رؤية عمان 2040

الاستراتيجية العمرانية
SPATIAL STRATEGY

وزارة الإسكان والتخطيط العمراني
Ministry of Housing and Urban Planning

Policies Document of Al Hajar Al Gharbi

Sustainable Urban Development towards Thriving Communities.

Paradigm Shift

Based on the Ministry of Housing and Urban Planning **approach in its journey towards moving housing services to advanced stages in placemaking,** the ministry continues its journey towards comprehensive transformation by launching **“2022 Executive Plan”** as a translation of the national priorities emanating from **Oman Vision 2040 and the National Urban Development Strategy.**

“Today, we stand with a strong will and unwavering determination on the threshold of an important phase **of development and construction** in Oman. You have participated in **shaping our aspirations through the Future Vision of Oman 2040,** and have contributed to defining its economic, social, and cultural objectives in a way that embodies a clear vision and great ambitions for **a more prosperous and developed** future.”

His Majesty Sultan Haitham Bin Tarik
-May Allah protect him-

“As we look forward to **the future with great optimism and determined resolve to achieve even** greater aspirations, it is first and foremost necessary to preserve the blessing of stability and all the blessings that God has bestowed upon our country. This requires intensifying efforts to the maximum possible extent to **build the future Oman,** God willing.”

His Majesty Sultan Qaboos bin Said
-May his soul rest in peace-

Statement

His Excellency Dr. Khalfan Bin Saeed Al-Shuaili
The Minister of Housing and Urban Planning

Being inspired by the widsom and stability of the noble approach of his Majesty, we set out, striving with determination and tireless effort to achieve our ultimate mission ... **Towards sustainable urban development for prosperous communities.**

We have taken firm steps, with careful and systematic plans, to keep pace with global progress and development and to **place the Sultanate of Oman among advanced nations.**At the same time, we seek to enhance communication and collaboration both domestically and internationally while taking into account the aspirations of youth and society in all its segments.

Continuing to make progress on the path of the paradigm shift, **armed with strong determination and national competencies in both leadership and executive positions,** we will store no effort to develop and empower them to play an effective and crucial role in performing their vital roles and contributing to attaining balance and stability. In view of that, we have established key performance indicators to evaluate achievements and link our work and sectors together in order to achieve our goals and aspirations.

Out of our deep concern and keenness to serve this nation and its citizens, we have made customer service a top priority that drives us to provide the best possible services, streamline procedures, digitise and automate all transactions.

In the Ministry, in its both housing and urban planning sectors, we have strived to offer alternatives and solutions to expedite the process of distributing lands and housing to eligible recipients. In addition, we have adopted structural plans for ‘Greater cities’ as well as smart cities, while providing special programs to qualify and train personnel and experts **to elevate the level of urban planning to a high level of excellence and professionalism.**

Given that efforts and endeavours cannot be achieved without clear methodology and sound planning, we have strengthened the financial sustainability sector and the ministry’s priorities including **competencies, capacity building, digital transformation, identity, communication, governance, legislation, and the creation of prosperous communities.** Consequently, the ministry could serve as an example for understanding and promoting identity, communication, and knowledge exchange, reaching for advanced institutional performance, modes of operation and service delivery to establish prosperous communities.

Building on these pillars and noble, ambitious messages, we will continue our journey of planning, accomplishing, and sustaining the achievements that we have set our sights on - **Oman Vision 2040** - with transparency, integration, and high, steadfast values.

His Excellency Dr. Khalfan Bin Saeed Al-Shuaili
The Minister of Housing and urban planning

Foreword

Sustainable development is a top priority for many countries, and the Sultanate of Oman is no exception. The Omani government has set a spatial national and regional strategy, aimed at achieving sustainable and integrated urban growth that balances social, economic, and environmental aspects. The goal is to create a thriving and attractive destination with modern cities and lively villages that support both social and economic prosperity.

This strategy involves identifying priorities and strategic objectives for development in each region. It also entails designing sustainable urban projects that meet the needs of local communities and including policies necessary to address different dimensions and achieve sustainable development within national urban development.

As the Director-General of the Directorate General of Urban Planning in the Ministry of Housing and Urban Planning, I recognise the importance of having clear policies and guidelines in place to ensure effective, efficient, and lawful urban development. This document contains a comprehensive set of policies and guidelines that will serve as a key reference for all Al Hajar Al Gharbi development proposals. From these policies and guidelines, a set of key actions, responsibilities, and procedures will be developed in a separate document.

I strongly advise all planners and stakeholders to embrace the contents of this document diligently, as its implementation is crucial for achieving optimal results in the sustainable and efficient development of Al Hajar Al Gharbi, in accordance with local laws and regulations. By doing so, we can ensure that urban development in the region is carried out sustainably, efficiently, and in compliance with local laws and regulations.

I would like to express my gratitude to the team who worked diligently to develop this document. Their efforts have resulted in a valuable resource that will help us enhance and achieve the development vision in Al Hajar Al Gharbi. I also extend my sincerest thanks to all the involved parties who provided us with their valuable feedback and comments on this document. Your input has been invaluable in ensuring that this policies document is comprehensive, effective, and aligned with the needs of the region.

Dr. Hanan Amer Al- Jabri
The Director-General of the Directorate General of Urban Planning

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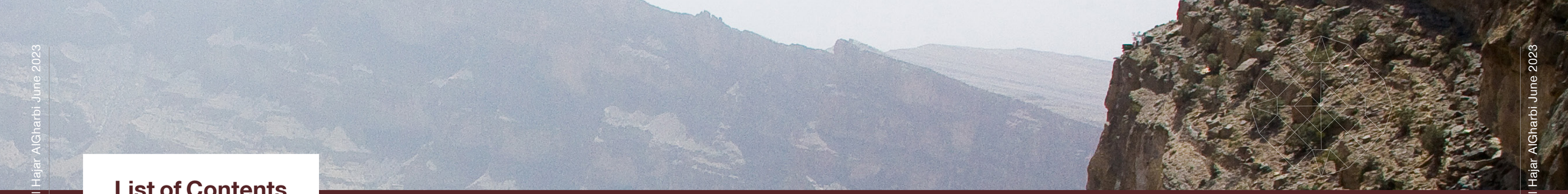

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List of Abbreviations

EA- Environment Authority
IBAO- Important Bird Areas of Oman
IBAs- Important Bird Areas
IDA- International Dark sky Association
IMAs- Important Mammals Areas
IPAs- Important Plant Areas
IRAs- Important Retiles Areas
IUCN- International Union for Conservation of Nature
MRMWR – Ministry of Regional Municipalities and Water resources (now Ministry of Interior)
NCAs- Nature Conservation Areas
OBG – Oman Botanic Garden
ONSS – Oman National Speciaö Strategy
RSS- Regional Special Strategy
SPZ – Special Planning Zones
WPZ- Wellfield Protection Zones

Policies Document of Al Hajar AlGharbi June 2023

Stakeholders

Ministry of Heritage and Tourism
Ministry of Agriculture, Fisheries, and water resources
Environment Authority
Oman Botanic Garden
Directorate General of Housing and Urban Planning in Ad Dakhilyah
Directorate General of Housing and Urban Planning in Musandam
Directorate General of Housing and Urban Planning in North Al Batinah
Directorate General of Housing and Urban Planning South Al Batinah
Directorate General of Housing and Urban Planning in North Al Sharqiah
Directorate General of Housing and Urban Planning in South Al Sharqiah
Directorate General of Housing and Urban Planning in Al Buraimi
Directorate General of Housing and Urban Planning in Al Dhahirah
Directorate General of Housing and Urban Planning in Al Wusta
Directorate General of Housing and Urban Planning in Dhofar

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Ministry's Vision

Sustainable Urban Development towards Thriving Communities

Our Message

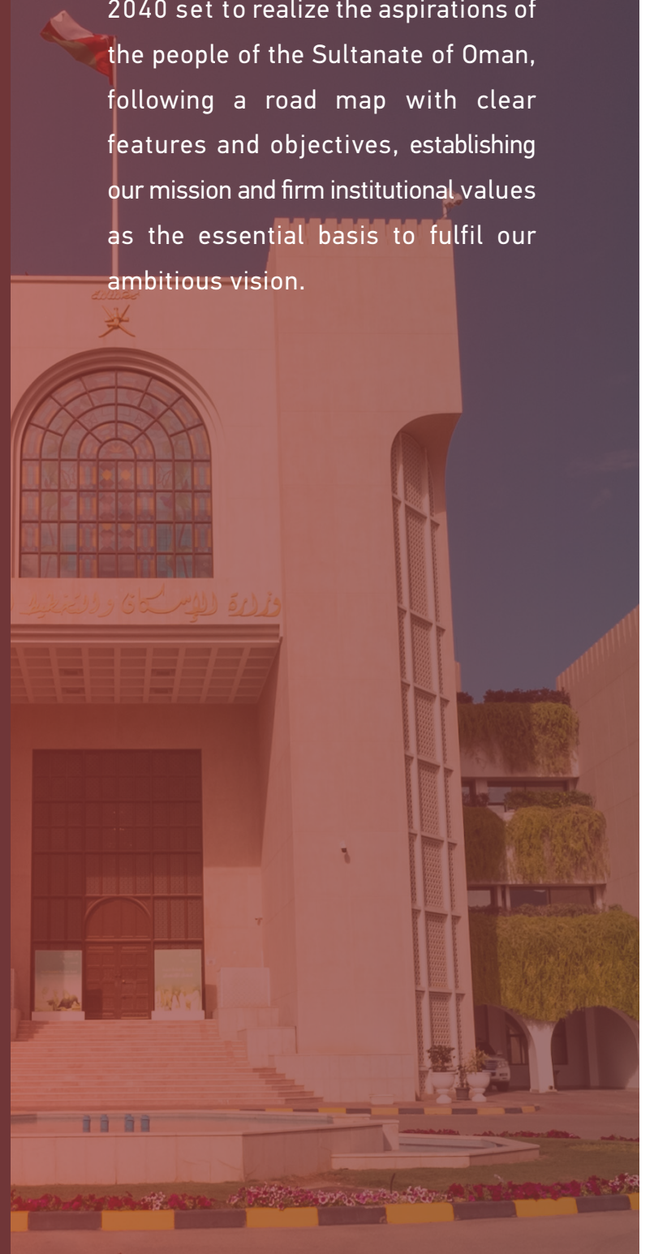
Moving housing services and urban planning to advanced stages of the concept of place-making with community partnership locally and internationally.

Our Values

Transparency
Efficiency
Integrative
Sustainability
Equality

Message of the Ministry

Stepping steadily forward, we seek to attain the highest standards of service efficiency in line with Oman Vision 2040 set to realize the aspirations of the people of the Sultanate of Oman, following a road map with clear features and objectives, establishing our mission and firm institutional values as the essential basis to fulfil our ambitious vision.



Document structure

The Document is divided into three parts as follows:

Part 1- Introduction
The introduction provides an overview of the Special Planning Zone and the Al Hajar Al Gharbi (The Western Hajar Mountains) initiative, emphasising the significance of Al Hajar Al Gharbi. It also presents the vision and objectives of the initiative as well as the methodology used in the policy-making process.

Part 2- Cross Cutting
Sustainable development and climate change

Part 3- Al Hajar Al Gharbi Planning Policies
The policy section is divided into 12 chapters, with each chapter containing several policies related to landscape enhancement, biodiversity, water resources, infrastructure, cultural heritage, and other aspects.
Each chapter includes an introduction that provides a summary of the topic to be discussed, followed by the policy title and its purpose. The policy clauses are presented as bullet points. The policy is then followed by guidelines to achieve the policy clauses.

1. Chapter

1. LANDSCAPE CONSERVATION AND ENHANCEMENT

A landscape refers to the visible features of an area of land, including its landforms and how they interact with natural or man-made elements. Landscapes, however, are more than just picturesque views; they embody a narrative of how the natural environment and human settlements have impacted each other over centuries. The rich cultural heritage and natural landscapes of Al Hajar Al Gharbi constitute an asset for sustainable development. The built environment should be designed in harmony with the surrounding landscape, drawing inspiration from distinctive regional examples of vernacular architecture and urbanism.

Al Hajar Al Gharbi area boasts stunning landscapes of pristine beauty, comprising rugged terrains of the Rocky Mountains, historic architectural designs in traditional buildings, varied vegetation, and water bodies, among other features. It is essential to preserve the region's natural beauty by ensuring that future development designs respect the environment and fit seamlessly into the area.
This section comprises three policies that relate to the landscapes of Al Hajar Al Gharbi.

SD11.1.1: Conserve and enhance the landscape character, SD11.1.2: safeguards significant views, and TE3.3.2: Conserves starlight sites.

2. Policy title

Policy SD11.1.1: Conserve and enhance landscape character

Landscape character refers to the unique pattern that emerges from the specific combination of various components that contribute to the sense of place in our surroundings (Countryside Agency 2002).

3. Policy purpose

Purpose

This policy has been formulated to establish a framework for preserving and improving the distinct landscape characteristics of Al Hajar Al Gharbi area. It aims to maintain the harmonious relationship between nature and culture by safeguarding land, continuing traditional building practices, and preserving social and cultural expressions.

4.Policy clauses

Development proposals will be supported if they:

- Are demonstrably informed by an assessment of the landscape context, as determined through a Landscape Visual Impact Assessment.
- Adopt an appropriate design, layout, and scale that complements and contributes to the distinctive character, pattern, and evolution of the adjacent landscape, building, or space.
- Encourage appropriate building signage if required.
- Enhance biodiversity by planting native species where appropriate and safeguarding green and blue corridors.
- Apply the natural landscape approach, as provided in the National Planning Standards.
- Convert electrical conductors to ground cables to mitigate their impact on visual appeal.
- Raise awareness about the importance of preserving the landscape character and architectural identity of Al Hajar Al Gharbi.

Introduction

Special Planning Zones

Special Planning Zone (SPZ) is a proposed new planning designation which provides greater protection of areas where the interaction of people and nature over time has produced an area of distinct character with a combination of significant ecological, geological, cultural, and scenic values. An SPZ does not prevent development, rather it provides a more stringent framework to guide development to ensure the unique assets contained within its boundaries are well managed – now and for future generations.

Under the SPZ system proposed for Oman, areas with rich environmental assets (especially high value landscapes) and which may be sensitive to projects, activities or changes in land use, will be designated SPZs.

The vision is for SPZs to be similar in format and culture to a “National Park” in the U.K. – designated contiguous areas of a large scale that should be planned and managed with landscape conservation and recreation uses in mind. They are “National” because they represent special qualities of which Oman should be proud and which should be open to citisens and international visitors to enjoy. They are also “National” as they are not Governorate -specific, for example the proposed Hajar mountains SPZ extends across nine Governorates.

Al Hajar Al Gharbi initiative

Al Hajar Al Gharbi (Western Hajar Mountains) initiative in Oman focuses on developing policies for sustainable development within the Western Hajar mountain range. It aims to balance economic growth with environmental conservation, biodiversity conservation, sustainable tourism, and community engagement. The initiative promotes regional cooperation and knowledge-sharing while preserving Oman’s natural and cultural heritage

Why Western Hajar Mountains?

As part of the Oman National Spatial Strategy (ONSS), the Hajar mountains have been designated as a special planning zone, which aims to ensure that the unique features of the region are protected while balancing the needs of economic development and sustainable tourism. This designation acknowledges the importance of the mountains as a cultural and natural asset that is vital to the country’s identity and future prosperity.

The Western Hajar mountains of Oman are unique from the rest of the Hajar mountains due to their geological composition, cultural heritage, and ecological significance. The Western Hajar mountains face several challenges in preserving their unique natural and cultural heritage. The increasing popularity of adventure tourism and off-road driving has led to significant environmental damage, with erosion, habitat destruction, and littering. The mountains are also threatened by climate change, with rising temperatures and water scarcity affecting both the natural and cultural features of the region. Additionally, the construction of new roads and infrastructure has the potential to further damage the fragile ecosystem of the mountains. Without adequate planning policies, these natural and cultural assets could be at risk of destruction due to unsustainable tourism practices or development projects.

Vision

“To protect and preserve the natural and cultural heritage of the Western Hajar Mountains through the implementation of evidence-based policies that promote sustainable development, environmental stewardship, and community engagement. By balancing economic, ecological, and cultural considerations, we aim to create a harmonious relationship between human communities and the natural environment of the region, fostering a culture of environmental responsibility and respect for the Western Hajar Mountains as a source of inspiration, wonder, and beauty for generations to come.”

Objectives

- To protect and preserve the natural and cultural heritage of Al Hajar Al Gharbi.
- To promote environmental stewardship by implementing policies and practices that encourage the responsible use and management of natural resources.
- To enhance the visitor experience by providing sustainable tourism opportunities.
- To empower local communities by providing opportunities for meaningful participation in decision-making processes.
- To foster collaboration and partnerships among stakeholders, to achieve including local communities, government agencies, and private sector actors.

Policymaking methodology

The development of policies for Al Hajar Al Gharbi started at the beginning of 2022. The methodology used in the policy-making process included data collection, data analysis, stakeholder engagement, policy development, and implementation plan. This comprehensive approach aimed to balance economic, ecological, and cultural considerations in promoting sustainable development while protecting the region's natural and cultural heritage.

Data collection

Data collection was the first step in the policy-making process. It involved gathering relevant information on the region's natural and cultural heritage, the current state of tourism development, the needs and perspectives of local communities, and the potential impacts of development on the region. Data was collected using various methods, including desk reviews, interviews, site visits, and secondary sources.

Data analysis

After collecting the data, it was analysed to understand the region's needs, challenges, and opportunities. Data analysis involved identifying trends, patterns, and gaps in the available data, identifying potential areas of conflict, and exploring the potential environmental impacts of current development trends. It also included linking the collected data with the RSS policies to draft specific policies for the Western Hajar mountains.

Stakeholder engagement

Stakeholder engagement was critical to ensure that policy decisions reflected the needs and perspectives of all stakeholders involved. Stakeholders involved in the development and implementation of the policies included various ministries and authorities, local communities, and others with an interest in the region's development. Stakeholder engagement involved workshops, meetings, and other forms of consultation to gather input and feedback on policy proposals as well as defining the region's boundaries.

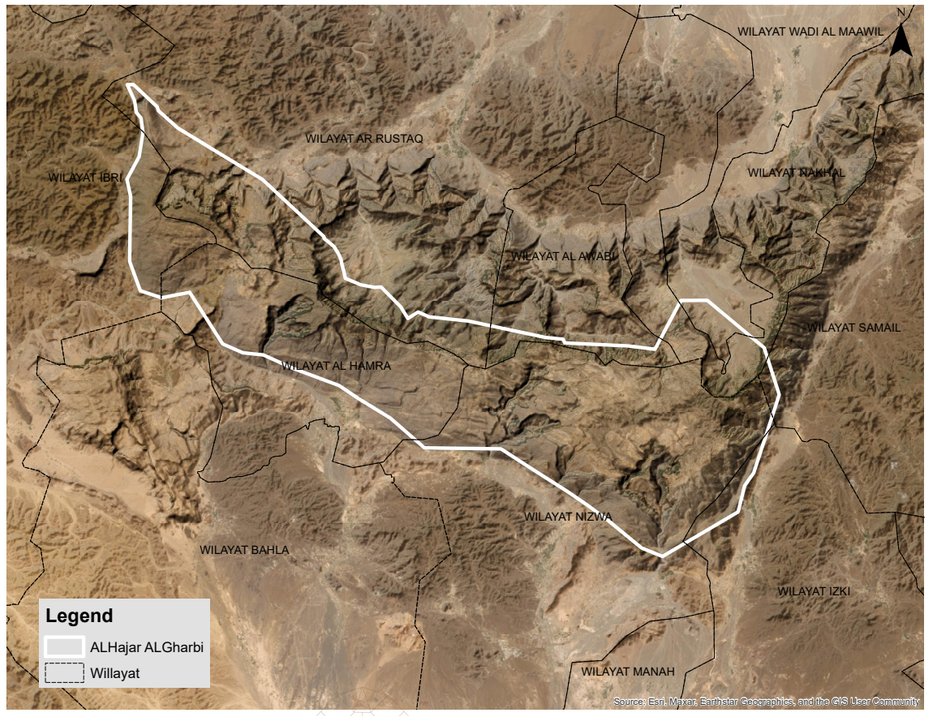
Policy development

Using the data collected and analysed and stakeholder input received, policy proposals were developed that aimed to balance economic, ecological, and cultural considerations. Policies included guidelines for conservation measures, tourism development, community engagement strategies, and regulations to protect the region's natural and cultural heritage. Policies were developed in consultation with stakeholders and in line with the goals and objectives of the Oman Spatial Strategy and Vision 2040.

During the policy-making process for Al Hajar Al Gharbi, collaboration took place with South Downs National Park planning experts. Based on the analysis conducted during this collaboration, 12 policies were initially developed. However, further data collection, analysis, and stakeholder engagement led to the development of 11 more policies, resulting in 22 policies and one strategy divided into 12 sections. This iterative process ensured that policies were evidence-based, stakeholder-informed, and effective in achieving their intended goal by regularly evaluating policy effectiveness and adjusting policies as necessary.

Policy implementation plan

The final step in the policy-making process is to implement the policies to ensure they are effective in achieving their intended goals. Implementation involve developing agreements with stakeholders who are responsible for the implementation of the policies. It also suggested to create an advisory board/group involving different stakeholders for Al Hajar Al Gharbi whom will be responsible for the implementation and further development of the policies.



The Study Area

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Cross Cutting

Sustainable development and climate change

The Oman National Spatial Strategy establishes the following strategic goal: to anticipate the potential impacts of climate change and include adaptation and mitigation measures, where necessary, within new developments, while ensuring future flexibility and the ability to respond to climate change. Sustainable development is intended to maintain a balance between short-term human needs and interests and long-term conservation of natural resources and ecosystems. Sustainable development encompasses environmental, economic, and social aspects.

A key challenge for sustainable development in Ad Dakhliyah, including Al Hajar Al Gharbi, is managing the exploitation of the Governorate's natural resources, especially large groundwater reserves, such that economic development is supported, natural processes and features are maintained, and resources remain available for future generations.

To this end, the Al Hajar Al Gharbi initiative proposes the growth of the agricultural sector in a way that achieves efficient use of land and groundwater and achieves the highest value by targeting land most suitable for supporting agriculture and promoting crop diversification (GP 3.1.2.). Development of the sector will be informed by a robust groundwater level monitoring network, ensuring the ongoing suitability and sustainability of agricultural development (WR2.1.1, WR3.1.1).

A key priority across the Governorate will be identifying and developing alternative, renewable water resources (such as treated sewage effluent, surplus desalinated water, and stormwater harvesting) for use across industries and municipalities (WR3.1.1).

An additional focus will be on managing the varied land uses (biodiversity conservation, livestock grazing, and tourism) of rangeland areas, some of which occurs in Al Hajar Al Gharbi. These land uses will be managed through the implementation of the SPZ (SD11.1.1), NCAs (TE1.1.1/TE1.2.1), traditional grazing practices (FS4.1.1), and sustainable design guidelines (SD11.1.1).

Ad Dakhliyah has a significant opportunity to develop a high-quality eco-tourism sector. The Hajar Mountains provide the greatest potential for growing the tourism economy in the region. The Hajar Mountains SPZ will govern appropriate low-impact development to ensure the creation of a sustainable eco-tourism sector (GP3.1.1).

In urban areas, the introduction of settlement boundaries (SD2.1.1) supports the sustainable development and management of the varied land uses in the Governorate, as will the incorporation of Sustainable Urban Drainage Systems (SD12.1.1) (UT2.1.1) and green infrastructure (SD12.1.1), in line with national green building codes (ONSS SD12), into new developments and regeneration schemes. These techniques have the potential to enhance urban areas for people and the natural environment, by, for example, improving water quality, increasing urban biodiversity, providing shaded corridors, or improving surface water drainage.

The document also addresses natural disasters and climate change impacts to populated areas and critical infrastructure. Inappropriate development, such as residential development on high-risk floodplains, will be disallowed (WR4.1.1), while existing developments or infrastructure situated in high-risk areas for flooding will be investigated for options to reduce flood risk (WR4.1.1).

1

Landscape Enhancement

1. LANDSCAPE CONSERVATION AND ENHANCEMENT

A landscape refers to the visible features of an area of land, including its landforms and how they interact with natural or man-made elements. Landscapes, however, are more than just picturesque views; they embody a narrative of how the natural environment and human settlements have impacted each other over centuries. The rich cultural heritage and natural landscapes of Al Hajar Al Gharbi constitute an asset for sustainable development. The built environment should be designed in harmony with the surrounding landscape, drawing inspiration from distinctive regional examples of vernacular architecture and urbanism.

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This section comprises three policies that relate to the landscapes of Al Hajar Al Gharbi. SD11.1.1: Conserve and enhance the landscape character, SD11.1.2: safeguards significant views, and TE3.3.2: Conserves starlight sites.

Policy SD11.1.1: Conserve and enhance landscape character

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Purpose

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Development proposals will be supported if they:

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- Raise awareness about the importance of preserving the landscape character and architectural identity of Al Hajar Al Gharbi.

Landscape Character and Context

The Hajar Mountain SPZ will be managed in accordance with the IUCN Category V protected area as a 'protected landscape' to support the conservation of Omani culture. Understanding the function of an area enables designers to articulate its character, context, and use. The region encompasses various landscape characters and contexts, as demonstrated in (Figure 1).

To promote character in the townscape, it is necessary to respond to and reinforce local and regionally distinctive patterns of development, landscape, and culture.

Figure 1 presented below illustrates the diverse landscape characters that exist within the region. This classification is based on a desk review and analysis of the Regional Spatial Strategy.

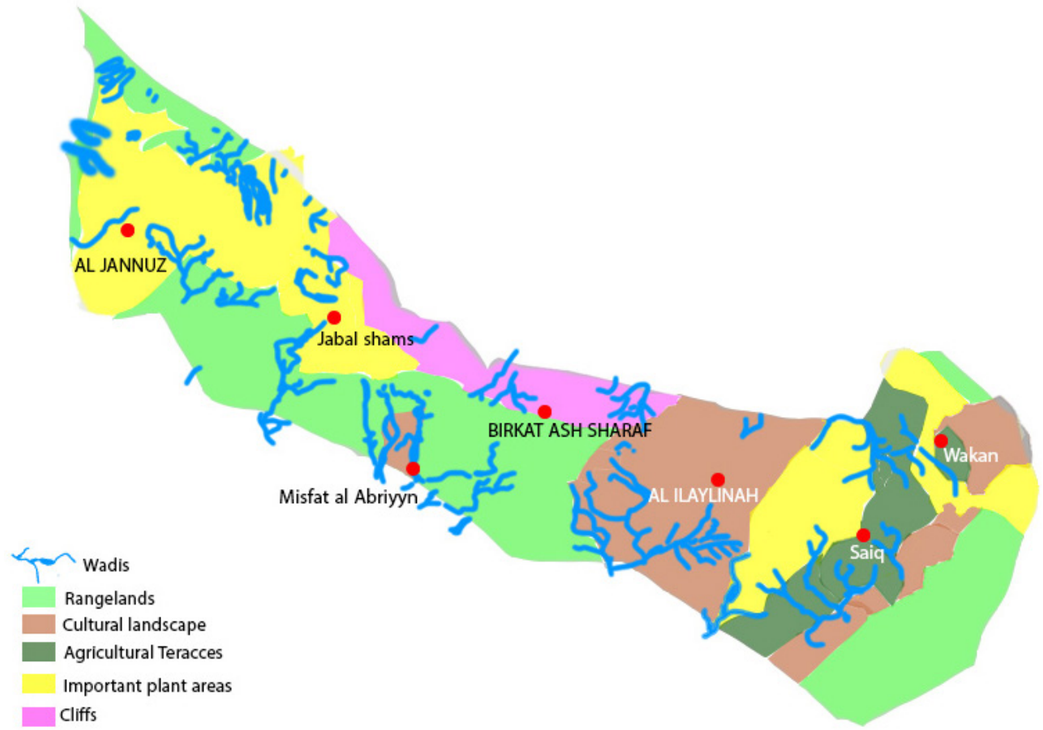

Figure 1: Landscape character within the study area.

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Enhance Biodiversity

Protected Landscapes play a crucial role in supporting biodiversity due to the preservation of traditional forms of land use that sustain biological diversity. Ad Dakhiliyah region hosts an exceptionally diverse range of flora and fauna, with many species being unique to the country. The study area features a variety of important species, including birds, mammals, reptiles, and plants, all of which contribute to its distinctive landscape character. Landscape design can reflect these regionally distinctive landscapes and work in harmony with nature in this area (Figure 2).

Figure 2: Landscape design.

Green and Blue Corridors

Green and blue corridors are areas or linear features that connect habitats and wildlife populations, providing opportunities for walking, cycling, and facilitating the movement of wildlife. They are a crucial element of the Al-Hajar Area's green infrastructure and offer benefits for both people and wildlife at the landscape and local scale.

The environment has been significantly altered by human activities, resulting in the prevalence of mosaic landscapes made up of human settlements, farms, and fragments of natural ecosystems. As time passes, most conservation reserves will be natural ecosystems that are isolated and surrounded by heavily altered environments.

Thus, it is essential to facilitate the movement of wildlife populations by guiding future developments to connect people and wildlife through green and blue corridors, such as wadis and Aflaj. Green corridors can also provide opportunities for walking and cycling, promoting a closer connection to nature. Degraded wadi corridors in existing urban areas can also be transformed into linear parks, enhancing the landscape character of Al Hajar Al Gharbi.

Planting

Valuable research on the propagation of Oman's native plants has been conducted at the Oman Botanic Garden (OBG) plant nursery, exploring innovative approaches to naturalistic, water-efficient planting using native species. It is recommended that all proposed and ongoing developments refer to the list of potential native plants prepared by OBG that could be used for landscaping (Figure 3). Using these species as a framework will help achieve regional distinctiveness.

Developments are advised to apply the natural landscape approach provided in the National Planning Standards. Native planting can be successfully combined with ground modelling and the use of appropriate natural hard landscape materials, such as rocks, boulders, and blankets of gravel mulch.

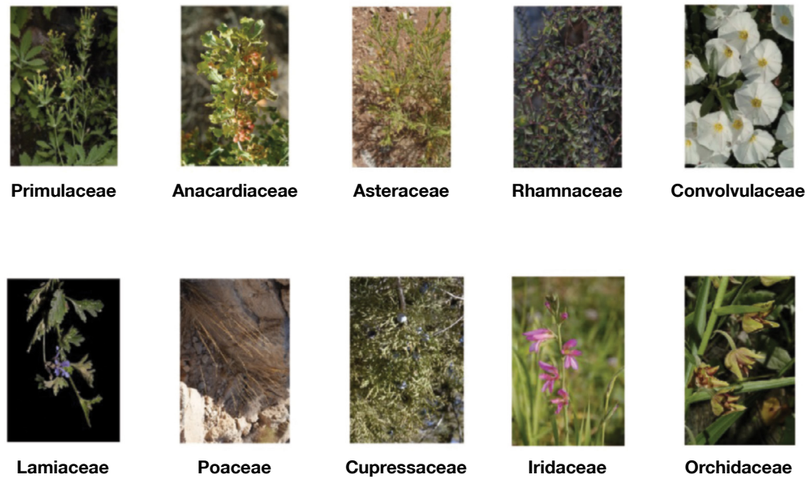

Figure 3: Landscape Plant Palette, OBG (2022).

Landscape and building design guidelines

Proposed developments within the Al Hajar Al Gharbi region are encouraged to adopt structural and architectural designs that are appropriate and consistent with the local character. The landscape and building design guidelines have been developed to provide further details on the materials, finishes, colours, height, etc., of proposed developments throughout the region.

Alila resort at Jabal Akhdar (Figure 4) serves as an excellent example of suitable building and landscape designs that could be implemented in the region. The resort has committed to an eco-friendly future and is designed to respect the environment, fitting harmoniously into the site and preserving the natural beauty of the region. The following images showcase the resort's design and its alignment with the landscape and building design guidelines.

Figure 4: Alila resort in Al Jabal Al Akhdar.

Materials and furniture palette

Historically, Omani buildings in mountain regions like Al Hajar al Gharbi were constructed using thick walls made of stones covered with mud, which acted as an effective thermal insulator (refer to Policy CC1.1). Currently, the materials used for construction and decoration in the region are either locally sourced or manufactured.

The majority of the public realm's streets and spaces should use the region's preferred and coordinated palette of available materials, which support the local distinctiveness of the site. All elements must be selected to be economic, attractive, exceptionally durable, and robust. Some elements currently used in the region include:

Local furniture refers to furniture pieces that are crafted using materials and designs that are specific to a particular geographic region or culture. Such furniture is often made by local artisans and reflects the cultural identity and traditional practices of the community.

Incorporating local and traditional furniture into spaces can add character and bring a sense of cultural identity to the area.

Building colour palette

Developments within Al Hajar Al Gharbi should harmoniously blend with the surrounding natural landscape through building designs and colours. Traditional buildings in the region are typically painted in shades of white, ochre, and brown, chosen for both functional and aesthetic reasons. The suggested colour palette (Figure 5) complements the earthy colours and textures of the rocky terrain in the region.

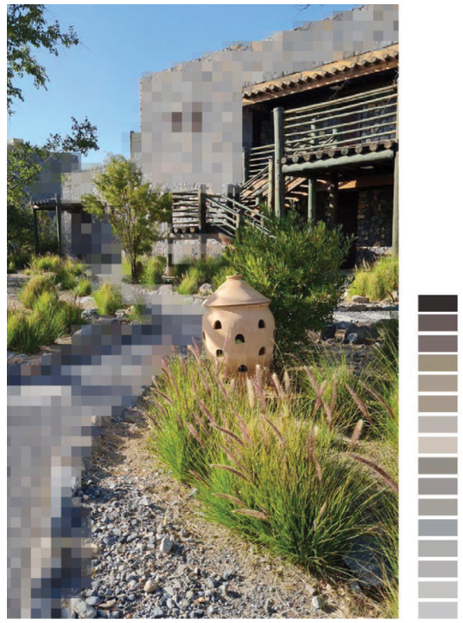

Figure 5: Suggested Colour

Building height and Typology

The current requirements of the Ministry of Interior (formerly: Ministry of Regional Municipalities and Water Resources (MRMWR)) mandate the flattening of land before construction begins, with drilling at a depth of two meters to stabilise foundations. In mountainous areas, these requirements pose construction challenges and increase the owner's physical burden. Therefore, there is a need to reconsider the municipal requirements for mountainous areas, including separate guidelines for building on rocky and sloping soil.

The advised maximum height for a structure located in the mountains is 10 meters or three floors. The basic construction guidelines state that the maximum height of a structure should be calculated based on the vertical distance of the grade (mean height of the highest and lowest elevations at which the structure meets the ground).

The structure should utilise the existing features of the mountain. For example, on sloping soil, construction as a staircase (Figure 6) is the most suitable way to avoid flattening the land and work with the site as much as possible, minimising the cost of building on a sloping site while reflecting the identity of the topographical area. One of the benefits of building on sloping land includes more natural sunlight, better natural drainage, and ventilation.

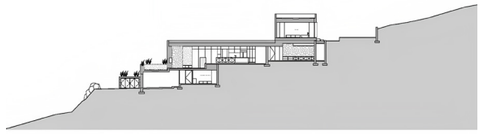

Figure 6: Construction as Staircase.

Policy SD11.1.2: Safeguard views

The scenic value of many of Al Hajar Al Gharbi landscapes and viewpoints is increasingly threatened by modern development in the form of urban sprawl, road construction, industrial developments, and more. The region has spectacular key views of wadis, cultural heritage, cliffs, and mountains, some of which have been highlighted in this policy.

Purpose

This policy aims to protect key views and landmarks from the adverse effects of proposed developments.

Development proposals within or around key views will be strengthened where they:

- Preserve the visual integrity, identity, and scenic quality of the area specifically key views and views of key landmarks such as:
  - Tourism and recreational destinations.
  - Publicly accessible areas.
  - Areas with specific features (e.g., Jabal Akhdar Scenic Reserve, Jabal Shams Grand Canyon, green terraces in Sayq).
  - Cultural Conservation Areas (refer to policy CH3.1.1).
- Enframe good views and use natural elements to screen bad views or utility features

Key Views and Landmarks

Several natural and cultural landscapes within the study area have been identified as key views and landmarks.

Jabal Shams

Jabal Shams (Figure 7) is considered rich in natural assets, such as the Grand Canyon at the edge of the path leading to its summit. The Omani Grand Canyon is one of the largest Grand Canyon in the world which makes it an important destination to many mountain climbers and visitors.

Figure 7: Jabal Shams.

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Jabal Al Akhdar Scenic Reserve

Jabal Akhdar is home to Jabal Akhdar scenic reserve (Figure 8) that is considered one of the hidden treasures, characterised by the diversity of terrain. It includes deep valleys, rocky cliffs, water springs, caves and forests rich in perennial juniper trees, which are aromatic evergreen trees, as well as wild olives and pomegranate trees.

Figure 8: Jabal Al Akhdar scenic reserve.

Special Protection Sites outside Jabal Al Akdhar Scenic Reserve

These specific sites are located outside the boundaries of the reserve and contain plant species that are similar to the characteristics of Jabal Al Akhdar.

Guidelines to preserve Key Views and Landmarks

- Discourage the establishment of new developments and expansion of old buildings.
- Camping activities are strictly encouraged in designated campsites.
- Discourage lighting fires except in the areas designated for such activities.
- Adhere to the specified lanes and roads to reduce the negative effects on plant species and green corridors.
- Exploit the available natural resources in a way that benefits the local community.
- Preserve archaeological and historical areas.
- Spread awareness to prevent logging, cutting or burning of trees or any area covered with weeds.
- Prevent the pollution of water sources or wadis within the region.
- Apply an effective solid waste management plan to prevent visual pollution.

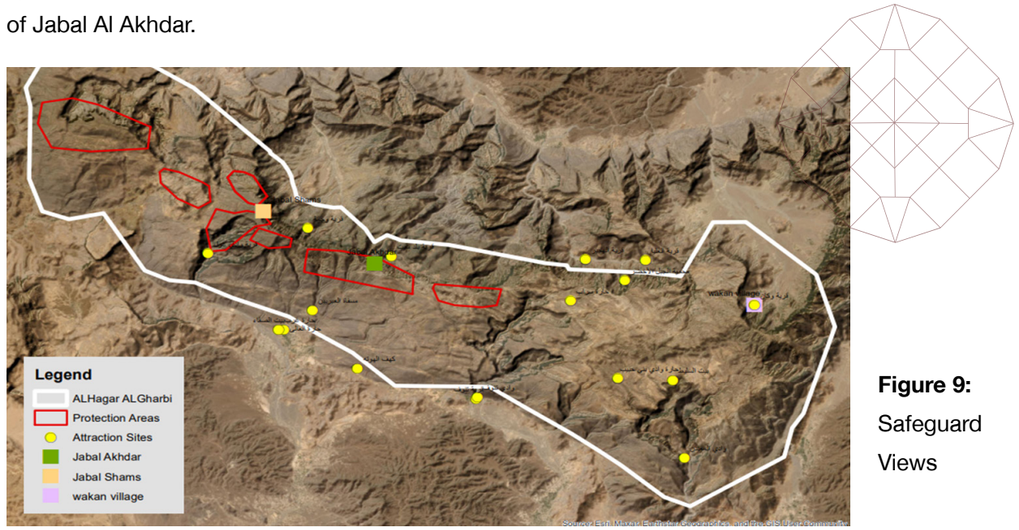

Figure 9: Safeguard Views

Policy TE 3.3. 2: Conserve Starlight Sites

Starlight sites are places where the darkness of the night sky is relatively free of interference from artificial light, providing the opportunity to see the stars and our galaxy, the Milky Way. Due to population growth and its attendant urban expansion and light pollution, dark sky sites have diminished. Thus, there is an urgent need to protect the remaining dark sky sites.

The IDA measures and defines the world's dark skies with the aim to "raise awareness about the value of dark sky" and encourage countries to adopt laws and legislation to protect it.

In Oman, the EA is the official authority responsible for the conservation of dark sky places.

Purpose

This policy seeks to ensure that future development does not negatively impact the quality of Dark skies, for the benefits of people and wildlife. The protection of these sites could be achieved by reducing unnecessary light spill caused by poor designs and lack of lighting guidelines.

- Development proposals will be supported where they conserve and enhance the intrinsic quality of dark skies through the following:
  - Installation of lighting is prevented in core areas.
  - If lighting cannot be avoided, it must be demonstrated to be necessary for its use.
- Development proposals will be allowed where they adhere to the specific dark sky laws of the EA and the IDA.
- Development proposals within dark sky areas must create best practice guidelines for using and installation of lighting to reduce light pollution in highly affected areas.
- Development proposals within dark sky areas must set Standards for the brightness, colour, temperature, density and direction of the lighting.

The Starlight reserave

The Starlight Reserve (Figure 10) boundary was designated under Royal Decree No. 40/2019 and is within the Jabal Shams area of the Western Hajar Mountains, which include the highest peaks within the mountain range. It falls into the north-west corner of Ad Dakhliyah and overlaps the Governorate boundaries with Adh Dhahirah to the west and South Batinah to the north. The reserve has been established to conserve the dark skies and enable watching of the stars; as such the area will be protected from light pollution, allowing associated benefits for people as well as wildlife.

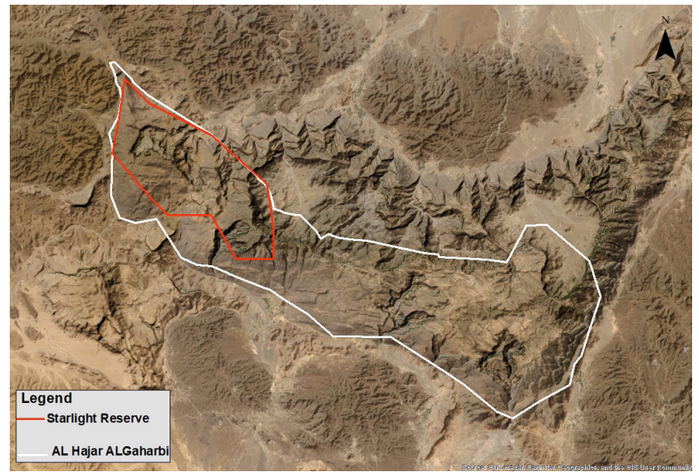

Figure 10: Boundary of the Starlight reserve.

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Zoning

The following is a proposed division of the reserve by the Ministry of Environment and Climate Affairs (now Environment Authority (EA)). The reserve is divided into two zones as shown in Figure 11:

- Core zone (5km diameter): this zone is classified as the darkest part of the reserve with strict lighting guidelines. Apart from starlight, the reserve has many unique natural features due to its high location within Al Hajar mountain. There are scattered settlements in this region due to the severity and harshness of its terrain and ruggedness, which leads to a decrease in the amount of light emitted, which causes light pollution.
- Buffer Zone (20km diameter): This zone surrounds the core zone and is notably vulnerable to light pollution. Topographically, it lies outside of the Jabal Akhdar and Jabal Shams ranges, surrounding them. However, it does include the main centres that surround both ranges. In this area, the amount of lighting increases widely, as it is a center for urban settlements and various service and economic activities.

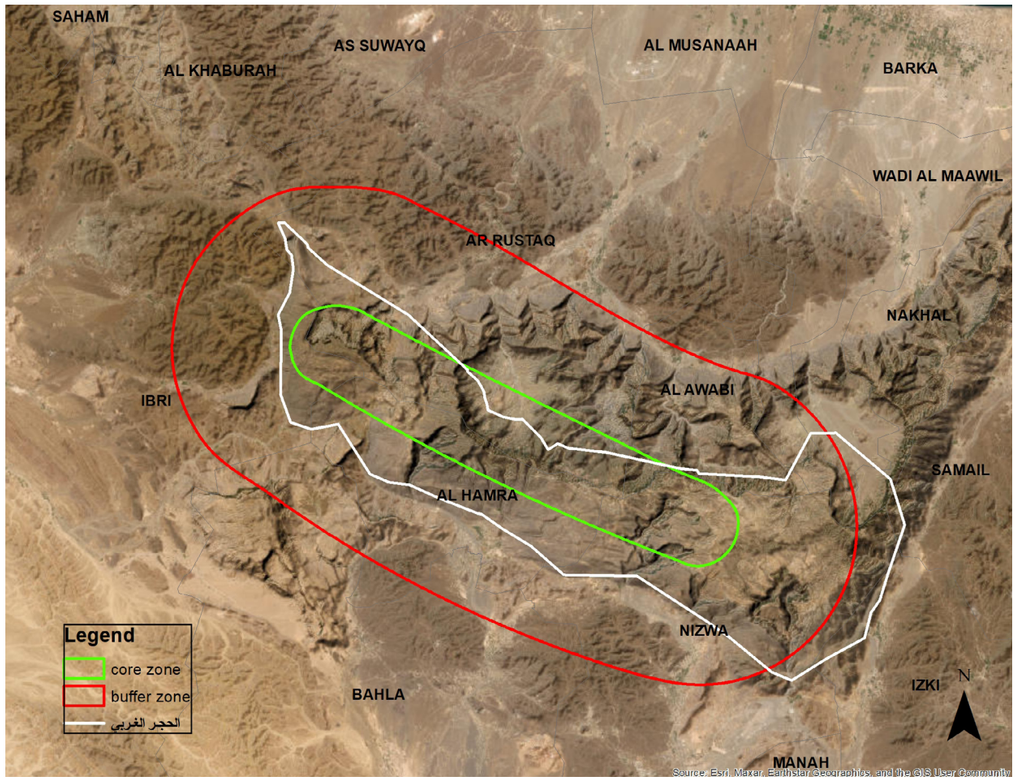

Figure 11: : Core and Buffer Zone of the Starlight reserve.

Table 1: Suggested measures to reduce and mitigate potential impacts to the reserve, International Dark Sky Association (IDA) and EA ().

Activity	Impacts	Suggested measures
Urban expansion	• Loss of land areas with unique natural features. • Increasing light percentages that spread to the atmosphere. • Increasing the rate of infringement on wildlife. • Settlement of people from outside the area.	• Reserve sites that have unique natural features and create a system in the process of urban expansion by avoiding sites of importance. • Develop a system and regulation for lighting for buildings and facilities. • Increase the number of wildlife monitors and create ways to raise visitor's and residents' awareness to preserve wildlife. • Ownership of lands located within this area is restricted to the local population.
Road construction	• Loss of land sites with unique natural features. • The opening of new areas due to human activities that did not exist before. • The arrival of individuals to new areas, which affects the existing wildlife. • The spread of street lights.	• Reduce road construction and find ways to use existing roads. • Increase the number of wildlife monitors and create ways to raise visitor's and residents' awareness to preserve wildlife. • Reduce or use more efficient lighting to save energy.
Tourism	• Loss of land areas with unique natural features. • Increasing tourism-related activities and sports. • The burning of trees and plants due to negative. practices of tourists and visitors.	• Set environmental requirements for tourism projects and encourage green building. • Set environmental requirements for tourism activities including camping. • Create ways to raise awareness to preserve wildlife. • Visitors centre**s.**
Fruit harvesting, logging & grazing	• The negative impact on plants due to harvesting the wrong way. • Stressing rangelands . • Loss of a lot of trees, especially those that are scarce in these areas.	• Raising awareness . • Set requirements and regulations for grazing and harvesting activities. • Raising awareness of the importance of trees, especially the rare and old species, also for using the right ways of harvesting. • Ongoing monitoring.

Good Lighting Design Practices

All proposed project developments lighting must meet or exceed the level of protection appropriate to the protected area:

- percentage of lighting (brightness and colour).
- Type of lighting.
- Light Angle.
- Lighting operation hours.

The following key requirements should be considered when selecting external lighting:

- Light Angle (Figure 12) - proposed developments should ensure that the intensity and direction of light does not disturb the quality of starlight. This may be achieved by pointing the light beam downward and avoiding pointing it directly at windows or other buildings. Shields and hoods can be used to direct light to only the necessary areas, which reduces light spread.

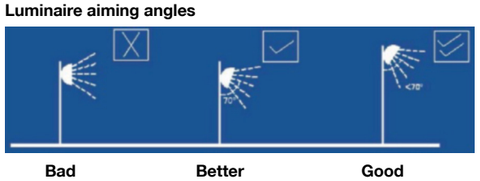

Figure 12: Light Angle.

- Light Cover (Figure 13) - it is recommended that only flat glass covers be used to prevent light from spreading over a wider angle than is necessary and that source lumens be installed horizontally.
- Location of Light Fitting - light spillage can be prevented by ensuring the height and position of the light fitting in relation to the space it is meant to illuminate.

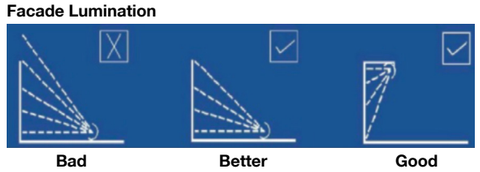

Figure 13: Facade illumination.

Lighting Rules and Regulations

Dark sky areas could be affected by urban expansion, tourism, infrastructure development projects, and grazing activities. These have varying effects depending on the activity and the extent in the region: while urban development has a significant and direct impact on the quality of Starlights, the impact of grazing activities is limited to the biodiversity present in the region.

The following table illustrate outdoor lighting rules and regulations to be applied in Al Hajar Al Gharbi.

Table 2: outdoor lighting rules and regulations.

Type of Development	Core Zone	Buffer Zone
Street and public roads	- No lighting (IDA) - Curfews' or automatic timer.	- All lighting poles must contain 100% of the covered lighting fixtures (which do not allow the light to diffuse upwards). These fixtures have modern designs that shine light directly on the area to be lit only (e.g. on the road asphalt). - Must strictly be in line with international standards. - Coordination with different authorities during the development of designs for road lighting poles to be specifically designed for areas within the starlight reserve.

Continue / Table 2: outdoor lighting rules and regulations.

Type of Development	Core Zone	Buffer Zone
Business and sport development	- No lighting (IDA) - Curfews' or automatic timers	- Prohibit installing new flood-lights in buildings. - No up lighting of buildings or structures. - Illuminated signs must be regulated as followed: - Strict lighting operation hours; AND - Displays must be single-colour on a black background; AND. - luminance must not exceed 100 nits (100 candela per square metre); AND. -The luminous/illuminated surface area of an individual sign must not excess 18.6 sqm. - Sky beams are not allowed. - Follow good lighting design.
Urban settlements (New dwelling houses and extensions to dwelling houses)	- No lighting (IDA) - Curfews' or automatic timers	- The use of glass globes for lighting used in fences needs to be prohibited by electrical stores, building consultants, and municipal inspectors that cause light to diffuse widley. - Follow good lighting design. - Prohibit installing new flood-lights in buildings. - No up lighting of buildings or structures. - Different surface types to reduce the amount of reflectivity.
Agricultural development	- No lighting (IDA)	- Halogen or sodium dusk-to-dawn lights should not be used on farms. - Prohibit installing new flood-lights in buildings. - Always switch off after work complete. - limit burning trees during daytime.
Tourism / camping	- No lighting (IDA) - Curfews' or automatic timers	- Regulate unnecessary artificial light introduced by visitors to the site - e.g. camping sites. - Prohibit installing new flood-lights in buildings. - Follow good lighting design. - Designate campfire sites.
Industrial/ construction sites	- No lighting (IDA) - Curfews'.	- Always switch off after work complete and minimise lighting operation hours. - Sky beams are not allowed. - Prohibit installing new flood-lights in buildings.

2

Tranquillity

2. TRANQUILLITY

Tranquillity refers to a state of calm and quiet that evokes a sense of rest and peace. It can support health and well-being for all and be a key contributor to quality of life, along with enjoyment of wildlife, landscapes, and heritage assets. However, tranquillity can be significantly impacted by intrusive movements, sights, and sounds associated with developments and human activity.

Due to the rugged terrain and location of Al Hajar al Gharbi region, most areas within the region are free from settlements and other urban activities. This indicates that many areas within the region are highly tranquil (Figure 14). Nature and its tranquillity are thus often sought after by people who want to escape their current city life.

Figure 14: A tranquil place on Al Hajar Al Gharbi.

TE3.3.1: Conserve and Enhance tranquility

Purpose

The Policy aims to ensure that future developments do not negatively affect the relative tranquillity of Al Hajar Al Gharbi region and to encourage the conservation and enhancement of positive tranquillity factors.

Development proposals will only be supported where they conserve and enhance relative tranquillity and should consider the following:

- Protect and provide the social and economic well-being of communities.
- Promote healthy lifestyles and physical, mental, and spiritual well-being through design and community engagement.
- Create high-quality, clearly defined public and private spaces within the public realm.
- Do not cause harm to the community and relative tranquillity.
- Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation (refer to policy TE3.3.1).

Tranquillity Zones

The region has been analysed through a desk review to identify areas of high tranquillity (Figure 15), areas with some tranquillity, and those of low tranquillity. The following considerations were used to analyse tranquillity within the region:

- Urban settlement patterns
- Land uses (tourism, industrial)
- Light pollution Poor or low tranquil areas are often located within or on the edge of urban areas. whereas highly tranquil areas are located away from urban areas.

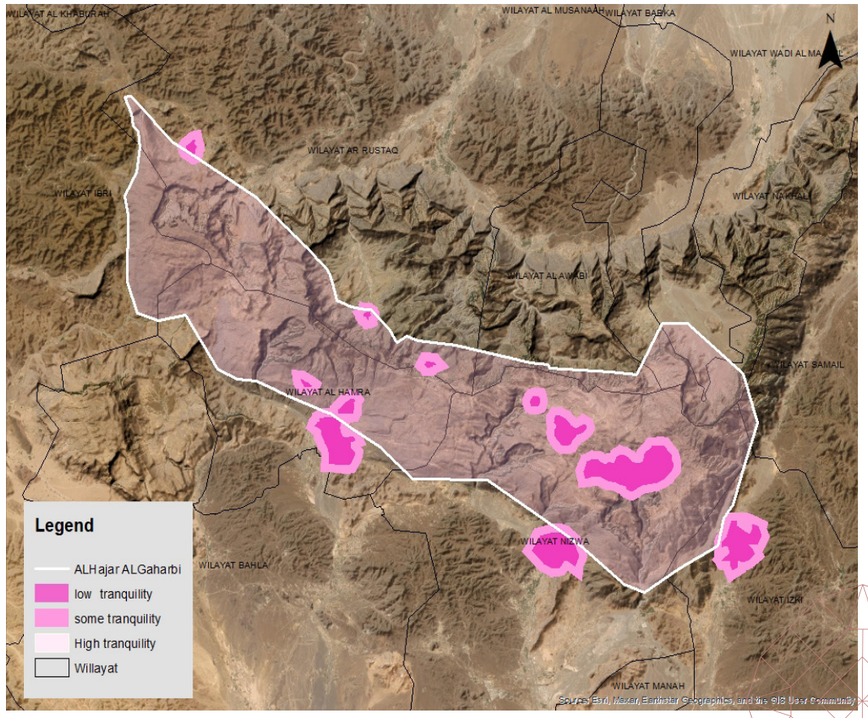

Figure 15: Tranquility Zones within Al Hajar Al Gharbi.

Tranquillity Conservation Guidelines

Applications for development proposals in (highly) tranquil areas should demonstrate that they conserve and enhance, and do not harm, relative tranquillity. Development proposals in areas of intermediate relative tranquillity are the areas that are most vulnerable to change and should avoid further harm to relative tranquillity and take every opportunity to enhance it. Wherever possible, development proposals in areas with poor tranquillity should seek to enhance relative tranquillity to the extent possible. The following table sets out the key considerations and guidelines relevant to the protection and enhancement of tranquil areas (Low and High).

Table 3: Key consideration and guidelines to protect tranquil areas.

Tranquillity contributors	Suggested measures
Naturalness of the land cover	• Avoid any development that disrupts areas of natural land cover. • Retain/avoid blocking views in relation to key natural landscape elements e.g. local ridgelines. • Consider aspects of design including colour and reflectivity to reduce visual prominence of the development and blend with natural landscape (Refer to Policy SD11.1.1). • Conserve existing local trees and encourage planting of new local trees. • Create areas of natural land cover as part of green infrastructure integral to development. • Create sense of natural open spaces and connections e.g. green corridors.
Wadies	• Avoid any development that disrupts views or experience of areas of water. • Ensure development conserves water quality and maintains water flows. • Restore natural water courses and ensure development does not block (physically or visually) public access to wadies. • Include calm natural spaces where people can experience and enjoy proximity to water. • Consider opportunities for providing areas of water within development.
Starlight	• Conserve dark skies where they exist and avoid new lighting influences within or close to those area where dark skies are a feature (Refer to Policy TE3.3.2). • Seek to recreate areas of dark skies by reducing lighting.
Bird Areas	• Maintain plants and trees that provide habitats for birds. • Seek to link and connect habitats to existing bird areas for example creation of new native woodland around new developments (Refer to policy TE1.1.1/TE1.2.1).

Continue / Table 3: Key consideration and guidelines to protect tranquil areas.

Tranquillity contributors	Suggested measures
Open Spaces/Landscapes	• Conserve Views, particularly views to and across open spaces. This is a key consideration in relation to views from highpoints. While the tranquil high spots themselves may not be threatened the sense of tranquillity could change by unsympathetic development in the wider setting. • Consider opportunities to orientate public open space, routes and views away from intrusive/detracting visual elements. • Avoid hard urban style boundaries in rural locations, limit signage and other streetscape 'clutter'. Create calm, legible environments. • Create visible open spaces within development in views for example along streets. Ensure that green infrastructure is integrated into development to provide maximum benefit for users and offers opportunities to experience a sense of tranquillity, e.g., avoid sources of noise such as roads, or encourage natural sound sources such as bird song.
Settlement	• Seek to create 'natural' edges in character with surroundings including opportunities for locally characteristic planting. • Ensure development edges are well integrated with the surrounding landscape. • Consider size, scale, height, reflectivity, colour and orientation of bulky large-scale development and blend into landscape context –to reduce visual prominence (Refer to Policy SD11.1.1).
Major roads	• Provide tree screening belts, where appropriate. Design planting to achieve acoustic screening. • Avoid introduction of further sources of noise as part of the development.

3

BIODIVERSITY AND GEODIVERSITY

3. BIODIVERSITY AND GEODIVERSITY

Al Hajar Mountains are the most important and significant environmental and geological feature of Ad Dakhiliyah. The mountain ranges are known for their rich biodiversity, geodiversity as well as scenic beauty. Therefore, many areas have been designated as protected areas due to their visual amenity, rich geodiversity, and biodiversity, with a high degree of species endemism.

Al Hajar Mountain SPZ will be managed in line with an IUCN Category V protected area as a 'protected landscape'[1]. This means support of the conservation of Western Hajar Mountains natural heritage, which includes biodiversity, geological and scenic value, through a robust planning system that prioritises conservation and enhancement of the land and specific character of the mountains, with an emphasis on sustainable proposals within its boundaries. This section includes two policies relating to the wildlife of Al Hajar Al Gharbi. Policy TE1.1: Integrated approach to the conservation of biodiversity and geology areas of natural importance seeks to enhance biodiversity and geodiversity across the study area.

[1] Some protected areas in Al Hajar mountains are classified with the other IUCN- Categories, these areas will be "mainly" managed by their original classification

Policy TE1.1.1: Integrated approach to the conservation of biodiversity and geology – Nature Conservation Areas (NCAs)[2]

Purpose

The aim of this policy is to direct development in a way that preserves and enhances the unique biodiversity and geodiversity of Al Hajar region. The NCAs in Al Hajar Al Gharbi and their management have been demonstrated in this policy.
Development proposals will be allowed where they:

- Preserve and enhance biodiversity and geodiversity of the designated NCAs (Starlight reserve, Jabal Akhdar scenic reserve & special protection areas, Sayq plateau, and Jabal Akhdar corridors).
- Development proposals will be allowed where they provide updated ecological and geological reports that cover the area of the proposed development.
- All tourism development proposals must follow the guidance of IUCN in tourism and visitor management in protected areas (NCAs), and where feasible define a limit of visitors in each area.

[2] NCAs are classified in the line of the IUCN category (International Union of Conservation of Nature), from Ia (strict nature reserve) to V (protected landscape). This includes guidelines for each NCA to ensure conservation and sustain the natural features.

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The identified areas within the Western Hajar Mountain SPZ include proposed and existing UNESCO Global Geoparks, Important Plant Areas (IPA), Important Bird Areas (IBA), and other important Fauna Areas.

The majority of these sites partly fall within the NCAs. NCAs were identified through a review of biodiversity, geology and landscape data which identified specific areas of high importance for natural heritage within the Governorate.
NCAs within Al Hajar Al Gharbi (Figure 16)

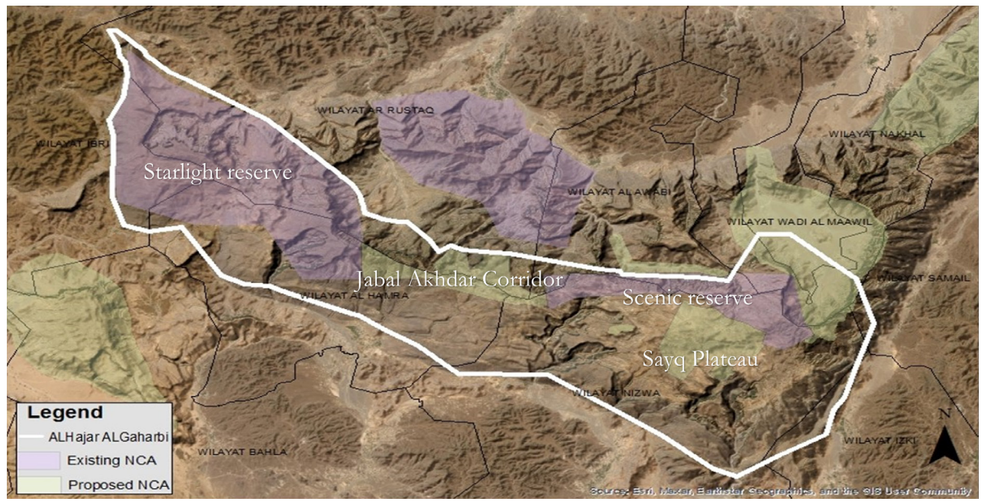

Figure 16: NCAs within Al Hajar Al Gharbi.

Existing NCAs

Starlight Reserve

In accordance with policy TE3.3.2, and apart from conserving starlight. The reserve (Figure 17) covers largely uninhabited mountain areas with important habitats and species present, providing rich biodiversity. There is no doubt that the reserve has unique environmental characteristics and remarkable biodiversity, as it constitutes a safe haven for some endangered wild animals such as Arabian caribou, Arabian wolf, fox, lynx, wild cat, and others. The area is also characterised by the presence of different types of wild plants and trees, some of which are rare, such as juniper trees. (sci. Juniperus seravschanica, ar. Al Alalan) and wild-olive (sci. Olea oleaster, ar. Al-Atm).

The reserve is anticipated to be managed as an IUCN Category Ib protected area. The primary objective is to conserve the long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure, and where natural forces and processes predominate so that current and future generations have the opportunity to experience such areas. A further objective is to provide public access in a manner that will maintain the wilderness qualities of the area and allow for educational and scientific research.

Figure 17: Starlight Reserve.

Jabal Akhdar Scenic Reserve and special protection areas (SPAs)[3]

Jabal Al Akhdar Scenic Reserve's boundary (Figure 16) was designated under Royal Decree No. 80/2011. It is characterised by beautiful landscapes such as mountain slopes, caves, and valleys. Jabal Al Akhdar is known for its cool temperatures all year round. The reserve is home to a remarkable diversity of wildlife, especially birds, as well as perennial trees, rare plant species, geological sites, mammal habitats, and high species richness.

As part of the management plan for Jabal Al Akhdar Scenic Reserve, six special protection areas (Figure 18), located outside of the reserve, have been designated by MECA based on the presence of the following:

- Species that are important for conservation and characteristic of the mountain region.
- Habitats for wildlife of the area.
- Representative landscapes.
- Elements of cultural or natural heritage; and
- Geological formations.

These special protection areas are only for access with the EA's approval for scientific research and environmental monitoring and security authorities' purposes.

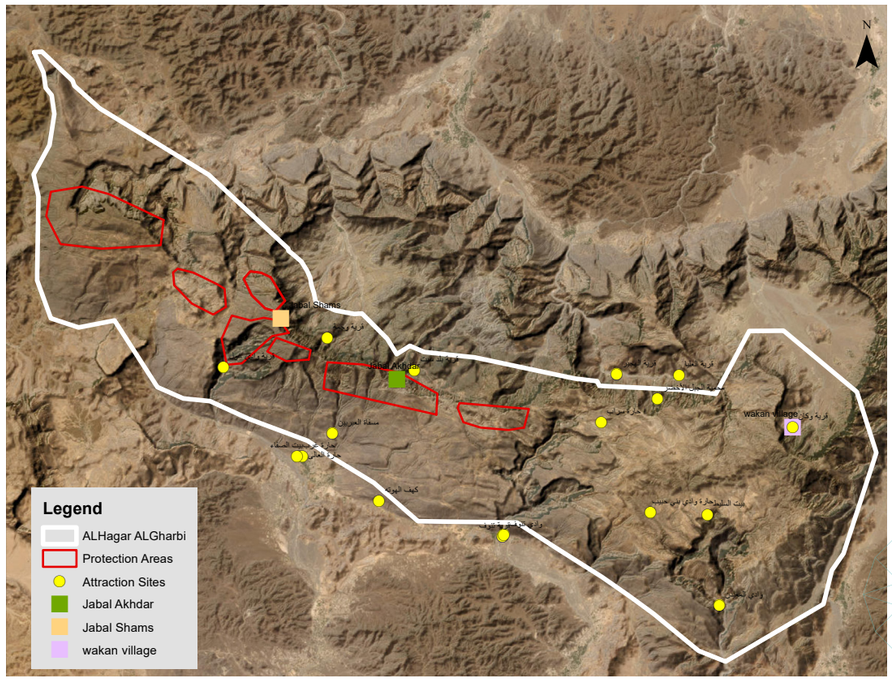

Figure 18: Special protection Areas.

[3] Special Protection Areas (SPA) were designated by the MECA (EA) as Special Protection Zones (SPZ). To avoid confusion with Special Planning Zones (SPZ), the term has been replaced with SPA in this Draft.

The Scenic Reserve and the protection Zones are proposed to be managed as an IUCN category V (Protected Landscape) with a central aim to safeguard regions that have built up a distinct and valuable ecological, biological, cultural, or scenic character. And have an existing management plan developed by MECA (2011) and updated by EA (2022).

Proposed NCAs[4]

Sayq Plateau

The area is adjacent to the existing Jabal Akhdar scenic reserve (Figure 16). It is an extensive mountain plateau of Jabal Al Akhdar covering an area of 71km², located at an elevation of around 1800 m within the Western Hajar Mountains, northeast of Nizwa. The settlement of Sayq, which is located adjacent to the NCA, provides a cool respite from the summer heat and is a popular destination for holiday homes.

The geographical and natural assets found in the proposed Sayq plateau provide suitability for various plant and animal species, some of which are threatened. Examples of threatened plant habitats and species of the Western Hajar found in the plateau include Juniper woodlands, needle-grass (sci. Stipa mandavillei), and Jabal Akhdar Bellflower (Campanula akhdarensis). In addition, the habitats provide a high richness of reptile species in the area, and provide important habitat for birds, particularly along wadis with dense vegetation.

[4] The proposed NCA is intended to be managed as an IUCN Category II (National Park) protected area, with the primary objective of protecting natural biodiversity, along with its underlying ecological structure and supporting environmental processes, as well as promoting education and recreation.

Jabal Akhdar Corridor

The corridor (Figure 16) is planned to be managed as an IUCN Category IV (Habitat Management area), with the main objective of ensuring the maintenance, conservation, and restoration of particular species and habitats. This corridor connects the existing six protection zones and includes an important ecological corridor for conservation between the Jabal Akhdar Scenic Reserve and the Starlight Reserve.

Policy TE1.2.1:

Integrated approach to the conservation of biodiversity and geology – Cultural Heritage outside of NCAs

Purpose

This Policy aims to support the protection and enhancement of features of biodiversity and geodiversity, improve habitat connectivity, and determine areas important to the conservation of local birds or plants as ecologically sensitive areas.

- Development proposals will be allowed where they:
  - Preserve and enhance biodiversity and geodiversity of the designated important areas (IPA, IBA, IMA, and UNESCO Global Geopark).
  - Determine areas important to the conservation of local birds or plants as ecologically sensitive areas.
  - Improve habitat connectivity along with local parks and s
- Development proposals that support the protection and enhancement of features of biodiversity and geodiversity, especially habitat and commuting routes of birds and mammals, will be required:
  - Landscaping with native plants benefits birds and reptiles by providing shelter & nesting areas and also helps birds, reptiles, and mammals by providing their food.
- Land development practices will be permitted if they:
  - Follow the national nature conservation laws and best practice guidelines, especially those designated to protect (endangered) species (e.g., old trees, birds, and mammals).
  - Are carefully planned and maintained a comprehensive environmental management plan to mitigate any impacts or disturbances.
  - Follow the local Building guidelines and encourage architects and builders to use bird-friendly building designs and materials in the bird important areas and areas known as corridors for migratory birds (refer to policy SD11.1.1).
  - Protect Tranquillity (refer to Policy TE3.3.1).
- Pasture activities should only be permitted under specified conditions and on designated rangelands to protect vegetation cover (refer to policy FS4.1.1).

A lighting and noise pollution Standard should be issued and frequently updated depending on the Birds and Plants species inhabiting the study area (refer to policy TE3.3.1)

Important Areas of Biodiversity and Geodiversity outside NCAs

IPAs

The study area contains four of Oman's designated IPAs: Sayq Plateau, Wadi Bani Awf, Hayal Al Juwari, and Jabal Shams plant area (see Figure 19). Sayq plateau and Wadi bani Awf are terraced for cultivating fruit trees and various other species. These irrigated areas, near mountain villages with their terraced fields and ancient aflaj irrigation systems, provide important habitats for many native wild species to thrive and are hence very biodiverse. The old terrace walls in Sayq are important "man-made" refugia which support both weeds and native species such as the Al Jabal Al Akhdar endemic Bellflower, of which the site supports over 1% of the global population, and the Arabian endemic Wall-Rocket.

The Starlight reserve largely incorporates Hayl Al Juwari and Jabal Shams IPAs, which have been identified due to the presence of the threatened Juniper woodland. The allocated six Special Protection sites with a total area of 116,9 km² are also characterised by their high vegetation density.

The vegetation of the Study Area is markedly altitudin+al with three major classes:

- Evergreen Sideroxylon mascatense-Olea europaea woodland.
- Juniper woodlands.
- Euphorbia larica -Moringa peregrina shrubland.

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The main threat to the vegetation cover in Al Hajar Al Gharbi is overgrazing, which causes vegetation damage and habitat loss of many species (refer to policy FS4.1.1). The Royal Decree 114/200: Law on conservation of environment and prevention of pollution, Article 21, paragraph B&C stipulates, therefore, that the following are not allowed:

- Cutting down, uprooting or damaging any tree, shrub, or grass in public forests, without obtaining a permit from the Ministry.
- Practising any activity which may damage the quantity or quality of the vegetation cover in any area, or which may lead to desertification or deterioration of the natural environment.

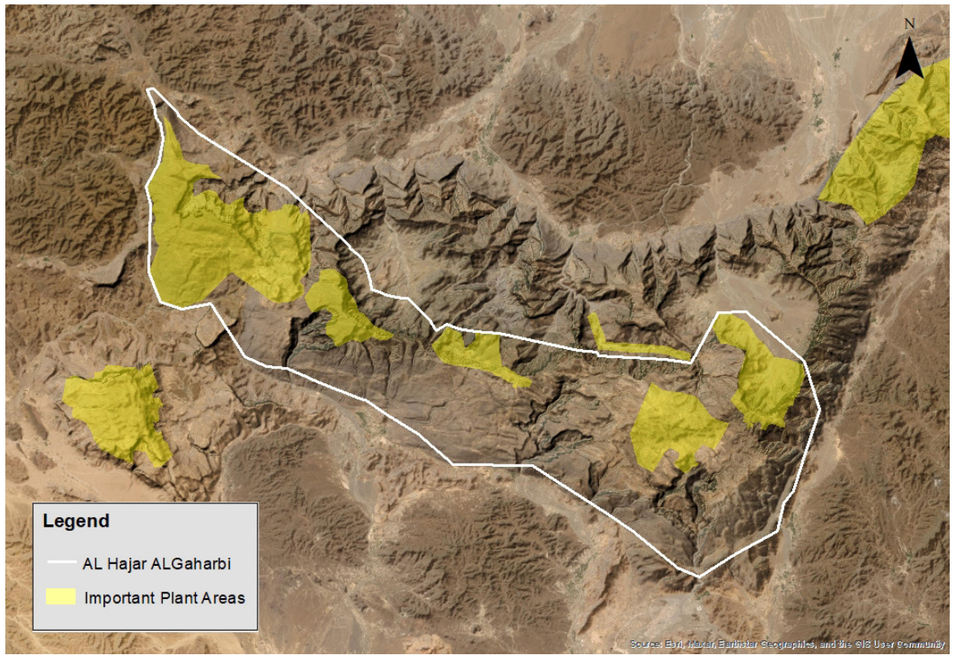

Figure 19: Important Plant Area

IBAs

Several areas within the Hajar Mountains in Ad Dakhiliyah have been identified as 'Top Birdwatching Sites', including Jabal Shams and Sayq Plateau. Furthermore, apart from Jabal Shams and Sayq Plateau IBA, Jabal Akhdar Scenic Reserve is recognised by BirdLife International as an important bird watching area, which protects six key bird species (BirdLife International, 2017). Habitats of the IBA in Al Hajar Al Gharbi include forest, grassland, shrubland, rocky areas, and wetlands (inland).

While IBAs are not legally protected, the Royal Decree No. 6/2003: Issuing the Law on Nature Reserves and Wildlife Conservation, , provides for protection of all falcon, owl, vulture, eagle, flamingo, pelican, gull and tern species.

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Each IBA contain a core area and a buffer zone (Figure 20):

Core Area. The core area of the site is deemed to be the most critical area for bird populations. Therefore, it is recommended that no major developments, such as the construction of roads, industrial buildings, hotels, housing estates, or similar infrastructure, should take place in this region, as it could potentially disrupt the birdlife. However, it is still permissible to construct bird observation hides, footpaths, and other minor structures that do not impede the natural habitat of the birds.

In fact, such constructions could even be encouraged to allow birdwatchers to appreciate the avian diversity of the area without adversely affecting it.

Buffer zone. Typically, this area refers to a 200 m region outside the core area, where fewer restrictions on recommended developments may apply. However, it is still advisable to conduct a proper Environmental Impact Assessment (EIA) to address any potential problems with the development.

Within the Starlight reserve, two areas recognised as Important Bird Areas of Oman (IBAO), Jabal Shams and Hayl Al Jawari. Notable bird species associated with this area include the Egyptian vulture, lappet-faced vulture, white-spectacled bulbul, and Hume's wheatear.

The Sayq plateau is acknowledged as an IBAO with three core areas. Notable bird species linked with the IBAO include the globally endangered Egyptian vulture and lappet-faced vulture. Unfortunately, an excessive number of visitors, picnickers, and campers are presently endangering the Sayq Plateau, with several groups lighting fires using juniper trees as fuel, which serve as habitats for many birds. In addition, Al Gubrah Bowl IBAO is partially located within the research area. Al Gubrah Bowl is a relatively flat mountain plain sloping gently from southeast to northwest, surrounded by a ring of mountains. This IBAO has two core areas for birds, Wadi Mistel and the mountain village of Wukan. Al Gubrah Bowl is renowned for the Omani owl, and although it is not endemic to Oman, it remains an exciting discovery for birdwatchers.

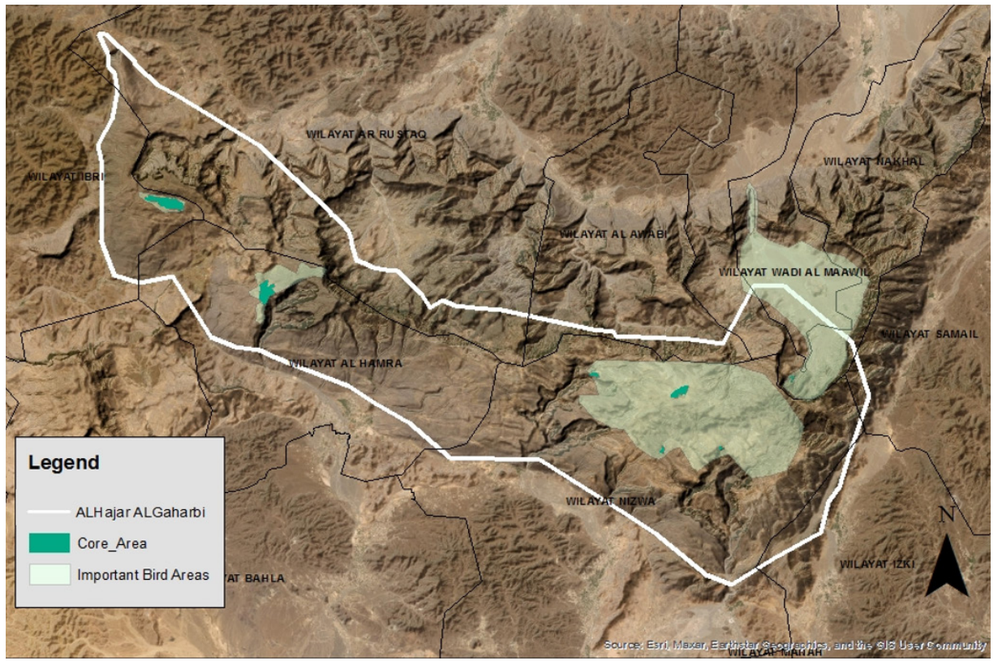

Figure 20: Important Bild Area.

Important Mammals Areas (IMAs)

The Hajar Mountains are home to several carnivorous species. However, the extensive landscapes and inaccessible terrain make it challenging to assess the status of many of these species. Among the carnivorous species found within the suitable Tahar habitat in the Al Hajar Mountains are Gordon's wildcats, Caracal, and Blanford's fox. Unfortunately, these carnivorous species are under threat due to habitat loss and fragmentation caused by the expansion of settlements and road networks.

Arabian gazelle is classified as a globally vulnerable species on the IUCN Red List and may also be regionally endangered. Gazelle populations have significantly declined across the Arabian Peninsula, with illegal hunting and overgrazing of livestock being major threats, ultimately reducing the potential prey base for caracal.

Additionally, the endangered Arabian tahr is an endemic species to the Hajar Mountains and the United Arab Emirates.

This species prefers steep, rugged mountain habitats to evade predation, resulting in an increase in plant species richness due to the diversity of climatic and habitat conditions. The distribution of the Arabian tahr species, which is most dense on the edge of the mountain range north of the town of Al Hamra, can help protect many other species located within the area that follow the linear pattern created by the tahr species. Similarly, managing and safeguarding areas with high vegetation density from urban sprawl and overgrazing activities could prove beneficial in this regard.

Figure 21: Arabian Tahar (left), Arabian Gazelle (right).

The intricate cave systems of the Al Hajar Mountains offer suitable roosting habitats for many other mammal species, including bats. Al Hoota Cave is renowned for its large number of various bat species. However, due to research challenges, there is limited comprehensive data available on the distribution and population trends of all bat species within the area. Nonetheless, the Al Hajar Mountains offer ideal roosting habitats for bats.

Reptile Areas

The Western Hajar Mountains have a high number of recorded species, with 44 reptile species identified in Ad Dakhiliyah and 40 in South Al Batinah. Within the study area, there are at least 17 reptile species, including five endemic species: Asaccus montanus, Asaccus platyrhynchu, Hemidactylus hajarensis, Hemidactylus luqueorum, and Pristurus gallagheri. The Jebel Akhdar massif boasts the highest species richness, with up to 20 species per grid cell, and is also home to several endemic species of reptiles (Figure 22).

Oman's geographical location in southeastern Arabia, coupled with the presence of high mountains in the Western Hajar Mountains, gives rise to an exceptionally high level of endemicity among reptiles. This underscores the crucial role of reptiles as surrogates for conservation studies, as they can help define priority conservation areas and assess the adequacy of the current network of protected areas. Therefore, more resources should be allocated to study the reptile fauna, particularly the endemic species, to gain a better understanding of their population structure, biology, ecology, and threats.

However, the small home ranges, high levels of endemicity, thermoregulatory constraints, and

morphological specialisation of reptiles make them especially vulnerable to the alterations that humans make to their habitats. At the same time, some reptile species are highly adaptable and can thrive in human-modified environments and structures, such as tunnels and buildings. A comprehensive study of the threats and conservation status of all Data Deficient and not evaluated species would be crucial in planning appropriate conservation actions and mitigating any potential threats, especially those that may impact the endemic species.

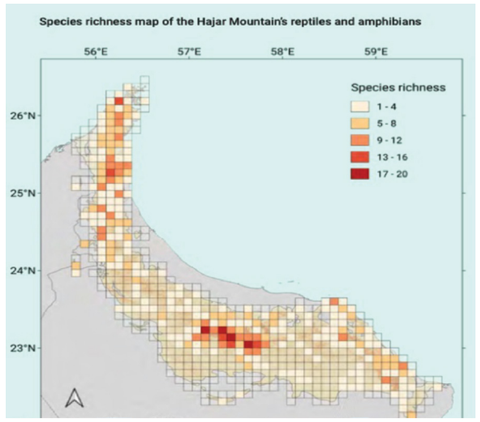

Figure 22: Species richtness map of Al Hajar Mountains.

Geoparks

Jabal Al Akhdar and Jabal Shams have been identified as potential UNESCO Global Geoparks and World Heritage sites (Figure 23). The areas feature an extensive cave system, including one of Oman's most well-known caves, Al Hoota Cave, located in Wilayat Al Hamra. It is imperative that these sites receive absolute protection from any future developments.

A UNESCO Global Geopark utilises its geological heritage, together with all other aspects of the area's natural and cultural heritage, to increase awareness and understanding of key societal issues, such as sustainable resource usage, climate change mitigation, and natural disaster risk reduction.

The establishment of Geoparks would recognise and safeguard areas with significant geological, mineralogical, and fossil features. Caves and high-quality rock-climbing locations offer other valuable geological assets. This initiative would provide better protection for natural heritage, potential integration with wider nature, biodiversity, and other protection initiatives, and opportunities for managed eco-tourism development.

The unique geology of the Western Hajar Mountains not only creates a stunning landscape but also provides a distinctive opportunity for geologists and nature enthusiasts to study and explore the region's geological history.

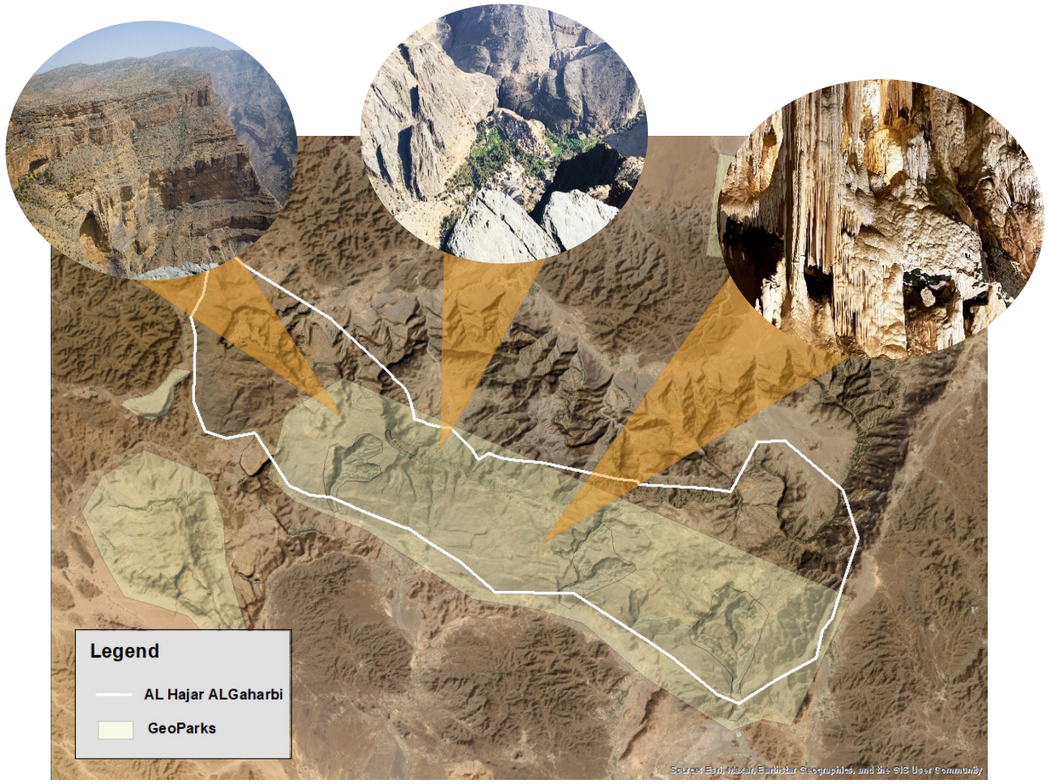

Figure 23: Geopark in Al Hajar Al Gharbi.

Guidelines for NCAs

The following tables present the threats and conflicts in the designated important areas including guidelines and clarification of the Stakeholder's role. The main threats to the study area are overgrazing, habitat loss, and climate change. Overgrazing is the major reason for plant degradation and desertification. Also, habitat fragmentation and loss due to the expansion of settlements and road networks harm biodiversity, as well as the changes in precipitation cause habitat loss, migration of local species and spread of invasive plants.

Table 4: Guidelines for NCAs.

Threats	Guidelines
Overgrazing	• Refer to Policy FS4.1.1.: Protection of Rangeland.
Street and public roads	• Carry out an assessment of the biodiversity and ecosystem services values that may be impacted by the proposal at all stages . • New major highways (and other highway development) are not allowed within 2 km of the NCA, unless in compliance with TM1.1.1 and TM1.3.1. • Adhere to the specified lanes and roads to avoid logging of plant species and green corridors. • Develop habitat and species restoration programmes (including reintroduction programmes for important species).
major mixed use developments	• Protect remnant wild places (e.g. natural juniper woodlands) from destruction by different development proposals. • Draw up Biodiversity Action Plans which can focus on priorities and targets for conservation. • Develop habitat and species restoration programmes (including reintroduction programmes for important species). • Carry out an assessment of the biodiversity and ecosystem services values that may be impacted by the proposal at all stages. • Encourage the use of native plant species for landscaping (e.g. cafes, restaurants, playgrounds, pedestrian walkways etc)(refer to policy SD11.1.1).
Urban settlements (New dwelling houses and extensions to dwelling houses)	• Carry out an assessment of the biodiversity and ecosystem services values that may be impacted by the proposal at all stages. • Vegetation screening before development. • Restrict the use of non-native plant species for landscaping (refer to policy SD11.1.1). • Allow remnant wild places (e.g., natural juniper woodlands) to survive within the area.

Continue / Table 4: Guidelines for NCAs.

Threats	Guidelines
Agricultural development	• Raising of agricultural awareness (Refer to policy SD 9.1.2). • Prevention of damage to natural habitats by harvest and collection activities. • Maintain or enhance the quality of natural resources used in farming (soil, water, air) through sustainable farming methods • Conserve biodiversity within traditional farming systems (e.g., Jabal Akhdar agrarian terraces). • Restore/rehabilitate/revive land that has been degraded by non-sustainable farming practices. • Develop programmes to control or eradicate invasive plants (Quarantine). • Protect and enhance priority plant species (e.g., endemic species) • Sustain a wide range of varieties of cultivated crops, specific to the site (e.g., olive, pomegranate, peaches, etc). • Revive traditional irrigation systems (such as Aflaj, springs, etc.) and introduce new systems (e.g., hydroponic). • Impose the use of local fertilisers.
Invasive plants	• Raising of environmental awareness (e.g., negative impacts of invasive plants) (Refer to policy SD 9.1.2). • Develop programmes to control or eradicate invasive plants (Quarantine). • Impose the use of local fertilisers.
Drought	• Integrated Water resources management • Refer to chapter 4: water resources and chapter 5: Climate Change

Continue / Table 4: Guidelines for NCAs.

Threats	Guidelines
Tourism / camping	• IUCN Tourism and Visitor management. • Immediate action to raise awareness and deal with the threat of off-road driving and developing tourism (Refer to policy GB 3.1.1.2). • Large tourism developments are not allowed within 2 km of the NCA. • 'mimic' natural conditions, thereby creating man-made biodiversity-rich habitats. • Protect remnant wild places through (e.g., fencing) within areas that are used productively. • Carry out an assessment of the biodiversity and ecosystem services values that may be impacted by the proposal at all stages. • Create programmes of interpretation for visitors to raise awareness on biodiversity. • Prohibit logging, cutting, or burning of trees/plants or any area covered with weeds. • Visitor's regulations. • No off-road driving. • No logging trees, specifically juniper trees. • No cutting native plants. • No lighting fires near surrounding trees/plants • Establishment of camping regulations: (some) camping rules • Camping activities are strictly encouraged in designated campsites. • No incineration or backfilling of liquid, solid or gaseous wastes at the campsite. • The camps should be easy to disassemble and install. • No construction work that may affect or damage the soil and plant cover. • Destroying, collecting wild plants is prohibited. • Discourage lighting fires except in the areas designated for such activities.

Continue / Table 4: Guidelines for NCAs.

Threats	Guidelines
Industrial / construction sites/ mining	• Establish EIA for site selection, operation, and management. • Develop programmes for the restoration of habitats and species that have been destroyed or degraded (including reintroduction programmes for important species). • Choose materials for site design during construction and operation based on sources that minimise damage and exhibit properties such as durability, recyclability, availability, and sustainability. • Carry out an assessment of the biodiversity and ecosystem services values that may be impacted by the proposal at all stages. • Implement waste management controls to prevent the release of production by-products and waste into the natural environment. • Compensation (offset) plan–creating new protected areas, supporting existing protected areas. • The following are not allowed within 2 km of the NCA. • Mining activities, unless meeting the requirements of policy MM1.1. • Expanded or new oil and gas development.
IBAs	
Habitat fragmentation	• Management and monitoring of (major) development (rural development, urbanisation, agricultural development ect.). • Ensure existing habitats are well connected through green corridors. • Impose the use of native plants.
Major mixed use developments	• Carry out an assessment of the biodiversity and ecosystem services values that may be impacted by the proposal at all stages to avoid habitat clearance and fragmentation. • Evaluate developments within the buffer zones and perhaps suggest alternative locations that are less sensitive to the birds. • Risk assessment needs to be carried out to assess vulnerability to exploitation. • Implement building designs that support and enhance birds activity (e.g. material, green roofs/walls, sheds, bird-safe glass, etc). • 'mimic' natural conditions with native plants, thereby creating man-made biodiversity-rich habitats. • Follow the local Building guidelines and encourage architects and builders to • use bird-friendly building designs and materials and areas known as corridors for migratory birds (refer to policy SD12.1.1).

Continue / Table 4: Guidelines for NCAs.

Threats	Guidelines
Continue / IBAs	
Agricultural development	• Focus on crops and trees that attract birds. • Prevent the use of barbed wire fencing.
Drought (climate change)	• Integrated Water resources management. • Refer to chapter 4: water resources and chapter 5: Climate Change.
Tourism / camping	• Carry out an assessment of the biodiversity and ecosystem services values that may be impacted by the proposal at all stages to avoid habitat clearance and fragmentation. • Evaluate developments within the buffer zones and perhaps suggest alternative locations that are less sensitive to the birds • Risk assessment needs to be carried out to assess vulnerability to exploitation • Prohibit logging, cutting or burning of trees/plants or any area covered with weeds. • 'mimic' natural conditions with native plants, thereby creating man-made biodiversity-rich habitats.
Industrial/construction sites/ mining	• Carry out an assessment of the biodiversity and ecosystem services values that may be impacted by the proposal at all stages to avoid habitat clearance and fragmentation. • Evaluate developments within the buffer zones and perhaps suggest alternative locations that are less sensitive to the birds. • Risk assessment needs to be carried out to assess vulnerability to exploitation. • Construction waste management. • Compensation (offset) plan–creating new protected areas, supporting existing protected areas.

Continue / Table 4: Guidelines for NCAs.

Threats	Guidelines
IRAa and IMAs	
Habitat fragmentation	• Management and monitoring of (major) development (rural development, urbanisation, agricultural development ect.). • Ensure existing habitats are well connected through green corridors. • Impose the use of native plants. • Immediate action to raise awareness and deal with the threat of off-road driving (Refer to policy GB 3.1.1.2). • Carry out an assessment of the biodiversity and ecosystem services values that may be impacted by the proposal at all stages to avoid habitat clearance and fragmentation. • Create habitat mosaics to attract a diverse assemblage of species. • Develop habitat and species restoration programmes (including reintroduction programmes for important species).
Road constructions	• Carry out an assessment of the biodiversity and ecosystem services values that may be impacted by any development. • Minimising road construction (if not feasible: sustainable road construction). • Adhere strict rules and regulations on speed limits specifically in areas within close proximity to sensitive areas and corridors. • Implement lighting regulations for all developments within the area (refer to policy TE 3.3.2).
Overgrazing (loss of habitat)	• Refer to Policy FS4.1.1: Protection of Rangeland.
Drought	• Integrated Water resources management. • Refer to Policy 4: water resources and Policy 5: Climate Change.

Related Laws

- RD 114/2001, Article 21.
- RD 8/2003: Issuing of pastures and animal resources management law.
- MD 12/2005: Implementing regulation on Pasture and livestock Management.
- MD 46/2017: Land use regulation - Designation of Ezbah and Animal Pens, applications for Ezbah.
- RD 19/2019: Promulgating the mineral resources regulates all mining activities.

Policy FS4.1

Protection and management of Rangelands - Protection, Management, and Restoration

Purpose

This policy seeks to reduce uncontrolled grazing by safeguarding and managing the rangelands, for the benefit of Soil, livestock, and important areas.

Development proposals should support:

- Well- Planned and monitored livestock grazing based on scientific principles and meets the management goals.
- Integration of wildlife management and livestock management.
- Enhancement of the aesthetic value of Rangelands.
- Enhancement of Watershed quality and reducing soil erosion and sedimentation.
- Development of awareness programs, capacity building in management of rangeland as well as provision of technical and financial support.
- Increase awareness of the benefits of sustainable grazing in conservation of vegetation cover.

Rangelands provide an important food resource for livestock, with grazing maintaining the structure and composition of flora, which can lead to a more productive and diverse species assemblage.

In Al Hajar Al Gharbi, intensive grazing by goats is a serious threat to the rare and important plants.

This issue is a factor contributing to the lack of regeneration of many tree species. Additionally, most working donkeys that were once used for transportation within the mountains have been set free and survive well in the wild, eating large quantities of the same plants that are eaten by goats. This activity causes deterioration of vegetation composition, decreased biomass productivity, and subsequently land degradation and desertification.

The negative effects of overgrazing are not only limited to plant degradation, soil erosion, or desertification, but also extend to other animal habitats and bird species for which these plants are a main food provider. According to (IUCN 2018) the population trend for Arabian gazelle is decreasing with major threats overgrazing of livestock. Also, Sand Cat is threatened by overgrazing which causes loss of their habitats and degradation (Mallon & Budd 2011).

Although laws and regulations exist, the problem of overgrazing and its damage persists. This is an indication of the need to review the regulatory process and the effective management of the Agriculture and Animal sector.

The RD 8/2003 on the issuing of Pastures and Animal Resources Management Law sets out the aspects that may be contained in the ministerial decrees and regulations on rangeland management. Article 7 stipulates the protection of pastoral areas from overgrazing and identifying carrying capacity. Article 8 of the same RD also stipulates that no logging or construction should be permitted in grazing areas without permission, as well as the introduction of new plant species that are not suitable for Omani nature.

By reviewing the MD 12/2005: implementing regulation on pasture and livestock management, promulgated by the MAFAWR based on the RD 8/2003, and the MD 46/2017 Land use regulation - Designation of Ezbah and Animal Pens, applications for Ezbah, issued by MOHUP, it should be noted that the MDs do not contain detailed procedures, particularly on the side of rangeland development, rangeland quality control, criteria for determining pastoral carrying capacity, and awareness-raising. They are limited to the development of general guidelines.

Additionally, the responsibl authorities and their roles in the organisation and management of pasture areas have not been addressed.

Common grazing areas can function well when they are underpinned by clear collective rules and protocols. A lack of institutional structures and safeguards, which promote collective responsibility, can lead to “Tragedy of the Commons” scenarios.

Following are recommendations for more sustainable and suitable rangeland management:

Allocating livestock barns within the designated rangelands and reassessment of existing pastures

Figure 24 depicts the designated Rangelands as defined by the ONSS, along with the existing grazing sites according to the MAFWR. It is evident that some of the existing pasture areas fall outside the designated rangelands. This necessitates a re-evaluation of both the designated and existing grazing sites, as well as an assessment of the state of vegetation cover, to ensure that grazing is limited to the most appropriate area.

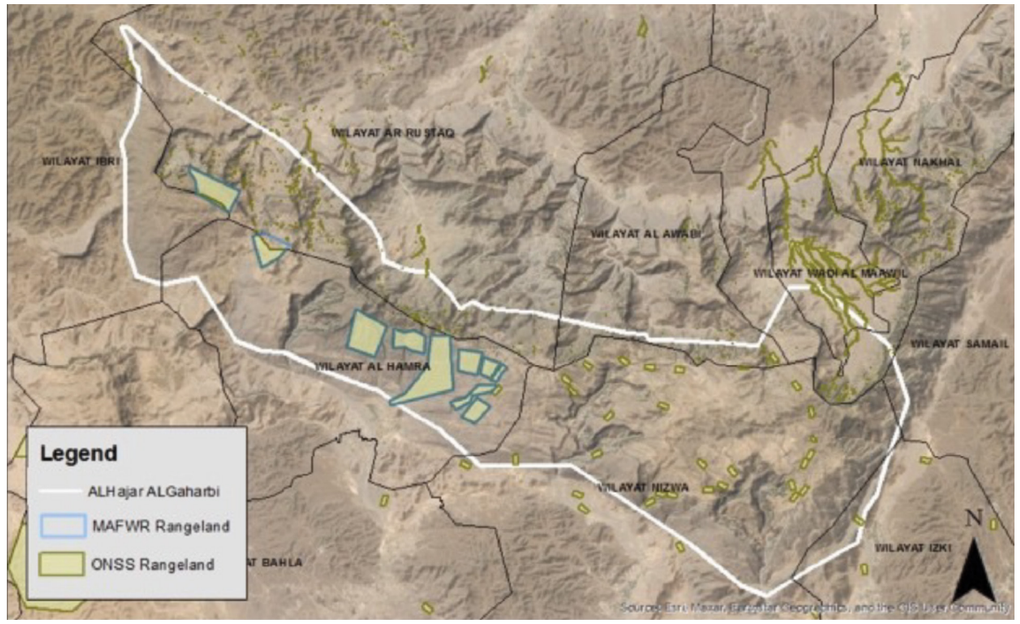

Figure 24: Designated Rangeland as defined by ONSS.

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Both existing and designated Rangelands overlap with the NCAs (as illustrated in Figure 23), leading to conflicts in Al Hajar Al Gharbi, particularly in highly sensitive and IPAs. Therefore, it is necessary to review and address the overlap between designated Rangelands and other important areas and land uses. This may involve temporary exclusion to allow for regeneration of plant species, or permanent exclusion of areas of high value and sensitivity that are not suitable for sustaining grazing. The decision should be based on ecological information and involvement of the local community.

Controlling and Monitoring

The lack of active control and monitoring by the livestock sector is one of the main reasons for the inability to manage pastures to sustain the rangeland and range resources. In addition to the RD 8/2003 and the MD 12/2005, the following, but not limited to, should be considered:

- Apply a continuous monitoring system to guarantee the pastoral carrying capacity and its suitability for the size of grazing areas:
  - Linking the future expansion of Rangelands to studies based on the assessment of growth in the number of livestock.
  - Assess vegetation status and adopt grazing systems appropriate to the state and quality of the vegetation, and plant flowering seasons.
- Practice a mixed Grazing system that integrates open grazing and traditional Hima[5] grazing system depending on the state of the vegetation.
- Using stall feeding and limiting grazing during dry seasons.
- Planning resting periods for pastures.
- Introducing watershed management.

Market-oriented livestock

Improving the Quality of livestock through practicing a grazing system that is oriented depending on the need of livestock (younger animals/animals with nutriment needs have access to high-quality forage).

- Increasing the quality of livestock by reducing their number.
- Exploiting the economic importance of donkeys:

Abandoned donkeys pose a risk that exacerbates the effects of overgrazing in Al Hajar Al Gharbi. Unfortunately, there is currently no authority responsible for their management, which makes controlling their population more difficult. In countries such as China and Turkey, donkeys are considered of high economic value, not only for their traditional role as work animals but also for their skins and milk. Therefore, it is recommended to explore the potential for economic growth by finding investment opportunities and encouraging locals to benefit from this resource. By doing so, abandoned donkeys can be utilised in a productive manner, while also reducing the negative impact of their presence on rangeland resources.

[5] Hima is a sustainable grazing system with a history of Islamic law. Its concept is to set aside rangelands managed and owned by the authority permanently or seasonally for the public good (IUCN 2017, Klos ()).

Building Capacity and Awareness

he MAFWR offers an animal extension program for pasture license holders, which should play an essential role in the development of the livestock sector. The program performs tasks such as communicating technical ideas and information, utilising modern techniques and methods in the process of care, nutrition, shelter, health, quality control, marketing, and other necessary processes for the development of livestock production. However, the program is currently an optional rather than a compulsory program and focuses only on the technical aspect, without addressing other important aspects. A continuing need exists for individuals formally educated in range management to play a major role in decisions regarding the management of rangelands. Therefore, the program should be one of the prerequisites for obtaining a pasture licence and be restructured to provide expertise in the climate-soil-plant-animal complex in relation to human needs and uses of the resources. It should also help livestock owners improve grazing practices to ensure the sustainability of the sector. The renewal of pasture licences must be in accordance with the extent to which the herder applies the requirements and techniques learned within the program.

4

WATER RESOURCES

4. WATER RESOURCES

Oman is a water-constrained country that primarily utilises groundwater resources as its water supply. Due to the country's arid climate little rainfall occurs, which consequently provides little water to supply and replenish wadis and aquifers. The annual rainfall in Northern Oman Mountains is over 300 mm. Where the wettest period starts from February to April, accounting for 38% of the total annual rainfall. A second relatively wet period occurs from July to August (resulting from the Khareef monsoon), accounting for 30% of the total annual rainfall.

The continued population and economic growth have the potential, without intervention, to increase pressure on natural resources, particularly water resources within the agricultural sector, and increase levels of pollution from waste, wastewater, and industrial discharges, with detrimental impacts on human health, well-being, and the integrity of the natural environment. In addition, the topography of Al Hajar Al Gharbi makes it difficult to recharge groundwater: the higher slope generates rapid runoff from the terrain, thereby providing a small volume of water to recharge groundwater, which impedes meeting the region's increased water demand. The potential impacts of climate variability and climate change also increase with time and are likely to be site-specific, with variation across the area.

This section includes two policies relating to the management and protection of water resources. Policy WR 2.1.1: Protect water resources from pollution focuses on the conservation and protection of limited water resources from pollution. Policy WR 3.1.1: Optimise Collection, Storage, and Use of All Water Resources - Optimisation and Diversification of Water Resources seeks to promote and encourage utilisation of all available water resources.

Policy WR 2.1.1:

Protect Water Resources from Pollution

Purpose

This policy aims to conserve and protect water resources in Al-Hajar Al-Gharbi.

- Development proposals based on the use of surface water and groundwater sources should:
  - Prevent water pollution.
  - Enhance the quality and quantity of water resources and help achieve the requirements of the water resources legislation of MAFWR.
- Development proposals dependent on Wells or Daoudi-Aflaj must be balanced with the quality and level of groundwater and will be permitted if:
  - The source is known and has been excavated by the drilling laws of MAFWR.
  - The source is not classified as contaminated.
  - The constant abstraction of groundwater does not cause future wells' pollution.

Water resources quality trend

The main surface- and groundwater quality problem in Al Hajar Al Gharbi Region is nitrate pollution. This quality issue, which is concentrated mainly in Sayq plateaus, is associated with the disposal of untreated effluent to aquifers either directly or indirectly via septic tanks, the use of fertilisers in agriculture, and the discharge of wastewater to wadis. According to a survey conducted by Victor et al. 2006[6] surface water in Jabal Akhdar is not fit for drinking by humans. The most crucial issue is the anthropogenic fecal contamination of surface waters, and the eutrophication of all reservoirs is linked to the fecal input from goats and donkeys.

Additional research, such as that conducted by Al Kalbani et al. 2017[7] indicates that the drinking water quality index for the examined resources in Al Jabal Al Akhdar is good or medium, indicating that they are suitable for human consumption and falling within the quality limits permitted by Omani drinking water standards. However, there is an indication of the presence of high nitrate concentration in some groundwater wells, which requires more investigations and monitoring programs.

Figure 25 illustrates areas of potential nitrate contamination through point sources (septic tanks in areas of human habitation), and diffuse septic (pastoral and agricultural areas).

[6] See: https://link.springer.com/article/10.1007/s13201-017-0621-6

[7] See: https://link.springer.com/article/10.1007/s13201-017-0621-6

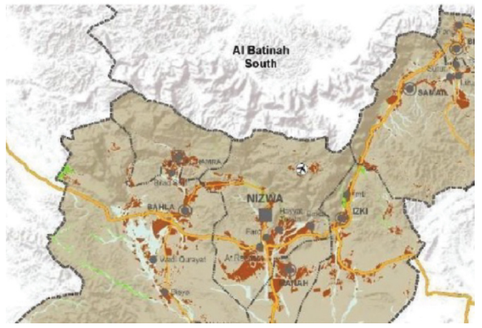

Figure 25: Designated Rangeland as defined by ONSS.

Well protection Zones

Region water supply wellfield protection Zones (WPZ) are present in Sayq. The purpose of the WPZ is to develop resources and to protect water resources and public water supply wellfields against pollution. Each WPZ is divided into four colour-coded areas: red, orange, yellow and blue. In each Zone various practices that could be practised within the WZP are regulated: A: not allowed – D: allowed if the maximum volume of liquid is specified in the permit obtained prior proceeding with the activity.

The following figure 26 shows the WPZ in the Study area. According to the ministerial decree 91/2001 the following practices are not allowed in the defined WZP:

- Using of fertiliser, pesticides, herbicides of invasive plants.
- Building of private dams.
- Industrial activities.
- Mining activities.
- Oil and fuel storage; Solid waste landfill.

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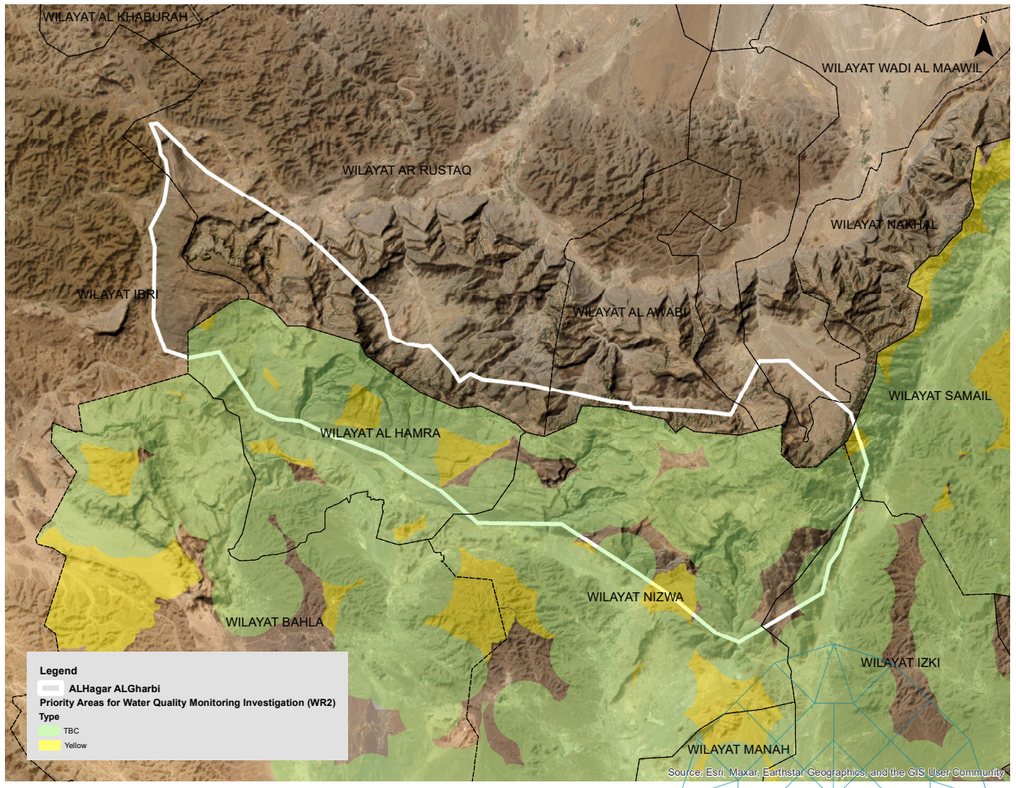

Figure 26: Designated Well protection Zones.

Policy WR 3.1.1:

Optimisation and Diversification of Water Resources

Purpose

This policy aims to support efficient utilisation and diversification of water resources apart from groundwater in the region to ensure water sustainability.

- Development p roposals should provide alternative water resources.
- Development proposals that do not provide alternative water resources could be supported, if:
  - There are clear economic and social benefits of utilising existing water resources.
  - Groundwater abstractions do not undermine existing rights/cause unacceptable groundwater quality deterioration.
  - Proposals for enhanced water storage, flood protection, and recharge of aquifers, will be approved by MAFWR subject to technical studies that demonstrate both significant net socioeconomic.
- Development proposals should consider the future water demand and its sources by protecting groundwater resources to reduce the negative environmental impacts from such practices (refer to Policy WR 2.1.1).
- Development proposals should provide outreach and capacity building to encourage landowners to use alternative resources and integrate alternative irrigation.

The water resources in Al Hajar Al Gharbi and throughout Oman (Figure 27) are subdivided into conventional (natural) and non-conventional water resources. Conventional water resources are those that are obtained in a natural way, such as by precipitation (surface water and groundwater), whereas non-conventional water resources are those that are produced artificially, that is, by means of desalination plants and wastewater treatment plants.

Al Hajar Al Gharbi area is dependent largely on shallow, low storage capacity aquifers, developed in alluvial deposits along the main wadi channels and the flood plains which drain the rugged mountains of Al Jabal Al Akhdar. Minor supplies are also obtained from the Hajar SuperGroup and Hawasina sediments. Aflaj systems in the foothills bordering the mountains comprise an important water source and are central to agricultural communities. While desalination is the main source of potable water, groundwater is the dominant source of water servicing industrial and agricultural sectors through private wells and aflaj.

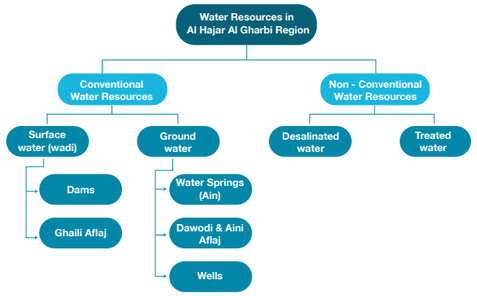

Figure 27: Water resources in the Study area.

Water resources trend in Al Hajar Al Gharbi

During the last years, the Sultanate witnessed a significant transformation in the method of using water; it increased in the agricultural, industrial, commercial, municipal, and tourist spheres to more than triple. The great economic development coordinates the increase in water demand.

As illustrated in Figure 28, 83% of the consumed water in these sectors comes from groundwater, while the remaining amount is from desalinated water (10%), surface water (5%) and treated water (2%).[8]

Water demand will continue to increase with the growth of all sectors: According to an assessment of water consumption[9], the abstractions for domestic and industrial purposes have increased by about 86% on average. Since the construction of the Barka Desalination Plant in 2011, the domestic requirements of Ad Dakhiliyah Governorate, including al Hajar Al Gharbi have been largely met by desalination. However, with domestic and industrial abstractions representing 4% of groundwater abstractions, this water usage and any increase have only a marginal effect on the total current volumes of groundwater being abstracted.

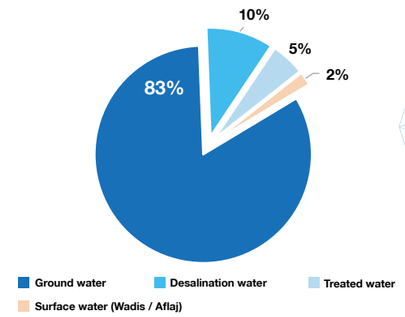

Figure 28: Distribution of Water resources in the Study area.

8 The listed Statistics present estimates not measured abstractions.
9 Water Balance Computation for the Sultanate of Oman Final Report (2013)

The majority of water usage is associated with agriculture, this sector represents over 96% of groundwater abstraction, however, agriculture groundwater abstraction usage has remained stable during the years, balanced by increases and decreases in various agricultural areas. For all crop types, flood irrigation is the dominant irrigation method. There is a general increase in usage of modern irrigation techniques for field crops and dates, while a proportionate increase in flood irrigation techniques in vegetable crops.

Despite the decrease in the agricultural areas, this has not contributed to reducing the pressure on Al Hajar Al Gharbi's water resources. Therefore, there is a need to provide alternative water resources. The MAFWR has to ensure that the Impoundment is actually used for supply of private households, agriculture, and other sectors or for aquifer recharge. In Al Hajar Al Gharbi, only a small part of the rainwater blocked by dams is used and the rest is discharged into the Wadi valleys. So, more recharge dams have to be built by the MAFWR for rainwater harvesting to increase groundwater level. Especially with the surface storage dams, the water is only temporarily intercepted, and a large part of the water evaporates (refer to policy UT2.1.2).

In Oman, rainwater is discharged into the sea via channels, which are intended as protective measures. There are currently no proposed projects known to reuse rainwater through infiltration systems, neither in the streets nor in the homes. Therefore, the construction of rainwater infiltration systems (Figure 30) is necessary to use more rainwater by different sectors.

A good further method for the reuse of water is grey water systems (Figure 29), which contribute to the economical use of water. It is recommended to equip mosques and households with such facilities in the future. Here, recycled water could be used, for example, for garden irrigation or toilet flushing.

These systems have various advantages: Thus, costs can be saved by reusing the water. They also consume little energy and have no negative environmental impact. However, the disadvantage is that retrofitting a house with such systems is complex. Therefore, it is recommended that the MOHUP and the PAEW ensure that these systems must be included in the future design of residential units.

For the development and conservation of water resources, the MAFWR as the responsible ministry should include all authorities in its planning process for better effectiveness. It is undisputed that the existing laws aim at the conservation and sustainable use of the resource water. However, the plans and visions based on this need to be made more concrete. A successful and sustainable development of water resources depends on a comprehensive understanding of the available resource, demand, and integrated water resource management.
ecommended to equip mosques and households with such facilities in the future. Here, recycled water could be used, for example, for garden irrigation or toilet flushing.

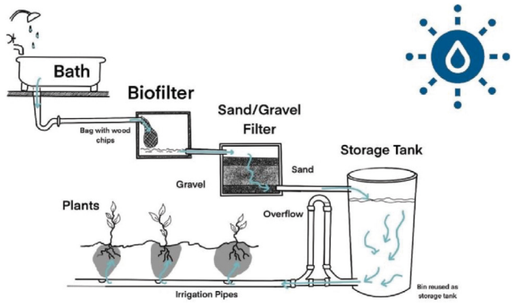

Figure 29: Greywater System.

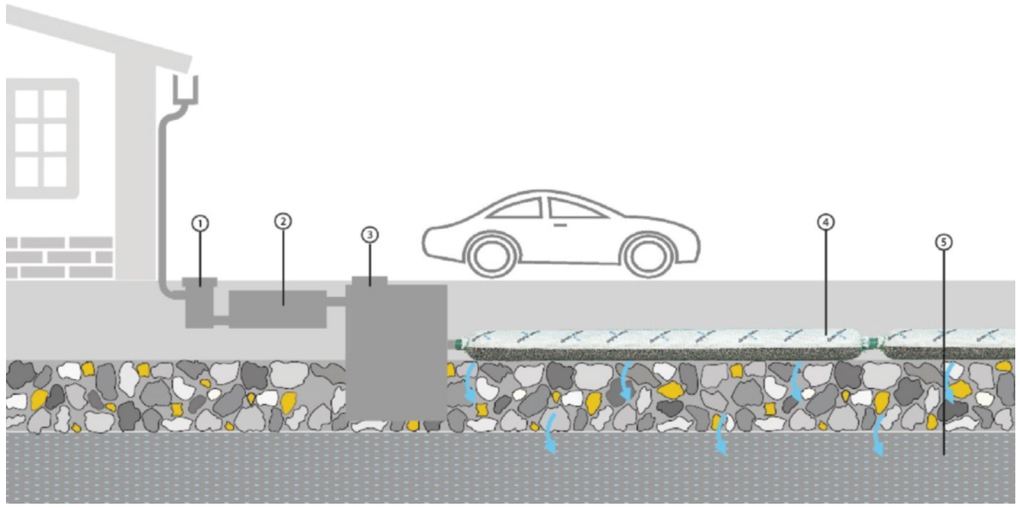

Figure 30: Rainwater infiltration system.

Related Laws

- RD 114/2001: Issuing the Law on Conservation of the Environment and Prevention of Pollution.

Table 5: Guidelines to protect water resources.

Threats	Guidelines
Pollution	• Enact laws and regulations that limit the amount of pollutants that industries and individuals can release into water sources. • Encourage industries and individuals to adopt best practices that reduce pollution: ◈ Encourage Farmers to use natural fertilisers and pesticides. ◈ Encourage industries to use water-efficient technologies that reduce the generated wastewater. • Invest in infrastructure that helps prevent pollution and improves: ◈ Stormwater retention ponds or green infrastructure (such as rain gardens). ◈ Allocation of Off-stream watering system away from mother wells or sources. • Raising Awareness ◈ Educate the public on the importance of protecting water from pollution. ◈ Encourage individuals to properly dispose of hazardous waste and to reduce the use of fertilisers and pesticides. ◈ Cooperation with community groups to raise awareness and promote practices that protect water quality.

Continue / Table 5: Guidelines to protect water resources.

Threats	Guidelines

Overconsumption	• Dublin Principles in Integrated Water Resources Management.
	• Encourage the use of alternative water resources.
	• Increase Water Use Efficiency:
	  ❁ Use of low-flow fixtures.
	  ❁ Rainwater harvesting.
	  ❁ Water-saving technologies.
	• Improve Water Infrastructure:
	  ■ Development of new water treatment facilities.
	  ❁ Improved distribution systems.
	  ❁ Implementation of water reuse and recycling systems and grey water systems.
	• Implement Water Trading and Pricing Mechanisms:
	  ❁ Tiered pricing systems that charge higher rates for excessive water use.
	  ❁ Trading systems that allow users to buy and sell water permits (example: for agricultural purposes).
	• Develop integrated water resource management plans that take into account the needs of all stakeholders, including farmers, urban residents, and industries.
	• Conservation and Protection of Watersheds:
	  ❁ Establishment of protected areas and reforestation programs.
	  ❁ Implementation of best management practices for agriculture and forestry.

5

CLIMATE CHANGE

5. CLIMATE CHANGE

According to climate change projections, Ad Dakhiliyah is set to face various challenges in the coming decades. These include rising minimum and maximum temperatures, more frequent hot spells, and potentially less annual rainfall (although this is uncertain). Additionally, extreme storm rainfall and associated wadi floods are predicted to become more intense, and there may be increased dust storm activity and cyclone severity. The declining Juniper woodlands of the Western Hajar Mountains serve as a compelling example of the impact of climate change on plants in Oman. Figure 31 illustrates the average yearly temperature in Oman between 1950 and 2000. The data reveals that the Hajar Mountains experienced lower mean temperatures than other regions.
In summary climate change projections suggest Ad Dakhliyah can expect:

- increased temperatures of 2.5 to 3.5 degrees by the 2050s.
- increased frequency of hot spells.

  likely decreased annual rainfall (though there is some uncertainty).
- increased intensity of extreme storm rainfall and associated wadi floods.
- potential increase in cyclone severity; and potential increased dust storm activity.

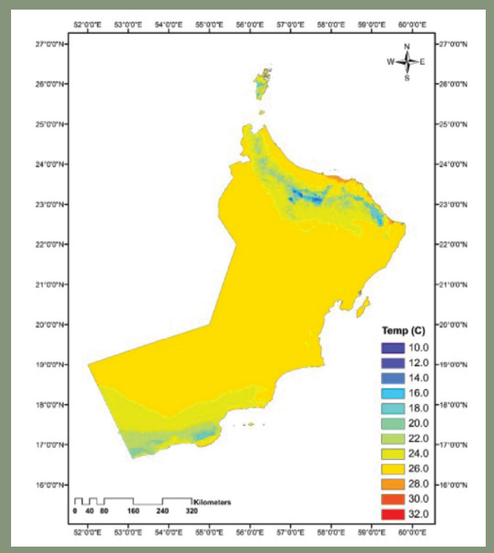

Figure 31: The Average yearly temperature in Oman.

Policy CC1.1.1: Climate Change - Mitigation

Purpose

The aim of this policy is to reduce and stabilise greenhouse gas emissions in Al Hajar Al Gharbi region by enabling high-quality, well-functioning ecosystems, increasing open green space, promoting transition to a non-combustion society through implementation of renewable energy and increasing public transport services.

- Development proposals for improved, supporting, or new infrastructure will be permitted where they represent the least polluting options.
- Development proposals should encourage:
  - Implementation of energy reduction initiatives.
  - Supporting Net-Zero Policy (Proposed by the Ministry of Energy and Minerals); and carbon pricing.
    - Supporting the objective of zero carbon program.
    - Sustainable land allocation, shifting away from southern parts of the mountains to the coolest parts.
    - Incorporating decentralised renewable energy.
    - Improving access to lower-emissions transit modes (walking, cycling, and electric public transport).
    - Utilising areas of high biodiversity as carbon ‘sinks’ and intensifying vegetation where applicable.
    - Transitioning to a more decentralised waste management system to reduce carbon footprint (recycling, e-waste, composting).
    - Adopting sustainable design and construction guidelines/codes to improve energy efficiency associated with cooling buildings and reduce embodied carbon.
  - Co-locating infrastructure and maximising reuse of resources.
  - Embedding circular economy principles into construction and industry.
  - Raising awareness of the measures contributing to the reduction of carbon emissions.
  - Highlighting the importance of conserving energy, water, and natural resources.
  - Encourage reducing waste, and promote recycling and composting programs.

Efficient ways to mitigate climate change:

- Transition to renewable energy (refer to policy EN2.1.1.1).
- Promote sustainable transportation (refer to policy TM 6.1.1).
- Support reforestation (refer to policy SD 11.1.1).
- Energy efficient building.

Buildings within Al Hajar Al Gharbi should be made more energy-efficient by implementing simple solutions, as demonstrated in Figure 32. In recent years, several green building standards have been adopted to promote sustainable construction practices and reduce the environmental impact of buildings. Some of the key green building standards include:

- Oman Energy Conservation Building Code (ECBC): This code was developed by the Ministry of Housing and Urban Planning to promote energy-efficient building design and construction. The code sets energy performance standards for buildings and requires the use of energy-efficient materials and systems.
- Estidama Pearl Rating System: This rating system was developed by the Abu Dhabi Urban Planning Council but is used in Oman as well. It provides a framework for sustainable building design and construction and covers topics such as energy efficiency, water conservation, and material selection.
- LEED: The Leadership in Energy and Environmental Design (LEED) certification system is widely recognised in Oman as a benchmark for sustainable building design and construction. The system provides a rating system for buildings that meet certain environmental performance criteria, such as energy efficiency, water conservation, and indoor environmental quality.

Despite this, there is a need for a comprehensive green code that is tailored to the characteristics and nature of the region. Such a code provides a framework for achieving these goals and ensures that buildings are designed and constructed in a way that promotes sustainability and reduces the environmental impact of the built environment.
This code should cover, but not be limited, to the following:

- Energy efficiency: Standards to improve energy efficiency in buildings, appliances, and transportation - including envelope insulation, efficient lighting and HVAC systems, smart metering, and the use of renewable energy sources such as solar panels.
- Water efficiency (refer to Policy WR 3.1.1).
- Standards for the use of natural, local sustainable and environmentally friendly building materials, such as recycled content materials, low-emitting materials, and materials with a low carbon footprint. which will contribute in reducing the use of air conditioning and heating devices that generate huge amounts of GHG emissions. (refer to Policy SD11.1.1)

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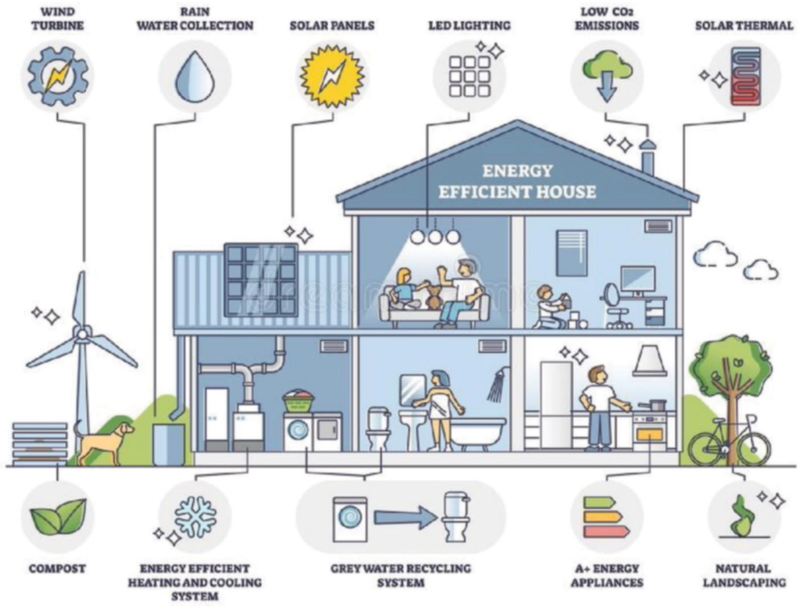

Figure 32: Energy efficient House.

- Standards for sustainable site planning, including the protection of natural features.
- Standard for waste reduction and recycling during construction and operation of building.
- Adaptation to climate change (refer to policy CC2.1)
- Standards for building design and construction that promote the health and wellness of occupants, such as access to natural light, views, and outdoor spaces (refer to policy SD11.1.1).

Reduce Heat Island effect

Urban areas with buildings, pavement, concrete, and other materials tend to experience the heat island effect, which raises air temperatures and increases cooling costs while affecting comfort levels. To mitigate (Figure 33) this effect, impervious surface areas can be reduced, and a tree canopy can be incorporated into the landscape. Trees provide shade, which absorbs heat that is radiated back to the environment. Additionally, choosing light and reflective colours for parking lots, roofing surfaces, and other large surface areas can help reflect heat energy. Dark surfaces such as black asphalt parking lots absorb heat energy and continue radiating heat long after sunset.

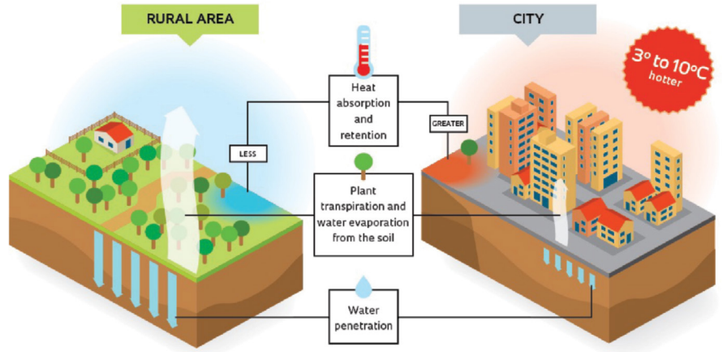

Figure 33:
Measures to reduce Heat Island.

Policy CC1.1.1: Climate Change - Adaptation

Adaptation simply refers to the process of adjusting to the impacts of climate change within Al Hajar Al Gharbi in order to reduce the risks and take advantage of any opportunities:

- Reductions in groundwater recharge interacting with population growth, tourism and economic development to increase water stress.
- Higher temperatures and changes in rainfall affecting vulnerable ecosystems and temperature-sensitive fruit crops in the Hajar Mountains.
- Potential for desertification from reduced rainfall and increase in dust storm activity; and
- Potential increase in severe rainfall from increased cyclone intensity in the Arabian Sea interacting with population growth to increase the threat of, and exposure to flash flooding from extreme rainfall events.

Purpose

This policy seeks to adjust and adapt to the actual or projected future climate to reduce our vulnerability to the harmful effects of climate change in the region. Through sustainable land allocation, directing development away from flood risk areas or providing flood protection, and increasing flood storage/recharge capacity, increasing water efficiency and use of alternative water resources.

- Development proposals should be prohibited by default in areas liable to flooding and only allowed by exception if there is a demonstrable need and that the applicant can demonstrate that their proposals are adapted to accommodate the risks.
- Development proposals should encourage:
  - Sustainable land allocation, shifting away from southern parts of the mountains to the coolest parts.
  - Implementing a sustainable design to minimise carbon emissions through energy efficiency and more resilient to climate change risks (flooding & drought).
  - Adopting a sustainable wastewater management system (refer to policy UT2.1.1).
  - Providing green infrastructure for localised water quality, air quality, and surface water runoff benefits in urban areas.
  - Switching to sustainable grazing methods (refer to policy FS4.1.1)

Efficient ways to adapt climate change

- Development early warning systems and emergency response (refer to policy WR4.1.1).
- Development resilient infrastructure (refer to policy EN2.1.1, UT 2.1.1).
- Development resilient communities.

Adapting to the impacts of climate change requires the development of resilient communities. In order to achieve this, it is necessary to conduct thorough risk assessments, engage with stakeholders, develop and implement comprehensive adaptation plans, invest in sustainable infrastructure, protect and restore natural ecosystems, promote social and economic resilience, and foster innovation and learning. By undertaking these initiatives, communities can better adapt to the various impacts of climate change and effectively reduce the associated risks to human populations, ecosystems, and economies.

Table 6: Guidelines to Mitigate Climate Change.

Threats	Guidelines
Climate Change (Carbon emission)	• Building Materials • -Material selection: Choosing materials that are non-toxic, locally-sourced, renewable, and have a low environmental impact. Examples: sustainably harvested wood, recycled materials, and natural materials like straw, clay, and hemp. -Energy efficiency: Materials should be chosen for their energy efficiency, and buildings should be designed to maximise passive solar gain and natural ventilation. - Water efficiency: Buildings should be designed to minimise water consumption and incorporate water-saving features like rainwater harvesting and greywater systems (Refer to WR3.1.1). - Durability and maintenance: Materials should be chosen for their durability and ease of maintenance, reducing the need for replacement and waste. - Waste reduction: Minimising waste through careful material selection, design, and construction techniques. Recycle and reuse materials wherever possible. • Building design and construction • -Access to natural light: Designing buildings with ample windows and skylights, and using light-coloured materials to reflect natural light. -Thermal comfort: Ensuring that buildings are designed to provide comfortable indoor temperatures and humidity levels, and provide occupants with control over their environment. • Sustainable transport (refer to TM6.1.1) • City planning • -Using green infrastructure - Using cool roofs and pavement -Using mixed-use development, green space, and pedestrian-friendly design.

6

SUSTAINABLE COMMUNITY ENHANCEMENT

6. SUSTAINABLE COMMUNITY ENHANCEMENT

Policy SD2.1.1: Settlement Boundaries and Urban Containment

Purpose

This policy aims to control urban growth in Al Hajar Al Gharbi, with the goal of improving the quality of life for residents and protecting the natural environment while preserving natural resources.
Development Proposals will be permitted where they:

- Ensure all settlement developments are accommodated within - designated settlement boundaries without the addition of new greenfield expansion areas and do not surpass the proposed settlement boundaries SD2.
- Encourage consistent settlement patterns to control and prevent scattered and random planning patterns.
- All development proposals in scale and location will be permitted if they are dependent on the need for local community housing, the role of settlements as employment providers, and the capacity of infrastructure, including having regard to the environment.
- Partnership with other government authorities (e.g. Ministry of defence).
- Housing needs assessment.

The mountains of Al Hajar Al Gharbi have been inhabited for thousands of years, and the settlement patterns in the region have been shaped by the geography, climate, and natural resources of the area.

Traditionally, the Hajar Mountains were home to small, scattered settlements of semi-nomadic pastoralists who moved their herds of goats and sheep between seasonal grazing grounds. The settlements were often located near water sources, such as springs, wadis, and afalaj.

In the mountainous terrain, many of the settlements were located on or near high plateaus and mountain peaks, where the inhabitants could better protect themselves from raiders and invaders. Some settlements were fortified with walls and towers, while others were built on inaccessible cliffs and caves.

As the region has modernised and developed, the settlement patterns have changed. Many of the smaller, isolated settlements have been abandoned as people have moved to larger towns and cities in search of better economic opportunities. However, some traditional settlements still exist in the region, and efforts are being made to preserve them as cultural heritage sites.

Overall, the settlement patterns in the Hajar Mountains of Oman have been shaped by a combination of geography, climate, natural resources, and cultural traditions.

Al Hajar Al Gharbi is home to several towns and villages that are located in the valleys and on the mountain slopes. Some of the main settlement areas within the region include:

- Saiq is the main village located in the Jebel Akhdar mountain range in the region. While there are no other settlements in the immediate vicinity of Saiq, there are a few other small villages and communities located within the larger Jebel Akhdar region, which is accessible by road from Saiq. Some of the nearby settlements and communities include:

- **Al Aqr:** This small village is located a few kilometers southeast of Saiq and is known for its traditional architecture and terraced farms.
- **Al Ayn:** Al Ayn is a small mountain village located about 10 kilometers southwest of Saiq. It is known for its natural springs, which have been used for irrigation and drinking water for centuries.
- **Ash Sharayjah:** This small village is located about 15 kilometers northeast of Saiq and is known for its historic fort and traditional souq.
- **Wadi Bani Habib:** Wadi Bani Habib is a small village located about 20 kilometers northwest of Saiq. It is known for its historic houses and terraced farms, which are built into the mountainside.
- **Al Khitaym:** Al Khitaym is a small village located on the northeastern slope of Jabal Shams. The village is known for its beautiful terraced farms, which produce a variety of crops including pomegranates, apricots, and grapes.
- **Wadi Ghul:** Wadi Ghul is a small village located on the western slope of Jabal Shams. The village is known for its stunning canyon, which is often called the “Grand Canyon of Oman.”
- **Misfat Al Abriyeen** is a historic village that dates back hundreds of years, and many of its buildings and structures have been preserved to showcase its traditional architecture.

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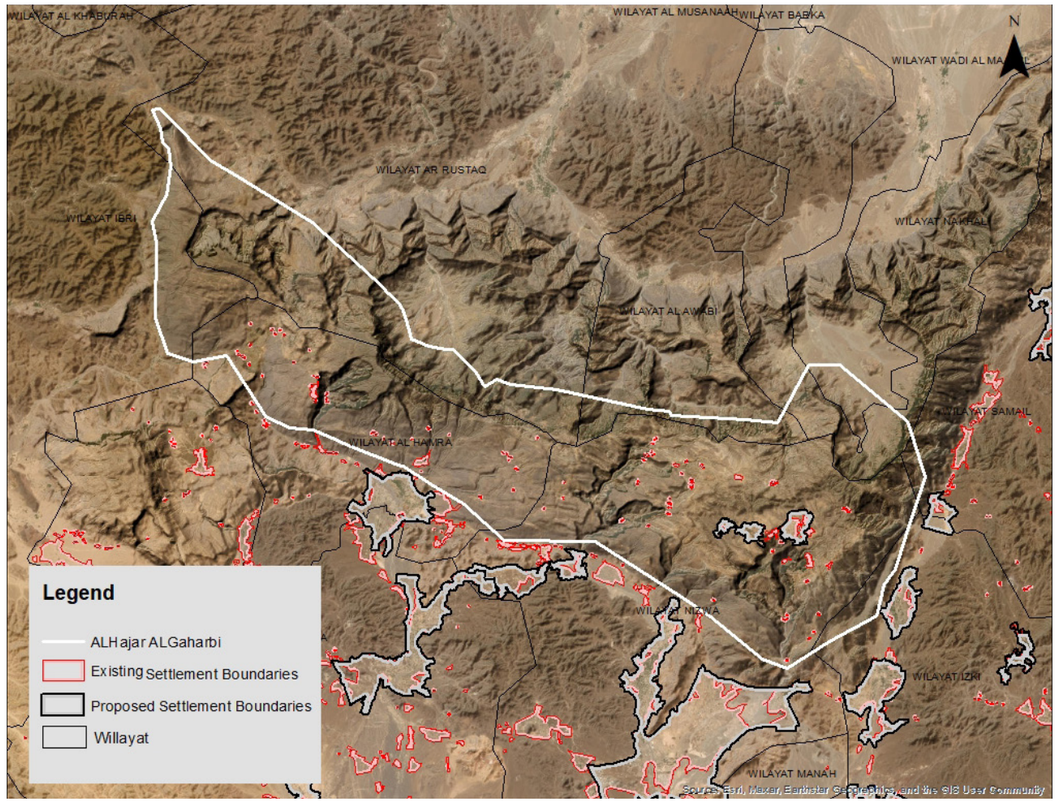


Figure 34: Settlement Boundary of Al Hajar Al Gharbi.

Policy SD 12.1.1: Greening the Built Environment

Purpose

The aim of this policy is to encourage community engagement and create vibrant and liveable neighbourhoods within Al Hajar Al Gharbi region through the creation of valuable open spaces.

- Development proposals will be supported where they:
  - Allocate community gardens in proposed residential complexes.
  - Provide accessible, green, lively, and well-connected open spaces.
  - Connect people and wildlife through well-defined routes, public and private spaces within the public realm.
  - Encourage local business through pop-up markets (e.g., souq Al Juma) (refer to policy GP 3.1.1).
  - Engage communities in the design, construction, operation, and maintenance phase of projects thereby increasing opportunities for rural employment and enhancing sustainability.
  - Provide green and resilient infrastructure for sustainable communities.
  - Support public health, well-being, and prosperity by providing and maintaining facilities enabling the Community to live in harmony with the environment.

Most towns of Al Hajar Al Gharbi lack well maintained natural open spaces and public gardens which provide opportunities for people to interact and socialise, and if well designed, can encourage physical activity supporting healthy lifestyles. There is an urgent need for the development and creation of new productive urban open spaces. Therefore, taking a strategic approach to creating a linked network of natural open spaces, including linking wadi parks, will be important. They also provide an important recreational asset, which forms the basis of the creation of 'green and blue' infrastructure networks within settlements. Urban greening also has an important role to play in encouraging walking and cycling in the region.

Green Infrastructure

Green infrastructure is not simply an alternative description for conventional open space. It includes parks, open spaces, playing fields, woodlands – and also street trees, private gardens, green roofs, etc. Green infrastructure can reduce a community's infrastructure costs, promote economic growth and create jobs, whilst more green space, the use of wadi beds as linear parks and playgrounds, parks and shaded roads and pathways will encourage outdoor physical activity, reducing obesity and preventing associated chronic diseases.

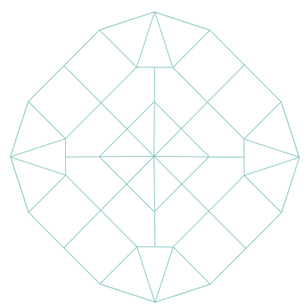
The Urban Environment

Greening the urban environment within the region will make the urban environment more liveable. Planting within the region can be used to shield roofs and walls from direct sunlight, cool the surrounding environment and filter airborne sand and dust. Native plants require less water, and no pesticides or fertilisers. They also enhance biodiversity and provide a habitat for local fauna.

Community Engagement

Community engagement is based on the democratic idea that everyone who is affected by an issue that impacts their community should have a say in the decision-making process. It holds the promise that public participation can influence decisions that affect the provision of services, future visions, and sustainability of our communities. The significance of community engagement are:

- Building and sustaining cohesive communities.
- Improving outcomes.
- Ensuring access and community empowerment.
- Helping local governments to promote sustainable decisions.
- Driving social transformation
- Deepening democracies



7

INFRASTRUCTURE

7. INFRASTRUCTURE

In Oman, infrastructure development has played a key role in the country's economic growth and development, enabling it to become a regional hub for trade and commerce. The country has made significant strides in developing its infrastructure, including transportation systems, energy networks, communication technologies, and water and sanitation systems. These investments have helped attract foreign investment, create employment opportunities, and improve the standard of living for its citisens. However, as Oman continues to grow and develop, the demand for water and energy has expanded rapidly, and the government has adopted privatisation to improve the performance of its infrastructure services. Currently, the Nama Group is committed to providing reliable electricity and water supply through its group of companies, which consist of MZEC, MJEC, RAECO, OETC, OPWP, among others.

This section covers three different policies relating to infrastructure. Policy EN2.1.1: Energy-Developing Resilient Renewable Generation aims to ensure the provision of reliable, affordable, and sustainable energy. Policy UT 2.1.1: Delivering Resilient Urban Infrastructure Networks - Water Supply and efficiency, Wastewater and storm water management seeks to ensure a resilient infrastructure in terms of water supply, wastewater management and stormwater. Policy WR 4.1.1: Delineate and Manage High-risk Flood Plain - Mitigation and Adaptation to Flood Risk sets out actions to support the development of a national flood mapping programme and set measures to mitigate and adaptate flood risk.

Policy EN2.1.1: Energy - Developing Resilient Renewable Generation

Purpose

The aim of this policy is to encourage the incorporation of decentralised renewable energy generation and storage, either at the level of the individual building or within a community wide network.

The following development proposals will be supported:

- Development of green building code for new developments and energy efficiency retrofit for existing buildings to reduce demand.
- Sustainable Energy particularly solar energy.
- Developing and implementing an energy security plan that includes diversification of energy sources, energy storage, and emergency response measures.
- Transition to a smart grid, incorporating bulk storage, demand response and dynamic management facilities.
- Developing and implementing a national energy conservation awareness campaign to educate the public about the benefits of energy conservation and encourage energy-efficient behaviours.

Oman's electricity sector heavily relies on the country's domestic natural resources, such as natural gas, oil, or fuel oil. In 2013, natural gas accounted for more than 80% of the country's electricity generation. Due to the high growth and remarkable increase in power demand, new generation capacity is urgently needed to prevent power outages and brownouts, especially during peak demand times. The Governorate is connected to the Main Interconnected System (MIS) and is a net importer of electricity, as there is not enough power generation to meet current demand. Consequently, new energy resources are needed to accommodate demand growth and enhance the quality of service. The National Energy Strategy to 2040 was finalised in 2015, recommending that around 10% of Oman's energy mix should be from renewables by 2025. Transitioning to a greater proportion of renewable electricity offers benefits, such as climate change mitigation (reduced carbon emissions), contributing to Oman's Net Zero 2050, improving air quality, resource efficiency, reduced discharges, diversifying the economy, futureproofing, and securing inward investment.

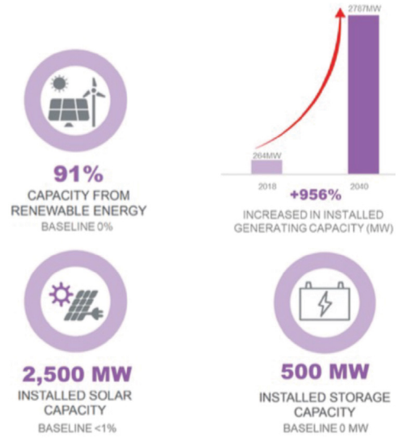


Figure 35: Proposed capacity from renewable energy.

Sustainable Energy

The most promising renewable energy generation technology within Ad Dakhiliyah is solar. Based on resource assessments carried out to date, large areas of the governorate are considered suitable for solar generation. The solar resource availability shows limited variability across the governorate, meaning that other considerations dominate site selection decisions (e.g. proximity to grid connections and populations, road access for construction and maintenance, favourable topology, environmental constraints). A potential location for a future solar facility has been identified at Manah, and Adam has also been proposed as a possible location.

Using solar energy in Al Hajar AL Gharbi is covered by challenges such as the need for specialised mounting systems to accommodate the steep terrain and harsh weather conditions. Additionally, the angle of the sun may change more rapidly in mountainous areas, requiring more frequent adjustments to solar panels to ensure optimal energy generation. Therefore, it is necessary to seek other solutions that are suitable for the region, such the following:

- Off-grid solar systems: In areas where grid infrastructure is limited or non-existent, off-grid solar systems can be used to generate electricity. These systems typically include solar panels, a battery bank for energy storage, and an inverter to convert the stored energy into usable electricity.
- Grid-tied solar systems: In areas where grid infrastructure exists, grid-tied solar systems can be used to generate electricity and feed it back into the grid. This can help offset electricity costs and provide a reliable source of renewable energy.
- Solar-powered water pumps: In mountainous areas where water sources

are located far from population centres, solar-powered water pumps can be used to pump water to villages and other areas. These systems typically include solar panels, a pump, and a storage tank.

- Solar-powered lighting: Solar-powered lighting can be used to provide outdoor lighting in mountainous areas, such as hiking trails or campsites. These systems typically include solar panels, a battery bank for energy storage, and LED lights.
- Solar-powered telecommunications: In areas where telecommunications infrastructure is limited, solar-powered telecommunications systems can be used to provide reliable communication services. These systems typically include solar panels, a battery bank for energy storage, and telecommunications equipment.

Policy SD UT2.1: Delivering Resilient Urban Infrastructure- Water Supply and Efficiency, Wastewater Management and Storm Water Management

Purpose

This policy aims to improve the resilience of urban infrastructure networks, specifically in terms of water supply, wastewater management, and stormwater management. The policy recognises the importance of ensuring that the critical infrastructure systems are designed, operated, and maintained in a manner that can recover from shocks and stresses, such as natural disasters, climate change, and other disruptions.

- Development proposal will be permitted if they:
- Develop and implement national strategic plans to improve water supply, efficiency, wastewater management, stormwater, and encourage private and public investments in this field.
- Encourage the use of sustainable utility fixtures and fittings in upgraded development, such as low-flow fixtures, greywater systems, water metering, and modern irrigation systems within the building, and make them a requirement as part of the new Green Building code.
- Introduce control and data systems to monitor the operation and maintenance of infrastructure.
- Provide adequate and sustainable financing for improving water infrastructure and encourage private and public investments in this field.
- Commission research and guidance on the implementation and ongoing maintenance of sustainable urban drainage systems, wastewater treatment, and water supply systems.
- Provide training and capacity building for technical and managerial personnel in the water sector, and promote cooperation and partnerships between public and private sectors to exchange knowledge and achieve common goals.

Delivering Resilient Urban Infrastructure Network refers to the creation and maintenance of sustainable and efficient infrastructure systems in urban areas. Specifically, in the context of water supply, wastewater, and stormwater management, it involves developing and implementing practices that ensure the reliable delivery of clean water, safe and effective management of wastewater, and designing and maintaining infrastructure systems that can handle heavy rainfall and prevent flooding. This requires careful consideration of factors such as water demand, source protection, water conservation, and infrastructure maintenance, as well as the promotion of public-private partnerships and sustainable financing mechanisms. By delivering resilient urban infrastructure networks, cities can improve the quality of life for their residents, promote economic development, and contribute to a more sustainable future.

Water supply Infrastructure

Water supply infrastructure is divided into potable water, wastewater, stormwater, and surface water systems. Historically, people in Al-Hajar Al-Gharbi used groundwater and surface water (Adi-Aflaj) for irrigation and drinking. However, groundwater played a significant role in the water cycle in the past and continues to do so in the present. Due to the dramatic increase in population, agriculture, and the economy, alternative resources had to be found (refer to policy WR3.1).

Desalination plant

AL Hajar AL Gharbi area, like any other region in the Sultanate, is suffering from water shortages due to population growth, economic growth, and the growth of tourism. Therefore, another water resource for potable and agricultural use has been utilised. The main supply of water for irrigation and potable use in the area is the Barka desalination plant, which provides 1.76 million gallons of water per day. The water is pumped from Al-Khod pumping station through a transmission pipeline to the area, helping to cover the water shortage in Al-Hajar Al-Gharbi. In addition, potable water is transported to areas not covered by pipelines by tankers. However, there are a number of private and municipal wells in the area as well.

There is an ongoing project to develop a second line to pump desalinated water parallel to the existing one from Barka station. Furthermore, there is an initiative to create a Main Interconnected System (MICS), which will help to create an integrated transmission network to provide alternative supply systems with sufficient capacity for future demand. Additionally, there is a report on developing a desalination distribution station to supply Al-Jabal Al-Akhdar with desalinated water.

Wastewater Treatment plants (or Sewage treatment plants)

To reduce the demand for desalinated water and groundwater, wastewater treatment plants have been developed by Haya Water Company. The company is responsible for building and operating wastewater networks, pumping stations, and sewage treatment

plants. There are five sewage treatment plants in the studied area, which produce a volume of 40 m3/d, 150 m3/d, and 600 m3/d in order. Another STP in Mesfah Al-Abriin provides water for the Jabal Shams area. Although the quantity produced seems large, it is fully used in agriculture. As a future plan for the sewage treatment system, Oman Water and Wastewater Company has a plan for a future sanitary drainage project, which includes a strategy for Al-Jabal Al-Akhdar.
Figure 36 shows the existing and proposed sewer lines.

Figure 36: Existing and design sewer lines in Al Hajar Al Gharbi.

Dams

The management of stormwater in mountainous regions, such as Al Hajar Al Gharbi, poses unique challenges due to the presence of steep slopes, rocky terrain, and limited vegetation. To address this issue, stormwater management in Al Hajar Al Gharbi involves the construction of dams and the implementation of a natural drainage system. According to Figure 38, the study area contains a total of 58 dams, which can be classified into three types: surface storage dams, recharge dams, and flood protection dams.
Surface storage dams (Figure 37), which are commonly used for agricultural purposes, function as flood retention basins. These small dams are typically constructed using concrete or reinforced concrete and have a maximum storage capacity of 5,000 Mm³.

The primary purpose of surface storage dams is to intercept wadis and temporarily retain the water, reducing its speed before slowly releasing it. This process allows the water to seep into the ground while providing protection against floods.

Figure 37: Surface Storage dam.

However, the small size of surface storage dams limits their effectiveness, as they can only hold a small portion of the wadi water. Additionally, most of the water quickly evaporates during the slow-release process due to the high temperatures in the region (MRMWR 2010: 58 ff.).

An alternative is the construction of recharge dams. These dams have multiple openings to allow water to seep into the ground as quickly as possible. The openings are equipped with a filter (partition) to separate the mud (stones, clay, branches, etc.) carried by the wadis from the water.

The purpose of recharge dams is to enrich the groundwater. Some recharge dams are used to increase the water flow of Aflaj by building them near Ghaili-Aflaj and diverting the trapped water there. They could be used to provide the water needed for irrigation purposes, especially during the dry season. (MRMWR 2010: 40 ff).

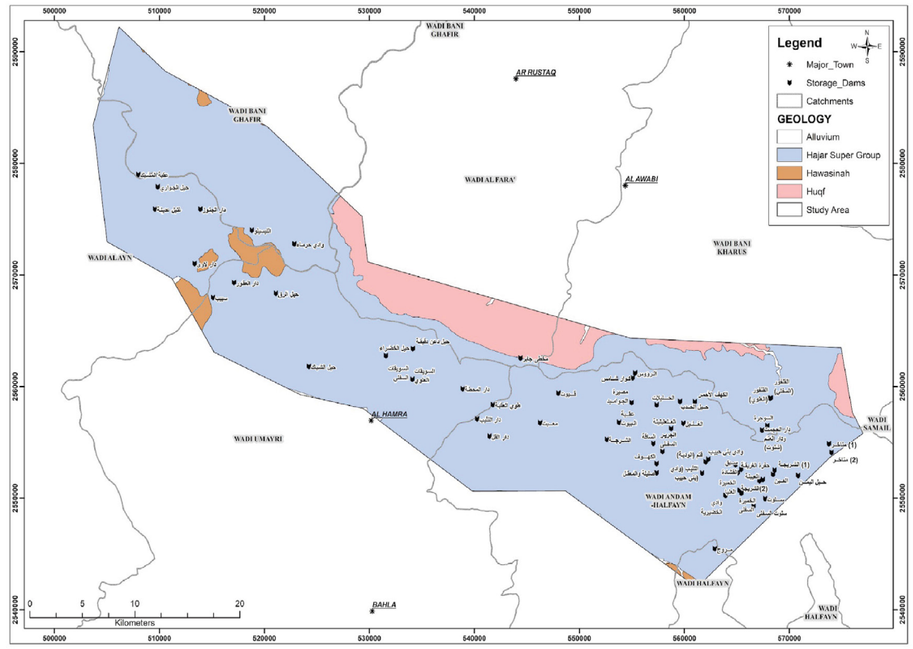


Figure 38: Distribution of Dams in Al Hajar Al Gharbi.

Policy WR 4.1.1: Delineate and Manage High-risk Flood Plain - Management, Mitigation and Adaptation to Flood risk

Purpose

The aim of this policy is to reduce the potential for flood damage and protect public safety. This policy involves identifying areas at high risk of flooding, establishing regulations for development and promoting sustainable and resilient communities in the face of flood risks.

- Development proposals should consider implementing the following:
  - Building codes and standards.
  - Implementing flood protection, mitigation, and adaptation measures that are suitable for the specific needs of the proposal, development site, and other potentially affected areas.
  - Establishing minimum requirements for the design, construction, and maintenance of buildings in high-risk flood plains to ensure that they are resilient to flood hazards.
  - Avoiding the areas that are identified by the Ministry of Housing and Urban Planning as high-risk flood areas.
  - Ensuring that the flood setback of the wadi is maintained and not compromised.
- Considering the “sponge cities” concept refer to SD12.1.1-4 To prevent roads from flood issues, sponge cities require.
- Stormwater management that aims to reduce the amount of stormwater runoff that enters high-risk flood plains by promoting the use of green infrastructure, and implementing stormwater management plans (including stormwater drainage in all settlements).
- Emergency management that outlines strategies for responding to flood events, including evacuation plans, emergency shelters, and communication plans.
- Floodplain restoration and conservation that aim to restore natural functions and values of floodplains by removing structures and restoring natural habitats.
- Public outreach and education that aim to increase public awareness of flood risks and promote individual and community actions that can reduce the impact of flooding.

High Flood Risk Areas are defined as areas that have a 1 in 100-year flood risk. When strategic development or critical infrastructure is located within these areas, priority must be given to implementing flood risk management, mitigation, and adaptation measures. These priority areas are identified as Priority Areas for Flood Risk Management (PAFRM) in Ad Dakhliyah, which include the main centers of Nizwa-Manah, Adam, Al Hamra, Bahla, Samail/Lizugh and Izki/Imti. Areas with lower flood risk as AL Hajar Al Gharbi are also identified for consideration in development decisions. To ensure the long-term resilience of development in Ad Dakhliyah, it is important to avoid development in high-risk zones and improve the capability of urban systems to evacuate floodwaters and return to a functional state, for instance, through drainage (SD12.1.1, UT2.1.1), or implement flood protection measures.

Mitigation and Adaptation measures

Green infrastructure

Green infrastructure refers to the utilisation of natural systems, such as vegetation, soils, and wetlands, to manage stormwater and reduce the impact of floods. This encompasses various techniques, including wadi park,s rain gardens, bioswales, green roofs, and permeable pavements.

One of the key benefits of GI is that it can mimic the natural water cycle, allowing rainwater to be absorbed and filtered through vegetation and soil before it enters the water system. This caracterstic reduces the volume and velocity of stormwater runoff, effectively mitigating the risk of flooding.

Wadi Parks

Wadi Park (Figure 39) is a specific type of park that is strategically located along a wadi, aimed at providing recreational spaces for communities, while also mitigating flood risks. The incorporation of green infrastructure within these parks is a common feature that enables the absorption and deceleration of stormwater runoff, effectively minimising the possibility of flooding. Furthermore, Wadi Parks are equipped with various recreational features, including walking paths, seating areas, and playgrounds, which offer an array of leisure opportunities for community members. In areas where flooding poses a significant threat, Wadi Parks play a crucial role in managing stormwater runoff naturally, thereby reducing the impact of flood-related hazards on the surrounding communities. Additionally, these parks serve as pivotal community gathering spaces that foster social interaction and promote community cohesion.

Figure 39: Example of wadi park that can occur within wadi flood plains in a rural area, saudi arabia, wadi Hanifah.

Floodable Park

A floodable park (Figure 40) is a type of green infrastructure that is designed to provide a multifunctional approach to stormwater management. The park's design includes features such as floodable basins and channels that allow water to flow in and temporarily inundate the park. This approach to park design has been shown to effectively manage stormwater runoff, mitigate the risk of flooding, and improve water quality. Floodable parks also offer additional environmental benefits, such as the provision of wildlife habitat and carbon sequestration. These parks are particularly useful in urban areas where flooding is a significant risk, as they provide a natural and sustainable approach to stormwater management. However, it is important to note that floodable parks require careful design, maintenance, and management to ensure their effectiveness and safety during flooding events. A comprehensive understanding of the hydrological and ecological processes involved is essential for the successful implementation of floodable parks.

Figure 40: Example of a floodable park before and after rain in the Netherlands.

Biowales

Biowales (Figure 41) consist of vegetated channels designed to filter and decelerate stormwater runoff. These channels are typically filled with various vegetation species, such as grasses, sedges, and wildflowers, which aid in the absorption and filtration of pollutants from the stormwater. By reducing the volume and velocity of stormwater runoff, bioswales can effectively prevent flooding and improve the quality of water. They are commonly utilised in urban areas to manage stormwater runoff from impervious surfaces like roads and parking lots. They serve as a sustainable and cost-effective approach to stormwater management, providing numerous environmental benefits while simultaneously reducing infrastructure costs.

Figure 41: Example of Biowales.

Raingarden

Raingardens (Figure 42) are shallow depressions in the ground that are filled with soil and vegetation, designed to collect and absorb stormwater runoff from impervious surfaces. The soil and vegetation in the raingarden function as a biofilter, aiding in the removal of pollutants from the stormwater. They have been shown to be effective at reducing both the volume and velocity of stormwater runoff, thereby mitigating the risk of flooding and erosion. They are a sustainable and cost-effective approach to managing stormwater runoff, and have been increasingly implemented in residential and commercial areas. The ecological benefits of raingardens include water quality improvement, soil retention, and biodiversity enhancement.

Figure 42: Example of Raingarden.

Development of Early warning system

The development of an early warning system involves the creation of a system that can detect and alert people to impending natural disasters or hazardous events. Early warning systems can be designed to detect various types of hazards. The development of an effective early warning system requires the integration of various technologies such as sensors, monitoring systems, and communication networks. The system must be able to collect and analyse data in real-time and provide timely alerts to relevant authorities and the general public. An effective early warning system can help to reduce the impact of natural disasters by enabling people to take appropriate actions and evacuate in a timely manner. The development of early warning systems is an ongoing process that requires continuous improvements and updates to ensure its effectiveness and reliability.

Oman has developed an early warning system to provide alerts and warnings for various hazards, including severe weather, flash flooding, and tropical cyclones. The system is called the National Multi-Hazard Early Warning System (NMHEWS) and is managed by the Public Authority for Civil Defense and Ambulance (PACDA). The NMHEWS utilises various technologies such as weather radars, satellite imagery, and computer models to monitor weather conditions and provide early warning alerts. The system disseminates alerts and warnings through various channels such as SMS, social media, and local media outlets. The NMHEWS has proven to be effective in providing timely alerts and warnings to the public, enabling them to take appropriate actions to protect themselves and their property from potential hazards. The system is continuously being improved to enhance its capabilities and ensure its effectiveness in mitigating the impact of natural disasters.

Development of emergency response plans

An emergency response plan typically includes the following components:

- Emergency contact information: This includes phone numbers and addresses for emergency services, key personnel, and other important contacts.
- Emergency response teams: This includes the identification of individuals who will be responsible for coordinating the emergency response effort, as well as their roles and responsibilities.

- Evacuation procedures: This outlines the steps that individuals should take to evacuate the area in the event of an emergency, including the locations of emergency exits, assembly points, and transportation.
- Shelter-in-place procedures: This outlines the steps that individuals should take to stay safe if they cannot evacuate the area, such as during a severe weather event or a hazardous materials release.
- Communication procedures: This outlines the methods and protocols for communicating with emergency responders, employees, customers, and other stakeholders during an emergency.
- Training and drills: This includes regular training and drills to ensure that everyone is familiar with the emergency response plan and knows what to do in the event of an emergency.

Implementation of evacuation systems

The implementation of evacuation systems involves the development and implementation of plans and procedures to safely and efficiently evacuate people from areas that are at risk of natural disasters. Evacuation systems can be designed for various hazards such as floods. The implementation of an effective evacuation system requires coordination and collaboration between various stakeholders, including emergency management agencies, local authorities, and the public. It involves the development of evacuation plans, identification of safe evacuation routes, establishment of evacuation centers, and the communication of evacuation orders to the public. The implementation of evacuation systems help to save lives and reduce the impact of natural disasters by enabling people to evacuate quickly and safely. It is important to regularly test and update evacuation systems to ensure their effectiveness and reliability in the event of an emergency.

Flood risk management

There are many different strategies that can be used for flood risk management, and these strategies can be implemented at different levels, from individual property owners to national governments. Some of the key strategies for flood risk management include:

- Floodplain management: This involves managing development in flood-prone areas, such as by restricting development in high-risk areas and requiring new developments to be designed to withstand flooding.
- Flood warning systems: These systems provide early warning of flood events, giving people time to evacuate or take other protective measures.
- Structural measures: These measures include building flood walls, levees, and other structures to protect against flooding.
- Natural measures: These measures include restoring natural features that help to absorb floodwaters and reduce the impact of flooding.
- Insurance: Flood insurance can help to offset the financial impact of flooding, making it easier for property owners to recover after a flood event.

Flood-resistant building codes and standards

Resistant building codes are codes that are designed to ensure that buildings are constructed in a way that can withstand natural disasters and other extreme events. Resistant building codes may include requirements for the use of specific building materials, such as reinforced concrete or steel, as well as guidelines for the design of building foundations, walls, and roofs. These codes may also specify minimum standards for the installation of electrical, plumbing, and mechanical systems. The goal of resistant building codes is to minimise the risk of property damage, injury, and loss of life in the event of a natural disaster or other extreme event. By ensuring that buildings are constructed to withstand the forces of nature, resistant building codes can help to protect communities and reduce the costs associated with disaster response and recovery.

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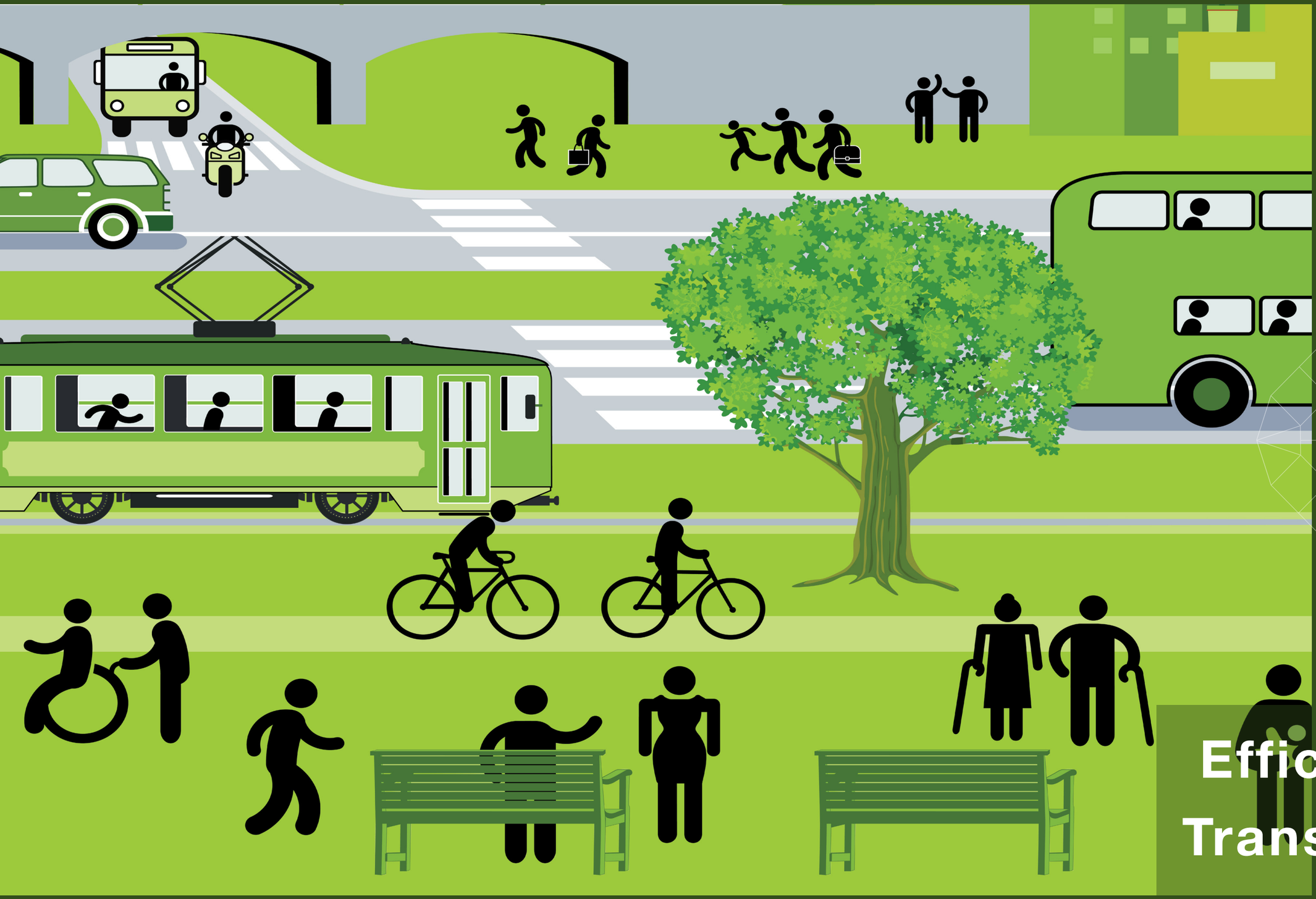

Efficient Transport

8. EFFICIENT TRANSPORT

The primary mode of transportation in Ad Dakhliyah is by car, accounting for 70% of journeys, according to Figure 43. School buses are the second most common form of transportation in the area. A desk review indicates that there are around 11 roads in the region, with many of them being unpaved and some crossing over distributed lands in Jabal al-Sharqi. The two main access roads to Al Hajar Al Gharbi are the Ad Dakhliyah road (Nizwa) for Jabal Akhdar and the Alhamra road for Jabal al-Sharqi and Jabal Shams. Additionally, there is an unpaved road directly connecting to Jabal Shams, known as the “yasab” road.

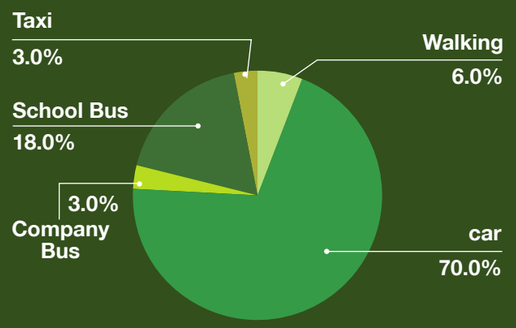

Figure 43: Transit Modes in Ad Dakhiliyah.

Policy TM 6.1.1 Encouraging Active, Healthy and Sustainable Transport

Purpose

This Policy aims to shift Al Hajar Al Gharbi towards a sustainable and walkable region through providing efficient transit modes throughout current and future settlements.

- All future development, whether intensification of land use in built-up areas, settlement expansions, or new transport interchanges should:
  - Ensure efficient connectivity of current and future towns.
  - Provide the necessary cycling and pedestrian infrastructure and reduce the impact of traffi.
  - Encourage electrification of private and public vehicles.
  - Provide continuous corridors run between proposed and existing protected areas (e.g. green and blue corridors).
  - Follow the national planning standards for dedicated walking and cycling infrastructure.
  - Promote education and awareness about sustainable transportation options to encourage behaviour change and support the transition

Encouraging active, healthy, and sustainable transport is a key objective for policymakers seeking to promote a cleaner, greener, and more efficient transportation system. Achieving this objective requires reducing the dependence on private cars and promoting more sustainable modes of travel, such as cycling and walking, which can improve public health, reduce congestion, and enhance the overall quality of life in communities.

In Ad Dakhiliyah, the pedestrian infrastructure is limited to pavements with varying degrees of quality, and there are currently no designated cycling routes or infrastructure in the area. This deficiency makes it challenging for cyclists to navigate the roads safely and limits the potential for active modes of transport to replace private car usage. To encourage active, healthy, and sustainable transport, investment is required to enable and promote these more active forms of travel.

Investment in sustainable transport infrastructure could entail the development of dedicated cycling paths and the improvement of pedestrian infrastructure, including wider pavements, pedestrian crossings, and better lighting.
Education and awareness campaigns could also be implemented to promote the benefits of these sustainable modes of travel and encourage more people to adopt them.

Policy interventions aimed at reducing the growth of private car usage should focus on reducing the demand for travel by car and increasing travel by more sustainable modes, including cycling and walking. Such interventions can reduce the carbon footprint of transportation, improve public health outcomes, and decrease traffic congestion, leading to a more sustainable and environmentally friendly transportation system.

Sustainable Transit Modes

Hiking trails (Figure 44)
Al Hajar Al Gharbi region boasts numerous hiking and donkey trails, 18 of which are allocated by the Ministry of Tourism and Heritage as itineraries, which are linked to a variety of attractions and future tourism developments. Such trails pass through:

- Geological features such as caves and hot springs.
- Cultural landscapes such as agrarian terraces and aflaj systems.
- Archaeological monuments: The site of the wreckage of the British plane participating in the Al Jabal Al Akhdar War.
- Heritage sites such as Harat, castles , forts and historical towers.

The lack of supportive amenities along hiking trails in Al Hajar Al Gharbi has hindered the accessibility and enjoyment of the outdoor activity for many people. The absence of rest areas with benches, trash and recycling bins, and clear trailheads and signage can make hiking a challenging and uncomfortable experience. To address this issue, there is a pressing need to provide supportive amenities along the trails. Such amenities may include restrooms, water fountains, and first aid stations, which can offer hikers the necessary support to enhance their comfort and safety on the trail. By providing these amenities, more visitors could be potentially attracted, and in turn, stimulate the local economy. Moreover, the provision of supportive amenities can also help to preserve the natural beauty of the region for future generations to enjoy.

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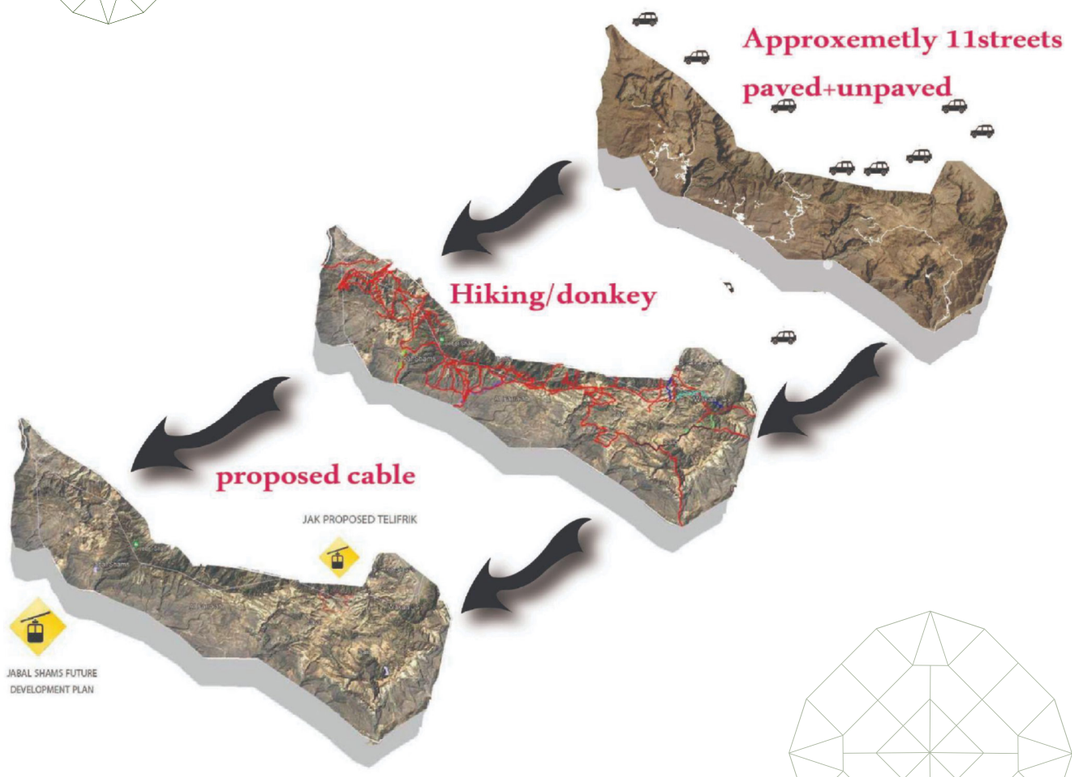

Figure 44: Proposed and Existing transit modes in Al Hajar Al Gharbi.

Cable cars

The implementation of interventions for sustainable alternatives to private cars in Al Hajar Al Gharbi, particularly for accessing mountainous areas for tourism development, is of paramount importance. One potential solution is the installation of cable cars, as indicated in the current transportation scenario. The study area has proposed the establishment of two cable car stations: Jabal Akhdar, planned by Atkins, and Jabal Shams cable car proposed by the Ministry of Heritage and Tourism.

Busses

Local bus services have the potential to enhance the public's perception of the services and the benefits they offer, particularly with respect to education, commercial, and residential development. The seamless interchange of passengers from intercity bus routes to local routes could significantly increase passenger numbers. Mwasalat, as the primary public transport service in Oman, has expressed its commitment to expanding and improving its intercity bus fleet, developing new urban routes, and creating a long-term transport master plan. However, the existing bus routes by Mwasalat do not encompass Al Hajar Al Gharbi. To address this issue, e-buses are considered a sustainable transit mode that can be introduced in the region, specifically to connect tourist attraction sites.

Walking and Cycling

The pedestrian infrastructure in Al Hajar Al Gharbi is currently limited to a range of pavements with varying degrees of quality, and there are no designated cycling routes or supporting infrastructure in the region. To promote walkability and an active lifestyle, the following improvements are recommended:

- The provision of supportive and accessible amenities and facilities, such as signage, maps, drinking water fountains, shaded corridors, and waiting areas.
- The creation of highly connected and safe walking and cycling routes to bus stops, which would enable seamless transitions between different modes of transportation.
- The introduction of e-bikes and e-scooters, accompanied by supportive amenities, to encourage the use of sustainable and active transportation modes.
- The construction of green bridges to provide safe crossings for both pedestrians and animals, which would mitigate the negative impacts of transportation infrastructure on local ecosystems.

The activation of corridors between buildings as walking pathways, which would create a more pedestrian-friendly environment and encourage active transportation. By implementing these improvements, the region can enhance its pedestrian infrastructure, promote sustainable transportation modes, and improve the quality of life for local resident.

Table7: Guidelines for sustainable transportation.

Threats	Guidance for sustainable transportation
Public transportation	❁ Promote and invest in public transportation systems such as buses to reduce reliance on personal vehicles.
Active transportation	❁ Encourage walking, biking, and other forms of active transportation by providing infrastructure such as sidewalks, bike lanes, and safe crossings.
Efficient vehicles	❁ Promote the use of fuel-efficient and low-emission vehicles such as hybrid and electric cars, and encourage the adoption of alternative fuels such as biofuels and hydrogen.
Smart growth	❁ Promote smart growth principles that emphasise compact, walkable, and mixed-use development to reduce the need for personal vehicles and promote sustainable transportation options.
Transportation demand management	❁ Implement transportation demand management strategies such as carpooling, ride-sharing, and telecommuting to reduce the number of vehicles
Urban planning	❁ Incorporate sustainable transportation principles into urban planning and design, such as the use of transit-oriented development and complete streets.
Green infrastructure	❁ Encourage using interlock roads that leaks rain water, to prevent plants from excessive moisture, flood risks and fungal diseases.

9

CULTURAL HERITAGE

9. CULTURAL HERITAGE

The Hajar Gharbi region is widely renowned for its remarkable natural beauty, rugged topography, and significant cultural heritage. The mountain range is home to several ancient villages and archaeological sites that bear witness to the area's long and fascinating history.

Notably, the historic village of Misfat Al Abriyeen is a cultural landmark in the region. The village, nestled in the mountains, boasts traditional mud-brick houses, narrow alleyways, and ancient falaj irrigation systems, exemplifying traditional Omani architecture and providing a rare glimpse into rural Omani life.

Furthermore, the Western Hajar Mountains feature the UNESCO World Heritage Site of Bat, Al-Khutm, and Al-Ayn, which date back to the third millennium BC. These sites house numerous tombs, settlements, and other archaeological remains, offering valuable insights into Oman's ancient past. Additionally, the Jabal Shams and Jabal Akhdar mountain ranges in the region hold significant cultural assets.

The Western Hajar Mountains are also renowned for their traditional crafts, including weaving, pottery, and silverwork. These crafts have been practised in the region for centuries, and many artisans continue to produce high-quality, handmade goods using traditional techniques, contributing to the preservation of Oman's cultural heritage.

Policy CH3.1.1: Diverse cultural landscapes and "the living heritage"

Purpose

The aim of this policy is to introduce conservation tools for areas that qualify as mixed heritage in the Al Hajar Al Gharbi area. As well as sustain the original function of the living heritage site, traditional know-how and social practices.

- Development proposals within and outside designated cultural landscape sites will be permitted if they:
  - Adopt a landscape-led approach and respect the local and heritage character (refer to policy SD11.1.1).
  - Recommend special planning controls thus preventing the visual deterioration of these landscapes.
  - Provide a framework for the involvement of local communities in the conservation process in the form of a co-management board
  - Maintain sustainable traditional land-uses.
  - Boost tourism and create jobs for the local communities.
- Development proposals will be supported that market historical and cultural assets and should increase traditional know-how to prevent cultural erosion and promote tourism in such area.
- Implement The 'Living Heritage' approach which provides a practical process for communities to participate in the conservation and management of the historic and cultural environment.
- Encourage development proposals that aim to revive, renovate or reuse important historical and cultural sites/buildings.
- Raise awareness on the importance of rehabilitating, conserving and reviving the cultural heritage within the region.

Cultural landscapes represent a unique interplay between nature and human activity, reflecting a long and intimate relationship between people and their natural environment. This conservation tool, introduced by the World Heritage Committee in 1992, offers an option for listing sites of "mixed heritage," which feature both natural and cultural elements, such as the historic wadis in Oman.

In Ad-Dakhiliyah, the RSS has identified several cultural landscapes in the Al Hajar Al Gharbi region, including Wadi Al Nakher, Wadi Tanuf, and Wadi Bani Habib. Beyond the wadis, the area encompasses numerous historical landscapes shaped by human activity, such as agrarian terraces, harat, aflaj systems, and other built heritage. These sites possess significant ecological, cultural, and scenic value and merit prioritisation for conservation and protection.

Designating these cultural landscapes as heritage sites will enable their recognition and appreciation from a historic, cultural, and touristic perspective, harnessing their tangible and intangible heritage as drivers for sustainable development.

Existing heritage assets (Tangible and intangible) (Figure 47)

Agrarian terraces

Terraced farming has been a crucial element of Oman's local cultural landscape, serving as both a means of sustenance and a fundamental component of its agricultural practices. Agrarian terraces (Figure 45) are earthen structures built on rugged mountainous sites to grow a variety of crops while reducing water consumption used in irrigation. Stepped ridges are constructed on slopes to form a series of low, flat, cultivable ridges, connected to a runoff channel placed directly above these ridges.

Figure 45: The Agrarian Terraces in Jabal Al Akhdar.

The agrarian terraces are part of an ecosystem that encompasses the Harat or Village-Oasis (built fabric), the social fabric, as well as the falaj and should be preserved as such. These terraces are critical in increasing agricultural areas and their productivity, providing a natural and direct way of water harvesting and utilising rainwater for irrigation. Moreover, the presence of vegetation in mountainous areas contributes to the reduction of soil erosion and deforestation.

In the Al Hajar Al Gharbi region, these terraces are predominantly found in Wadi Bani Habib, Al Ayn village, Saiq Plateau, and Sayh Qatnah. Local communities and tourists alike may experience the harvest of pomegranates, peaches, walnuts, apricots, and grapes in Wadi Bani Habib, rose harvesting in Sayh Qatnah and Al Ayn village, walnut harvesting in Wadi A Manakhir, and mango harvesting in Blad Sayt.

Water Features

Water has been a vital resource for human settlements throughout history, and the same holds true for the Al Hajar Al Gharbi region. Settlements in this region have been established near water sources such as wadis, springs, and natural waterfalls, as seen in Sayh Qatnah. The traditional aflaj irrigation system (Figure 46), unique to Oman, holds significant cultural value in terms of its construction and management.

Apart from their primary function as an irrigation system, aflaj represent a heritage asset that remains largely unexploited from a touristic perspective. However, the aflaj, as a water provider, face mounting pressure due to the growing demands for water within the agricultural sector. In some cases, channels are drying up due to uncontrolled farmer practices of digging boreholes and pumping water from the water system.

Figure 46: Falaj.

Harat and Historical buildings (Forts, castles, towers)

Omani harat, of which they form an integral part, developed in areas where local resources, mainly water and cultivable land, allowed them to thrive. Depending on the location and the availability of building materials, the walls and buildings were constructed using sun-dried mud bricks or stone structures, or a combination of both. Ceilings and roofs were supported by quartered palm tree trunks. However, today, most harat have been abandoned by their former residents who have moved into new accommodation units serviced by modern infrastructure. Furthermore, in inhabited harat, the absence of development controls and urban design guidelines for traditional villages has led to a loss of the harat character.

Fortified architecture has always been a symbol of the Ruler's authority in Oman. The construction of forts and watchtowers increased significantly following the Portuguese occupation in the 16th century. However, the vast majority of forts, castles, and watchtowers are the legacy of the Yarubis and Al Bu Said dynasties. Typically, forts are constructed from stone and Sarouj, a local ingredient used for both mortar and plaster. The fragility of the building materials used in fortified architecture results in the rapid dilapidation of forts, posing a challenge to their conservation.

Harat and Historical buildings conservation strategy

Due to the large number of Harat and historical buildings in the Al Hajar Al Gharbi region, it is difficult to conserve and restore all of them.

Therefore, there is a need to find an economically viable adaptive reuse option that would be of public and touristic interest.

The MoHT has divided the Harat into three different levels, indicating their priority for restoration. The high-priority Harat are designated based on their historical importance, endangerment, and strategic location. The restoration of towers, on the other hand, is based on their endangerment, strategic location, and architectural interest for adaptive reuse, in order to enhance the tourism offerings.

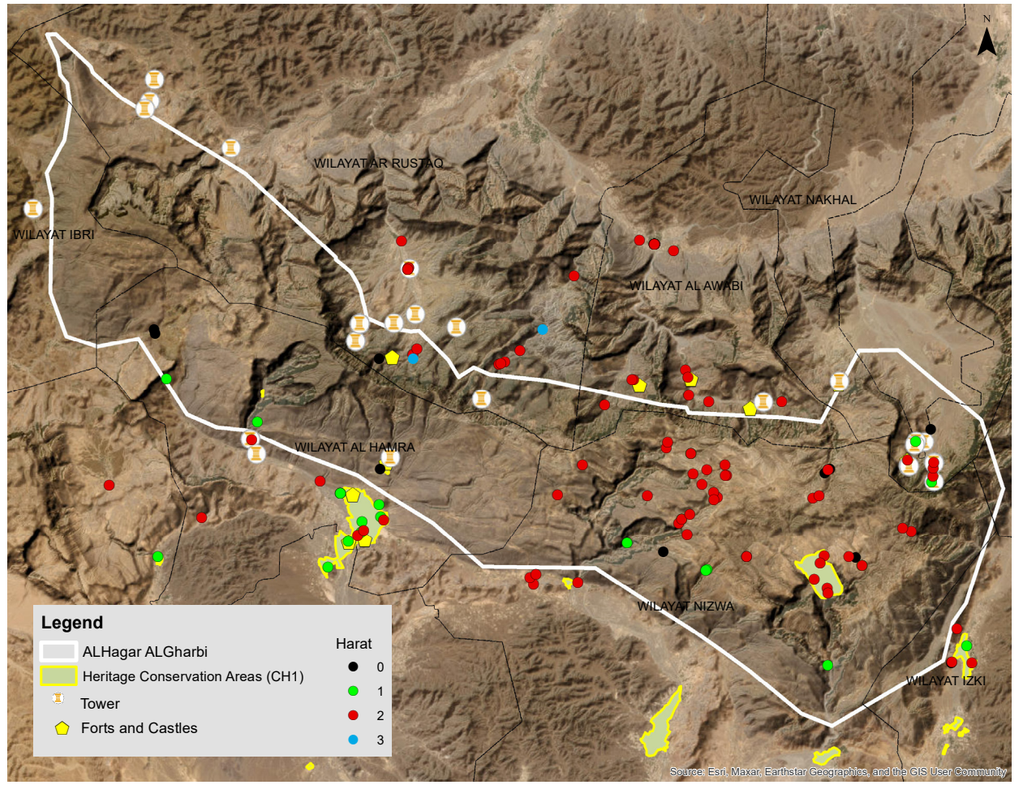

Figure 47: Heritage Conservation Areas.

Table 8: Guidelines to preserve and enhance existing cultural landscapes and living heritage within the region.

Existing cultural landscape	Preservation Guidelines
Agrarian terraces	• Revive existing agrarian terraces through reviving surrounding aflaj systems. • Encourage the use of hydroponic technology. • Grow High-value crops (refer to policy GP 3.2.1). • Promote the use of local fertilisers. • Discourage the use of agricultural pesticides. • Revive the abandoned agrarian terraces. • Increase traditional know-how on the importance of preserving agrarian terraces for future generations. • Promote ecotourism and create Eco-Lodges near agrarian terraces. • Connect the terraces to hiking trails.
Aflaj System	• Keep aflaj systems maintained and revive drying up systems; • Increase traditional know-how on the importance of preserving existing water bodies for future generations to inherent traditional omani values; (e.g. the traditional aflaj distribution system). • Prevent littering and polluting water bodies within the area (Refer to Policy WR2.1.1). • Encourage activities that embrace and utilise existing wadi channels, aflaj systems, etc (e.g. wadi parks).
Built heritage	• Preserve the inherited values of ancient Omani architectural skills and adopt some of these values in modern architecture to ensure cohesion with the surrounding environment (e.g. Earthen architecture, courtyards ventilation system). • Consider Heritage management plans set out by MoHT in restoration process. • Restore degraded built heritage using traditional building materials such as clay plaster or sarooj for buildings and wooden materials in the external doors & windows of the building. • New Developments surrounding built heritage site should apply appropriate setbacks , 80-100 m, to preserve the built heritage.

Continue Table 8: Guidelines to preserve and enhance existing cultural landscapes and living heritage within the region.

Existing cultural landscape	Preservation Guidelines

	• Provide supporting infrastructure to revive the built heritage and encourage tourism.
	• Celebrating, respecting, and reviving cultural heritage including the historic environment and the sense of local and regional identity.
	• Ensure new developments surrounding heritage building safeguard the visual integrity of the place by:
	  • Adopting the colours of sarooj or mud.
	  • Implementing appropriate building height – not higher than the archaeological site
	  • Motivate house owners within the harat to contribute with the development of their houses and encourage its maintenance, appropriate expansion and rebuilding to adaptively reuse (refer to MoHT for recommended/ reliable renovation companies).
	  • Safeguard Oman's cultural values by encouraging "The living heritage" approach to involvement of the local community and sustainability of intangible heritage (e.g. living museum)
	  • Restorate castles, forts and historical towers, and re-animate it by introducing (castles and forts museums) concept, as a method of connecting people with ancient Omani life stories.

10

GROWTH AND PROSPERITY

10. GROWTH AND PROSPERITY

The economy of Ad Dakhiliyah Governorate is primarily based on agriculture, livestock, and tourism. The region is well known for its high-quality agricultural products such as pomegranates, apricots, and dates. Livestock farming is also an important sector with cattle, sheep, and goats being the main types of animals raised. In addition to agriculture and livestock, the governorate has been making strides in the tourism industry, with visitors coming to see the historic forts, museums, and traditional markets that are located in the area. The development of infrastructure and the promotion of cultural heritage sites are some of the key areas that are being focused on to attract more visitors to the region. Overall, Ad Dakhiliyah Governorate has a diverse and thriving economy that is continuing to grow and evolve.

This section includes three policies contributing to the growth and prosperity of the Hajar Gharbi region: Policy GP3.1.1: Local economy aims to cover the local economy assets within the region, Policy GP3.1.2: Agriculture which aims to revive and enhance the agricultural sector, and Policy GP3.1.3: Tourism focusing on the importance of activating and managing tourism activities within the region.

Policy GP 3.1.1: Local Economy

Al Hajar Al Gharbi region has diverse economic assets that can be leveraged to support sustainable economic development and improve the livelihoods of the local communities. In addition to agriculture, livestock, and tourism, there are other economic assets within the region. These include the handicrafts of the locals which attach great importance to visitors and tourists in the region, as well as manufacturing, metalwork, jewellery, pottery, and medium and small local businesses.

Purpose

This policy aims to strengthen and develop the local economy sector to ensure the ability of the western Hajar region to absorb all developments and activities related to the local economy. Preserving the assets and resources of the existing local economy, improving the well-being and prosperity of the local economy with sustainable development in its true sense.

• Proposals for local economic development will be supported within Al Hajar Al Gharbi that will:

- Promote and protect local businesses linked to key sectors such as farming and tourism specifically in town centres.
- Encourage rural supply chain km (e.g., local handcrafted, and manufactured products).
- Encourage family-owned independent businesses (mom-and-pop businesses).
- Allocate areas dedicated to pop-up markets supporting seasonal festivals and local business (e.g., rose harvest festival).
- Establish entrepreneurial souqs that are dedicated to new and developing businesses.
- Promote a healthy business environment considering quality sites, supporting infrastructure, etc.

• Within the smaller village centres, development proposals will be permitted where they are compatible with their historic nature, relevant to any existing shops and services.

• Attract domestic and foreign investment where applicable through encouraging all development proposals to be well served with infrastructure and accessible via multi-modal transport networks and facilities (refer to policy TM 6.1.1).

• Giving priority to development projects for the local community in order to raise the standard of living of the residents.

Strategies to boost the local economy of Al Hajar Al Gharbi

Implementing these strategies, the Western Hajar Mountains can attract more tourists, create jobs, and generate income for local communities, while also preserving the region's natural and cultural heritage.

Promote local products

Pop-up markets (Figure 48) are temporary markets that can be set up in various locations, such as public spaces, parks, or community centres, for a limited time. Encouraging pop-up markets in the Al Hajar Al Gharbi region can promote entrepreneurship, support local businesses, and provide a platform for artisans and farmers to sell their products.

Encouraging local entrepreneurship can promote economic self-reliance and reduce dependence on external sources of income. Supporting local businesses and start-ups can also create employment opportunities and keep money circulating within the local economy. In addition, supporting traditional handicrafts can preserve cultural heritage while generating income for local artisans. Promoting the use of eco-friendly materials and production techniques can also reduce the negative impacts on the environment.

Figure 48: Local Market (Pop-Up Market)

Develop supporting infrastructure

By taking a comprehensive approach to infrastructure development, the region can become a more attractive place for businesses to invest, tourists to visit, and residents to live and work. (Refer to Infrastructure & Transport sections)

- Improve transportation networks: Better roads, highways and public transportation options can help to connect the Western Hajar Mountains with nearby cities and towns, making it easier for people and goods to move in and out of the region. (Refer to Policy TM6.1.1)
- Invest in telecommunications: Access to reliable and fast internet and mobile networks can help businesses to connect with customers, suppliers and partners beyond the region, which can lead to increased business opportunities and growth.
- Developing water infrastructure: Identifying water sources, developing treatment and distribution systems, implementing conservation measures, educating the public, and exploring alternative sources of water.

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Foster Collaboration

Working together with local government and private authorities, businesses, and community organisations can help to identify common goals and priorities for the region, and develop solutions that benefit everyone.

Encourage innovation

Encouraging innovation and entrepreneurship can create new products, services, and industries, creating new economic opportunities. This can be achieved by providing financial and technical support to entrepreneurs and start-ups.

Policy GP 3.1.2: Agriculture

Jabal Akhdar is renowned for its agricultural terraces, biodiversity, and climate (Al-Kalbani et al., 2014), and holds significant cultural importance in Oman, as well as being a popular tourist destination. However, the high-altitude agroecosystems are vulnerable to modern development, road construction, and climate change. The Al Hajar Al Gharbi region is famous for its wadis and terraced orchards, where pomegranates, apricots, and roses grow in abundance due to the mild Mediterranean climate.

The main issue facing agricultural lands within the region is water availability. Traditional irrigation methods such as flood or surface irrigation are still commonly used by farmers in conjunction with the Aflaj system. Pomegranate cultivation and rosewater extraction are the main activities that require irrigation with water from dams and aflaj. Therefore, reduced availability of groundwater in the future could be a limiting factor on agriculture, which is the main groundwater user.

In the future, the focus in the Al Hajar Al Gharbi region is expected to shift towards high-value crops, cultivated especially for high-value Omani food markets and restaurants associated with the growing tourism sector. This would allow for the showcasing of local produce and the heritage value of agriculture, which in turn could support growth in the region's cultural tourism sector.

Purpose

The aim of this policy is to preserve and revive agricultural lands within Al Hajar Al Gharbi for future agricultural development.

- Development proposals within or nearby agricultural land will be permitted if they don't obstruct the maintenance of agricultural areas and ensure optimal water use.
- Safeguarding land suitable for agriculture to allow for future agricultural development.
- Raise awareness on the importance of maintaining a healthy agricultural environment and encourage healthy solutions;
- Agricultural development proposals will be allowed if they:
  - Allocated within designated lands suitable for agriculture uses.
  - Prioritise commercial agriculture, over other types of development.
  - Optimise water consumption.
  - Utilise Sustainable farming methods.
  - Maintain small-scale, family-based farming traditions.
  - Transferring know-how knowledge of sustainable agriculture to the locals.
  - Encourage and promote agro-tourism activities
- Expansion of agricultural areas will be permitted if:
  - Does not affect water resources (refer to policy WR 2.1.1).
  - It is in the public interest, local food security, and only with available land, suitable soil, and groundwater.
  - Based on high-quality crop cultivation (e.g., olive and pomegranate farms).

Revive agricultural lands

Due to its rugged terrain, harsh climate, and limited water resources, agriculture is a challenging endeavour in Al Hajar Al Gharbi. However, with the right techniques and strategies, it is possible to revive agricultural lands in the Hajar Mountains. One approach is to implement sustainable farming practices that conserve water and soil. By adopting sustainable measures and working in partnership with local communities, it is possible to rejuvenate agricultural lands in the Hajar Mountains and contribute to the economic and social well-being of the region. The following are some measures to revive agricultural lands within the region:

- **Share awareness on the importance of maintaining traditional farming methods**

Maintaining traditional farming methods is important for preserving cultural heritage, promoting sustainable agriculture, protecting biodiversity, supporting local economies, and ensuring food security. Raising awareness about their significance can help ensure that these methods are conserved for future generations.

- **Traditional festivals to showcase traditional farming methods and equipments**

Festivals are a great way to learn about, appreciate and relive the traditional farming methods that have been used in the Hajar Mountains region for centuries

- **Activating agrarian terraces**

By activating agrarian terraces in Hajar Mountains, farmers can improve crop yields, conserve water, reduce soil erosion, and enhance the natural beauty of the region. Additionally, this can provide economic benefits to local communities by promoting sustainable agriculture practices and creating new job opportunities.

- **Develop supporting infrastructure**

Developing supporting infrastructure for agricultural lands is important because it can improve farmers' access to markets, resources, and services, increase productivity, reduce post-harvest losses, and promote rural development. Investing in agricultural infrastructure can support farmers, improve food security, and promote sustainable agriculture.

- Focusing on adding value to traditional agriculture to improve the efficiency and productivity of the majority of existing farms.

Table 9: Sustainable agricultural practices.

Threats	Sustainable Measures
Soil	• Avoid overgrazing • Building healthy soil and preventing erosion • Prevent desertification caused by the removal of natural vegetation
Water	• Consider the use of drip irrigation systems to conserve water and reduce wastage • Prevent water pollution.
Pests and Invasive Plants	• Use eco-friendly farming techniques that minimise the use of harmful chemicals and pesticides. • Encourage organic local fertilisers. • Vehicles used for transporting produce should be kept clean and maintained in good condition. • Train volunteers/farmers on effective methods to mitigate and remove invasive species.
Crop Production	• Diversify agriculture production and encourage the production of high-value crops including fruit trees, vegetables as well as value-added products in both crop and livestock production to improve nutrition, income and livelihoods. • Encourage crop rotation.
Climate Change	• Storing carbon on farms • Increasing resilience to extreme weather by planting native or drought-resistant crops that are adapted to the local environment.

Sustainable agricultural practices

Encourage agro-tourism

Agro tourism is a synergistic combination of agriculture and tourism. Linking agriculture with tourism to develop experiences around culture, traditions, heritage, food and wellness. Agro-tourism in the Hajar Mountains provides visitors with a unique and authentic travel experience, allowing them to connect with the local community, learn about traditional farming practices, and explore the natural beauty of Oman's northern region.

Modernisation within the region should focus on augmenting traditional practices with modern techniques to improve efficiency and sustainability, without losing their heritage value. It is also essential to link farmers to markets, and provide subsidies for added value to the region's products and support of agricultural services and activities. The following are some agro-tourism activities that visitors can participate in the Hajar Al Gharbi region, including:

- Visiting local farms and orchards to learn about traditional farming practices and to taste and purchase locally grown produce, such as dates, pomegranates, roses and apricots.
- Participating in agricultural activities such as planting or harvesting crops alongside local farmers.
- Staying in a local guest house or farmstay to experience the local culture and way of life.
- Taking guided hikes or mountain biking tours through the rugged terrain of the Hajar Mountains.
- Learning about the production of traditional products such as pottery, weaving, rosewater and honey.
- Observing the local wildlife, such as the Arabian leopard and Ibex, in their natural habitat through guided wildlife tours.
- Exploring the local history and culture through visits to ancient ruins and historic sites.
- Participating in cooking classes to learn about traditional Omani cuisine and how to prepare local dishes.
- Experiencing the process of making traditional Omani handicrafts such as pottery and weaving.
- Participating in community-based conservation efforts, such as reforestation and animal conservation.

- Observing the local wildlife, such as the Arabian leopard and Ibex, in their natural habitat through guided wildlife tours.
- Participating in community-based conservation efforts, such as reforestation and animal conservation.

Policy GP 3.1.3: Tourism

Al Dakhiliyah is the third most visited governorate in terms of domestic tourism, after Muscat and Al Batinah South, with almost 1.3 million visitors each year, according to the MoHT. The primary purpose of visits is for leisure and recreation, followed by visiting friends and relatives.

The MoHT predicts that by 2040, tourism in Al Dakhiliyah will attract more than 700,000 overnight tourists, create over 20,000 tourism jobs, and offer 4,400 hospitality keys. The region's natural, adventurous, and cultural products will sustain this growth, operating year-round, engaging local communities, and adhering strictly to sustainability principles.

Al Hajar Al Gharbi's touristic appeal lies in its natural beauty, cultural heritage, renowned handcrafts, jewelry, and metalwork. Tourists often seek adventure, cultural immersion, and a chance to experience the region's unique beauty. The Hajar Mountains offer the greatest potential for growing the tourism economy, especially as part of the proposed cross-governorate heritage trail, known as The Copper Road.

The plots allocated for tourism purposes in Al Hajar Al Gharbi are grouped into five categories based on their current and potential future use (Figure 49).

Based on the preliminary analysis of available plots, there are approximately 100 tourism plots, proposed and existing, distributed in the study area provided by the MoHT. Roughly 85% of Plots are not implemented due to:

- Lack of proper integration among Government bodies and Authorities delaying the implementation of the proposed project.
- Limited holding capacity of the Hajar Al Gharbi region.
- Non-strategic tourism land distribution.
- Lack of balance between proposed future tourism development master plans and tourism land requests.

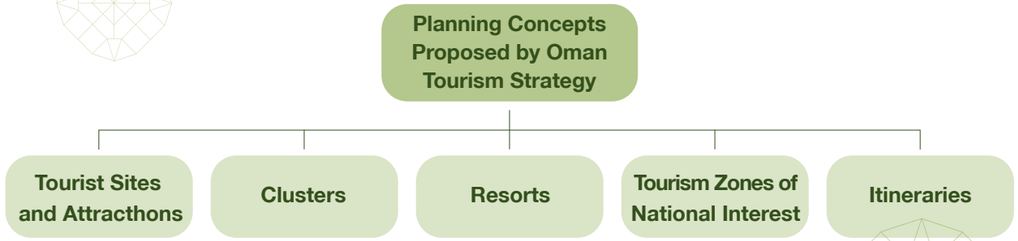


Figure 49: Categories of allocated plots for tourism.

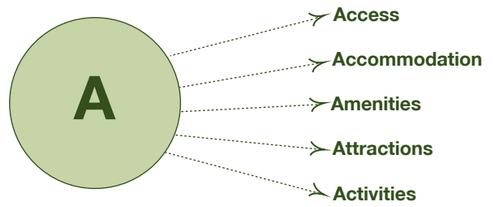
Purpose

The aim of this policy is enhance and grow the tourism sector in a way that ensure the extent to which Al Hajar al Gharbi area is able to accommodate all tourism related developments and activities; preserving existing tourism assets and resources, and safeguarding, and or improving, the welfare and prosperity of local communities - sustainable development in its true sense.

Tourism development proposals within Al Hajar Al Gharbi will be supported where they:

- Support and enhance the economic development potential of locally-driven eco-tourism.
- Encourage locally owned and managed tourism.
- Optimise social and economic returns for the local population and the Governorate;
- Introduce interventions for sustainable alternatives to private cars (refer to policy TM 6.1.1).
- Ensure that tourism developments are carefully planned and managed to minimise environmental impacts (refer to Policy TE 1.1.1).
- Support creation of visitor centres or Eco-museums showcasing the history of Aflaj water management system and traditional agricultural practices (Refer to Policy CH3.1.1).
- Bring investment to support tourism infrastructure including transportation, visitor facilities, and hospitality.
- Enhance the quality of control and evaluation of tourism projects to ensure their sustainability and provide several options for prices to ensure the benefit of the largest segment of society.
- Immediate action to raise awareness and deal with the threat of off-road driving and developing tourism.

The '5As of Tourism' that represent the essential requirements to boost tourism in the region:



Access

Transportation is essential for physically moving tourists from their place of residence to their destination. Most of the existing tourist attractions in the region are accessible via surfaced roads. However, some attractions in Al Hajar Al Gharbi are located between summits, wadis, and archaeological sites and need to be accessible to visitors. The primary mode of transportation in the region is currently fossil fuel vehicles. Implementing sustainable transportation alternatives, as outlined in Policy TM6.1.1, would help reduce the negative impact on the environment caused by private cars.

Accommodation

Accommodation supply in Al Dakhiliyah is concentrated in small establishments (on average 30 rooms), mainly low quality accommodation. The low occupancy rate (30%) can create profitability issues for owners. However, the 6 hotels rated 3 - 5 stars are achieving an occupancy of 57.3%, but are perceived to be expensive and do not offer a family product. Several new developments in the region appear to cater to family tourism at upscale levels domestically and regionally.

According to Oman Tourism Strategy, an important share of tourists do not choose hospitality services due to the lack of quality and affordable services. In 2016, 65% of GCC tourists travelled to Oman stayed with friends and relatives, as it was the second most popular accommodation preference.

Leisure and recreation tourism is the main motivation for Europeans. The Omani tourism industry caters primarily to European tourists (from UK and Germany) travelling for Leisure and Recreation purposes. Consequently, tourism products and services need to respond to the particular demands of Europeans in terms of service quality standards. Main segment is Senior Adults interested in discovering nature or cultural assets of the region.

There are approximately more than 14 implemented projects in Al Hajar Al Gharbi area, including resorts, hotels and rehabilitated Harat used as lodging houses. Alila hotel is one of the most popular hotels in Al Hajar Al Gharbi region due to its sustainable approach. This hotel was able to generate local employment opportunities, use local building materials to blend in and promote different activities within the vicinity. However, many domestic tourists cannot afford it due to its skyrocketing prices!

Amenities

Amenities are the services required to meet the needs of tourists while they are away from home. These include public toilets, signage, retail shopping, restaurants and cafes, tourist centers, telecommunications, and emergency services.

According to the Oman Tourism Strategy, tourists in Al Dakhiliyah do not have convenient access to amenities, especially in the mountains where services are in short supply. There is a limited number of tourist information centers, and informational materials are scarce.

Tourist information centers can be established to provide information about the attractions, activities, and amenities in the region. They can also offer maps, brochures, and other helpful resources to help visitors plan their trips.

Attractions

The Hajar Mountains offer a variety of unique attractions for tourists interested in cultural heritage, nature, and adventure. The MoHT has proposed tourism clusters within the region that are connected by 18 itineraries (hiking trails) passing through different attractions to achieve an optimal touristic experience (Figure 50). Jebel Shams, the highest peak in Oman, is a popular destination for adventurers seeking a challenging hike and stunning views of the surrounding canyons. The traditional village of Misfat Al Abriyeen offers visitors a glimpse into Oman's rich cultural heritage with its ancient mud houses and narrow streets. The Al Hoota Cave is a remarkable underground wonderland filled with stunning rock formations and subterranean lakes. Wadi Ghul, also known as the "Grand Canyon of Oman," offers breathtaking views of the rugged terrain and is a popular destination for hiking and mountain biking. The cool, refreshing waters of Wadi Bani Khalid's natural pools provide a welcome respite from the heat of the desert. Overall, the Western Hajar Mountains offer a diverse range of attractions that appeal to both adventure seekers and those interested in exploring Oman's cultural heritage.

Activities

The Al Hajar Mountains offer a unique and diverse range of natural landscapes and cultural experiences that can attract tourists from around the world. By providing tourism activities in this region, local communities can benefit from increased economic opportunities, job creation, and the preservation of their cultural heritage. Tourists can engage in activities such as hiking, rock climbing, bird watching, and exploring traditional villages, which not only offer a unique travel experience but also support the local economy. Moreover, the revenue generated from tourism can be used to fund conservation efforts, protecting the region's natural beauty and biodiversity.

Overall, providing tourism activities in the Western Hajar Mountains can have a positive impact on both the local community and the environment.

Develop adventure sports

The region is popular for adventure sports such as rock climbing, hiking, and mountain biking. Investing in infrastructure and facilities for these activities can attract adventure tourists and generate income for local businesses.

Develop ecotourism

The Western Hajar Mountains are rich in natural resources such as wadis, mountain trails, and unique flora and fauna. Developing ecotourism in the region can help create jobs and generate income for local communities. This can include offering guided tours, building eco-lodges, and promoting responsible tourism practices to preserve the region's natural beauty and biodiversity.

Support cultural heritage

The Western Hajar Mountains have a rich cultural heritage, including traditional norms, historic buildings, etc. Preserving and promoting these cultural practices can attract tourists and generate income for local communities. This can include organising cultural events, building museums, and creating cultural trails for visitors. (refer to Policy CH3.1.1)

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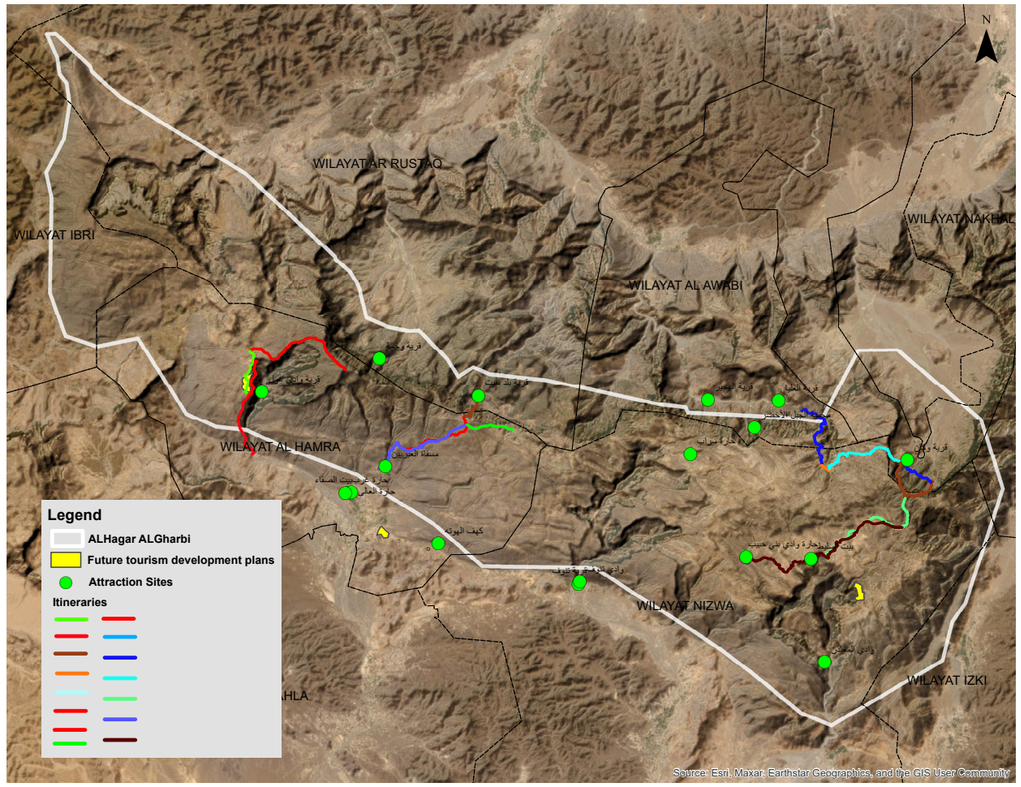

Figure 50: Policy GP 3.1.3: Tourism.

Table 10: Guidelines for thr 5As of Tourims.

'5As of Tourism'	Guidelines
Access	❁ Green corridors that promote walking and cycling . ❁ Encourage investment ❁ Encourage sustainable transit modes (refer to Policy TM6.1.1). ❁ Introduce cable cars. ❁ Provide shared shuttles to main tourism attractions and clusters. ❁ Utilise current alleyways between building as shaded pedestrian walkways to connect places together. ❁ Promote shading through building façade and landscaping.

Continue / Table 10: Guidelines for thr 5As of Tourims.

'5As of Tourism'	Guidelines
Accommodation	❁ Ensure that future accommodation proposals match the expected number of visitors and in line with the area's holding capacity to achieve high occupancy. ❁ Avoid disturbing and pressuring existing settlements ❁ Provide inclusive and affordable accommodation services that caters to all ❁ Provide a variety of accommodation typologies (e.g. hotels, resorts, glamping, lodging houses, etc)
Amenities	❁ Create a consistent wayfinding and signage system along the routes, in both English and Arabic. ❁ Encourage cooperation among stakeholders in the provision and management of supporting amenities. ❁ Avoid repetition by providing a diverse range of amenities within close proximity. ❁ Support existing tourist attractions and developments, including hiking trails, with proper amenities. ❁ Introduce the concept of Wadi parks with necessary services, such as public restrooms, signage, restaurants, and more. ❁ Provide Omani boutique shops and tourist information points to acknowledge the importance of the cultural heritage in the area.
Attractions	❁ Preserve natural and cultural attraction sites from major developments, littering, and other harmful activities. ❁ Ensure that all proposed developments within close proximity to attraction sites follow the Landscape Policy and guidelines. ❁ Encourage soft development to minimise the impact on the environment and preserve the natural beauty of the region. ❁ Include the local community and/or rangers to maintain and preserve attraction sites.

Continue / Table 10: Guidelines for thr 5As of Tourims.

'5As of Tourism'	Guidelines
Activities	• Develop a comprehensive tourism management plan that considers the environmental, social, and economic impacts of tourism and provide guidelines for sustainable tourism development. • Protect natural resources from the negative impacts of tourism (Refer to Policy TE1.1.1/TE1.2.1). • Develop strategies to promote cultural awareness among visitors, such as offering guided tours by local experts and promoting cultural events and festivals. • Encourage responsible tourism practices such as: ◍ Minimising waste. ◍ Respecting local customs and traditions. ◍ Informational materials, such as brochures and signs. ◍ Monitor and evaluate tourism activities: The management plan should include a system for monitoring and evaluating tourism activities and making adjustments as needed.

11

Community Involvement and Awareness

11. COMMUNITY INVOLVEMENT AND AWARENESS

Policy SD9.1.1: Involvement and engagement.

Effective communication and coordination across partnerships is key. Well-run community engagement will bring extensive benefits to the development of Al Hajar Al Gharbi, as demonstrated in Figure 51, and will encourage the involvement of residents, groups, businesses, and developers.

Purpose

Community engagement is the active participation of local residents and community groups in the decisions that affect their lives. This policy aims to provide guidance for effective community communication, as well as a range of consultation methods that can be used for engagement.

- All major development proposals should encourage:
- Active involvement and consultation of local communities in planning processes, communication, sharing of knowledge, best practices, and experiences across the region.
- Community participation in the management of valued landscapes and the natural resources and heritage values that they contain.
- Urban planning workshops in partnership with stakeholders or locals.

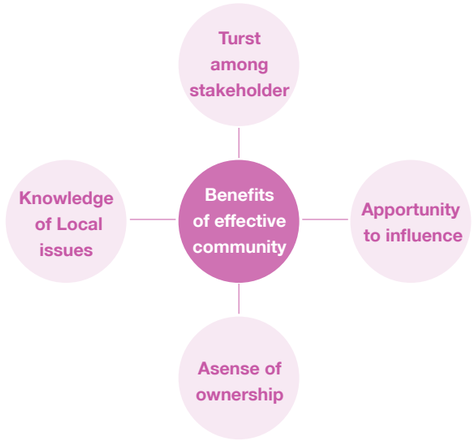

Figure 51: Benefits of effective community.

Effective Engagement Approaches

Effective community engagement methods should be tailored to the needs of the community and provide a range of options for community members to participate in the planning process. It is important to be transparent, responsive, and open to feedback to build trust and foster collaboration with the community.

Public meetings

Public meetings are a good way to float ideas and explore possible proposals and involve the community during planning processes before they are formalised. They can be held in open-spaces, community halls (majlis), and public schools.

Social media

Social media platforms, such as Instagram, Facebook, and Twitter, can be used to engage with community members, share information, and gather feedback. In addition, planning competitions can be encouraged, which can be open to professionals or the general public and are often used for high-profile projects, such as public buildings, parks, or urban design projects. Social media platforms can also be used to conduct surveys to gather information and opinions from community members who may not be able to attend public meetings. Surveys can be conducted online, through the mail, or in person.

Community workshops and events

Workshops (Figure 52) can be used to provide more in-depth information on specific issues or to gather feedback on proposed solutions. Community events, such as festivals or fairs, can be used to engage with community members in a more informal setting and provide an opportunity to gather feedback and share information.

Policy SD 9.1.2: Awareness

The region boasts remarkable natural wonders, with stunning landscapes, unique flora and fauna, and rich cultural heritage. Protecting and conserving the natural and cultural assets within this region is of utmost importance, and there is a growing awareness of this among local communities, authorities, and visitors alike. This has been driven by a number of factors, including increased tourism, climate change, and the recognition of the need to preserve these assets for future generations. The Omani government has taken several steps to safeguard the Western Hajar Mountains, including the establishment of nature reserves, such as the Jebel Akhdar and Jebel Shams Nature Reserves, which provide a sanctuary for endangered species and protect delicate ecosystems.

Figure 52: Al Hajar Al Gharbi 1. Workshop.

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Raising awareness in Al Hajar Al Gharbi can be achieved by:

- Developing and implementing educational programs to provide information about the ecological and cultural significance of the Western Hajar Mountains.
- Promoting eco-tourism practices that minimise the impact on the environment and local communities (refer to Policy GP3.1.3).
- Following policies that promote the protection and conservation of the region's natural and cultural assets (refer to Policy TE1.1.1/TE1.3.1 & CH3.1.1).
- Collaborating with NGOs, local communities, and other stakeholders to create a coordinated conservation strategy that aligns with the region's ecological and cultural values.
- Ensuring that all development proposals follow the human resource development, capacity building, training, and monitoring program as shown in ONSS (refer to RSS-D15 Report Ad Dakhiliyah Volume 2)

Effective Awareness Approaches

Community fairs

Community fairs can be an effective way to raise awareness about the importance of preserving the Western Hajar Mountains. These fairs provide a platform to educate the public about the fragile ecosystem of the mountains and the need for sustainable practices to protect it. By highlighting the various threats to the environment, such as overgrazing, habitat destruction, and littering, community fairs can help people understand the impact of their actions on the natural world. Additionally, these fairs can also provide an opportunity to showcase successful conservation efforts and encourage individuals to take action in preserving the Western Hajar Mountains.

Engaging with local communities

Local communities are the primary custodians of the Western Hajar Mountains and can play a critical role in conserving its natural and cultural assets. Engaging with these communities through workshops, seminars, and awareness campaigns can help to build a sense of ownership and responsibility towards the region.

Using social media

Social media is a powerful tool for reaching a wider audience and can be used to promote awareness about the Western Hajar Mountains. Creating engaging content, such as photos, videos, and infographics, can help to educate people about the region's ecological and cultural significance.

Conducting guided tours

Guided tours can provide an immersive and educational experience for visitors, allowing them to learn about the Western Hajar Mountains' unique ecosystems and cultural heritage. These tours can be led by local experts and can include visits to protected areas, cultural sites, and natural landmarks.

Collaborating with schools and universities

Schools and universities can play a crucial role in promoting awareness about the Western Hajar Mountains. Collaboration with these institutions can involve developing educational programs, conducting field trips, and supporting research projects.

Working with travel agencies and tour operators

Travel agencies and tour operators can be important partners in promoting responsible tourism practices and raising awareness about the Western Hajar Mountains. Collaborating with these organisations can involve developing sustainable tourism packages, promoting responsible travel practices, and providing educational materials to visitors.

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12

BRANDING STRATEGY

12. BRANDING STRATEGY

Branding is a tool primarily used in business and marketing to help people identify, and fabricate a perception of a company, an individual or a product. The same concept can be extended to places by applying branding techniques to the economic, political and cultural development of geographical locations. Under the umbrella term place branding, mental images and perceptions of nations, states and cities can strategically be projected. Branding a city is the process of developing and promoting a unique identity or image for a city that sets it apart from other places and attracts visitors, businesses, and investment. Through branding, a city can be transformed into a place people want to live, work, and play.

Enhancing Al jabal Identity

Al Hajar Al Gharbi is known for its natural beauty, rich cultural heritage, and unique adventure tourism opportunities. The region is characterised by rugged mountain terrain, deep valleys, and wadis that are home to a variety of flora and fauna. It is also a home to several historic sites, including ancient forts, castles, harat and watchtowers, which reflect the region's rich cultural history. In addition, the region offers a range of adventure activities such as hiking, rock climbing, and mountain biking, making it a popular destination for adventure tourists.

In recent years, the Western Hajar Mountains have become a popular tourist destination, attracting worldwide visitors. Despite its popularity, the Western Hajar Mountains still offer a peaceful and pristine environment, making it an ideal destination for those seeking to escape the hustle and bustle of city life.

Purpose

The purpose of branding Al Hajar Al Gharbi is to create a unique identity and image for the region that sets it apart from other destinations and promotes it as a must-visit destination for tourists, generating more revenue from tourism, stimulating economic growth, and preserving and protecting the region's natural and cultural heritage.

• Developments proposals within the region will be approved if they:

- Create liveable and resilient cities and communities by maintaining the Omani identity through design and architecture. (Refer to Policy SD11.1.1)
- Accommodate continuous local feedback to ensure regional identity is considered.
- Preserve natural and heritage sites districts to retain local identity (Refer to Policies TE1 & CH3.1.1).
- Adopt marketing strategies of historical, cultural, and natural assets.

Five Place Branding Principles

Distinctiveness

The Western Hajar Mountains are distinctive in several ways:

Geology

The Western Hajar Mountains in Oman exhibit a diverse range of geological formations and landforms, including rocks dating back over 600 million years, towering cliffs, deep gorges, and expansive plateaus. This geodiversity has led to the development of diverse habitats, supporting a wide range of flora and fauna, including many endemic and endangered species.

Biodiversity

The Western Hajar Mountains are characterised by exceptional biodiversity, with a wide range of species adapted to the area's diverse habitats,home to a unique range of flora and fauna, many of which are endemic to the region. This is because the region is at the crossroads of three different biogeographic regions. Some of the unique species include the Arabian Tahr, a type of wild goat, and the Oman Rock Lizard. Refer to section Biodiversity and Geodiversity.

Culture

The region offers a unique glimpse into Oman's rich cultural history. It is also home to several ancient settlements and cultural sites, such as the pre-Islamic village of Al Ayn and the abandoned village of Misfat Al Abryeen. In addition, the region's cultural heritage is evident in its crafts, such as pottery, weaving, and metalwork, which are still practised by local communities today.

Landscape

The Western Hajar Mountains offer unique and beautiful landscapes that showcase the region's natural and cultural heritage shaped by the area's geology, climate, and cultural history. The mountains rise steeply from the coastal plain, creating an impressive landscape of towering peaks, deep canyons, and rugged cliffs. The region is home to several high peaks, including Jebel Shams, the highest mountain in Oman, and Jebel Akhdar, known for its lush valleys and terraced agriculture. (Refer to Section Landscape Conservation and enhancement).

Memorable

To make a place branding memorable, it is important to create a strong and distinctive brand identity that resonates with people and captures the essence of the place.

Authenticity

The authenticity of the Western Hajar Mountains has played a significant role in promoting tourism to the region by highlighting traditional Omani handicrafts and cultural activities, such as weaving, pottery, and music. Visitors are encouraged to explore local villages and interact with locals, providing an opportunity to experience the region's rich cultural heritage firsthand.

The Western Hajar Mountains are also marketed as a destination for ecotourism, with a focus on preserving the natural environment and wildlife of the region. Visitors are encouraged to take part in activities.

Co-creation

In the case of the Western Hajar Mountains, co-creation could involve working with local communities and stakeholders to develop tourism experiences that showcase the unique natural and cultural heritage of the area. This could include guided hiking tours, cultural exchanges with local communities, and culinary experiences that feature local cuisine and traditions.

Co-creation could also involve using technology to create immersive experiences that allow visitors to explore the mountains in new and innovative ways. For example, virtual reality experiences or interactive mobile apps could be developed that provide visitors with a more engaging and personalised experience of the area. The co-creation of tourism experiences in the Western Hajar Mountains could have several benefits, including creating more sustainable and responsible tourism practices, generating economic benefits for local communities, and providing visitors with more authentic and memorable experiences.

Place making

In Western Hajar Mountains can involve various activities to enhance the physical and cultural attributes of the area to make it more attractive and functional for residents and visitors. Here are some possible ideas for place making in the Western Hajar Mountains:

Enhancing natural trails and viewpoints

Al Hajar Al Gharbi mountains offer many stunning views of the landscape and nature. Developing natural trails that lead to the most scenic viewpoints and waterfalls could attract more visitors and provide an opportunity to showcase the region's natural beauty.

Cultural festivals and events

The region has a rich cultural heritage, and organizing festivals or cultural events that celebrate the traditions and customs of the local communities could attract visitors and promote a sense of community pride.

Developing eco-tourism initiatives:

The Western Hajar Mountains have many opportunities for ecotourism activities such as hiking, camping, and exploring the wildlife. Developing eco-tourism initiatives that are sustainable and responsible can provide an economic boost to the region while protecting its natural resources.

Creating public spaces and amenities

Developing public spaces and amenities such as parks, benches, restrooms, and visitor centres can enhance the experience for visitors and residents, providing them with comfortable places to rest, gather, and enjoy the outdoors.

Policies Document of Al Hajar AlGharbi June 2023

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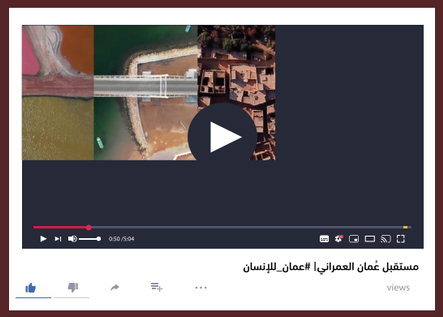

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The video for the spatial Strategy

The spatial strategy forms a national framework for regulating and directing urban growth, aiming to establish a connection between the site and its optimal use, to maximise investment opportunities for each governorate and city.

A dynamic strategy with an integrated vision consistent with the objectives of Oman Vision 2040 and the UN Sustainable Development Goals.

رؤية عمان 2040

الاستراتيجية العمرانية
SPATIAL STRATEGY

وزارة الإسكان والتخطيط العمراني
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Sustainable Urban Development towards
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