḥát* which is translated 'plain' in the archived material but is not present in the *Jibbāli Lexicon*.

54. *b-eyyɛl tɔ́ḳhoben b-**ēdaʕn** bi-kɔ̄lʕaynī yinḳef yɔ̄ yeḥolb eləhúṫī ʕaḳ **ṣarḥát** / flo ʕaḳ daḳəf* [70]
'and camels spend the hot part of the day on **the lower plains** and in the late afternoon people milk cows on the **plain** or in shelters'

In this example, J004 is describing the rhythms for livestock when the star called *śermūm* rises at the end of the *xorf* (Ś). Because the flies are so bad at this time of the year, the camels go to the *ēdaʕn* (Ś) in the heat of the day but the cows are milked on the *ṣarḥát* (Ś) in the afternoons.

None of these words has cognates in Mehri with landscape meanings. There are cognate roots, but the meanings of the words do not include the type of plains or forest area. This is evidence that even though these languages have been in close contact for centuries if not millennia, the location in which they evolved/developed was distinct enough that they developed separate landscape vocabulary.

5.3.1.8 Camels

Finally, landscape categories manifest in Mehri in the types of camel which lives in each region. Because the landscapes are so varied, camels in each region have distinguishing characteristics, particularly on the pads of their feet, *mnawḳəśˀ*. These distinguishing

[70] 20130304_ShehretCJ_J004_mushroomsandstars_20160718

characteristics were salient because people in the past were able to tell a lot about a camel by the tracks she left.

Camels that come from the shore are called *ḥīḵeytən* from the word for shore, *ḥayḵ*. There are also camels that live in the *śḥayr* which are called *śḥəraytən*. These camels are smaller and lighter than other varieties and have smaller feet because they have to be able to climb through the mountains (al-Mahri et al., 2020a). Their feet do not have obvious toes and have small grooves in their pads[71].

Camels which are from the north-flowing wadis are called *ākədayt* which also have short tracks. There are three types of desert camels, *sīḥayyət* are from the *sayḥ* 'gravel desert', *angədiyyūt* which are from the *nagd*, also 'gravel desert' but *angədiyyūt* camels have smooth foot pads whereas *sīḥayyət* camels do not. Camels from the sand desert, *ramalayyət*, have long toes with a split in the middle. In the description of camel tracking, these appear to be inherited characteristics rather than ones that develop due to the environment.

These camel types are categorized by region in which they live and generally correspond to the regions described earlier: camels from the *gərbīb* (5.3.1.1) are called *ḥīḵaytən*, from the the *śḥayr* (5.3.1.2) are called *śḥaraytən*, from the north-flowing *ūday* (5.3.1.5) are called *ākədayt*[72], and those from the various desert types (5.3.1.4) are called *sīḥayyət*, *angədiyyūt*, and *ramalayyət*.

5.3.2 Soil types

Soil types are divided into at least ten categories, each with a unique name. Each soil type was historically important enough to warrant its own name and there were enough circumstances in which the distinction was significant to maintain the vocabulary.

[71] 20141104_MehriDhahbun_M043_cameltracking_M001_trans_20160512
[72] The root for *ākədayt* is not found in the *Mehri Lexicon*, but one consultant explained these camels are found at the heads of north-flowing *ūday* which is at the southern edge of the *ḵāṭən*.

The soil in Dhofar changes from one region to another, some fertile soil is found in the *gərbīb* along with sand, rockier soil in the mountains, and gravel transitioning to sand in the *ḳāṭən*. The Mahra have traditionally lived on the northern mountain slopes and plateau, so have extensive vocabulary for types of dust, sand, and gravel ranging from *sōfī* 'wind with dust in' or 'fine dust' (Morris et al., 2019, p. 21) to *ḥaṭḥayṯ* 'gravel' and *ṣarāf* 'flat stones'.

5.3.2.1 Dust

Dust is important for the Mahra because dust in the air can help read the weather. When storms blow in, they are preceded by a wind with fine dust in it (Said Baquir, p.c. 2021). There are also highly specific words for dust such as *marġāt* 'dust, especially that produced by camels rolling on the ground' (Morris et al., 2019, p. 21). Finding free-range camels without GPS tags can be aided if one can recognise the *marġāt* they produce.

5.3.2.2 Stone

Stone was used extensively for tools, cooking and building. The root for 'stone' is ṣ-w-r. It also carries the meaning of 'to stand' in the base form of the verb *ṣōr/ yəṣáwr* 'to stand' (Johnstone, 1987, p. 368) perhaps linking to stones as markers or permanent fixtures. Permanent shelters for humans *strit* (Ś) and animals *diṣ̃af* (Ś) were built with walls of stone 1.5-2m high by Śḥerēt speakers of the mountains (Watson et al., 2024).

There are also specific words for stone such as *ḳaṣṣ* 'limestone stones'[73]. *ḳaṣṣ* were used as weights for shark nets. Flat rock, *ṣarāf* (M), *ṣarfit* (Ś) was used as the foundation for the permanent buildings in the mountains, especially the *diṣ̃af* (Ś) because mucking the buildings out is easier on rock than on soil or sand (Watson et al., 2024). The ṣ-r-f root is also associated with the place where water flows:

55.	*ykūn*	*b-amsaylət*	*hāl*	***əṣərfayt***	*wə-hāl*	*adahəḳ* [74]
	be.IMPERF.3.M.SG	by-the.flood	with	**the.flat.stones**	and-with	the.large.rocks

'it is found where the flood waters run by **flat stones** and large rocks'

[73] 20141111_MehriHask_M044_sharknetsM001_20200603
[74] 20140613_MehriRabkut_M021_plantscamelseat_20161025

This quote is describing where a plant, called *haḥark* (M), grows. It was important to know this information in the past because this plant was eaten by camels. This root also produces words for 'to be economical' *ṣərūf* and 'rations, supplies' *məṣráwf* (Johnstone, 1987, p. 366).

There are *mḳadrēt* 'rocks used for holding cooking pots over the fire' (Ali al-Mahri, p.c. 2018) and *ḥiṣṣ*, pl. *ḥəṣṣayt* 'pebbles' which were heated in fire and then added to milk bowls, *ḳālīw*.

56.	***ḥəṣṣayt***	*bərk*	*əḳālīw /*		*wə-yḥābəm*		*ṭār*	*ṭār*
	pebbles	in	the.milk.bowl /		and-milk.IMPERF.3.M.PL		on	on
	ḥəṣṣayt	*ḏikmah*	*ṭār*	***ḥəṣṣayt***	*ḏikmah*	*bərk*	*əḳālīw* [75]	
	pebbles	those	on	**pebbles**	those	in	the.milk.bowl	

'**pebbles** into the milk bowl and they would milk over those **pebbles** in the milk bowl'

These *ḥəṣṣayt* were heated first in a *mśarfūt* 'fire for heating stones' then scooped into the *ḳālīw* 'milk bowl.' Then the goats were milked onto the hot stones, immediately heating and pasteurising the milk. These stones are found at the bottom of *ūday* and are white.

5.3.2.3 Sand

In the *Comparative Glossary* there are two types of sand (p. 21). The word for sand in general is derived from the root r-m-l as are words to do with being sandy and the sand desert (Johnstone, 1987, p. 327). The word for sand from the coast, however, *ḥayḳ* is the same as the word for 'shore' (Johnstone, 1987, p. 197).

5.3.3 Water

Water, especially permanent water, was of central importance to life in Dhofar prior to the installation of water infrastructure in the 1970s and 1980s. As such, there is an extensive vocabulary surrounding water and its sources. Traditionally, the permanent water sources in the monsoon-affected mountains were controlled by the Śḥari (Śḥerēt speakers) people. According to M003, his father taught him that those water sources belonged to the cattle-herding people of the mountains. When the tribal lands were nationalised in 1974 (Janzen,

[75] 20141103_MehriDhahbun_M017_goatmilk_20160718

2000), the Śḥari people's right to defend these springs was removed, and today the springs, though less important than in the past, are no longer under Śḥari control.

The Mahra traditionally controlled the water sources to the north. There are many stories about interactions and conflict around water (see Chapter 4). Access to water was a matter of life and death. Ideally, tribes that controlled water would allow others to use it, and to refuse someone access was shameful and justification for armed conflict. As discussed in 4.2.2, there is a root in Mehri ḥ-k-r which forms words such as *ḥəkūr* 'to keep so's livestock off your pasture' (Johnstone, 1987, p. 174). Other words from this root have connotations of frustration: *ḥátkər* 'to have to wait a long time and become frustrated' and entrapment: *šəḥkūr* 'to be unable to leave a place repugnant to you' (ibid.). That there is a root that in the base-form of the verb produces a word about preventing livestock from watering demonstrates again the importance of this concept. And while it may not be particular to the Dhofar region, it is linked to an ecosystem that has traditionally not had enough water resources to sustain the population comfortably.

Water sources were not only difficult to come by, but also unreliable from one year to another. Thus, the Mahra developed an extensive vocabulary relating to the various types of water available. The following sections describe the vocabulary of water sources from the past.

5.3.3.1 *məhṣāt* 'waterscrape'

When ground-water sources such as *fḳawwa* (5.3.3.4) or *məḥlōḳ* (5.3.3.6) run dry, the Mahra have developed a technique for finding ground water that is within about 2m of the ground surface. Gasparini & al-Mahri (2023) explain that a large rock is thrown down and the sound it makes on impact is analysed for the presence and depth of water in that location. There is an entire root in Mehri from which words for this type of water source are derived: ḥ-s-v[76] in the *Mehri Lexicon* but Watson transcribes the words with an emphatic /ṣ/ and plain /h/: h-ṣ-v. Watson's transcription is supported by the quality of the long vowel in the final syllable (see Watson, 2012, p. 15). Watson translates the noun *məhṣāt* as

[76] *Mehri Lexicon* uses 'v' to represent a vowel within a root without specifying whether the vowel is 'w' or 'y'.

'waterscrape', the *Mehri Lexicon* does not contain *məhṣāt* but gives *ḥəsū* 'to make a water-hold, dig for water' (Johnstone, 1987, p. 189) and the *Jibbāli Lexicon* has *máḥsi*, pl *maḥábsi* as 'well' (Johnstone, 1981, p. 116).

When asked to explain what a *məhṣāt* is, M018 used a verb from the same root:

57.	*tġayrəb*	***məhṣāt***	***məhṣāt***	*bərk*	*əbaṭḥ*	*ḥmoh*	*bərk*
	know.IMPERF.2.F.SG	**h-ṣ-v**	**h-ṣ-v**	in	the-ground	water	in
	abaṭḥ /	***yhaṣyəm***		*tēs /*	***nhayṣəs*** [77]		
	the-ground /	**h-ṣ-v**.IMPERF.3.M.PL		DO-F.SG /	**h-ṣ-v**.IMPERF.1.PL.DO-F.SG		

'do you know about **waterscrapes**? Water in the ground they **dig** it, we **dig** it'

This sentence might be translated into English as 'Do you know waterscrapes? Waterscrapes are water in the ground. They waterscrape it, we waterscrape it.' The verb is derived from the same root as the noun. This strategy of 'waterscraping' for finding water and the vocabulary that goes with it developed because of the scarcity of available water and the geography that results in ground water remaining close to the surface in certain circumstances.

5.3.3.2 śtrīr *pl.* śtrōr ~ gabyət[78] *pl.* gwōbi *'water pool'*

Water pools are called *śtrīr*, pl *śtrōr* 'water pool; rain-filled small or large patch of water' or *gabyət*, pl *gwōbi* 'water pool; walled pool or pond for collecting water' (Morris et al., 2019, p. 21). The roots for these two words both also have a word to do with raising capital; from ś-t-r *śətūr* 'to raise capital from o's fellow tribesmen' (Johnstone, 1987, p. 386) and from g-b-y *gəbō* 'to levy contributions or taxes, to go around to one's tribe asking for help with a debt' (Johnstone, 1987, p. 113). Perhaps the semantic connection comes from 'collect' where *gabyat* and *śtrīr* are collectors of water, *śətūr* and *gəbō* are verbs for collecting money.

There are several synonyms like *śtrīr ~ gabyət* in the lexicon. Often my Mahriyyōt consultant would know a word from Mehreyyet but say something like 'we don't use that word, we say

[77] 20131018_MehriRabkut_M018_headingforwaterstory_20200622
[78] *gabyat* in the *Comparative Glossary.*

_____ instead.' The *Mehri Lexicon* does not indicate which dialect group uses which synonyms; further investigation would be necessary to discuss this.

5.3.3.3 ʔayn *'spring'*

Besides water pools, there are also springs, *ʔayn*, and the resulting pools from them. The Mehri word for spring is transparently related to other Semitic words – Arabic: *ʕayn* Hebrew: *ʔayn* etc. And, as in other Semitic languages, it can also mean 'eye'. Springs are mostly found in the mountains of Dhofar.

5.3.3.4 fōḳa *pl.* fḳawwa *'rain pool' (Johnstone, 1987, p. 91)*

When a spring seeps through rocks and into a pool, that pool is called *fōḳa,* pl *fḳawwa* as in:

58.	*ta*	*kōsa*	***fōḳa***	*bərk*	*dəḥlēl*	*əwkōb*	*bərk*
	until	find.PERF.3.M.SG	**rain.pool**	in	small.cave	enter.PERF.3.M.SG	in
	adəḥlēl	*wə-təḳ*		*tā*	*rēwi* [79]		
	the.small.cave	and-drink.PERF.3.M.SG		until	satisfy thirst.PERF.3.M.SG		

'then when he found **a pool of water** in the cave, he went into the cave and drank till his thirst was slaked'

According to Gasparini & al-Mahri (2023), these pools were frequently found after rainfall but often available throughout the year. Knowing places where these pools could be found was very important in the past.

5.3.3.5 krayf *pl.* krōfat *'water pool' (Morris et al., 2019, p. 21)*

Other types of pools include *krayf*, pl *krōfat*/ *krift* 'water pool; dug-out pool that is larger than *gabyət*' (Morris et al., 2019, p. 21). Being larger than *gabyət* suggests that a *krayf* could support a family for longer into the year post-monsoon.

5.3.3.6 maḥlīḳ *pl*. məḥlōḳ *'water pool; rock pool' (Morris et al., 2019, p. 21)*

Lastly, *maḥlīḳ*, pl *məḥlōḳ/ amḥəlōḳ* is a 'water pool; rock pool' (Morris et al., 2019, p. 21).

[79] (Johnstone, 1987, p. 91)

59. *maṭṭawr* *ḥāmyih* *wə-tkūsa* *bīs* ***amḥəlōḳ /***
sometimes water.PL and-find.IMPERF.2.SG.M in.DO-3.F.SG **rock.pool**
wə-ṣarāf / *mēkin* [80]
and-flat.rocks many
'in places water and there [in the *ḳāṭən* (*5.3.1.3*)] you find **rock pools** and flat rocks, a lot'

maḥlīḳ is not included in the *Mehri Lexicon* but there is a root ḥ-l-ḳ that has to do with circles as in *ḥewḳāt*, pl *ḥəlēḳ* 'circle, ring' (Johnstone, 1987, p. 178). It is possible that these words are not related, or it could be that the pools tend to be round.

5.4 Climate and culture

Dhofar experiences four distinct seasons, but they do not follow the order typical of seasonal changes elsewhere. This unique climate is reflected linguistically in the names of the seasons and culturally in the activities associated with each season. The following sections describe the seasons (5.4.1), activities associated with various seasons (5.4.2), and plants that have been important for livestock (5.4.3).

5.4.1 Seasons

The escarpment mountains in Dhofar block monsoon winds from the Indian Ocean and cause the moisture to condense into thick fog and rain each year. This means that a unique climate has developed with four distinct seasons in the region. The seasons of Dhofar occur roughly in these Gregorian months:

Mid-June – September	*xarf*, wet
October – December	*ṣayrəb*, moderate
January – March	*śētu*, cold
April – June	*ḳayṭ*, hot

Translating the names of these seasons into English season words such as 'autumn' or 'summer' does not provide correct or necessary information (Watson, 2017). This section

[80] 20161009_MehriRabkut_M001_topography_seatodesert_20161114; 20131018_MehriRabkut_M018_headingforwaterstory_20200622

describes the typical weather for the four seasons and the following section describes seasonal activities.

5.4.1.1 xarf

The *xarf* season is from June to September. It is characterised by monsoon winds blowing in from the Indian Ocean bringing fog, heavy clouds, and rain. The monsoon season interrupts the expected seasonal pattern by coming at the hottest period for most of the northern hemisphere. During this season, the sea is inaccessible because of 3m-5m waves throughout the season (al-Qumairi et al., 2024; Information Portal, 2024).

In the past, this season was one of hardship because by the beginning of *xarf*, the grazing and fodder plants for livestock were dormant due to the hot pre-monsoon season, *ḳayṭ* (M) (5.4.1.4). Hungry livestock produce less milk, meaning people would go hungry as well. In addition, the damp and colder weather brought on many health complications (Miller & Morris, 1988). Many families in the mountains would, and some still do, move north to avoid the persistent mists and rain of the *xarf*. Even today, there are families north of the mountains who choose to live in smaller settlements to avoid the *xarf* weather. Camels especially must be moved out of the *xarf*-affected mountains because they are unable to safely walk on wet soil or vegetation. Even today veterinary services are not equipped to provide surgery for a camel that has fallen and broken a bone (see: śēṣər).

On the other hand, the *xarf* brings rainwater to the region. The run-off feeds *ūday* which flow into the *ḳāṭən* and *nagd* where the Mahra raise camels and goats. The water flows mostly underground, especially north of the mountains, and sustains the local flora far beyond the reach of the *xarf* rains and mists. One of the most important *nagd* trees was *ḥəruṣ*, *Acacia tortilis*[81], one of the only trees to grow in the desert. In the past, Mahra tribes have made treaties protecting these trees from being cut or damaged. More recently, camel herds in the mountains were culled because they were causing too much damage to these trees (Janet Watson, p.c. 2021).

[81] *Vachellia tortilis*

5.4.1.2 ṣayrəb

The post-monsoon season, called *ṣayrəb* in Mehri, is described as having pleasant weather, not too hot and not too cold.

60. ***əṣarbī*** *ykūn* *ykūn*
the-post.monsoon.season.DESC be.IMPERF.3.M.SG be.IMPERF.3.M.SG the-
əjaww *jīd* *ykūn* *mātadál* *ykūn* *ḳāṣəm /*
weather good be.IMPERF.3.M.SG mild (A) be.IMPERF.3.M.SG cold /
wə-ykūn / *ḥabōr* *wīyən* *lā* [82]
and-be.IMPERF.3.M.SG / cold very NEG
'the **post-monsoon period** the weather is good and mild, it is cool and not very cold'

The name for this season comes from the root for collecting sardines because, in the past, this was when camel herders would come to the seashore to collect sardines for their livestock (Saeed al-Qumairi, p.c. 2023). Through this season, the greenery left by the *xarf* slowly dries and becomes increasingly brown. When the *xarf* rains are good, *ṣayrəb* is a time of good milk yields and plenty of pasture. This allowed for more free time, so in the mountains people would often have circumcision parties and weddings in this season (Tabook, 1997). In Dhofar, boys were circumcised around puberty because they were not considered adults until after circumcision. By being classified as 'not-adult' they were shielded from the inter-tribal disputes and blood-debts (Tabook, 1997).

In this season there are many flies, which make life uncomfortable. One strategy used to mitigate the flies was to seal livestock into caves with smoky fires burning to deter flies and allowing livestock to graze at night. *ṣayrəb* gets progressively cooler.

5.4.1.3 śētu

After *ṣayrəb* comes *śētu* 'winter' when shelter from the cold winds was necessary for both humans and livestock. Sometimes rains would come to the *nagd*, allowing livestock to be pastured there in the hotter seasons later in the year.

[82] 20161107_MehriHawf_M066_seasons_stars_20161120

61. *b-anagd* *hām* *nagd* *šarḥawm* ***śtəwī*** *ḥābū*
in-the.desert if desert rain.PERF.3.M.SG **cold.season.DESC** people
yhəngīd / *ād* *yhiḳfīd* *agēʔ* *lā* [83]
go.to.desert.3.M.SG / still go.down.3.M.SG gullies NEG
'if rain comes in the desert in the **winter** people move to the desert; they don't go to the gullies'

This quote is taken from a discussion about the hot period when camels cannot cope with the heat on the slopes. If there had been rain in the *nagd,* then the camels and their herders will go to the *nagd* instead of the *agēʔ*. If there was no rain in the *nagd*, then the herds would go to the *agēʔ*.

5.4.1.4 ḳayṭ

The season before *xarf* is called *ḳayṭ*. It is hot and pastures are greatly reduced during this season. In this season the sea wind (5.2.2.1) blows and brings relief from the heat:

62. *əmdīt* *ḥall* ***ḏ-aḳayṭ****…* *wə-ḥābū* *yfərḥəm*
the.sea.wind season **GEN-hot.season**… and-people be.happy.IMPERF.3.M.PL
bīs [84]
in-DO.3.F.S
'the sea winds come in the **hot period**… and people delight in it'

Also, during *ḳayṭ*, people and animals would sleep in the open or under trees rather than in shelters.

63. *mākəni* *barhəm* *ār* ***ḳayṭ*** *ykūn* *ār*
but PARTICLE.3.M.PL only **hot.season** be.IMPERF.3.M.SG only
bə-ġīyərtən [85]
in-flat.area
'but in the **hot season** they are on open ground'

This quote is from a recording about wind shelters and how they are not needed in *ḳayṭ*; people and animals would sleep in *ġiyartən* 'flat place on the *ḳāṭən*' (5.3.1.3) or shelter under trees:

[83] 20140612_MehriRabkut_M021_movingtopasture_Arabic_English_20160708
[84] 20161114_MehriRabkut_M019_winds
[85] 20140613_MehriRabkut_M021_windshelters

64. *mət* *hēh* *hawb* *amūxafsən* *ār* *wala* *l-ḥaybaṭ*[86]
when it.M hot night.shelter.GEN-3.F.PL only or by-*Ziziphus.leucodermis*
wala *l-ḥarzīt* [87]
or by-*ḥarzīt*.tree
'when it is warm their [goats'] night shelter is by a *Ziziphus leucodermis* (see Figure 6) or a *ḥarzīt* tree'

This is contrasted in the ELAR recordings with the colder months when people and animals would sleep in shelters, usually caves.

Figure 6 ḥaybaṭ in Rabkut

5.4.2 Seasonal activities

Each season in Dhofar had its own activities which developed within the unique seasonal rhythms described above and the ecological and geographical characteristics of the region.

5.4.2.1 ʔarf *work and trade*

Because of the availability of underground water, the *ʔarf* (M), *Nannorrhops ritchiana* tree grows abundantly on *wōdi* beds well into the *ḳāṭən* (see Figure 9 for photo). Harvesting and shipping *ʔarf* to the coast was one of the main economic practices the Mahra regularly employed in the past (Tabook, 1997). The *saʕf* (M) 'fronds' were cut during the *xarf* and *ṣayrəb* seasons and shipped to the coastal towns by camel (Tabook, 1997; Watson & Morris,

[86] p.c. Janet Watson, 2024. In the ELAN transcription online this is transcribed as *ḥaybaś*, a plant with unknown botanic nomenclature.
[87] 20141103_MehriDhahbun_M017_goatmilk_20160718

2016a). Women, both of the *nagd* and the coastal towns, would use the *saʕf* 'fronds' to weave *ḳālīw* 'milk bowls', mats including *səggōdət* 'prayer mat'[88], *ḳayd* 'rope', *həddūt* 'baby cradle', *əmġadfēt* 'sardine nets'[89] etc. which they would also sometimes sell or barter and sometimes keep for household use. This harvest of *ʔarf* and subsequent production have largely fallen out of practice due to imported plastic goods. Some women still make these types of household goods to be sold, but these products are then displayed as decoration rather than used.

5.4.2.2 məġrāt *pl.* amġar *'Frankincense tree'*

Another very important economic activity of the region governed by climate and seasons is the frankincense harvest. The sap of *məġrāt* pl. *amġar* (M)*, Boswellia sacra* 'frankincense tree', runs in every season except *śētū*. In the past, people would travel by foot from as far away as Ḥawf, Yemen to work in the harvesting in central and eastern Dhofar. From the fourth century BCE to the fifth century CE, southern Arabia was central in the frankincense trade (Seland, 2014). Ancient trade routes through the Red Sea, Indian Ocean, and Persian/Arabian Gulf brought Dhofari frankincense through the Indian, Mediterranean, and Persian regions.

Figure 7 məġrāt in Wadi Gzayl

[88] (Johnstone, 1987, p. 343)
[89] 20141111_MehriHask_M044_castnets_sardinecatchinganddrying_trans

məġrāt requires a dry climate but also access to ground water. Their tolerance for temperature variation is quite limited, so they do not grow very far to the north of the mountains because it gets too hot there (Miller & Morris, 1988). They are mostly found at the north-flowing *wōdi* heads on the northern side of the escarpment; however, they can also be found on the sea-facing southern mountains.

The quality of the resin, *śeḥaz*, produced depends on the humidity surrounding the plants – high humidity leads to lower-quality resin. The Mahra have names for four levels of quality of frankincense. *ḥōgəri* (M), the highest quality frankincense, is opaque and white and comes from the trees in *Wōdi* Ḥōgər. *nagdi* is from trees in the *nagd*, *šazəri* is from the foothills of the escarpment, and *šāʕbi* is the lowest quality and from the mountains near the sea (al-Mahri & Boom, 2020). According to Miller & Morris (1988) who focussed on Śḥerēt speakers, the quality of resin also depends on the season it is harvested in. The best quality frankincense is harvested during *xarf* and is called *śáḥaz xarfí* (Ś), particularly when harvested east of the monsoon regions where *xarf* is a hot season rather than wet. The frankincense gathered following *xarf* is called *śáḥaz ṣerbí* (Ś) which is also good quality but second to *śáḥaz xarfi*. *śáḥaz ḳīḍí* (Ś) was the lowest grade and harvested during the hot season, *ḳayṭ* (M). These grades of resin are then further refined by the location in which they were collected, the further from the moisture of the sea and monsoon, the better. The source of the resin was more important when used dried, for example in fumigation or medicines, than fresh. The Śḥerēt speakers also believed the best quality frankincense came from Habjer which could be the Śḥerēt name for *Wōdi* Hoger.

The history of management of the frankincense harvest and tree ownership either varies from one family group to the next or is shrouded in secrecy. Given the enormous value of the trade historically, both could be the case – great value is protected by great secrecy, so diverse management strategies arise. Miller & Morris (1988) report that ancient writings

Figure 8 śeḥaz, frankincense resin in Wadi Gzayl

from Greek and Roman explorers and traders gave varying descriptions of ownership and protection of the frankincense trees. Some of these ancient authors wrote that only certain family lines had inherited access to the trees and other authorities wrote that the trees were held in common. It is also possible that the ownership strategies shifted over time. Tabook (1997) writes that *jinn* were believed to guard the valleys where trees were found, citing the trees' value and the logic behind wanting to deter intruders.

In interviewing Dhofaris, information about frankincense management is difficult to obtain and corroborate. In the archived recordings on frankincense work, speakers describe working hard from sunup to sundown with a break mid-day for lunch and prayers. One speaker describes a tradesman, *tōgər*, who was in charge and hired a foreman, *ṭəbayn*, to

organise and direct the workers, *āwēn*. Sometimes the *ṭəbayn* was responsible for organising the workers and carrying food and water to them during the day[90]. In other texts, workers would return to their shelter, *mənzīl*, for a meal, mid-day prayer, and rest[91].

The resin harvested was split between the *ṭəbayn* and the *āwēn* by weight. *āwēn* could then either keep their share of the frankincense for their own use or sell it at market.

Frankincense was traditionally harvested in cycles of three cuts with rest time in between; some sources report ten days in between each cut, others 5-7 days[92]. The first set of cuts is called *tūḳāʔ*, the second is *ṣāf* and the third is *dwūrər*. The time between cuts allowed the tree to rest and therefore the harvesting was sustainable for millennia. Miller & Morris (1988) report that the ancient Greek and Roman accounts match closely with how frankincense was harvested during their research. Today, however, the traditional harvesting practices have been largely abandoned. Many Dhofaris no longer take part in the harvest and instead hire migrant workers, often from the Horn of Africa, to carry out the harvest instead. These migrant workers are not motivated to maintain the health of the trees, so tapping is done more vigorously and with less opportunity for the trees to rest and recover. At the same time, camels eat *amġar* and with increased numbers of camels in the region, the young trees are unable to reach maturity before they are grazed to death. As a result, the health and population of the frankincense trees has greatly diminished. This is an example of the traditional knowledge being both accessible and helpful for sustainable management that could be applied to harvesting today.

5.4.2.3 Transhumance

Transhumance is, by definition, a seasonal activity. In Dhofar, pasture is available when and where the rains fall, so paddocks in which animals can remain full-time are not usually found. The rain patterns are variable from one year to another, so pasture availability constantly shifts. Much time and effort were invested in finding pasture, particularly in the

[90] 20131115_MehriRabkut_M010_frankincense_20160711
[91] 20110227_MehriRabkut_M004_frankincense
[92] Much of this paragraph is taken from al-Mahri et al. (2020b).

more northern regions where the Mahra traditionally raised their livestock. The Mehri word *záyhēd* ‘an expert, possessed of good counsel’ includes the meaning ‘know the best pastures’ (Johnstone, 1987, p. 466; Watson et al., 2020, p. 321).

Transhumance verbs

Transhumance is central to Mahra vocabulary and understanding of the world, even today. I have not found general descriptions of how transhumance was practiced by the Mahra in the past, but Chatty (1987) describes how the Ḥarsasiis, neighbours of the Mahra, would manage household movement: “Homesteads are generally moved a significant distance three or four times a year. A serious husbandman, though, will shift his homestead every few weeks to ensure that the family herd of goats and sheep does not destroy what graze exists around the campsite.” (p. 17) Since moving was so central to Mahra livelihood, there are several vocabulary items to do with this movement.

nśoh *(*nəśū *in Johnstone p. 303) ‘to transhume, migrate following pasture’*

nśoh ‘to transhume, migrate following pasture’ is the verb most often used in the archived material for moving for pasture. In the archive, it is often translated ‘to head for water’ rather than ‘pasture.’ As discussed, these two concepts are intimately connected in Mehri because *ərḥəmēt* means both ‘pasture’ and ‘rain’ (see 5.2.2.2).

65. *nəḥōm* ***nənśah*** */* *bēr* *wə-rawn*
want.IMPERF.1.PL **head.for.water.**IMPERF.1.PL / camel and-goat
*wə- wə-**nōśən*** *wə- wə-ḳīṯōy* [93]
and- and-**head.for.water.**PERF.1.PL and- and-hot.season.DESC
'we want to **head for water** with the camels and goats so we **headed for water** and it was in the hot period’

[93] 20131018_MehriRabkut_M018_headingforwaterstory_20200622

zəmūl *'to follow the pastures, the rain' (Johnstone, 1987, p. 468)*

A seeming synonym of *nśoh* found in the *Mehri Lexicon* is *zəmūl*, though Johnstone notes that this meaning is from Southern Mehri which he recorded in Dubai (p. 468). *zəmūl* is related to words for camel gear and loads.

xṭawl *'to move towards grazing after the monsoon [camels]' (Watson et al., 2020, p. 320)*

Another verb specific for camels is *xṭawl* 'to move towards grazing after the monsoon [camels]' (Watson et al., 2020, p. 320). It only appears twice in the archived texts examined here, both times by the same speaker – M021. In the following quote, he explains what *xṭawl* means:

66. ***yəxṭay:l*** *yaxah* ***yəxṭayl*** *kall*
yəxṭayl mean.IMPERF.3.M.SG.DO-M.SG ***yəxṭayl*** all
yəgtamam *kall* *faxra* ***wə-txaṭlən***
come.together.IMPERF.3.M.PL all together **and-x-ṭ-l.IMPERF.3.F.PL**
xōtər *tḳəfdən* *xōtər* [94]
down go.down.IMPERF.3.F.PL down
'*yəxṭayl*, *yəxṭayl* means that they all get together and move down, they move down'

From this explanation, *yəxṭayl* is both a gathering and a moving together.

ḳəlōb *'to return to o's place with o's animals when the pasture is exhausted' (Johnstone, 1987, p. 229)*

There is a word for the action taken once the pasture has been consumed: *ḳəlōb* 'to return to o's place with o's animals when the pasture is exhausted' (Johnstone, 1987, p. 229). Words from this root also include *aḳōləb* 'to upset', *əḳtəlōb* 'to be upset' and *ḳāb* 'heart', in some dialects realised as *ḳalb*. The sense of being upset on returning after the pasture is depleted fits with the difficulty of finding pasture.

[94] 20140612_MehriRabkut_M021_movingtopasture_Arabic_English_20160708

ṭōf *'to scout for water'*

There are also verbs found in the ELAR texts that are connected to transhumance but not the act of the movement itself. One is scouting for water: *ṭōf*. This was not practiced for every household relocation:

67.	*fnōhən*	*haman*	*āmūr*	*ḏ-ərḥəmēt*	*əgidət*
	at.first	hear.PERF.1.PL	say.PERF.3.M.SG	GEN-the-rain/pasture	good
	*wə- wə-**ṭōfən***		*lā* [95]		
	and- and-**scout**.PERF.1.PL		NEG		
	'we first heard they said the rain was good so we didn't scout'				

This decision not to scout for water turned out to be unwise as the rain this family was following was insufficient for their needs. This is the only instance of this word in the ELAR texts examined here, so it is uncertain what was involved in *ṭōf* and how regularly it was practiced. Since there is a word for this action it can be presumed that it was a common, and wise, practice.

śxūlūl *'to stay; to sit'*

Lastly, there are words for remaining. *śxūlūl* is used for short rests as in the frankincense work description:

68.	***yəśxawlīl***	*mən*	*nhūrən /*	*yāṣalyən*	*əṭahər* [96]
	stay.IMPERF.3.M.PL	from	midday /	pray.IMPERF.3.M.PL	midday.prayer
	'they **rest** at midday and pray the midday prayer'				

It is also used for longer stays, for example, the length of time it takes for camels to stop producing milk when pasture is not available:

[95] 20131018_MehriRabkut_M018_headingforwaterstory_20200622
[96] 20110227_MehriRabkut_M004_frankincense

69. *wə-hbēr* *kənhūr* *fəġśaytən* *wə-**śxawlōlən*** *ḥəlakmah*
and-camels in.the.past full.of.milk.F.PL and-**stay**.PERF.1.PL there
l-ād *bīsən* [97]
no.longer with.F.PL
'and the camels had been full of milk and we **stay[ed]** there until they no longer had [milk]'

həbrūk *'to make [a camel] kneel*

Lastly, another word used in Mehri for a sense of 'staying' is *həbrūk* 'to make [a camel] kneel.' This word is used in the sense of 'to make camp'.

70. *wə-gəhmā* *həlḥōḳən* *lḥəḳ* ***həbrōkən***
and-tomorrow round.up.camels.PERF.1.PL upstream **kneel.camel**.PERF.1.PL
bə-ḥəwōdi *mšəġrēt* [98]
in-wadi next
'and the next day we moved upstream and **knelt** in the next wadi'

This quote comes from a story in which the family group is searching for pasture and includes a list of places in which they camped on their journey. *hebrōkən* is 1st person plural form of *bərūk* (but Johnstone reports *bərōk* which is the pronunciation found in Yemeni dialects) '(camels) to kneel' (Johnstone, 1987, p. 52). Related words include *məbrēk* 'camping-place', and *bəráyk* 'blessed' (both from Johnstone, 1987, p. 53). The link between kneeling camels and camping could come from forcing camels to kneel so they can be unloaded to set up camp.

Pasture

Another area of the language related to transhumance is the vocabulary about pasture. There are many words in the *Mehri Lexicon*, *Təghamk Āfyet*, and the ELAR texts to do with pasture.

[97] 20131018_MehriRabkut_M018_headingforwaterstory_20200622
[98] 20131018_MehriRabkut_M018_headingforwaterstory_20200622

mətwē *'pasture or grazing' (Johnstone, 1987, p. 404)*

mətwē 'pasture or grazing' (Johnstone, 1987, p. 404) seems to be a general word for 'grazing' found in the *Mehri Lexicon* and the ELAR texts.

71.	*wə-bawməh*	*kūsan*	***mtwē***	*nḥōm*	*nśxawwəl*
	and-here	find.PERF.1.PL	**pasture**	want.IMPERF.1.PL	stay.IMPERF.1.PL
	bawməh [99]				
	here				

'and here we've found **pasture**, we want to stay here'

This root is t-w-y and has to do with eating for both animals, as in *mətwē* 'pasture', and people, as in *twoh* 'to eat' (Watson et al., 2020, p. 107) and *táywi* 'meat' (Johnstone, 1987, p. 404). *twoh* can also be used in relation to livestock as in:

72.	*ḥārawn*	***ttawiyən***	*tēs* [100]
	goat.PL	**eat**.IMPERF.3.F.PL	DO-F.S

'goats eat it'

maray *'pasture' (Johnstone, 1987, p. 268; Watson et al., 2020, p. 174)*

maray is another word that simply means 'pasture' (Johnstone, 1987, p. 268; Watson et al., 2020, p. 174). There are no related words in the *Mehri Lexicon*, though *Təghamk Āfyət* also gives the translation of 'grass' for this word (p. 97). In the following example, *maray* grows and becomes a different type of pasture, *faġś*, one that is specifically good for milk production (and discussed below).

73.	*wə-mġōrən*	*wīḳa /*		*ʕəśś*	***amaray /***
	and-then	become.PERF.3.M.SG /		grow.PERF.3.M.SG	**pasture** /
	wīḳa		*xayr*	*wə-faġś* [101]	
	become.PERF.3.M.SG		goodness	and-good.pasture	

'and then the **pasture** grew and there was plenty of good pasture for milking'

[99] 20131018_MehriRabkut_M018_headingforwaterstory_20200622
[100] M010 p.c. 2021
[101] 20131018_MehriRabkut_M018_headingforwaterstory_20200622

marawt *'pasture' (Morris et al., 2019, p. 4; Watson et al., 2020, p. 39)*

This word is only found in the *Glossary* (p. 4) and *Təghamk Āfyət* (p. 39) but without information about how it contrasts with *maray.*

ṛayf *'good pasture' (Morris et al., 2019, p. 4; Watson et al., 2020, p. 10)*

This word is found in the ELAR texts, *Təghamk Āfyət* and the *Comparative Glossary* but not in the *Mehri Lexicon*. It has the relatively uncommon emphatic /ṛ/ which is contrastive with /r/ as in the minimal pair *ṛayf* 'good pasture' (Morris et al., 2019, p. 4; Watson et al., 2020, p. 10) and the word *rayf* 'refractory (camel), unbroken' (Johnstone, 1987, p. 311).

In the archived texts, this definition was given for *ṛayf*:

74.	***aṛayf***	*nʔōmər*	***aṛayf /***	*hēh wə-hēh*	*mtəwē*	*mēkən* [102]
	aṛayf	call.IMPERF.1.PL	***aṛayf /***	when	pasture	much

'*aṛayf*, we call it *aṛayf* when there is lots of good pasture'

ṛayf includes the idea of abundance, in contrast with *mətwē* 'pasture or grazing' (Johnstone, 1987, p. 404) which is modified by *mēkən* 'much' in this example.

fəġaś *'to flourish' (Johnstone, 1987, p. 89)*

Another pasture word that has to do with abundance comes from the root f-ġ-ś which gives the verb *fəġāś* 'to flourish' (Johnstone, 1987, p. 89) and the noun *faġś* occurs as a woman's name (Janet Watson, p.c. 2024) and is defined as 'plentiful grazing' (Johnstone, 1987, p. 89) or 'good pasture for milking', as in this example:

75.	*wə-mġōrən*	*wīḳa /*	*ʕəśś*	*amaray /*	
	and-then	become.PERF.3.M.SG /	grow.PERF.3.M.SG	pasture /	
	wīḳa	*xayr*	*wə-**faġś*** [103]		
	become.PERF.3.M.SG	goodness	and-**good.pasture**		

'and then the pasture grew and there was plenty of **good pasture for milking'**

[102] 20131018_MehriRabkut_M018_headingforwaterstory_20200622
[103] 20131018_MehriRabkut_M018_headingforwaterstory_20200622

The link to abundant milk is one that is explicit in the descriptor word derived from this root, which is *fġəśyūt* pl. *fəġśaytən* 'full of milk f.' (Watson et al., 2020, p. 55) and found in the ELAR texts here (among others):

76.	*wə-hbēr*	*kənhūr*	***fəġśaytən***		*wə-śxawlōlən*		*ḥalakməh*
	and-camels	in.the.past	**full.of.milk**.F.PL		and-stay.PERF.1.PL		there
	l-ād	*bīsən*	*śxōf*	*śī*	*lā*	*ham[ak]*	*w-ūbūdən*
	NEG-until	with-DO.F.PL	milk	any	NEG	do.you.hear	and-become.PERF.1.PL
	xass [104]						
	worse						

'and the camels had been **full of milk** and we stay[ed] there until they no longer had any milk are you listening? And our situation was bad'

The connection between flourishing and an abundance of milk is transparent when considering that many Mahra existed on a diet of milk from their livestock prior to the changes of the 1970s and 1980s. Flourishing livestock is full of milk and flourishing pasture supports lots of milk.

> šərkūz *'to be prosperous, have plenty [of] pasture and milk' (Johnstone, 1987, p. 324)*

šərkūz is a verb meaning 'to be prosperous, have plenty [of] pasture and milk' (Johnstone, 1987, p. 324), similar to the f-ġ-ś root. However, *šərkūz* includes all of the meanings of the words from f-ġ-ś into one verb. The related words from the r-k-z root have to do with being upright or straight – the semantic link is not clear and I have been unsuccessful in finding the word in context elsewhere.

> śēfa *'good, virgin pasture that has not yet been grazed. Contrasts with* daws*'*
>
> *(Morris et al., 2019, p. 4)*

śēfa 'good, virgin pasture that has not yet been grazed. Contrasts with *daws*' (Morris et al., 2019, p. 4). This word is not in the *Mehri Lexicon*, though *daws* is, with the definition 'to

[104] 20131018_MehriRabkut_M018_headingforwaterstory_20200622

trample on' (Johnstone, 1987, p. 76). By extension, *śēfa* is pasture that has not been trampled.

> māmīḳ *'pasture for goats only'* ~ mfəlēʔ *'pasture for all livestock' (Morris et al., 2019, p. 4)*

There are also words to describe pasture based on which animals can graze there. *māmīḳ* is pasture 'for goats only' and is compared with *mfəlēʔ* pasture 'for all livestock' (Morris et al., 2019, p. 4). Further investigation is needed to tease apart what the difference is between these two pastures. It could be botanical, but there are few plants which goats eat that camels will not and both goats and camels are able to scale steep slopes, so a landscape difference also does not fit well. Unfortunately, words like these are falling out of use so the knowledge of how they differ may not exist for much longer.

> háwrət *'barren land'*

There is also a word for lack of pasture, or barren land.

77.	*kūsən*	*əḳā*	*bih*	*mtwē*	*fōna*	*bih*
	find.PERF.1.PL	ground	with-DO.M.SG	pasture	before	with-DO.M.SG
	mtwē /	*mtwē*	*ḏə-**hawrət*** [105]			
	pasture /	pasture	GEN-**drought**			
	'we found there had been grazing here there was grazing, but grazing found when there **hasn't been rain for a while**'					

mtwē ḏə-háwrət in this quote could be translated as 'pasture of drought' but the word has also been translated as 'parched, barren land' (Johnstone, 1987, p. 162). The root of *háwrət* is h-w-r, according to Johnstone, and the verb formed with this root is *hwūr* '(animals) to eat up all the grass and be without pasture'. This suggests *háwrət* could be caused by human mismanagement as much as by drought.

[105] 20131018_MehriRabkut_M018_headingforwaterstory_20200622

Grazing verbs

There are several verbs to do with grazing. These words do not involve moving an entire household and their livestock, unlike the verbs of transhumance.

həḳśūś 'to take (goats) a little way to pasture' (Johnstone, 1987, p. 241) is one of these grazing verbs. This is the only word in this root and there is not a comparable word for camels in the *Mehri Lexicon*. There are, however, words for taking camels out at different times of the day: *awōgəh* 'take camels out in the morning' (Johnstone, 1987, p. 84) and *aḍōləm*[106] 'take camels out at night' (Johnstone, 1987, p. 423). Related to *aḍōləm* is the word *həḍláwm* 'to stay with o's animals to let them pasture after dark (when it is cooler and there are no flies)' (Johnstone, 1987, p. 84). This root also derives words to do with oppression: *ḍələōm* and being cruel: *ḍōləm*. The semantic connection is not immediately clear, but perhaps *həḍláwm* is an escape from the oppression of the flies and heat.

5.4.3 Important plants for livestock

For the Mahra, there are three trees that have had significant importance for livestock. The first two were discussed above – *ʔarf*, *Nannorrhops ritchiana* (5.4.2.1) and *amġār*, *Boswellia sacra* (5.4.2.2). The third is *ḥərūṣ*, *Acacia tortilis* (also mentioned in 5.4.1.1). The importance of this tree can be demonstrated through the amount of vocabulary associated with it. The tree's growth is divided into a number of categories, each with a different name: *ṣəmīr 'A. tortilis* flowers' which dry and fall to the ground and are then called *ṣəmtūt*; on the tree, the fruit develops into *ḥəblīt* which, once dry, is called *ənḳəśīt*; new shoots that animals can eat are called *wəgūš*, slightly older branches that have become too tough to eat are called *xāṣəb*.

[106] Johnstone transcribes the dental, emphatic consonant as voiced, which I have reproduced here. Watson transcribes this as devoiced /ṭ/ which is reproduced in quotes and vocabular taken from her sources. See **Error! Reference source not found.**.

Figure 9 ḥərūṣ and ʔarf in Rabkut

There are also many tools used to manipulate the branches of the trees to give goats access to the *wəgūš* and *ḥəblīt*: *məśxār* is a forked stick used to push branches down for goats and *əmśəgīn* is a hooked branch used to shake the trees so the *ḥəblīt* falls to the ground for the goats to eat. The *šūk* 'thorns' were used as needles, particularly for leather work. The wood burns cleanly and is good for building, though these uses were more common closer to the escarpment where other trees grew as well (Miller & Morris, 1988). Without this tree, existence in the desert regions of Dhofar would be much more difficult. Due to the climate and the uses of this tree developed by the Mahra, it is central to both the local ecosystem and the Mahra traditional knowledge.

There are many other plants that have been used as fodder or graze for livestock in the region. They generally have less vocabulary associated with them than *amġār*, *ʔarf*, and *ḥərūṣ*. They are presented in Table 5 with thumbnail photos of the plants. Larger photos can be found in Appendix 8. Transcriptions for these plant names largely come from fieldwork. Some are also mentioned in the ELAR texts, but the fieldwork transcriptions were usually more accurate because the interviews were specifically about the plants and their names (whereas the ELAR texts are generally not). Plant names are exceptionally local and pronunciation and sometimes even names shift from region to region.

Livestock raised by the Mahra were traditionally camels and goats; donkeys are now wild in the region – they were released when automobiles took over the work they once

performed. ‘All livestock’ in the information below refers to goats and camels. Cows are also raised in the mountains but not typically by the Mahra of central Dhofar.

The photos were taken during fieldwork and the name of the *wōdi* is given under each photo. Figure 10 gives locations for these *ūday*.

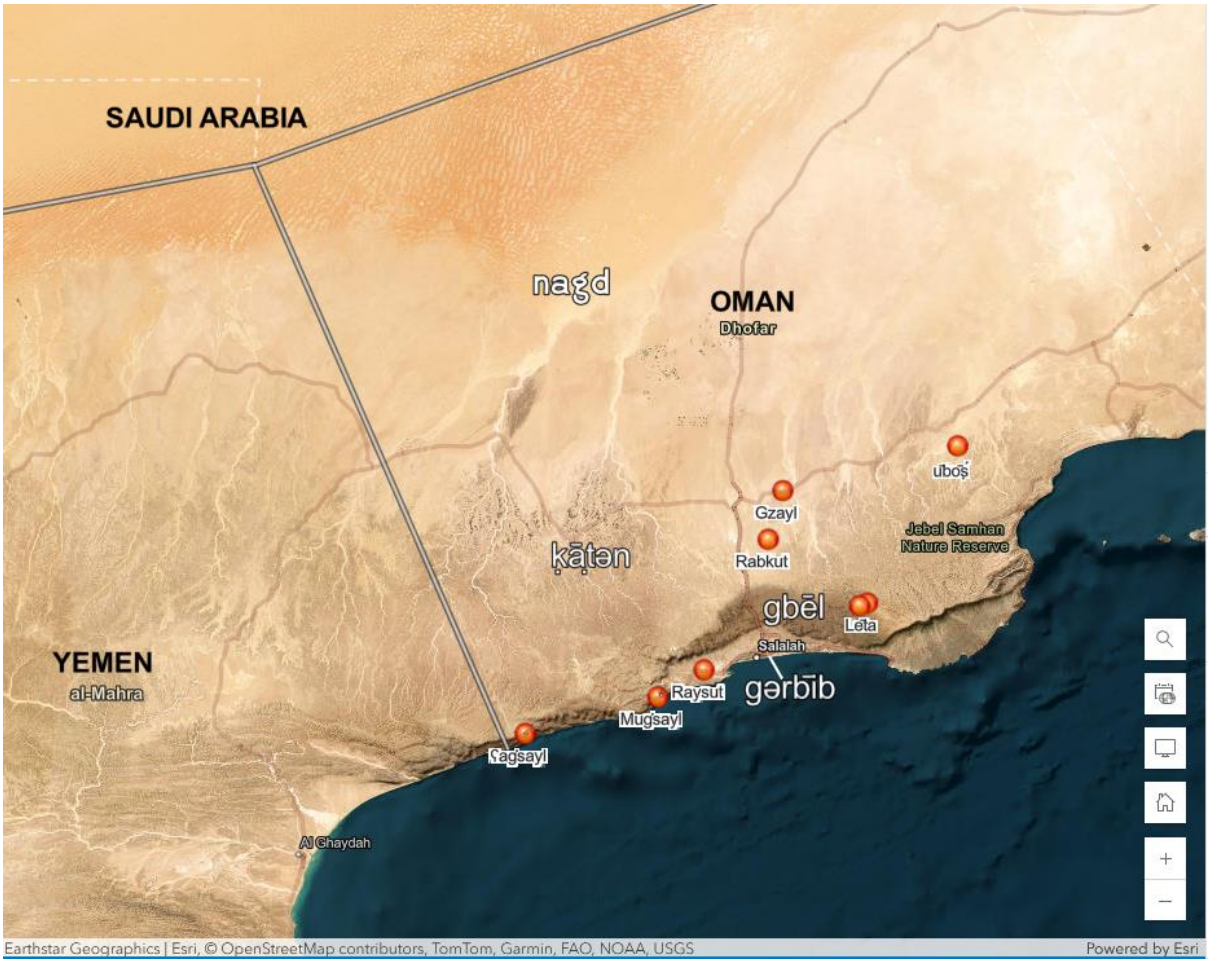
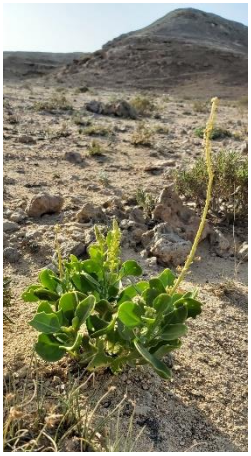


Figure 10 Photograph locations

Photo Location	Mehri name[107] Botanic name	Information[108]
 Gzayl	*amhīr* *Reseda sphenocleoides* (Royal Botanic Gardens Edinburgh [RBGE])	Eaten by camels, makes them fat.
 Gzayl	*arbīt ~ ārəbīt* *Chloris plumulosus* (Ghazanfar, 1992, p. 131)	*arbīt* grows after the rains and dries like hay. All livestock will eat it.
 Gzayl	*argəfīf* unknown	Goats love this plant, but its botanic identification is unknown.

[107] These transcriptions are my own from my fieldwork.
[108] This information is from fieldwork consultants unless referenced to published work.

 Rabkut	*āśūr* *Calotropis procera* (Miller & Morris, 1988, p. 24)	*āśūr* is a common plant and can be found across the Arabian Peninsula. Camels will eat the leaves from this plant when they are dry. The sap of this plant is explosive once dried and has been used as gunpowder in the past. The flower buds make a satisfying pop when squeezed but cause serious eye problems, including blindness, if the sap enters one's eyes.
 Raysut	*gənɪgənət* *Chrozophora oblongifolia* (RBGE)	This plant is eaten by animals but not by people. Miller & Morris (1988) report that this plant could be found on the coastal plain only in an area that was undisturbed near the airport. They suggest that it might have been more plentiful in earlier times on the coastal plain. This photograph was taken on the western end of the coastal plain where there is a smaller human presence than in and around Salalah.
 Gzayl	*ḥarṭawt* possibly *Ephedra milleri* (RBGE)	This plant is reported to grow by water. Camels will eat it, but goats eat it less. It was also used to dye fishing lines black prior to the importation of nylon fishing line.

 Rabkut	*ḥaybəṭ* *Ziziphus leucodermis* (Miller & Morris, 1988, p. 240)	All livestock eat *ḥaybəṭ*. This plant only grows in the drier areas of Dhofar and is not found at all in northern Oman (Ghazanfar, 1992, p. 100). According to Miller & Morris (1988), this plant was very important in the past, especially in the desert areas where it was one of very few food sources for humans. The fruit was picked when ripe and stored in dry caves for long periods of time. When eaten, it was crushed and then eaten raw or cooked with water, milk, or butter milk. Already by the 1980s this was remembered as a quaint practice of the past. Its leaves were also used in treatments for mastitis, burns and boils (p. 240). See also ex. 34 in mayər
 Gzayl	*rəḵṣayt* possibly *Dichanthium foveolatum* (Ghazanfar, 1992, p. 133)	This plant is eaten by both goats and camels. It can be found year-round but is more plentiful after rains. It only grows in the *gərbīb* and *nagd*, not in the mountains. It stays small. The photo here was taken in Gzayl which is in the *nagd*. This photo shows a dried specimen that appears to have been eaten.

 ʕaġsayl	*sēḳal* *Aloe inermis* (Miller & Morris, 1988, p. 184)	*sēḳal* is eaten by camels and only grows in the drier regions on the north side of the escarpment, not in the monsoon regions. It is one of two species of aloe that grow in Dhofar. The other species is *ṭayf* which is discussed below. In addition to being eaten by camels, *sēḳal* has been used in treating human ailments such as painful eyes, breathing problems and sore joints (Miller & Morris, 1988, p. 184).
 Gzayl	*śərbīṯ* *Maytenus dhofarensis*[109] (Miller & Morris, 1988, p. 98)	*śərbīṯ* is eaten by camels and goats. Its large spikes mean it was also used for making protective fences and doors for huts or caves. It grows in both the dry and monsoon-affected areas of the escarpment.
 Rabkut	*śēru* *Citrullus colocynthis* (Miller & Morris, 1988, p. 120)	Only goats will eat *śēru*, and then only the fruit. Camels do not eat this plant. The fruit is very bitter and can cause inflammation and watering in the eyes, so children were encouraged to stay away from it. In Śḥerēt, the fruit is called *aḥśebé eṯīrīn* 'hyena's cucumbers' to reinforce its harmful attributes (Miller & Morris, 1988, p. 120). The fruit has been used to treat localised pain. It is mostly found in *ūday* but not on the *gərbīb*.

[109] *Gymnosporia dhofarensis*

 Gzayl	*ṭayf* *Aloe dhufarensis* (Miller & Morris, 1988, p. 182)	Mountain camels are reported to only eat this plant when they need salt, otherwise they do not eat it. This plant has been used to treat many human ailments including constipation, burns, and infected eyes and wounds. Unlike most treatments for infected eyes, the sap of *ṭayf* was put directly into the eye; most other treatments were applied around the eye (Miller & Morris, 1988, p. 182). If a person were desperately thirsty, they could drink the sap of *ṭayf* but they would have to be very desperate and it would need to have rained recently because the sap of these plants is extremely bitter (Miller & Morris, 1988, p. 182).
 Gzayl	*ṭənṯīt* unknown	M010 reported that goats will eat it a little bit. In an ELAR text it is reported that when camels eat this plant, the taste stays in their milk and meat for a whole year.
 Ūbōṣ	*ṭīfīr* *Tephrosia purpurea subs. apollinea* (RBGE)	*ṭīfīr* is a common plant found throughout Oman (Ghazanfar, 1992) though mainly in the drier regions rather than the monsoon-affected escarpment. M010 says camels will only eat it when they are hungry and goats never eat it.

 Ūbōṣ	*tūṣəfēt* Possibly *Iphiona scabra* (RGBE)	Camels will only eat *tūṣəfēt* when they are hungry, but donkeys will always eat it. Donkeys are generally wild in Dhofar today, having been liberated from labour by the arrival of motorized vehicles. This is a common plant that comes with the rains and is a medium size.
 Lēta	*ūṣawf* *Capparis cartilaginea* (Miller & Morris, 1988, p. 92)	Sickly camels were encouraged to eat the leaves of this plant. It would give them diarrhoea but once that cleared up, they would regain their strength and appetite. The fruit is a bit like peppers and is highly nutritious for humans.

Table 5 Plants used in livestock care

5.5 Conclusion

This chapter discussed three ways that language and culture are linked to the natural environment. 5.2 describes semantic and metaphoric extensions of Mehri words about directions and weather. The links between goodness, happiness, and safety with *aġawf* 'up' and danger but necessity with *xōtər* 'down'; and the goodness and mercy of God alongside the inconsistency and unreliability of the weather.

5.3 demonstrates the conceptual categorisation of landscapes, soil type and water. The divisions within these topics give insight into how the local inhabitants understand their environment.

5.4 described some seasonal activities which are also shaped by the unique environment the people inhabit and the vocabulary linked to these activities. Included in these descriptions are plants that were important for the seasonal activities and for raising livestock.

Future work will investigate more topics for semantic extensions in both prose and poetry. This work was limited both by time and space, there is much more to be added to the description of how Mehri is linked to the environment in Dhofar.

6 Resilience in biocultural diversity

Following the description and analysis in the previous two chapters of some Mahra institutions and their link to the environment as well as the impact the environment has had on the language and culture of the region, this chapter takes a first step in describing the resilience of biocultural diversity in Dhofar.

Resilience is the ability of a system to regain equilibrium after disturbances (Holling, 1973). Instead of striving for stability, resilience looks at the adaptations which systems implement to deal with disruptions to their equilibrium. Adaptive management is a strategy proposed by Walters (1986) and extended in Titon (2016) to manage disruptions to ecological and cultural systems. The process involves investigating which disruptions could cause the greatest loss to a system and developing strategies (either within the community or in partnership with outside researchers) to mitigate that damage. In Dhofar, many of the disruptions that significantly impact the equilibrium of the region have also benefited the human and livestock populations tremendously, so removing these disruptions is out of the question.

As in much of the world, human activity has significantly impacted biocultural diversity in Dhofar. Oman modernised recently and rapidly due to both oil revenue and a change in government (see 1.2). This modernisation has had enormous impact on wellbeing measures such as infant mortality rates, which decreased by 99.24% from 1972 to 2008 (Alshishtawy, 2010). The socioeconomic development has also impacted the local ecosystem; as wealth and stability increased, livestock and human population also increased leading to significant ecological damage (Ball et al., 2020).

Traditional knowledge has been disappearing as the domains in which it was used have shifted. For example, traditional houses have been replaced with concrete cinderblock houses (Watson et al., 2024); traditional water sources, once necessary for survival, have been replaced by indoor plumbing (al-Mahri, 2015); plants used in medicine have been replaced with modernised hospitals and imported medications; and likewise, plants once used for food or manufacturing have been replaced with imported food products and

plastics. In much the same way, the indigenous languages are negatively impacted by these changes; as schooling, modern healthcare, and other government services were introduced, Arabic replaced local languages as the language for business, entertainment, and education (Watson & Al-Mahri, 2023).

Because the socioeconomic changes in Oman occurred so rapidly, traditions and languages have often been completely replaced with little opportunity to adapt to the changes. The cloud forest has been losing ground to scrubland and unpalatable plants that livestock will not graze (Ball et al., 2020; Ghazanfar, 1998) and wild animals such as the hyena, wolf, Arabian leopard, and oryx are disappearing or no longer found in the region (Spalton et al., 2006; Spalton et al., 1999). As already discussed, the languages have rapidly been replaced with Arabic. The ecosystems were managed successfully for centuries by the local governance institutions, and the knowledge of the ecosystems is contained within the local languages. Therefore, approaching sustainability through the lens of biocultural diversity allows for the language, culture, and ecosystem to be incorporated into building resilience.

Data for this chapter is described in section 6.1. Following that, 6.2 describes the disconnect between younger and older community members due to language shift and modernisation of resources and the resulting biocultural decline. 6.3 discusses the concern within the community over these changes. Examples from other areas of the world where similar changes have occurred and how adaptations have been managed to encourage and strengthen resilience are then discussed in 6.4 with suggestions for implementing similar adaptations in Dhofar.

6.1 Data

This section describes the data analysed for this chapter. Quantitative data was collected through an online survey and qualitative data was collected throughout the project through participant observation.

6.1.1 Survey and results

This section describes the structure of the online survey and, in sub-sections, the results of the questions participants were asked.

The online survey was run from 22 November until 10 December 2022. It was aimed at MSAL speakers and sought to gain insight into their level of ecological knowledge and their interest and involvement in ecological conservation and publication. This section describes the structure and basic results of the survey.

The survey was sent to nine personal contacts in Oman and shared through a WhatsApp group of 65 researchers working on language and nature among the MSAL from around the world, approximately 15 of whom are Dhofari. Because it was shared in the WhatsApp group, some screening of participants was necessary. Participants who indicated they were from outside of the Dhofar – al-Mahra region, and/or were not a speaker of MSAL, and/or were under the age of 18 were excluded from the results.

The survey was constructed around a story map built using the Esri online StoryMap tool (https://storymaps.com/). The story map is based on information about local plant names and uses in skin care and is available in English (https://arcg.is/0XSWPH) and Arabic (https://arcg.is/S0XWL). It was written together with Kamela al-Barami and translated into Arabic by Hammal al-Balushi.

Excluded participants were given a link to the story map so that access to the information in it was not limited by survey participation.

The survey was divided into four sections: demographics (6.1.1.1), botanic knowledge and current conservation involvement (6.1.1.2), an embedded version of the story map (6.1.1.3), and follow-up questions (6.1.1.4) (for survey questions see Appendix 3 Survey questions). It was available in Arabic and English which provided greater accessibility for people in Dhofar as Arabic is used more than English. Translating the survey into Mehri and Śḥerēt was considered, but ultimately this would not have expanded the scope enough to warrant the effort. This is because the population that does not know Arabic well enough to complete the survey also cannot read well enough to complete the survey in Mehri or Śḥerēt. Unfortunately, this meant that older, monolingual MSAL speakers were excluded from the survey. In the future, the survey will be run in-person in Mehri and Śḥerēt to include these speakers.

The number of participants was lower than hoped. Several factors played into this. First, (as mentioned in 3.3.2.3) culturally it is unusual to express personal opinions or experiences, especially with a stranger. Second, women are especially reluctant to share which possibly impacted the number of women who participated in the survey. Lastly, having the survey online meant it was only written, not conducted orally which excluded older participants.

6.1.1.1 Demographics

Participants' age, gender, location, tribal affiliation, and language use were collected in the demographic section. This information was compared against participants' knowledge and conservation participation. It was also collected to exclude participants who are underage or who are not from southern Arabia.

The rapid socioeconomic changes that have occurred since the ascension to power of Qaboos bin Said (1970) and the end of the Dhofar War (1965-1975) (see 1.2) have led to dramatically different upbringing experiences for young Dhofaris (Risse, 2019; Watson & Al-Mahri, 2023). As such, participants were asked to give their age range.

Following this question, participants were asked about their comprehension and frequency of use of Mehri and Śḥerēt. Both languages are in danger of falling out of use (Watson & Al-Mahri, 2023) which could also result in the loss of the local knowledge (Cámara-Leret & Bascompte, 2021).

a) Results: Survey participants

Ten people participated in this survey. Two participants have been excluded from the results because they are in Saudi Arabia and neither speak MSAL, leaving eight participants included in the results presented here. There are fewer participants than envisioned when the survey was set up, but the results offer insight into ecological knowledge and conservation in the region, nonetheless. Table 6 summarises the results of the demographic questions.

PARTICIPANT	DOB	GENDER	LOCATION
A	1982-1997 (age 25-40)	Male	*gerbīb* – Coastal plain
B	1982-1997 (age 25-40)	Male	Not reported
C	1982-1997 (age 25-40)	Male	*gerbīb* – Coastal plain
D	1982-1997 (age 25-40)	Male	*ḳāṭən* – Northern plateau
E	1967-1981 (age 41-55)	Male	*gbēl* – Coastal mountains
F	1967-1981 (age 41-55)	Male	*gerbīb* – Coastal plain
G	1982-1997 (age 25-40)	Male	*ḳāṭən* – Northern plateau
H	1982-1997 (age 25-40)	Female	*ḳāṭən* – Northern plateau

Table 6 Survey participant demographics

Two participants gave their age range as 41-55, the rest were 25-40 at the time of the survey. Dhofaris born after 1980 generally have stronger technology and literacy skills which could have been a barrier for older participants. The two respondents over the age of 40 are new contacts.

Seven participants are men, one is a woman. Most of the researchers in the WhatsApp group and my personal contacts are men, which could partly account for this disparity. The female respondent had similar answers to the other participants in her age group except in one area: she was the only respondent to decline participation in future surveys or creating other e-resources which, along with her being the only female participant, could indicate women are less inclined to participate in this type of survey.

All participants included in the results are living in Dhofar. The regions represented are on the coastal plain, on the plateau north of the mountains, and in the coastal mountains in western Dhofar. These locations encompass many of the biomes of the region (see Figure 2).

b) Results: Language comprehension and use

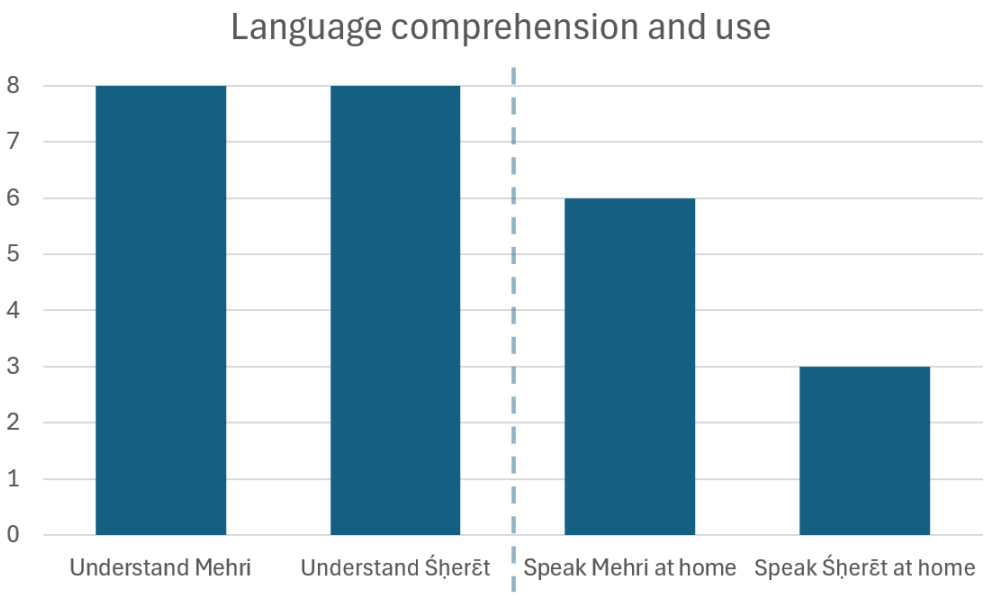


Figure 11 Language comprehension and use

Every participant reported comprehension in both Mehri and Śḥerēt. Both languages are widely spoken in the regions represented, which could account for this result. Six participants speak Mehri at home and three participants speak Śḥerēt at home – one household is bilingual.

Only one household uses both languages at home even though each respondent reports understanding both languages. This is a pattern that is found more widely. One of our consultants, who did not participate in the survey, is a Mehri speaker but spends time each evening with her neighbours who speak Śḥerēt. She understands most of the conversation but does not speak Śḥerēt herself. Conversely, a visitor came to stay with a Mehri-speaking household during the 2021 fieldwork but only speaks Śḥerēt and Arabic herself. This pattern of mutual understanding and ability to communicate across the languages is not universal, however. Further away from the main city and in the diaspora, it is far more common that people only understand one MSAL.

6.1.1.2 Botanic knowledge, conservation, and use

Following the demographic section, the survey asked participants to identify three common Dhofari plants from photographs. The goal was to determine the baseline knowledge prior to viewing the story map which identifies two of the plants in question. The plants were

chosen for their usefulness, habitat, and prevalence. The first is an invasive species, *Prosopis juliflora*[110] which was introduced in landscaping and does not have traditional uses. The other two plants, *Aloe dufarensis* and *Anogeissus dhofarica*[111], are used in skincare (among several other uses). Each plant comes from a different biome in Dhofar, the coastal plain, the mountains and the plateau north of the mountains.

Further questions set a baseline for the participants' use of local flora for food and medicine, and their participation in conservation efforts. These results are compared with the demographic profiles determining who is using and conserving the local flora. These results are also compared with information collected following the story map to measure its impact.

a) Results: Botanic knowledge and use

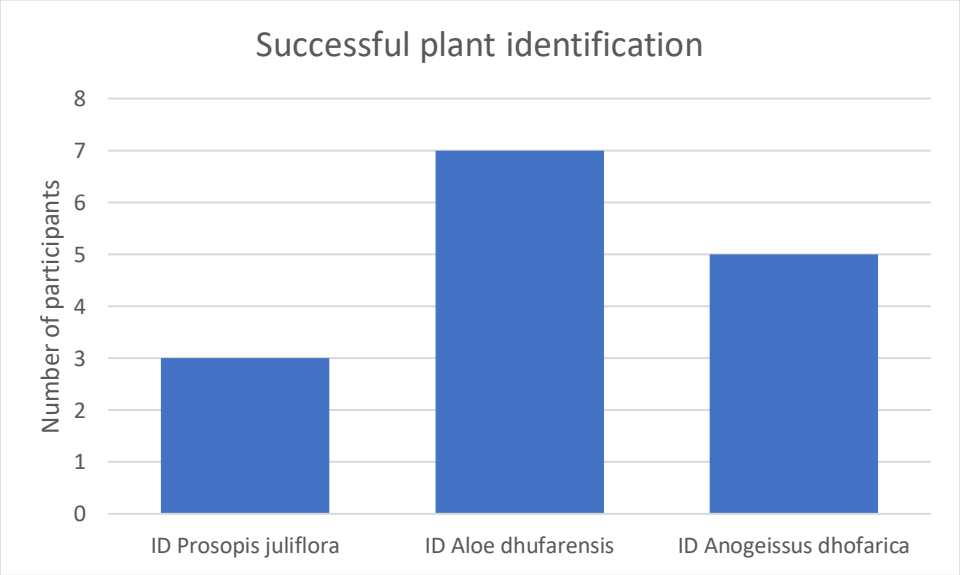


Figure 12 Successful plant identification

Three participants successfully identified all three plants, five successfully labelled two plants. Both participants aged 41-55 were successful in labelling all plants whereas only half of the 25–40-year-old participants could label two plants, and only one of the younger participants labelled all three plants. This implies older community members may have stronger botanic knowledge which is consistent with participant observation data. Each of

[110] *Neltuma juliflora*
[111] *Terminalia dhofarica*

the three who correctly labelled three plants came from a different region within Dhofar suggesting success in the identification task was not dependent on location.

These results show that *Aloe dhufarensis* is most easily identified. This could be because it is a distinctive plant (see Figure 35) – quite unlike other small plants in the area. It could also be that it is more widely used than other plants: it is widely used to treat coughs, fevers, and skin problems (such as burns), though *Anogeissus dhofarica* has similar uses and is a large tree (see Figure 43). Participants labelled *Anogeissus dhofarica* with less success than *Aloe dhufarensis* which could indicate the decline in traditional knowledge since this tree was widely used in the past for everything from animal fodder to antibiotic and wound treatment (J005, p.c. 2021). This could also be due to the growing habits of the *Anogeissus*. These trees are only found in the escarpment mountains, not to the north, so while the Mahra used it for medicine and fodder in the past, they probably traditionally traded for it rather than harvesting it themselves.

Because *Prosopis juliflora* is invasive, the three who labelled it correctly demonstrate an expanding botanic knowledge rather than traditional since the plant is not a traditional part of the ecosystem. Language spoken does not have a noticeable effect on participants' ability to label any of the plants. One Śḥerēt speaker and two Mehri speakers were unable to label more than one of the plants in question.

b) Results: Plant conservation and use

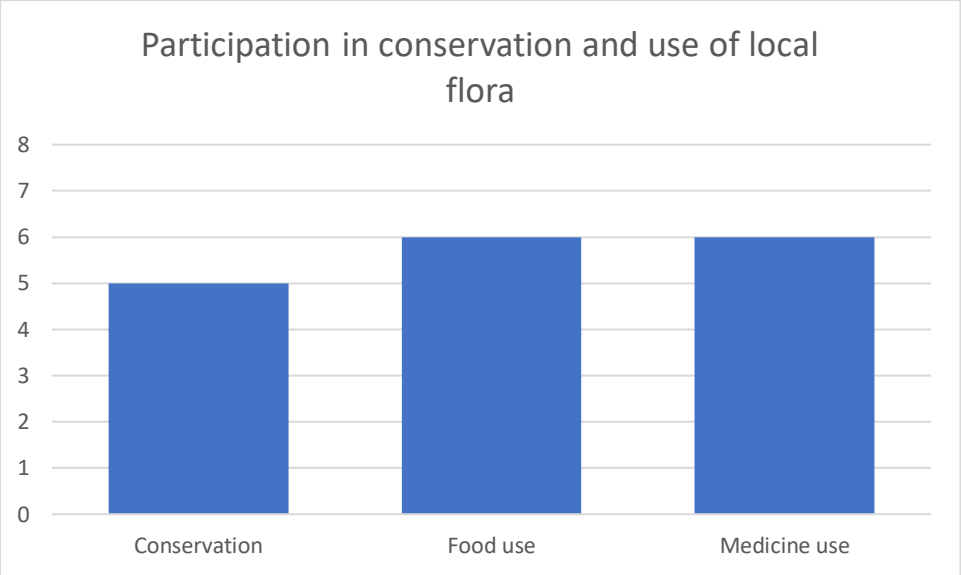


Figure 13 Conservation and use of local flora

Over half of the participants of this survey are involved in using the local flora and conserving it. Five participants reported that they were already involved in conservation efforts for the local flora and six participants reported they had used the plants for food and another six reported they had used the plants for medicine at least once. This suggests there is both concern for the local ecosystem and some use of it still present within the community.

The survey did not include questions about how participants were involved in conservation efforts because the amount of time participants were willing to spend answering questions was limited. However, in-person interviews revealed that some villages in the mountains were making concerted efforts to remove the *Parthenium hysterophorus* weed from their area, and that agreements between tribes had led to a cull of camel herds in recent years when the camels were eating too many of the *Acacia tortilis* trees.

c) Results: Knowledge compared with age, region, and conservation participation

Three participants did not label more than two of the plants. All three of these participants were in the 24-40 age group. Two of these participants are from the northern plateau and one did not give his location. These three were also the participants who were not already involved in conservation. This suggests that botanic knowledge could be linked to one's

likelihood of participating in conservation. All three of these participants indicated that they were interested in increasing their participation in conservation efforts which could indicate increasing awareness of the local ecosystem (for example, through the StoryMap and survey) could encourage greater interest in conservation.

6.1.1.3 Story map

At this stage in the survey there is an embedded version of the story map available in English: https://arcg.is/0XSWPH and Arabic: https://arcg.is/S0XWL.

6.1.1.4 Follow-up

The follow-up section measured the attitude change toward using and conserving local flora after learning some traditional uses. This was done through a series of questions relating to participants' intention to conserve and/or extend the use of the local flora. These results are compared to baseline information about conservation and use to measure the impact of making information about the plants accessible.

Participants could then provide contact information to be notified when other e-resources are published, other surveys are available, and to volunteer to help build more e-resources. The contact information is held in a separate location to protect participants' identity.

a) Results: Intention to extend local flora use and conservation

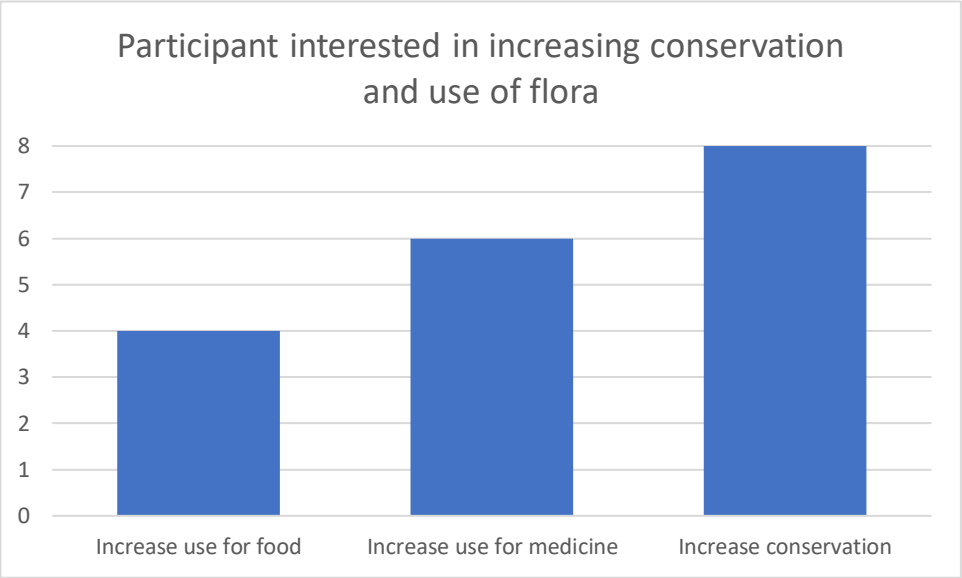


Figure 14 Interest in increasing conservation and use of flora

Four participants indicated they would like to increase their use of local flora for food. This is a striking result because food is readily available in Dhofar today, with imports from around the world and immigrant cooks regularly employed by households. Every household visited during the 2021 fieldwork employed a cook and the cook's night off was an event worth mentioning because the women of the family prepared the food themselves. Interest in local food sources could indicate an interest in traditional cultural practices.

The use of traditional medicines was still prevalent across much of the Arabian Peninsula even into the 1990s (Ghazanfar, 1994). This is corroborated by the results above where six of the eight survey participants have used plants for medicine in the past. When asked about future intentions, six participants again indicated they were interested in increasing their use of the local flora for medicine. This could again be connected to a desire to know the history and tradition of the region, as discussed above. However, it could also be due to the difficulty in getting doctors to listen to health concerns. For example, while on fieldwork, my friend's nine-month-old daughter was having difficulty breathing, so together we took her to a nearby hospital. The triage nurses there dismissed the mother's concerns and told her it was probably a birth defect. We then tried a medical clinic and the doctor there was unable or unwilling to give advice. Eventually we returned home with no care strategy, next steps, or treatment. The mother used an aloe (a plant indigenous to the region) on the baby's face and chest and turned off the air conditioning, and her breathing improved

significantly in the next couple of days. While healthcare is available and can treat many health problems, home treatments are sometimes still more accessible.

Lastly, all eight participants indicated they were interested in increasing their participation in conserving the ecology of the region. This is evidence of a concern for the health and well-being of the ecology present in the community.

b) Results: Future involvement in publication

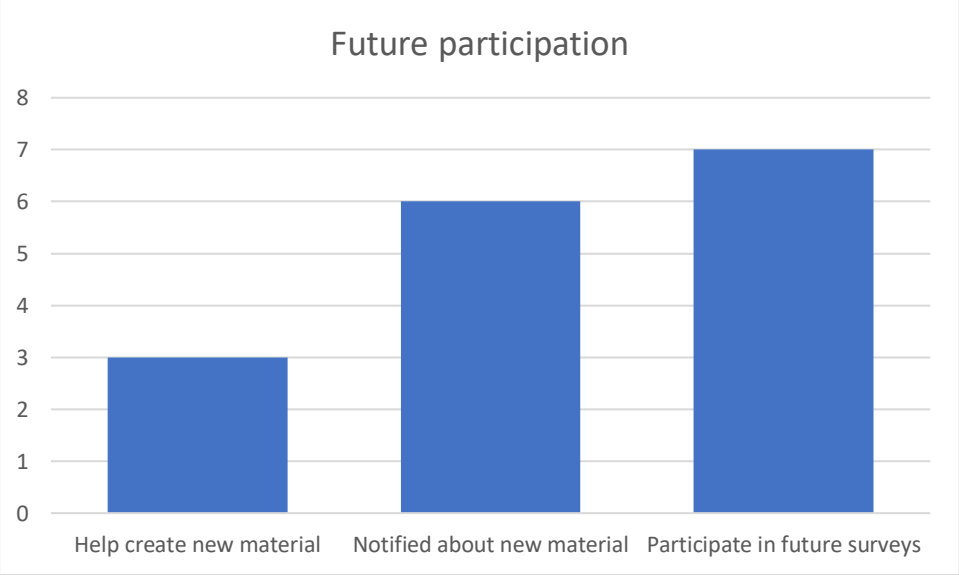


Figure 15 Interest in future involvement

Three participants were interested in contributing to future e-material and their contact information has been noted. Several applications for funding to establish a cybercartographic atlas (see 6.4.1) have been submitted to various funding bodies in partnership with MSAL speakers and academics from around the world. When funding is secured or another project arises, these interested parties will be contacted.

Six participants expressed a wish to be notified when new materials are available and seven were willing to participate in future surveys. This group includes the new contacts suggesting that personal contact is not necessarily the motivation for this willingness to collaborate.

The only participant who did not indicate interest in participating in future surveys was the only female participant. This could indicate that an in-person approach could be more effective in involving women in the research and future publication. This result could also be

linked to the cultural role women play in Dhofari culture, where their voices are always represented in public by their male relatives (see 4.1.3.1)

6.1.2 Participant observation data

Fieldwork for this research was conducted November 2021 in Salalah, from June 2022-May 2023 in Dammam, Saudi Arabia and online throughout the PhD tenure (3.3.2). Participant observation data was gathered throughout as I did research in Salalah and Dammam, and as I worked together with colleagues on various output projects including conference presentations, book chapters, YouTube videos, translations, and e-books.

6.1.3 Conclusion

The survey results demonstrated that there is interest in the local flora, its uses, and conservation. It also showed a generational difference in botanic knowledge with both participants aged 41-55 able to label all three plants and only one of the six participants aged 25-41 able to do so. The survey results also showed that people do use the local plants for food and medicine and that several participants are interested in increasing their use of local plants for both food and medicine. Location does not appear to have an impact on botanic knowledge with participants from three different regions showing similar levels of botanic knowledge.

Participant observation data complements the survey data and is used below to give further evidence for the conclusions drawn from the survey. The rest of this chapter discusses the generational disconnect and its impact on traditional knowledge and language use (6.2) and the concern these factors have been inspiring within the community (6.3). The chapter concludes with some suggestions from other areas of the world where biocultural diversity has been in decline and how the disruptions have been mitigated (6.4).

6.2 Generational disconnect and its consequences

One of the significant impacts of the socioeconomic shifts in the past 50 years is a generational disconnect. Urbanisation and modernisation of healthcare and food systems

have fed into this disconnect. These in turn lead to a decrease in traditional language use and in the transfer of traditional knowledge from older to younger generations.

Urbanisation has led to physical disconnect from the ecosystem as people move into cities and spend more and more time inside buildings. For example, M010's family was entirely nomadic until the early 1990s when they acquired a house north of the Dhofar mountains. In subsequent years, many members of the family have settled in Salalah where the children attend school and medical care is available. This shift in livelihood means that the domains in which Mehri was used – everyday life and subsistence animal husbandry, have largely disappeared and so the knowledge about the ecosystem is not necessary for survival and is therefore not being passed on to younger generations.

Modernisation of healthcare and food systems has led to a decrease in dependence on the local ecosystem. Imported medications and food sources have greatly improved the standard of living, essentially eradicating hunger and decreasing infant mortality rates by as much as 99.24% (Alshishtawy, 2010). However, this shift has interrupted the transfer of traditional knowledge from generation to generation because the knowledge is no longer necessary for survival.

Younger consultants consistently demonstrate less knowledge and awareness of the ecosystem. These consultants were between the ages of 25 and 40 during the PhD research and would confidently answer questions they were certain of, but when questions of traditional uses or growth habits of plants came up, they consistently referred to their parents. Said and Abdullah were both happy to drive outside of the city to take photos of plants and knew names and uses of the larger plants and trees, such as *ʔarf* (5.4.2.1), but the smaller plants required their mothers' input. M100, my female consultant in Saudi Arabia, confidently and consistently translated information from videos into English and Arabic, explaining grammar and pronunciation points of interest. However, when the video included plant names or landscape terms she would consult with her mother via WhatsApp.

This break in the knowledge transfer appears to have happened fairly recently because the 41–55-year-old survey participants were both able to label all three plants presented in the survey and only one of the six 25–40-year-old participants could. Additionally, field work

consultants over the age of forty were able to answer most questions about the local flora. This suggests that somewhere in the past 35 years the knowledge was passed down from one generation to the next with decreasing frequency. This matches the socioeconomic shift timeline as well, since much of the changes from nomadic subsistence to sedentary and modern lifestyles took place through the 1980s and 90s (see 1.2).

These socioeconomic shifts have also had significant impact on the language use in Dhofar. For example, formal education has increased the use of Arabic in households with school-aged children, which has decreased the use of the local languages. However, Arabic proficiency is necessary for accessing healthcare and other government services.

An example of language shift is found in M010's family. During the fieldwork, her children were all proficient in Mehri but functioned in Arabic in their employment and to access government services, health care, and education. Her grandchildren, mostly school-age during fieldwork in 2021, were entirely educated in Arabic and had little need for proficiency in Mehri outside of interacting with their grandparents' generation. Likewise, M026's nieces spent almost all their time either in the house or at school and had markedly lower language proficiency than the elders. When visiting with them in the mountains, I found I could understand much of what they said to me in Mehri. Professor Watson later commented that she suspected that was because they do not use Mehri very often and so they used simpler sentences and expressions. M026 regularly commented on their lack of vocabulary and made a point of teaching them the Mehri and Śḥerēt numerals and words for body parts.

Disconnect from the local ecosystem and language shift have led to declining linguistic proficiency and loss of traditional knowledge transfer between generations. These two events are linked: the traditional knowledge is shared in relation to the local ecology – when the relationship to the ecosystem is interrupted or weakened, so is the transfer of the knowledge. In addition, the traditional knowledge is shared in the local language so when the local language is used less frequently and with a decrease in proficiency, the knowledge transfer is also interrupted. Section 6.4 reviews some examples of how similar socioeconomic shifts have been mitigated in other parts of the world such as adapting formal education and increasing partnerships between elder and younger generations.

6.3 Concern over ecological health and linguistic decline

The community expresses concern over the local ecological health and (to a lesser degree) linguistic decline. Five of the eight survey participants have already been involved in conservation projects aimed at the local ecological health (see Figure 13) and all eight participants indicated they were interested in increasing their participation (see Figure 14). Even with such a small number of participants, this indicates that there is concern over the declining ecological health of the region present within the community.

Consultants often described how the ecology had changed in recent years. J005, a female Śḥerɛ̄t speaker in her mid-60s during the research, talked about species of trees that were no longer found in the mountains. Her son is knowledgeable about invasive species in the mountains and some of the efforts to remove especially *Parthenium hysterophorus* which has spread rapidly through Dhofar after being imported in animal fodder. M010 talked about how the plateau to the north of the mountains once sustained goat herds but with shifting weather patterns and the use of ground water for manufacturing, the fodder plants no longer grow abundantly enough to support livestock. There is awareness that the ecology has changed and evidence of concern about these shifts.

Linguistic decline is also a salient shift within the community, though less than the ecological health. Evidence for this awareness comes through several ongoing projects working to mitigate the linguistic decline. The first example is in the Dhofari researchers (for example, Said Baquir, Abdullah al-Mahri, and Saeed al-Mahri) who continue to document the spoken language and archive recordings at ELAR. This helps to preserve the vocabulary linked to the specific location the languages have developed within (see Chapter 5). In addition, a growing number of local academics are publishing about their traditional languages and knowledge both independently and in partnership, for example al-Barami et al. (2023); al-Qumairi et al. (2024); al-Qumairi & Watson (2018); Watson et al. (2020); Watson et al. (2024); Watson et al. (2019). There are also publications in Arabic less easily accessed outside the region. Furthermore, Abdullah al-Mahri and Professor Watson have developed and published a number of children's books and e-books found online here: https://ahc.leeds.ac.uk/modern-south-arabian-languages/doc/resources-2. These stories are believed to be the first

children's stories written in Mehri. Watson et al. also published a textbook for teaching Mehri to English speakers which has been used by other European colleagues, ex. Fabio Gasparini, to teach university-level Mehri (Watson et al., 2020). Finally, the introduction of language courses developed by Professor Watson and Ali al-Mahri teaching Mehri to non-Mahra (both international students and Omani colleagues) has both increased the perceived value of the language locally and among outsiders.

Lastly, there is evidence of interest in the history and tradition of the region. One survey participant indicated they were interested in increasing their use of the local flora if someone showed them the plants and how to use them. In addition, six participants indicated interest in increasing their use of the flora for medicine and four participants indicated interest in increasing their use of the flora for food. This is also demonstrated in the participant observation data – M100 said to me "I wish my parents could take me to the desert and show me these plants and how they have been used in the past." She is also working on writing children's books in Mehri to make the knowledge she has about her language and culture accessible to other Mehri speakers. This is evidence of increased interest in the history and tradition, not food insecurity, because she lives among the diaspora in Saudi Arabia and does not struggle to access food or medical care. Another example is Said Baquir, a researcher in Dhofar who has grown up with modern conveniences but describes himself as someone who "has a deep curiosity about his cultural heritage" (Petocz & Segal, 2024, p. xiii).

The concern evidenced here demonstrates that the MSAL-speaking community, or at least a subset thereof, wishes to maintain the cultural and linguistic diversity of the region and do so sustainably within the ecosystem.

6.4 Moving forward

This section suggests strategies for encouraging greater resilience in the biocultural diversity by looking at some ways resilience has been built into other biocultural systems around the world such as Nunavut, Canada; Wisconsin, USA; and Mali.

6.4.1 Knowledge accessibility – Cybercartographic atlas

As seen in the survey data, the information about the local ecosystems and its traditional uses is still available and younger people are interested in learning that information, but the transfer of that knowledge has been disrupted. This disintegration of knowledge transfer is not unique to Dhofar, it is a common result of rapid social and cultural changes. Another region facing an extreme level of inter-generational disconnect is the Inuit population in northern Canada. In Nunavut, Canada this disconnect has partly been bridged by building cybercartographic atlases – collections of digital resources on topics ranging from historical events to current sea ice and wildlife observations (Taylor, 2019). These atlases were developed by outside researchers who then trained young researchers to work with local Elders to digitise the knowledge about the land. The digital atlases often evolve into something pragmatic for the community they were built for: one is now a social media platform allowing people to track sea ice, wildlife sightings, hunting journeys, etc. (https://siku.org/); others have become archival websites with histories, documentation, and sound files (see for ex.: https://inuktutlexicon.gcrc.carleton.ca/index.html; https://clyderiveratlas.ca/index.html). Building an atlas could be a way of putting the traditional knowledge into a format that is more accessible to younger generations in Dhofar thereby mitigating the loss of the knowledge and the languages. There has been interest expressed in Dhofar in mapping traditional lands and journeys (Yahya al Mahri, p.c. 2021) and there are already several e-books and digital resources published in Mehri that could be hosted by or linked to an atlas.

In Nunavut, the atlases were built on research conducted in pairs with a high school or college student and an Elder, while outside researchers gave support for the technical aspects of the website as well as research methodology (Taylor et al., 2019). In Dhofar, youth-elder partnership is already a regular pattern in the local research. Outside involvement would include the initial build of the website and possibly hosting the platform until a suitable web host could be secured locally in addition to methodological and technical training for researchers. Outside researchers can also work with the elder population to record their knowledge and with the younger population to digitise and translate the information. As more and more of the traditional knowledge is archived in an

accessible way for younger generations, it can be applied to more and more current challenges of sustainability.

6.4.2 Language use domains – writing

Documentation is an important first step to revitalisation, whether through an online atlas or other means. However, for language revitalisation to be successful, language use must be expanded to new domains of use (Stone & Anonby, 2019). As discussed above (see 6), societal changes of the past fifty years created new domains such as schools, hospitals, government agencies, the internet, etc. These new domains have all been filled with Arabic use. Intentionally extending the local languages into these new domains could improve the languages' resilience to these changes.

The DEAMSA project developed an Arabic-based orthography for the MSAL allowing speakers to expand the use of MSAL into domains which require writing. The online messaging app WhatsApp has been a natural domain for using the new orthography because it is easily accessible and widely used. In the WhatsApp screenshot below (Figure 16), Professor Watson was asking a group of people in Mehri to see if anyone was available to meet to discuss a book we were working on together. Abdullah answers that he is at work and that the rest of the people in the conversation should work out a time to meet; if

Figure 16 WhatsApp conversation in Mehri

he finds time he will let the others know. Professor Watson then asks if Said, Andrea or Hussein have time to meet today.

Another new writing domain for the languages is children's books. As discussed above in section 6.3, these stories were developed and produced by Professor Watson and Abdullah al-Mahri. These have been a wonderful tool in further fieldwork as well. M100 worked through each of these books and told me which words she did not understand, which words she would say or spell differently, and which words she knew but would not use. From that I was able to draw up a few dialectal comparisons between her more-western dialect of Mehri and Abdullah's more-eastern dialect. One of these children's books, *Sēləm wə-hhaləh: Selim and his Shadow*, has recently been printed (al-Mahri et al., 2023)[112]. M100 was very interested in receiving one and almost immediately passed it on to another friend and asked for more copies to share.

A third new domain is on social media such as X (formerly Twitter), YouTube and TikTok. There are X users who post about Mehri and a growing number of videos of traditional songs, poems, and chants in Mehri on platforms such as YouTube and TikTok (see Figure 17 for an X post sharing a TikTok video). Śḥerēt is less represented on social media.

[112] This book has also been published in Mehri and Galician in late 2023 *Sélim e a súa sombra* and is currently being translated into Irish Gaelic.

Figure 17 X post about Mehri language day
https://twitter.com/Bo_ham_ad/status/1576674819029934080

Language use has also been expanded into teaching the languages to outsiders, as mentioned above. This interest in the languages and outsiders using them has raised their perceived value in the region. When Professor Watson meets new people and speaks the local language with them, there is often excitement that a foreigner can speak the language.

These new domains for language use are still small. This adaptation provides hope for the languages' continued use, but further expansion will increase the language's resilience in the face of the current disruptions. The DEAMSA project has made many of these domains possible through the new orthography and valuing traditions and history by recording them.

6.4.3 Formal education

One of the new domains that could bear much fruit is the education system. Formalised education is a disruption to traditional knowledges and languages according to Pretty et al. (2009), however, simply eradicating education will not revitalise traditional knowledges or

languages so another approach is needed. I suggest adaptive management as a possible strategy. Adaptation to formalised education has been implemented with some First Nations in North America such as the Anishinaabe in Wisconsin. There, secondary school graduation rates rose from 57% in 2009 to 98% in 2014 following the incorporation of hands-on learning of traditional knowledge such as how to build canoes and how to harvest wild rice into the formal education programming already present (Richardson et al., 2023, p. 195). This indicates that students held secondary education in higher esteem when it included traditional knowledge.

In terms of language use, formal primary and secondary education in Oman and Yemen is currently offered in Arabic with students switching to English at the post-secondary level. The Mehri Center for Studies and Research in al-Ghaydha, Yemen, was working toward introducing Mehri into schools in Yemen but have paused that endeavour due to lack of teachers, available literature, and government approval (Saeed al-Qumairi, p.c. 2024). Arabic proficiency and literacy are necessary skills in Oman, Yemen, and Saudi Arabia. However, it has been found that mother-tongue language of instruction may improve reading, writing and oral proficiency in a later acquired language (Nakamura et al., 2023). Research from Mali, where mother tongue language of instruction was implemented in the 1990s, reports that mother-tongue primary education decreased drop-out rates and increased graduation rates (Bender, 2006). Mother tongue primary education can increase a child's literacy in their mother tongue and later acquired languages as well as their likelihood of persevering through primary levels and increase their employability later in life.

Involving universities and university students would be beneficial to developing a primary education curriculum for mother-tongue language of instruction. Dhofar University, in Salalah, offers teacher training programmes. Introducing modules on local ecosystems and languages as options for students studying education would extend this knowledge again. Encouraging creativity in applications of the local knowledge and an understanding of the challenges facing the ecosystems requires cross-disciplinary and cross-generational methodologies.

6.4.4 Knowledge application

Like the local languages, extending traditional knowledge to new domains could increase the longevity of this knowledge. These new domains could include urban planning, livestock management, and biodiversity conservation (Boom, 2022). For this to become a reality, though, the traditional knowledge must be passed on to children and youth. Children who grow up with traditional knowledge will have influence on future policy and can incorporate that knowledge into the way the resources are allocated and used in the future. However, children are not regularly receiving this local knowledge today. A possibility for involving younger children is through traditional children's rhymes. There is a wealth of local knowledge held within the traditional children's rhymes which were once used to teach children proper behaviour and creative thinking (al-Qumairi et al., 2024). For example, the following rhyme entitled '*yətbōr xoh*' (al-Qumairi et al., 2024) was chanted by parents and their children during the harvest of the *dawm* fruit from the *Ziziphus leucodermis* tree (5.4.3).

78. yətbōr xoh //	*də-ytayw dawm*
Would that his mouth break //	he who eats the dawm fruit,
yətbōr xoh //	*də-yəḵərḥawm*[113]
Would that his mouth break //	he who is crunching [it].

The rhyme helps persuade children not to eat the fruit during the harvest – an important lesson if the harvest is to be available for consumption in later seasons.

Another example is found in riddles teaching creative thinking. Consider the following riddle also from al-Qumairi et al. (2024):

79. yā ḥzayl lūk wə-yā mzayl lūk
I challenge you to know this,
mən ḏə-bərkōt bə-kazz?[114]*(al-Qumairi et al., 2024)*
About she that knelt in the hill?

[113] (al-Qumairi et al., 2024, p. 10)
[114] (al-Qumairi et al., 2024, p. 16)

To solve this riddle, the listener must know that *bərkōt*[115] (see *həbrūk* 'to make [a camel] kneel') is a verb that is only used for camels: *brōk* '(camels) to kneel'. A human being cannot *brōk*, only camels can. This riddle is about something that looks like a camel kneeling in a hill. The solution for the riddle is *xīzmōt*, the nose ring traditionally worn by married women which was pierced through the tip of the nose, not the nostril, therefore looking like a hill. For a photo of this type of nose ring, see Tabook (1997, p. 294). This riddle requires children to draw a comparison between a hill and a nose and then a camel and a nose ring.

The revitalisation of children's rhymes could strengthen cultural identity through traditional values and ecological knowledge at the same time as the local language. This could be instigated through an afterschool club or something similar where children are taught a traditional nursery rhyme and a simple game that goes along with it and encouraged to ask their parents, aunts and uncles, or grandparents for similar rhymes they learned and games they played as children. This can then be expanded to include interested adults who would be willing to teach the children the rhyme or game at another gathering or the children could teach one another. These gatherings can also be augmented by stories from the past, either traditional stories, similar to fairy tales in European cultures, or stories of what life was like before automobiles entered society, for example. As the repertoire grows, recordings can be made, either written or audio/visual allowing the stories and rhymes to be shared further afield. This programme could then be expanded to new schools or areas. This could be expanded further into primary curriculum, teaching the histories and cultures of a wider area. As children grow up with this knowledge and cultural identity, it can be reapplied to policies as they gain influence in their country. Today this knowledge is still available, though disappearing with older generations.

6.5 Conclusion

In conclusion, despite numerous disruptions confronting biocultural diversity, particularly amid rapid societal changes, this chapter provided evidence for concern over the health of the biocultural diversity from within the community. However, the disruptions causing these

[115] The /ō/ vowel is found here because of the dialect

changes cannot be reversed, so the language, culture, and ecosystems must adapt to them. Resilience can be built into biocultural diversity by intentionally managing the adaptations as the systems respond to the disturbances – as has been demonstrated in other areas of the world with declining biocultural diversity. Recommendations discussed here include increasing access to local knowledge through partnerships between youth and elders, including indigenous languages and knowledge in formal education settings, integrating local knowledge into post-secondary level education, and revitalising children's rhymes in the region.

7 Conclusions

7.1 Overview

The goal of this thesis was to begin a description of the biocultural diversity of the region of Dhofar, Oman and al-Mahra, Yemen by expanding our understanding of the links between the languages, cultures, and ecosystems and to describe strategies for building resilience found in other areas of the world with declining biocultural diversity.

7.2 Summary of Findings

This research found that the institutional framework of governance among the Mahra exhibit each of the eight principles of long-lasting CPR governing institutions described by Ostrom.

This research expanded our understanding of the link of the language and culture to the ecosystem with a biocultural approach to describing the language, culture, and ecosystem.

This research also examined the factors impacting the biocultural diversity of Dhofar and al-Mahra and gives examples of how resilience has been built into other areas of declining diversity in the world.

7.3 Contributions

This thesis makes several contributions to our understanding of how humans and their ecosystems interact. First, it describes the governance institutions of the Mahra and how resources were managed in the past in the context of Ostrom's eight principles for long-lasting institutions. The governance institutions of the Mahra have not previously been compared to other institutional frameworks. Second, this thesis extends the description of the link between the language, culture, and ecosystem giving insight into the divisions within the language of landscape concepts, the positive and negative implications connected with directions and weather, and the unique vocabulary and activities that developed due to the local climate. Lastly, this research examines the factors affecting diversity in Dhofar and al-Mahra to better build resilience across the languages, cultures,

and ecosystems of the region. This type of analysis of Dhofari diversities has been lacking in the literature and provides possible paths forward in the goal of continued or renewed sustainability.

7.4 Implications

Implications of these findings and contributions include implications for the theory of institutional economics by confirming the findings of Quinn et al. (2007) that Ostrom's eight design principles are found not only in sedentary, agricultural contexts but also in nomadic, pastoral contexts. This research also extends that finding to include a majority Muslim context which has not been considered in the past, to the best of my knowledge. The unique cultural patterns linked with Islamic belief, tribal orientation and pastoral livelihoods do not influence governance institutions to the extent that the principles do not apply.

Policy implications taken from this research include extending language of instruction to include local languages. Ideally this would be incorporated into formal education structures in the region, but other possibilities are suggested such as teaching traditional children's rhymes and games outside of school hours.

In addition, the place-based knowledge of the Mahra has much to contribute to sustainability policy. Documenting the knowledge of the ecosystem has been in process for many years, but younger generations are still struggling to access the information. Projects linking youth and elders to build resources in the local languages and Arabic would make the knowledge accessible to be included in future policy development.

7.5 Limitations

This study has some limitations. First, my language capabilities limited my ability to interview speakers independently. I relied upon native speakers who are also proficient in English for interviews, translation, and context. Without them, this research would not have been possible.

Second, the COVID-19 pandemic affected my ability to travel, so the traditional model for an ethnographic programme of a long-term presence in the community for research purposes

was diminished. I compensated for this by conducting research online. The possibility of online research became a reality due to the pandemic, however, since the Omani government lifted bans on online video calling at this time.

Third, biocultural diversity is a significantly broader topic than could fit inside a PhD dissertation. Further work on the biocultural links is necessary to fully understand their connections and extend policy and practical applications of the work.

7.6 Further Research

This research has built on the work of many researchers in the past and pulled together several diverse theories to build a biocultural perspective of the region of Dhofar and al-Mahra. Much more work is yet to be done in describing the links between language, culture, and ecosystems of the region and managing adaptations to disruptions and increasing resilience. To extend our understanding of the link of the language to the ecosystem, more topics should be examined for semantic extension and poetic use. Further work on dialectal differences and boundaries is needed, as well as a description of how the changes in society have affected the variation and boundaries. This research is also largely based in central Dhofar with a few consultants from outside of the region; more work with people from a more diverse range of tribal groups is needed. In addition, we do not know how many children are using the local languages and with what level of proficiency, so more insight into geographical locations where the languages are disappearing most rapidly would help target revitalisation efforts.

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Appendix 1 Interview questions on Dhofari institutions

- How were land boundaries decided? At what level of organisation – tribe/sub-tribe/family?
- How was grazing land distributed?
- Fishing areas?
- Who makes the decisions about the distribution?
    - How was this person/group chosen?
    - Did they need special training? If so, where did they get it?
- Whose camels or cows are allowed and whose are not?
- If someone wanted to change the rules, was that a possibility?
    - If yes:
        - Who would they talk to?
        - What if the person was from outside the tribe/sub-tribe/family?
        - What if that person was a woman?
        - Has that changed today?
- How were disputes handled –
    - If someone crossed a boundary and was living in the wrong place?
    - If someone brought their camels or cows somewhere they shouldn't?
    - If someone wanted to join a tribe or live among a tribe and use the pasture for their own camels was that possible?
        - What kind of process did they have to follow?
        - Who made the decisions?
        - What if it was a single woman? An orphan?
- What would happen during a drought?
    - Who decided who would get what pasture is available?
    - How were disputes decided?

- Who makes sure only the correct people are using the land/ocean?
    - What if someone moved their camels or cows into someone else's or some other tribe's grazing land?
    - Who reports it?
    - To whom?
    - What might happen to someone if they report someone else? Possibility of retribution?
- Were there different punishments for rule-breakers over time? If someone does something wrong once, is the punishment different if they do it again, or if they do it over and over?
    - Ex. in UK increased fines for repeated offenses
    - (How were people discouraged from repeatedly breaking the rules?)
    - Has this changed today?
- If a poor man had a complaint about a richer man, could he bring it to the dispute moderator?
    - How long would that take?
    - Who would look after his family/property while he did that?
    - What if there was no one to look after his family?
- What about women, could they bring complaints or disputes to the moderator?
    - Would the process be the same?
    - What about disputes just between women, would they go to the same moderator?
    - If there was a disagreement among family members, was the dispute process the same as if it were between different tribes?
    - If no:
        - How are they different?
        - Who decided which level the dispute goes to?
        - What if there was uncertainty about which level it belonged at – how was the decision made about who would decide where the dispute was heard?

Appendix 2 Survey Privacy Notice

Privacy notice

You are being invited to participate in a research study titled Traditional Practices in Dhofar, Oman. This study is being done by Andrea Boom from the University of Leeds.

The purpose of this research study is to disseminate cultural knowledge about traditions from Dhofar and measure its impact on communities there. This survey will take you approximately 15 minutes to complete. Your participation in this study is entirely voluntary. You do not have to answer any questions you do not want to except the question about your age group. This survey is open to people aged 18 and above. If you are under 18 or if you wish to skip the survey you can access the e-book here.

We believe there are no known risks associated with this research study; however, as with any online related activity the risk of a breach is always possible. To the best of our ability your participation in this study will remain confidential, and only anonymised data will be published.

We will minimise any risks by only collecting anonymous data (unless you would like to participate in further surveys) and destroying the collected data upon completion of the PhD thesis. Personal information will be held separately from data collected for research purposes. Further information is available via the University of Leeds Privacy Notice.

أنت مدعو للمشاركة في دراسة بحثية بعنوان الممارسات التقليدية في ظفار، عمان. يتم إجراء هذه الدراسة بواسطة أندريا بوم من جامعة ليدز.

الغرض من هذه الدراسة البحثية هو نشر المعرفة الثقافية حول التقاليد من ظفار وقياس تأثيرها على المجتمعات هناك. سيستغرق إكمال هذا الاستطلاع حوالي 15 دقيقة. مشاركتك في هذه الدراسة تطوعية بالكامل. لا يتعين عليك الإجابة على أي أسئلة لا تريد الإجابة عنها باستثناء السؤال الخاص بفئتك العمرية. هذا الاستطلاع مفتوح للأشخاص الذين تزيد أعمارهم عن 18 عامًا. إذا كان عمرك أقل من 18 عامًا أو إذا كنت ترغب في تخطي الاستبيان، يمكنك الوصول إلى الكتاب الإلكتروني هنا.

نعتقد أنه لا توجد مخاطر معروفة مرتبطة بهذه الدراسة البحثية؛ ومع ذلك، كما هو الحال مع أي نشاط متصل بالإنترنت، فإن خطر حدوث خرق ممكن دائمًا. بقدر ما نستطيع، ستظل مشاركتك في هذه الدراسة سرية، ولن يتم نشر سوى البيانات مجهولة المصدر. سنعمل على تقليل أي مخاطر من خلال جمع البيانات مجهولة المصدر فقط (إلا إذا كنت ترغب في المشاركة في مزيد من الاستطلاعات) وتدمير البيانات التي تم جمعها عند الانتهاء من أطروحة الدكتوراه الخاصة بـ Andrea. سيتم الاحتفاظ بالمعلومات الشخصية بشكل منفصل عن البيانات التي تم جمعها لأغراض البحث. يتوفر مزيد من المعلومات عبر إشعار الخصوصية بجامعة ليدز.

Appendix 3 Survey questions

Language [select one]
1- English
2- Arabic
How old are you? [select one]
1- 0-17
2- 18-25
3- 25-40
4- 41-55
5- 56-84
6- 85+
What is your gender? [select one]
1- Male
2- Female
3- Prefer not to say
Which tribe do you belong to?
Which country do you live in? [select one]
1- Oman
2- Yemen
3- Kingdom of Saudi Arabia
4- other
If you selected 'other' please specify:
Which governate do you usually live in?
Which governate do you usually live in? [select one]
1- Dhofar
2- Al Wusta
3- Ad Dhahirah
4- Ad Dakhiliyah
5- Ash Sharqiya N
6- Ash Sharqiya S
7- Muscat
8- Al Batinah S
9- Al Batinah N
10- Al Buraimi
11- Musandam
12- other
If you selected other, please specify
Which town or city do you live in or nearby?
How long have you lived in this area?
Can you understand the Mehri language? [select one]
1- Yes
2- No
Can you speak the Mehri language? [select one]
1- Yes

2- No
Is Mehri spoken in your home? [select one]
1- Yes
2- No
How often is Mehri spoke in your home? [select one]
1- Never
2- Every day
3- Once a week
4- Once a month
5- When someone visits
6- To a particular person, but not others
Can you understand the Shehret[116]/Jibbāli language? [select one]
1- Yes
2- No
Can you speak the Shehret/Jibbāli language? [select one]
1- Yes
2- No
Is the Shehret/Jibbāli language spoken in your home? [select one]
1- Yes
2- No
How often is Sheret/Jibbāli spoken in your home? [select one]
1- Never
2- Every day
3- Once a week
4- Once a month
5- When someone visits
6- To a particular person, but not others
Do you know what type of tree this is? [select one]
1- Yes
2- No
What is the name for this type of tree?
Prosopis juliflora
What is this tree used for?
Do you know what type of plant this is? [select one]
1- Yes
2- No
What is the name for this type of plant?
Aloe dhufarensis
What is this plant used for?
Do you know what type of tree this is? [select one]
1- Yes
2- No
What is the name for this type of tree?

---

[116] This is an Anglosised spelling of Śḥerēt.

Anogeissus dhofarica

What is this tree used for?

Have you ever participated in conservation efforts for local plants/trees? [select one]

1- Yes
2- No

In the past year, how frequently have you participated in conservation projects? [select one]

1- Every day
2- Once a week
3- Once a month
4- A few times per year
5- Once a year
6- One time

Do you ever use local plants for food or medicine? [select one]

1- Yes
2- No

In the past year, how frequently have you used local plants for food or medicine?

A- Food [select one]

1. Every day
2. Once a week
3. Once a month
4. A few times per year
5. Once a year
6. One time

B- Medicine [select one]

1. Every day
2. Once a week
3. Once a month
4. A few times per year
5. Once a year
6. One time

Now that you know some uses for these local plants, would you consider increasing your use of local plants for food or medicine?

A- Food [select one]

1. Yes
2. I want more information first
3. If someone were to show me the plants
4. No
5. Other

B- Medicine [select one]

1. Yes
2. I want more information first
3. If someone were to show me the plants
4. No
5. Other

If you selected other, please tell me what might help you decide whether or not to use more local plants.

Now that you know some uses for these local plants, would you consider increasing your involvement in conservation efforts? [select one]

1- Yes
2- Yes, but I need a project to join
3- Yes, and I have a new project that I would like to start
4- Yes, but only if others were to join as well
5- No
6- Other

If you selected other, please tell me what might convince you to increase your conservation involvement.

Do you have any questions about this information that you would like to see included in this e-resource?

Are there other topics you would be interested in learning about through another e-book like this one?

Are you interested in participating in putting together another website like this? [select one]

1- Yes
2- No

Please provide an email address or WhatsApp number you can be contacted at.

Are you interest in being notified when another information website is published? [select one]

1- Yes
2- No

Please provide an email address or WhatsApp number you can be contacted at.

Would you be willing to participate in further surveys like this one? [select one]

1- Yes
2- No

Please provide an email address or WhatsApp number you can be contacted at.

Appendix 4 Photograph cataloguing scheme

File name	Name of the file is in the format YYYYMMDD_HHMMSS_placename
Date taken	YYYY-MM-DD
Place taken	Rough area name, for example 'Wadi Gzayl' or 'Rabkut'
Camera used	SAMSUNG – SM-A705FN SONY – DSC-HX350 SONY – HDR-PJ410
Photographer	Andrea Boom, Janet Watson, Mohammad al-Shanfari, Abdullah al-Mahri
Description	Brief description of the contents of the photo
Latin	In the format *Genus species*
Latin informant	Source of the Latin name,
Mehri	Mehri name for the plant, if more than one name given then separated by commas if from same source or semi-colons if different sources, ex ʕōtəb; ʕośər, aśūr in wadi ūbōṣ
Mehri informant	Source of Mehri name, if more than one source then divided by semi-colons to match the names data
Śḥerēt	Śḥerēt name for the plant, if more than one name given then separated by commas if from same source or semi-colons if different sources
Śḥerēt informant	Source of Śḥerēt name, if more than one source then divided by semi-colons to match the names data
Hobyot	Hobyōt name for the plant, if more than one name given then separated by commas if from same source or semi-colons if different sources

Hobyot informant	Source of Hobyōt name, if more than one source then divided by semi-colons to match the names data
Ḥarsūsi	Ḥarsūsi name for the plant, if more than one name given then separated by commas if from same source or semi-colons if different sources
Ḥarsūsi informant	Source of Ḥarsūsi name, if more than one source then divided by semi-colons to match the names data
Standard Arabic	Standard Arabic name for the plant, if more than one name given then separated by commas if from same source or semi-colons if different sources
Arabic informant	Source of Standard Arabic name, if more than one source then divided by semi-colons to match the names data
Dhofari Arabic	Dhofari Arabic name for the plant, if more than one name given then separated by commas if from same source or semi-colons if different sources
Dhofari Arabic informant	Source of Dhofari Arabic name, if more than one source then divided by semi-colons to match the names data
Uses	Common uses for the plant
Use informant	Source of uses information
Important	Which PowerPoint slideshow the plant was included in and the slide number
Video/sound file	Interview recording or video of conversation about the plant
Consent status	Whether or not I have permission to use the photograph

Appendix 5 Ethics approval form

Application reference	FAHC 21-008	**Date reviewed**	30/09/2021
Project title	Language and Nature in South Arabia: Ethnographic Description of Traditional Practices of Dhofar and Mahrah		

General comments (These will be returned to the applicant)

This is an excellently set out project with very careful attention to cultural norms, to anonymization, data protection and to how consent will be obtained. The project should bring benefits in cultural and also environmental terms. Perhaps, however, it would be a good idea to add one or more of the research partners to the list of people who are going to be contacted regularly: they could be given contact details of the participants the PI intends to visit each day.

Application section	**Comment**	**Response required/ amended application required/ for consideration**
Risk assessment form	Add one or more research partners to the list of people to be contacted regularly while doing fieldwork.	For consideration
Please indicate who you would like to review the applicant's response		Reviewers/ Chair/ Administrator

Appendix 6 Participant information sheet

School of Languages, Cultures and Societies

UNIVERSITY OF LEEDS

05 June 2024

You are invited to take part in a research project. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the project?

This research project will describe the ways people lived and worked in the past in the Mehri language. The information gathered during this research will be published so that younger people can learn about the ways their grandparents lived in the past through story books and information both in Arabic and in Mehri.

Why have I been chosen?

You have been chosen to participate because you are a speaker of Mehri and you are an expert in the ways of life from before automobiles became common in Dhofar.

Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep (and be asked to sign a consent form or record your consent verbally). You can still withdraw at any time without it affecting any benefits that you are entitled to in any way. You do not have to give a reason if you wish to withdraw.

What do I have to do?

You will be asked to be a part of an interview which will last about one hour. If you are willing after that there is the possibility of further interview times. I will travel to you for the interview, either to your home or a home of a relative or a place close to your home that you can easily get to. I would like to record the interview with a video camera if you are willing to be filmed. If you do not wish to be filmed, I will record only our voices instead.

The research project will last for three years beginning in March, 2021. If you are willing to continue participating, I will contact you with more questions throughout the time of the project and either conduct another interview or ask questions that come up as I analyse the information you provide. I hope to work together to make this an enjoyable experience for you, so if at any time you wish to stop and restart later or end the interview, I will work with you.

In the interview, you will be asked a set of questions about the plants that were used in the past. I will have photographs of plants with me and the questions will be about who used the plants and for what, what the plants were called, whether you know where they are living today or not. I am especially interested in any stories you might have about the plants, whether it is an experience from your past or stories for children about a particular plant.

What are the possible disadvantages and risks of taking part?

We do not foresee any disadvantages or risks for taking part.

How will the data be stored?

All of the data will be stored securely in electronic repositories at the School of African and Oriental Studies, Endangered Languages Archive (UK).

05 June 2024

Your personal information will be stored securely and separately from the data in the archive. All the contact information that we collect about you during the course of the research will be kept strictly confidential.

How can I withdraw my contribution?

If at any point you wish to withdraw any part of or the entirety of your contribution you can contact me at +44 7547 976587 or mlabo@leeds.ac.uk and I will remove your data from the archive. Any data included in publications will be anonymised but you will not be able to withdraw it after publication.

Your name will not be used at any time on any written or spoken data records you provide and your participation in the project will remain anonymous. However, if you wish to be credited in any work resulting from this project in which you have participated, please let me know on your consent form and you will be credited in publications and oral presentations with your name.

What will happen to the results of the research project?

The results of the research will be published over the next three years in a variety of formats including but not limited to children's books, online information, archives of the data, academic papers, conference presentations and a PhD thesis. Please let me know if you would like to be notified when the results are published and if you would like to receive a copy.

Access to the recorded materials will be restricted to the researchers and the originating speakers and communities for the duration of the project (until 2024). After this time, any materials you give permission for will be made available to other researchers. Storage of the archive will be long term. This could lead to further publications of the information either by myself or by other researchers in the future. I cannot guarantee that this will be accessible to you, particularly if it is published by another researcher.

We will take steps wherever possible to anonymise the research data so that you will not be identified in any reports or publications.

You will only be named in the publication of the results if you give me permission to do so.

What type of information will be sought from me and why is the collection of this information relevant for achieving the research project's objectives?

The information you provide will help to describe life as it was lived in the past. Your knowledge of the natural environment is very important in keeping the natural world healthy and many young people don't have access to this information. I plan to give these young people access to it so that they can care for and benefit from the natural environment.

Who is organising/ funding the research?

This research is funded by the UK government through the Commonwealth Scholarship Scheme.

Contact for further information

If you have any questions or concerns, please contact either myself or my supervisor:

Andrea Boom – primary researcher
mlabo@leeds.ac.uk
+44 7547 976587

Professor Janet Watson – supervisor
j.c.e.watson@leeds.ac.uk
+44 [redacted]

05 June 2024

Thank you for taking the time to read through this information. It is very important that you understand all of the information in it. This copy is for you to keep and look back at if you have questions or concerns in the future.

I hope you are willing to participate in this research and that our work together will help others in the future.

Appendix 7 Participant consent form

School of Languages, Cultures and Societies

UNIVERSITY OF LEEDS

Consent to take part in Language and Nature in South Arabia: Ethnographic description of traditional practices of Dhofar and Mahrah **- Interview Phase**	Add your initials next to the statement if you agree
I confirm that I have read and understand the information sheet dated 23 November 2023 explaining the above research project and I have had the opportunity to ask questions about the project.	
I understand that my participation is voluntary and that I am free to withdraw until Jan 2024 without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline. Lead researcher: Andrea Boom WhatsApp, Signal, SMS: +44 7547 976587 Email: mlabo@leeds.ac.uk I understand that my data will be removed from the database, archive and researcher's files in the event that I choose to withdraw my consent.	
I understand that members of the research team may have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research.	
I understand that the data collected from me may be stored and used in relevant future research in an anonymised form	
I understand that the data I provide may be archived at the School of Oriental and African Studies Endangered Languages Archive in Germany.	
I understand that relevant sections of the data collected during the study may be looked at by individuals from the University of Leeds or from regulatory authorities where it is relevant to my taking part in this research.	
I agree to take part in the above research project and will inform the lead researcher should my contact details change.	
I agree to provide spoken data	
I agree to provide audio-visual data	
I agree to showing my face in still photographs	
I agree to showing my face during audio-visual recordings	
I agree to having my name mentioned in the acknowledgements to any published books and articles	
I agree to be contacted again later for another interview or for specific questions about the information I share in the first interview	

Name of participant	
Participant's signature	
Date	
Name of lead researcher or person taking consent	
Signature	
Date*	

*To be signed and dated in the presence of the participant.
Once this has been signed by all parties the participant should receive a copy of the signed and dated participant consent form, the letter/ pre-written script/ information sheet and any other written information provided to the participants. A copy of the signed and dated consent form should be kept with the project's main documents which must be kept in a secure location.

Appendix 8 Plant photographs

Figure 18 amhīr in Gzayl

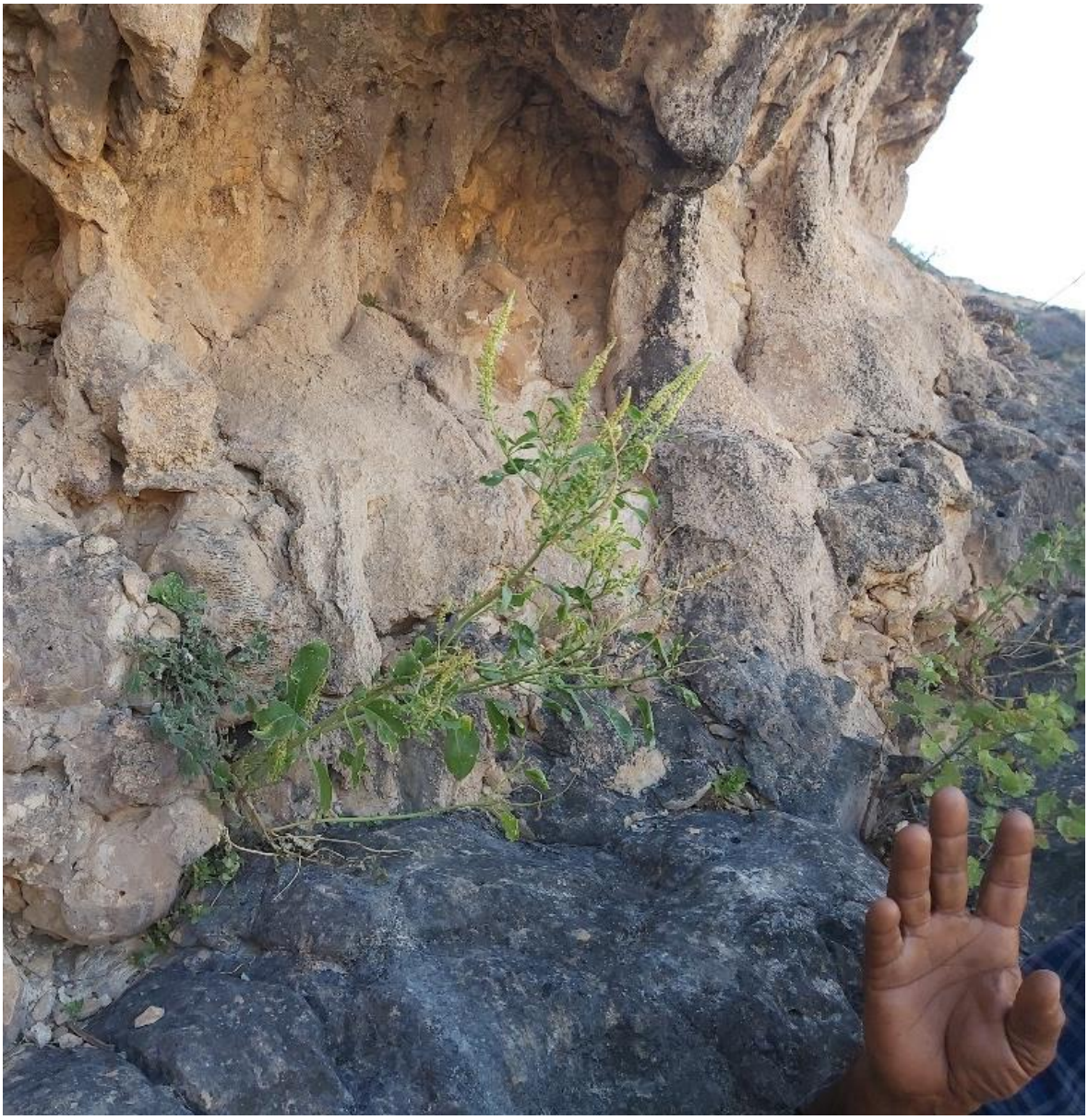

Figure 19 amhīr in Wadi Lēta

Figure 20 argəfīf in Gzayl

Figure 21 arbīt in Gzayl

Figure 22 āśūr in Rabkut

Figure 23 āśūr flower and buds

Figure 24 āśūr in Ūbōṣ

Figure 25 gənɪgənət in Rabkut

Figure 26 gənɪgənət in Raysut

Figure 27 ḥarṭawt in Gzayl

Figure 28 ḥaybəḍ in Rabkut

Figure 29 ḥaybəḍ in Rabkut – leaves and thorns

Figure 30 rəḳṣayt in Gzayl

Figure 31 śərbīṯ in Gzayl

Figure 32 sēḳal near ʕaġsayl

Figure 33 śēru in Rabkut

Figure 34 śēru fruit in Rabkut

Figure 35 ṭayf in Rabkut

Figure 36 ṭayf in ʕaġsayl

Figure 37 ṭayf in Gafgīf (near Wadi Lēta)

Figure 38 ṭənṭīt in Gzayl

Figure 39 ṭīfīr in Rabkut

Figure 40 ṭīfīr in Ūbōṣ

Figure 41 tūṣəfēt in Ūbōṣ

Figure 42 ūṣawf in Lēta

Figure 43 səġōt (Ś) ~ Anogeissus dhofarica near Dirbat