A SOCIO-ECOLOGICAL APPROACH TO COMBAT DESERTIFICATION FOR SUSTAINABLE FUTURE

EcoFuture

Work Package 2

Deliverable 2.1 Mapping current socio-ecological systems in JV

Anan Jayyousi, Abeer Albalawneh, David Lehrer, Rasha Aburukba, Safaa Aljaafreh, Luma Hamdi, Maram al Naimat, Mohammad Ali Mudabber, Sawsan Qudsi, Ammar Khraisheh, Michael Gilmont, Shlomo Wald, Iddo Kan, Shiri Zamah Shamir

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PRIMA IN THE MEDITERRANEAN AREA

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Lead Authors Anan Jayyousi, Abeer Albalawneh, David Lehrer

Email anan@najah.edu

Contributions from Rasha Aburukba, Safaa Aljaafreh, Luma Hamdi, Maram al Naimat, Mohammad Ali Mudabber, Sawsan Qudsi, Ammar Khraisheh, Michael Gilmont, Shlomo Wald, Iddo Kan, Shiri Zamah Shamir

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Internal Reviewer 2 Maria Lilli

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Executive Summary

Despite the very different socio-economic and political circumstances between Palestinians, Israelis and Jordanians, they all face a number of common challenges such as land degradation, water scarcity and quality decline which have been extenuated by climate change. The resulting decrease in precipitation, increased urbanization/population, as well as competition between agricultural lands and natural landscapes are causes of environmental degradation and stress on water, energy and biodiversity resources.

This report aims to present an overview and analysis of the current socio-ecological dynamics within the Jordan Valley. Spanning territories in Jordan, Israel, and Palestine, it consolidates crucial information about the region, including land use, water resources, ecosystems, pollution sources, and infrastructure accessibility. Special attention is given to specific land utilization practices, particularly agriculture and urban expansion, alongside addressing pressing issues like water demand across residential, agricultural, and industrial domains. Furthermore, it examines the potential implications and significance of climate change.

Moreover, the report addresses significant challenges confronting the region, such as the origins of pollution, demographic changes, economic activities, and the broader socio-economic landscape of the Jordan Valley. Through this comprehensive analysis, the goal is to provide a holistic understanding of the valley, highlighting the intricate interplay between environmental health and human activities. Such insights are crucial for fostering sustainable development and shaping effective policy frameworks to ensure the well-being of both the environment and the communities reliant on it.

The land use distribution in The JV comprises of 61.5% of natural/uncultivated land, 32.9% agricultural land and aquaculture and the remaining to be urban areas, wadis and reservoirs. Pollution sources in the JV include untreated waste water, solid waste disposal, impacts from agriculture and aquaculture as well as land mines remnants of historical conflicts. Pollution sources and geogenic origin salinity have deteriorated the water quality of Jordan River and over-exploitation has decreased dramatically its flow. The surface water network of the JV is in urgent need for ecological restoration.

The socio-economic mapping revealed distinct discrepancies between the three territories in terms of population growth, economic status and unemployment as well access to resources and opportunities to development.

Even though the socio-ecological landscape presents significant challenges, ecological actions that would address preservation of biodiversity, sustainable water management, rehabilitation of degraded landscapes, sustainable agriculture, development of renewable energy and ecotourism and nature-based recreation, would guide the region towards environmental sustainability.

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Introduction

The Jordan Valley is an integral part of the broader Jordan Rift Valley, renowned internationally for its distinctive historical, religious, cultural, economic, and environmental significance, largely attributed to its characteristic rift valley topography. The Lower Jordan River (LJR), a segment of the Jordan River (JR) linking the Tiberias Lake to the Dead Sea, originates from Tiberias Lake, converges with the Yarmouk River, and meanders for approximately 200 kilometers through the Jordan Valley before reaching the Dead Sea.

This report endeavors to provide a comprehensive overview and mapping of the current socio-ecological system within the Jordan Valley. Encompassing territories across Jordan, Israel, and Palestine, the study synthesizes key aspects of the region, including land use patterns, water resources, ecosystems, pollution sources, and infrastructure accessibility. It delves into specific aspects of land utilization, notably agriculture and urban expansion, while also addressing critical issues such as water demand across domestic, agricultural, and industrial sectors. Additionally, the report investigates the potential impacts of climate change on these facets and evaluates ecosystem services in terms of provisioning, regulating, and cultural functions.

Furthermore, the report confronts significant challenges facing the region, such as pollution origins, demographic shifts, economic activities, and the broader socio-economic landscape of the Jordan Valley. Through this comprehensive examination, the aim is to offer a holistic perspective on the valley, elucidating the intricate relationship between its environmental well-being and human endeavors, and providing invaluable insights essential for fostering sustainable development and shaping effective policy frameworks.

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1. Mapping the Ecological Landscape of the Jordan Valley

1.1 Land Use

The geographical layout of the region exhibits typical characteristics of a rift valley, featuring steep declines in elevation over short distances from the valley's edges and gradually leveling off closer to the Jordan River. Along the valley axis, there is a consistent decrease in elevation from north to south. In the northern section, the elevation drops by nearly 200 meters across a span of 6 kilometers. Moving into the middle portion, this decline steepens, surpassing 500 meters over a distance of 10 kilometers. Towards the southern end, the drop lessens to 90 meters over an 8-kilometer stretch. Figure 1 provides a comprehensive overview of the topographical features of the Jordan Valley.

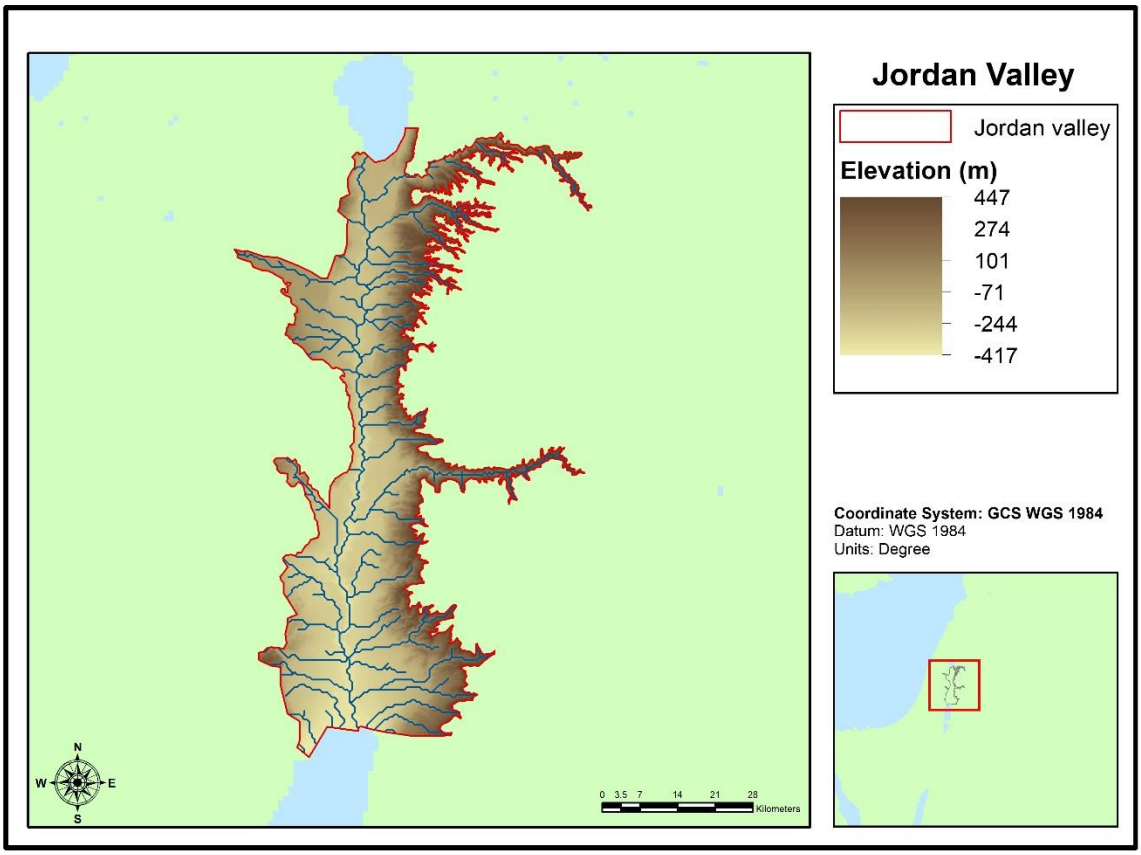

Figure 1 Topography of the Study Area

The study area has a total surface area of 2256 km2, most of which (61.5%) consists of uncultivated land. A total of 716.8 km2 (32%) is used for agriculture and 89.6 km2 (3.6%) as built up area. Table 1 presents the land use in the study area. Figure 2 presents the distribution of land use in the JV.

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Table 1 Land use in the study area

Land use	Surface area in km²	%
Agriculture	716.8	32
Built area	80.6	3,6
Fish farming	20	0,9
Natural/Uncultivated	1389	61,5
Reservoirs	6,4	0,3
Wadi's	43,2	1,7
Grand Total	2256	100

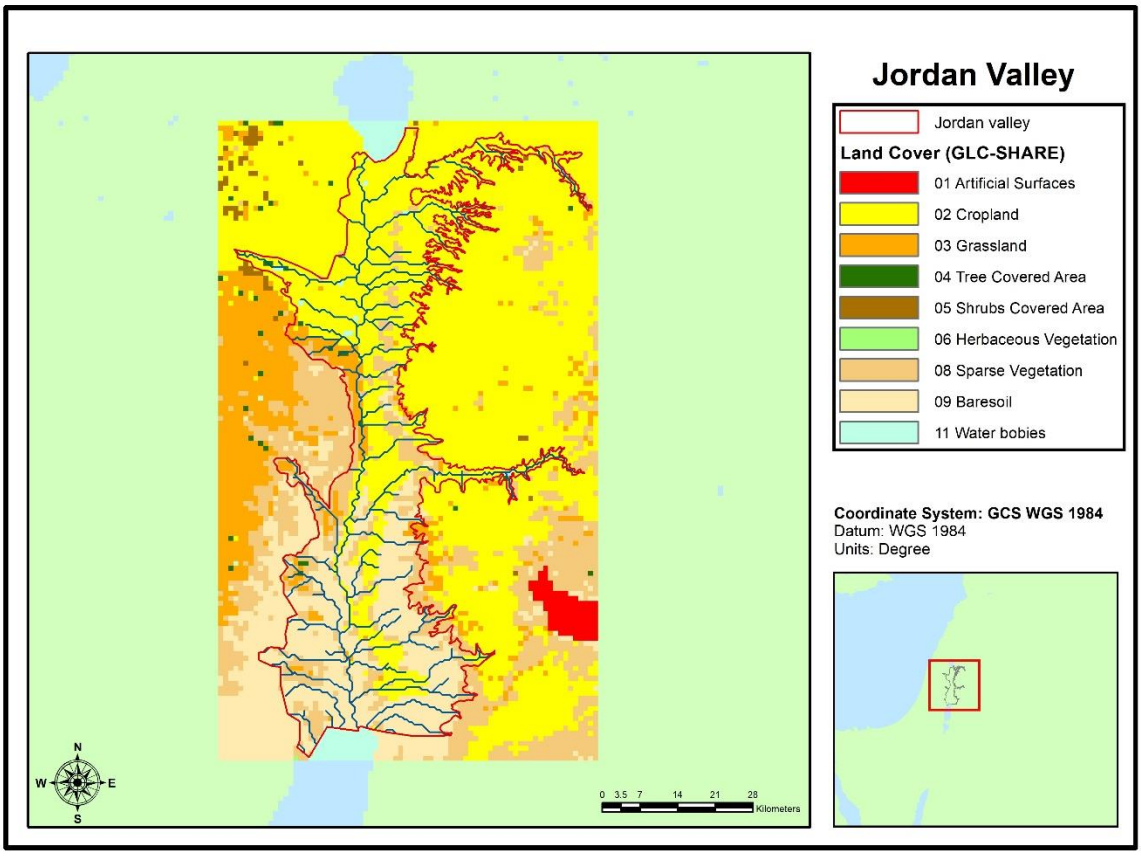

Figure 2 Land use distribution of the Jordan Valley

The dominant soil types in the area are regosols, rendzinas and serozems, which are mainly tertiary deposits, and to a lesser extend lithosols, all of them generally can be used for agricultural activities. As

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a result, the majority of land in the area that can be provided with water is used for agriculture and horticulture.

1.2 Water

1.2.1 Surface Water Resources

The Lower part of the Jordan River originates from the Sea of Galilee, stretching approximately 200 km through the Jordan Valley until it reaches the Dead Sea. Rainfall in the region varies significantly, ranging from over 550 mm annually in the north to less than 100 mm in the south near the Dead Sea. Meanwhile, high temperatures and dry conditions contribute to an average annual potential evaporation of 2100 to 2300 mm.

Historically, the Lower Jordan River received around 600 MCM/yr from the Sea of Galilee and about 470 MCM/yr from the Yarmouk River in the northeast. Additional inflow came from the Zarqa River and nine other streams from the East Bank, resulting in an outflow into the Dead Sea of approximately 1200–1300 MCM/year. However, water diversion projects, including the Israeli National Water Carrier and various dams and canals in Syria and Jordan, have significantly reduced the outflow, which now stands at about 70 to 100 MCM per year.

Recent pollution of the Jordan River is attributed to untreated wastewater and saline water diverted into the river from springs west of the Sea of Galilee via the Saline Water Carrier.

In the Israeli part of the study area, the southern shore of the Sea of Galilee historically served as a crucial water storage reservoir. Today, water supply comes from both locally abstracted groundwater and Israel's national water network.

In the Jordanian part of the study area, water resources in the North include the Yarmouk River, Sea of Galilee, and Mukheba wells. The Yarmouk River flows into the King Abdullah Canal, its flow varying significantly depending on annual rainfall and upstream discharge from Syria. The Zarqa River, mainly fed by seasonal rainfall and treated wastewater, suffers from severe pollution due to its proximity to populated areas.

Additionally, rainfall collected in side valleys creates ephemeral streams that run into the Jordan Valley, contributing to its hydrology. Important wadis in the Jordan Valley on the Jordanian side include Wadi Al-Arab, Wadi Zaqlab, Wadi Al-Yabis, Wadi Kufranja, and Wadi Rajeb, among others small valleys, where water is used for irrigation and industrial uses in the Jordan valley.

The King Abdullah Canal (KAC) is considered the main water carrier for irrigation in the Jordan Valley at present, transporting good quality water from the Yarmouk River, the field of wells of Al Mukhaiba, the Dajania / Tiberia's diversion channel and from the flow in the side valleys flowing from the eastern highlands of the Jordan valley (Water Yearbook 2019-2020). Table 2 shows the annual flow quantities of the various sources on the Jordanian side for the year 2022.

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Table 2 The annual flow quantities of the various sources in Jordan Valley within the Jordanian part of the Study Area Source: (Jordan Valley Authority Report 2022)

Sources	Mcm/year
Yarmouk River to The KAC	6.08
Yarmouk River to Unity Dam	27.68
Al-Mukhaib Wells	14.96
Conveyor Line/Tiberias	107.29
Total as follows	156.01

1.2.2 Ground Water Resources

The groundwater system in the Jordan Valley comprises of several aquifer systems dating back to different geological ages. The depth of groundwater aquifers in Jordan varies depending on the location and geological characteristics of the area. In some regions, aquifers may be relatively shallow, while in others, they may be deeper underground.

For instance, in parts of the Jordan Valley, groundwater aquifers can be relatively shallow, with depths ranging from tens to a few hundred meters. However, in other areas, such as the eastern desert regions, aquifers may be deeper, reaching several hundred meters or more.

The shallow aquifer system, originating from the Plio-Pleistocene ages, sits on top of the upper sub-aquifer system from the Upper Cenomanian and Turonian ages, and the deep confined aquifer from the Lower Cenomanian age. These groundwater resources play a crucial role in supplying water to the West Bank and the southern regions of the Jordanian study area.

However, salinity levels, particularly in the southern part of the study area, are on the rise. This increase is attributed to multiple factors, including overexploitation of groundwater and the up-coning of deep brines through the Jordan Rift Fault system. Additionally, contamination from agricultural return flows and sewage effluents contributes to the deterioration of water quality. This degradation, coupled with the current low flow levels, poses significant threats to the area's ecosystem, which boasts numerous unique features.

1.2.3 Non-conventional Water Resources

Other sources of water in the study area consists of reuse of treated wastewater and desalination of brackish water from groundwater wells. In Jordan, there are 5 desalination plants in the study area that utilize brackish water from groundwater wells in the area. Treated wastewater from the As Samra wastewater treatment plant on the Jordanian side has been used to partially substitute freshwater for farmers in the Middle Jordan Valley (complying with the Jordanian reuse standards). Here, treated

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wastewater is collected and mixed with freshwater at the King Talal Dam reservoir, followed by another mixing stage with freshwater from the Yarmouk River, Peace Conveyor and Mukheiba wells, before water reaches farmers to meet their irrigation needs.

1.3 Climate change

The region's annual rainfall typically begins in October and ends in May, with the bulk of precipitation occurring between December and February. The northern part of the Jordan Valley receives a long-term average of about 550 mm of rainfall per year. However, annual variations in precipitation can be quite significant; during dry years, the northern parts of the valley may receive as little as 200 mm, while areas on the shores of the Dead Sea may receive less than 100 mm. This situation is further exacerbated by the fact that the Jordan River Basin, which includes the Jordan Valley, provides Jordan with about 80% of its water resources. Given the importance of agriculture in the Jordan Valley and the reliance on rain-fed agriculture, these fluctuations in rainfall can have significant implications for the livelihoods of farmers and the overall socioeconomic stability of the region. The challenge for water resource planners and politicians is to manage these scarce and variable water resources effectively, ensuring that the needs of both the population and the environment are met. (Suleiman, 2003).

The Jordan valley, characterized by scorching dry summers and relatively milder and wetted winters. The challenge becomes even more prominent as you move southward through the valley towards the Dead Sea where the climate becomes more arid. However, this prevalent water scarcity issue is being further accentuated due to the ongoing climate change impacts. Research indicates that the elements of climate change, such as increases in temperature and evolving rainfall patterns, have started affecting Jordan's precipitation. Decreasing levels of rainfall are having severe repercussions on the availability of water resources and hence on the water supplies for all sectors (Salameh and Abdallat, 2020). Figure 3 shows the analysis of the annual rainfall data for Deir alla and Baqura spanning from the years 1990 to 2020. The line plots provide clear visualizations of the annual rainfall patterns and the decreasing trend over the years.

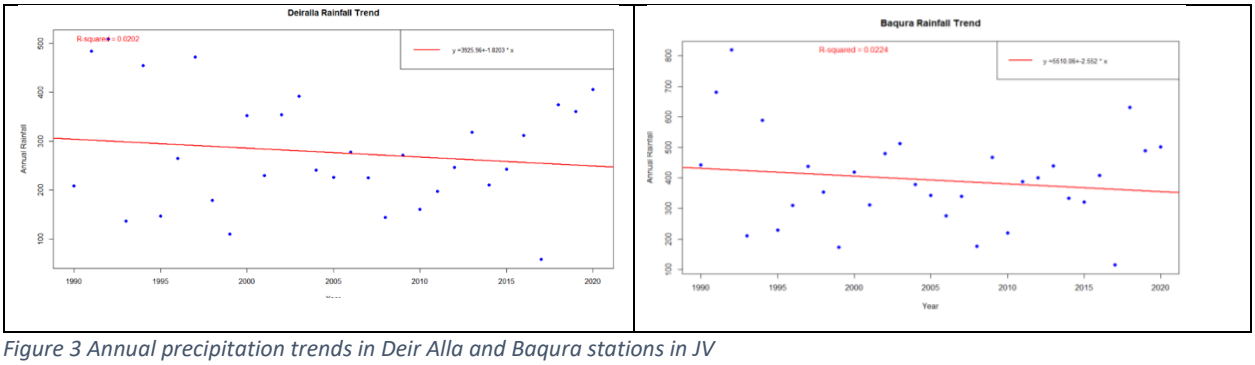

Figure 3 Annual precipitation trends in Deir Alla and Baqura stations in JV

A simulation study for the period 2040-2099 revealed that under a future climate setup, Jordan's precipitation will decrease by 17% in the middle of this century and by 21% at its end, enhancing negative

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impacts on the health, environment and socio-economic sectors. Impacts of climate change are pushing the MENA region, including the Jordan Valley, toward becoming even drier. The scarcity of water causes a decrease in vegetation and farmlands, creating a vicious cycle that further intensifies water scarcity. This poses significant problems for the region, including Jordan valley, and the local population is getting affected due to the effects of such scarcity. (Klassen, 2020; Salameh and Abdallat, 2020).

Climate change is having significant effects on agriculture in the Jordan Valley, including delayed planting seasons, reduced production, and declining agricultural productivity. The region is experiencing extreme temperatures, droughts, and water scarcity, leading to a decline in agricultural productivity and water resources. The delayed planting seasons and reduced production in the valley are indicative of the challenges posed by climate change. The erratic rainfall and its distribution, along with the frequent shifts in the rainy season, have harmed farmers and crops. The impact of climate change is felt across various sectors, including agriculture, water, and health. The shortage of water has led to over-pumping of underground wells, exacerbating the water crisis. Furthermore, the irregular distribution of rainfall and the frequent shifts in the rainy season have negatively affected both farmers and crops, contributing to the challenge of extreme weather patterns. The delayed growth of green pastures, critical for livestock feeding, coupled with a shortened feeding period, has escalated feed costs and significantly impacted the livelihoods of farmers. Additionally, climate change projections anticipate a gradual increase in diseases among children, posing risks to their development and learning capacities.

The northern part of the East Bank of the Jordan Valley in Jordan will be impacted most negatively by climate change, with a foreseen substantial reduction of annual and winter rainfall, although the summer rainfall will increase slightly. The southern part of the East Bank will see a slight improvement of rainfall conditions, both annually as during the summer.

1.4 Ecosystems

The Jordan Valley stands as a vital hub for freshwater ecosystems, with the winding Jordan River and its tributaries most notably exemplifying these. The river and its interconnected ecosystems play a crucial role in fostering the area's rich biodiversity. The Jordan Valley also features other freshwater ecosystems that contribute significantly to its ecological diversity. Freshwater ecosystems in the valley offer sanctuaries for a diverse range of flora and fauna, many of which are uniquely adapted to the aquatic environment. These habitats range from flowing watercourses to quiet pools, creating varied habitats for the resident species. They serve as vital breeding grounds, fostering biodiversity, and maintaining the delicate balance of the ecosystem. Iconic species, such as local fish populations and migratory birds, rely on these habitats for their survival (https://www.feow.org/ecoregions/details/438).

The Jordan River is particularly noteworthy in all this; originating from the Sea of Galilee, it crosses the valley and forms an extensive network of interconnected ecosystems. Moreover, the Jordan Valley hosts several other freshwater ecosystems that further enrich its ecological wealth. Seasonal streams and wetlands are a standout feature, often fed by runoff from the surrounding hills and providing dynamic environments for diverse flora and fauna.

Despite their importance, the freshwater ecosystems within the Jordan valley face threats. The lower Jordan River, for instance, has suffered severe depletion over time, with over 90% of its water sources diverted largely for large-scale irrigated agriculture. However, recent years have seen a growing awareness of the river's plight, with initiatives coming to the forefront aiming for its restoration.

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Moreover, an increasing emphasis on rehabilitating these ecosystems has led to innovative solutions, like the proposed peace park at the confluence of the Jordan and Yarmuk Rivers, designed to include a bird sanctuary, visitor's center, eco-lodges, and nature and cultural heritage trails (https://www.feow.org/ecoregions/details/438).

Overall, the freshwater ecosystems in the Jordan Valley, exemplified by the Jordan River and its tributaries, play a pivotal role in sustaining the region's biodiversity. Their contribution extends beyond just hosting a variety of aquatic fauna and flora. They also provide essential services such as water purification, nutrient cycling, and regulation of water flow, which are crucial to the region's human populations. The valley rich biodiversity and habitats, combined with efforts to restore and conserve them, underscore the valley's ecological importance and the need to keep prioritizing its protection (https://www.mei.edu/publications/jordan-river)

A total of 15 native freshwater fish species exists in the streams and springs in the Jordan Valley. In addition, another 12-13 native freshwater fish can be found in the Yarmouk River systems. Furthermore, several alien species were introduced in to the water systems of the Jordan Valley.

Over the past century, the region has undergone significant developmental changes, profoundly impacting local ecosystems and ecology. These transformations encompass the establishment of new communities, infrastructure, and industrial facilities, as well as the conversion of natural land into agricultural areas. Excessive groundwater extraction has led to depletion, alongside diminished flow rates in natural springs.

The slopes of Mount Gilboa, situated outside the study area, host significant springs that contribute year-round flows to the Jezreel Valley, serving as vital environmental habitats and historically crucial water sources for human activities. Wetlands, historically present, once provided aquatic habitats, but their drainage in the 1920s led to environmental degradation. However, modern-day fish farm ponds partially fulfill some of their roles, particularly for migratory birds.

Multiple ecosystem services are provided within the study area, including provisioning services like food, water, and raw material production, as well as regulating services such as air purification, climate regulation, water regulation, and erosion prevention.

The Lower part of the Jordan River has undergone significant alteration due to freshwater diversion and inflow of polluted water. The construction of the Deganya Dam in 1932 halted floods, which were crucial in maintaining the river's natural flow regime, shaping meanders, and sustaining a healthy ecosystem. Consequently, aquatic habitats have deteriorated, leading to a decline in macro-invertebrate and fish populations, as well as vegetation diversity.

Despite these challenges, the Jordan River still serves as important wildlife and fish habitat, particularly valued by national and international environmental agencies for avian species. In terms of nature reserves, Israel has designated a total of 44 natural reserves and national parks in the Western part of the Jordan Valley, spanning from the Sea of Galilee to the Dead Sea. Notably, the lower plain (the Zor), inland salt flats, and various wadis are significant for their biological and wildlife diversity. These areas contain rare plant species adapted to extreme conditions. Additionally, the Yarmouk River valley, bordering Israel and Jordan, remains largely untouched due to its strategic political location, supporting diverse plant and

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animal communities. Proposal exists to designate this area as a dedicated protection site, recognizing its importance for woodlands and wildlife.

1.5 Pollution sources

The major sources of pollution on the Jordan Valley include untreated wastewater and diversion of saline water into the valley, solid waste dumping and pollution from agriculture, husbandry, fishponds and land mines. The Jordan Valley confronts several major environmental challenges, predominantly stemming from these various forms of pollution.

1.5.1 Wastewater

Alarming concern revolves around untreated wastewater, where sewage devoid of proper treatment is discharged into the Jordan River Basin, stemming from both domestic and industrial origins.

Untreated sewage flowing into the Jordan Valley stands out as a primary source of pollution within the study area. The lower segment of the Jordan River exhibits elevated concentrations of Fecal Coliforms, indicative of substantial sewage discharges into the river system. Until recently, numerous communities in Israel, Jordan, and Palestine have been directly or indirectly releasing their untreated or inadequately treated sewage into the valley, exacerbating environmental contamination.

In the Palestinian part of the study region, wastewater collection and treatment have been overlooked for an extended period, as greater emphasis has been placed on ensuring a safe water supply and preserving dependable resources for domestic usage. Consequently, most Palestinian communities in the study area lack wastewater collection networks, relying instead on cesspits for wastewater disposal. An exception is Jericho, where a modern central wastewater treatment plant has recently been established through funding from Japan.

Israeli settlements in the West Bank primarily utilize oxidation ponds or cesspits for wastewater disposal. However, larger settlements are mandated by Israel to develop comprehensive wastewater treatment plants. Plans are in place for such facilities in settlements like Fazael - Netiv HaGdud and Shdemot Mehola.

1.5.2 Solid waste

The region also faces problems with solid waste management, generating around 162,000 tons of municipal waste annually, of which 120,000 tons originate from Jordan. The prevalent methods of waste treatment, particularly landfilling, often lack necessary environmental safeguards, and there is a limited practice of recycling and reuse.

Apart from the Israeli section of the study area, there is a lack of adequate sanitary waste disposal or treatment, both for domestic waste as well as industrial waste. Recycling and reuse of waste takes place in only very limited amounts. Land filling is the most common waste treatment technique within the study area and apart from Israel this is mainly done without adequate soil and environmental protection measures. It is estimated that less than 10% of the waste, or 16,000 tons per year is physically transported out of the valley area to be disposed off elsewhere.

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Waste collection, transportation and disposal in Jordan are handled by local municipalities. Sometimes, smaller municipalities combine forces into a Common Services Council. In the study area, the municipalities in the north co-operate within the Northern Joint Services Council. The Ministry of Municipal Affairs is responsible of providing municipalities and Common Services Councils with finance to provide these municipal services. The Ministry of Environment is responsible for policies and planning of the waste sector, and is currently (2014) in the process of developing a national waste management strategy based on principles of maximized recovery, reuse, and recycle, with disposed as final solution, as well as on the proximity principle.

The Hagal landfill, north of Gesher, is the only authorized landfill in the Israeli part of the study area. As an authorized landfill it has all the required infrastructure and operations of a sanitary landfill, including lining system, percolation water collection and treatment, landfill gas collection an energy production. The landfill is owned by the private Israeli engineering firm TAHAL, and started operations in 1999. The total landfill volume is 3.5 million m3.

The Palestinian waste is often dumped just outside the communities in the surrounding area. Luckily, as result of the very dry conditions, the waste material will dry out very quickly, so that leachate problem or nuisance of smell and pollution will be limited. However, the plastics waste remains, and this forms a visual nuisance as well as a threat to animals. Agricultural waste forms most of the waste generated in the Palestinian area. The only semi controlled landfill in the Palestinian project area is the Tovlan landfill site, operated by the Israeli settlements. It is managed by the settlements belonging to the Bik'at Hayarden Regional Council. It receives waste from municipalities in Israel and from Israeli settlements in the West Bank.

This all has a direct impact on public heath, groundwater quality and eventually the water quality in the Jordan River. It is expected that less than 10% of the waste, or 16,000 tons per year is physically transported out of the study area to be disposed of elsewhere.

1.5.3 Agriculture

Agricultural operations are a significant contributor to pollution, primarily through the contamination of return flows with phosphates, salts, nitrates, pesticides, and chemical fertilizers. Additionally, the utilization of plant tissue and plastics in farming practices adds to the accumulation of solid waste, posing risks to the pollution levels of the Jordan River and the surrounding valley. Moreover, concerns persist regarding the proper disposal of unused pesticides and fertilizers, further exacerbating pollution issues. Animal husbandry also presents environmental and public health challenges, particularly concerning the management of manure and animal carcasses.

A considerable portion of the study area is dedicated to agriculture, with water diverted from the Jordan River and its tributaries for irrigation purposes. Consequently, the return flows from agricultural activities often contain pollutants such as phosphates, salts, nitrates, pesticides, and chemical fertilizers, which may contaminate groundwater and surface water in the Jordan Valley. Additionally, the use of plant tissue and plastics in agricultural practices contributes to the accumulation of solid waste, potentially polluting the Jordan River and surrounding areas. The presence of unused pesticides and fertilizers further heightens pollution concerns.

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Plastic waste generated in agriculture primarily includes greenhouse covers, mulch covers for soil protection, and irrigation pipes. While efforts are made to collect and sell this plastic waste to recycling facilities, many of these facilities are located outside the Jordan Valley.

1.5.4 Fish ponds

The fish farms constitute significant water consumers within the Israeli sector of our project area in the Jordan Valley. Covering approximately 20,000 dunums of pond surface area, more than 90% of these fish ponds are concentrated around Harod Stream and in the Valley of Springs Regional Council.

On average, each fish pond requires a daily inflow of water ranging from 5000 to 6000 m3 per dunum, resulting in a total consumption of about 100 MCM per year. These quantities exert a considerable impact on the water balance in this region of the Jordan Valley. To facilitate water consumption, a series of reservoirs at Gesher fish farm serve as both water storage and fish cultivation facilities. Each reservoir is designated for specific water qualities, distinguishing between fresh water (< 500 mg Chloride/l), treated wastewater, and saline water sourced from or mixed with local springs (> 500 mg Cl / l). This arrangement enables the fish farm to optimize its production.

Evaporation in the ponds contributes to increased salinity levels in the water. The discharged effluent water may exhibit chloride concentrations ranging between 2,000 and 4,000 mg/l, influenced by inflow concentrations and operational disparities. Approximately 75% of the effluent is discharged between October and December, with the remainder discharged as late as February

1.5.5 Mines

Furthermore, the enduring legacy of landmines stemming from historical conflicts along the 1949 Armistice border and surrounding former military installations presents significant environmental and safety hazards. The lack of adequate marking, fencing, and education regarding the risks associated with landmines, particularly for children, compounds these dangers (The Jordan Valley, 2016).

In the West Bank, over 2,000 hectares of land have been enclosed by the Israeli military as a precaution against the risks posed by landmines. Some of these minefields were laid by Jordan prior to 1967, along the 1949 Armistice border with Israel and near former military bases. Others were deployed by Israel after 1967, surrounding its own military installations and along the current border with Jordan. Portions of agricultural and grazing lands in the West Bank may still harbor landmines, posing a serious threat of injury or death to civilians.

The demarcation and fencing of these landmine zones are inadequately maintained, and there is a lack of mine risk education. Most casualties resulting from landmine accidents have been children. Efforts by the Israeli military to clear minefields have primarily targeted areas of tourism significance. In Israel, this includes regions such as Naharyim and Gesher, as well as areas surrounding the Baptism site in the West Bank.

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1.6 Cultural Heritage

The Jordan Valley boasts a rich cultural heritage, underscoring its profound historical, religious, and cultural significance. As a longstanding center of human civilization, the area offers a plethora of tourist attractions unique to its terrain.

Embedded within the Jordan Valley is a deep-rooted cultural legacy, comprising historical, religious, and archaeological treasures integral to the region's identity and narrative. Abounding with archaeological sites that chronicle its extensive history of human inhabitation, the valley also harbors the resting places of several companions of the Prophet Muhammad (PBUH), dating back to 639 AD. Moreover, the Jordan Valley presents promising opportunities for recreational pursuits, thematic explorations, and tourist ventures, despite the current underdevelopment of tourism infrastructure. Promoting sustainable tourism initiatives could amplify awareness of the valley's inherent value and underscore the imperative of its conservation and safeguarding on local, regional, and global scales.

In response to responsible tourism demands, the Jordan Valley and its environs promise authentic natural and cultural encounters. Beyond serving as a catalyst for tourism development, its unique natural and cultural heritage holds intrinsic educational and appreciative value, necessitating preservation efforts. Responsible tourism endeavors can significantly elevate awareness levels across local, regional, and international communities regarding the Jordan Valley's significance, potentially supporting conservation and protection initiatives. Consequently, it is imperative for developmental strategies in the Jordan Valley, including tourism, to acknowledge the region's susceptibility to resource overexploitation. The propensity for inter-country competition to maximize resource utilization risks depleting the valley's worth and escalating regional tensions, thereby elevating the imperative of international collaboration for the preservation of the Jordan Valley.

Further accentuating the valley's cultural eminence is the presence of several UNESCO World Heritage sites in Jordan, comprising cultural and mixed sites emblematic of the country's rich heritage. Noteworthy historical sites include:

1. Al-Maghtas: Recognized as the Baptism Site "Bethany Beyond the Jordan," this locale holds religious significance as the reputed baptismal site of Jesus Christ by John the Baptist. Situated on the eastern bank of the Jordan River, approximately 9 kilometers north of the Dead Sea and 10 kilometers southeast of Jericho, Al-Maghtas spans an area of 533.7 hectares. Encompassing Tell al-Kharrar (Jabal Mar Elias) and the Zor area, this site encapsulates centuries of religious history, earning UNESCO World Heritage Site status.

2. Pella (Tabaqat Fahil): Positioned in the Jordan Valley, Pella stands as an archaeological marvel, bearing witness to over 4,000 years of continuous human settlement since the Natufian Period. From Roman to Islamic eras, the site preserves remnants of diverse civilizations, with its nomination for UNESCO World Heritage Site status affirming its historical significance and potential for future recognition. (https://www.rjtravelagency.com/world-heritage-sites-in-jordan/)

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3. Yarmouk River Valley: This region sustains a diverse array of plant and animal communities, characteristic of pristine and minimally polluted river ecosystems, making it a significant area for the preservation of ecological and cultural heritage.

4. Jericho: Often regarded as the oldest continuously inhabited city globally, Jericho has hosted human settlements for over 10,000 years. During Roman rule (63 BC-423 AD), Mark Antony bestowed the city as a gift to Cleopatra, his beloved. Following her demise, it returned to Augustus Caesar, who later granted it to Herod. Subsequently, Jericho evolved into a center of Christianity and retained its importance throughout the Byzantine Period.

5. Tell Deir ‘Alla: Strategically positioned at the mouth of the river Jabbok/Wadi Zarqa, Deir ‘Alla corresponds to the Old Testament's Succoth site (Genesis 33:17; Joshua 13:27; 1 Kings 7:46; 2 Chronicles 4:17; Psalms 60:6; and 108:7), reportedly fortified by Jeroboam and visited by Gideon in pursuit of the retreating Midianites. Succoth, meaning 'small structures,' possibly alludes to the ancient town's role as a central marketplace for the Gilead region during the Late Bronze and Iron Ages. Today, it remains a commercial hub for the Jordan Valley, featuring an ancient sanctuary where donated offerings were likely made.

6. The Tomb of Abut ‘Ubaydah: Located north of Deir Alla, the Tomb of Abut ‘Ubaydah commemorates ‘Amr ibn al-‘As, a revered companion of the Prophet Mohammed and a trusted guardian of the Islamic Nation. Following his valorous acts during the Battle of Uhud, he led the Northern Muslim Army after the Prophet’s passing and contributed to the compilation of the Holy Quran. He was laid to rest in the central Jordan Valley, with a modern mosque complex erected over his tomb serving as a primary Islamic center in the region.

7. The Hydroelectric Power Station at Bakoura/Naharyim: In 1927, Pinchas Rutenberg, a Russian immigrant and founder of the Palestine Electric Company (PEC), struck a landmark agreement with HM King Abdullah I of Jordan to construct the company's principal hydroelectric power station.

8. As-Sinnabra: Situated on the southern shore of the Sea of Galilee, As-Sinnabra is a historic site known for its significant archaeological remains. This location, including Khirbet Karak of Beit Yerah, was inhabited during the Hellenistic, Roman-Byzantine, and early Islamic periods, serving as a winter retreat for the Umayyad from 650-704 AD. During the Crusader era, the "Crusader Bridge of Sennabris" was constructed over the Jordan River adjacent to the village.

9. Beit Alpha: Dating back to the sixth century, Beit Alpha synagogue is nestled at the base of the northern slopes of the Gilboa Mountains near Beit Shean. Now part of Bet Alfa Synagogue National Park and managed by the Israel Nature and Parks Authority, the synagogue's architectural remnants indicate it was once a two-story basilica featuring a courtyard, vestibule, and prayer hall. The prayer hall housed a central nave, an apse for the Torah Ark, a bema, and benches, with the Torah Ark facing southwest, towards Jerusalem.

1.7 Infrastructure accessibility

The Jordan Valley holds immense significance for Jordan, Israel, Palestine, and the broader Middle East, serving as a vital nexus for connections and resources. Key infrastructure such as the Sheikh Hussein

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Bridge in the north and the King Hussein Bridge facilitate crucial links between the East and West, as well as between Palestine and Jordan. The King Hussein Bridge, situated near Jericho city, stands as the sole connection between Palestine and Jordan, serving as the departure point for Palestinians traveling abroad via the Queen Alia International Airport in Amman.

In Jordan, the Dead Sea Highway (Route 65) serves as the primary regional thoroughfare, traversing the Jordan Valley from north to south along the western Jordanian border and Dead Sea shoreline. All other roads leading to and from the Jordan Valley intersect with this vital artery. Passing through densely populated urban areas, the highway expands into a four-lane divided road lined with shops and buildings.

On the western side of the Jordan River, in Israel and Palestine, Route 90 serves as the main north-south route, stretching from Metula in northern Israel to Eilat in the south. Additional major roads include Routes 505 and 508, also known as the Alon Road in Hebrew.

Regarding energy infrastructure, Jordan's national interconnected grid distributes electricity from power stations to distribution substations and transformer substations across the Jordan Valley through 400-kV and 132-kV power lines. The grid, with a distinct north-south axis, extends from Aqaba through Amman to the Syrian border in the north and connects to the Egyptian grid in the south. Similarly, the Israel Electric Corporation (IEC) supplies nearly all of Israel's electricity needs, including those in the Jordan Valley, with a standard voltage of 220V and frequency of 50Hz.

In Palestine, electricity infrastructure differs between the Jordan Valley and other regions. While the Jordan Valley receives power from both Israeli and Palestinian sources, capacity remains insufficient to fully meet Palestinian needs. Plans for interconnection with Jordan aim to address this shortfall, with a proposed 33kV transmission line through the King Abdullah Bridge and a transformer substation in Jericho. Other Palestinian communities receive electricity from JDECO or the Israeli company Qutria.

The Jordan Valley is often viewed as a strategic corridor facilitating west-east and north-south transportation and energy connections. It presents opportunities for regional integration, with potential for enhanced land transport, energy, and communication links among neighboring countries. Such developments could bolster regional and international economic activities, providing diverse and efficient routing options for goods and people.

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2. Mapping the Socio-Economic Landscape of the Jordan Valley

2.1 Population

The part of the Jordan Valley under consideration houses a population of about 394,000 people. For the Jordan and Israeli parts of the study area there has been an organic growth of the population, except for the recent influx of refugees from Iraq and Syria in Jordan. This contrasts with the Palestinians, for which the economic opportunities in the region have been much more limited since the late 1960s. Palestinian youth has often been commuting or migrated to other regions in and outside the West Bank looking for opportunities in the labor markets.

The population growth rates for the Jordan and Israeli sections of the study area are estimated at respectively 2.2 and 1.9%. For Jordan the growth rate during the period 1994-2004 was calculated at 2.6% and decreased to 2.2% during the period 2004-2020. A slightly further decline of the birth rate in Jordan is expected, however the communities in the Jordan Valley follows the national trends with some years delay and therefore the birth rate for the period 2011 to 2020 is estimated at 2.2%. Table 3 below provides an overview of the population figures.

Table 3 Population Figures in the Study Area

Parameter	Israel	Jordan	Palestine
Population	40779	312730	58700
Male	20438	160118	29895
Female	20342	152612	28805
Male (%)	50.1	51.2	50.9
Female (%)	49.9	48.8	49.1
Population Growth (%)	1.9	2.2	2.1
Population Density (Capita/ km^2)		228.5	563

2.2 Water Demand and Supply

Water resources serve as a vital environmental and socio-economic asset in the Jordan Valley, crucial for sustaining all human activities. However, the region faces significant challenges related to water scarcity, exacerbated by factors such as rapid population growth, inadequate infrastructure, water pollution, and political tensions. The problem is particularly acute in irrigated agriculture, which consumes a substantial portion of freshwater resources needed for drinking.

Water demands in the area are categorized into domestic/industrial and agricultural sectors. Domestic water needs vary greatly among the riparian states and between urban and rural populations. Industrial

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water demand is minimal, with only a few industrial sites established in the valley, primarily in Beit Shean and near Jericho, consuming approximately 1.5 MCM/year, primarily in the Beit Shean region.

Agricultural water demand is significant, encompassing crop cultivation, animal husbandry, and fishery production systems. While crop production systems dominate the valley, a combination of crop and livestock systems is prevalent in both Israeli and Palestinian territories. Irrigation requirements depend on various factors, including climate, soil type, crop-specific needs, and irrigation system efficiency, with management practices varying between demand and supply-based approaches.

Fishponds play a crucial role in local water consumption and balance. However, significant water losses occur due to percolation, evaporation, and discharge, with Israel operating the majority of fishponds in the region. The table below summarizes the water demand per country and per sector.

Table 4 Water Demand in the Area in Mcm/year

Country	Israel	Jordan	Palestine	Total
Agriculture	171	133	42.5	346.5
Domestic	11	13	3.0	27.0
Industrial	Included with domestic	4.6	0.3	4.9
Total	182	150.6	45.8	378.4

Overall, there is a gap between water demand and actual supply throughout the valley. In Jordan, the total water supply, about 78 Mcm/year only meets half of the water demand. In the Palestinian territories, the total water supply, some 39 Mcm/year, is approximately 75% of Palestinian demands excluding potential agricultural lands left unused due to limited water resources.

These figures highlight the pressing need for effective water management strategies to address the growing water demands and ensure sustainable use of water resources in the Jordan Valley.

2.3 Socio-economic situation – economic activities

Historically, during the early 19th century, the primary inhabitants of the Jordan Valley, known as Al Ghawarna (meaning people of Al Ghor), engaged in mixed farming practices encompassing both crop cultivation and livestock rearing. Semi-nomadic Bedouins also utilized the valley for grazing their sheep and goats during the winter due to its warm climate and abundant fodder, though they relocated to the hills in the summer to escape the intense heat.

Today, agriculture remains the predominant economic activity in the region, albeit with significant disparities among the riparian states. The Israeli section of the valley stands out as the most economically developed, boasting living standards comparable to some European countries. Conversely, in the Jordanian part of the valley, there exists a small cohort of affluent agricultural entrepreneurs alongside a larger segment of laborers hovering near the poverty line. In the Palestinian sector, excluding Israeli settlements, the standard of living mirrors that of Jordan, albeit with a smaller population subjected to stringent movement restrictions under Israeli occupation.

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The monthly income varies dramatically between the different territories. The monthly income in the Israeli territory is about 8107.6 euros while in Jordan and Palestine it is 1246 and 725 euros respectively.

Household sizes in Jordan and Palestine are similar, averaging around 6 persons per household, consistent with broader trends in the Middle East, whereas Israel tends to have smaller households, with approximately 3.3 persons per household, resembling European norms more closely. Spending patterns exhibit slight variations, with household and per capita expenditures in Jordan roughly 30% lower than those in Palestine. Conversely, in Israel, expenditures are approximately five times higher than in Jordan. However, despite the higher expenditures, Jordan boasts a lower Consumer Price Index, indicating that Jordanians can purchase about 40% more consumer goods for their money compared to Israelis and Palestinians.

Unemployment rates are relatively high across the region, with Palestine recording the highest rate at 31.8%, followed by Jordan at 27.5%, and Israel at 21.2%. In terms of employment by sector, Palestine has a higher proportion of its workforce engaged in agriculture (28.3%), compared to Jordan (20%) and Israel (1.6%). Although detailed agricultural employment data specifically for the Jordan Valley is unavailable, it is anticipated that agriculture holds greater significance in the valley compared to national averages.

Employment data from the 2008 census (the most recent available) in Israel indicates that out of 36 settlements in the study area, five lacked recorded data, likely subsumed within neighboring settlements for reporting purposes. Among individuals over the age of 15, 63% are employed, while the remaining 37% are unemployed, retired, or in full-time education. Employment is distributed across various sectors, with 10.6% in agriculture, 39% in manufacturing, 30.5% in construction, 7% in commerce and hospitality, 6.2% in transportation, and 28% in other sectors, with 79% classified under the service sector.

In Palestine, data from the 2017 census shows employment distributed across sectors as follows: 6.4% in agriculture, 13.1% in manufacturing, 16.8% in construction, 21.2% in commerce and hospitality, 6.2% in transportation, and 36.3% in other sectors.

In Jordan, recent data indicates employment distribution across sectors as follows: 20% in agriculture, 9.5% in manufacturing, 15% in construction, 20% in commerce and hospitality, 6.5% in transportation, and 29% in other sectors.

2.4 Socio-economic situation – economic activities

The Jordan Valley can be classified into three distinct agricultural zones, because of different agro-climatic and ecological conditions. The northern zones on the West and East Banks receive more rainfall; have lower temperature and better soils. These conditions enabled the farming communities to cultivate field crops and tree crops under rain fed conditions. The middle and southern zones receive marginal rainfall; have poorer soils and higher temperatures and therefore higher evaporations. These zones are unsuitable for rain fed agriculture and Bedouin nomadic communities used to rear their goats

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and sheep flocks there. The altitude, climate, soil types, and water resources are different and unique for each of the agricultural zones.

The Jordan Valley farming communities, notably the Arab-Palestinian group called Al Ghawarna, gained renown for their exportation of agricultural goods to nearby urban hubs. Initially focused on subsistence activities like herding and gathering, these communities later expanded into cultivating cereals such as wheat, barley, maize, and various vegetables. They progressively adopted irrigation methods to sustain these crops, drawing water from the Jordan Valley's rivers, streams, springs, and wells, as well as its adjacent wadis. Historical records commend the Al Ghawarna for their adept irrigation techniques and their ability to supply urban centers with agricultural produce. Additionally, Bedouins historically utilized the valley for winter grazing of their sheep and goats, migrating them to cooler highlands during the summer months.

The advancement of irrigated agriculture in Palestinian regions was primarily propelled by individual farmers. These farmers took charge of overseeing communal springs for their family or community units, as well as managing private irrigation systems if they had access to a well. Public and private agricultural support services acted as their collaborators, sharing valuable knowledge and expertise. However, commercial farmers began to rely more on Israeli private service providers, while peasants turned to NGOs and their own trial-and-error approaches for agricultural development endeavors. The majority of farming households were without irrigation infrastructure, limiting them to rain-fed agriculture and extensive livestock rearing on their small plots of land.

Irrigated agriculture in the Jordan Valley is primarily oriented towards cultivating high-value fruit crops and vegetables destined for export markets. Growers are required to adhere to strict standards set by export agencies, which emphasize the need for bug-free crops, judicious use of chemicals, and stringent packing and refrigeration requirements. In the Israeli portion of the region, growers collaborate with national experts to develop appropriate cultivation techniques for crops and livestock systems. Additionally, there's a growing partnership between Israeli agribusinesses and Palestinian commercial farmers, encompassing production, processing, and marketing of agricultural exports (Levy, 2011). Conversely, in the Jordanian sector of the valley, commercial farmers increasingly seek expertise from international agro-industries to navigate irrigated crop production technologies and meet the quality standards demanded by export markets.

Livestock production systems play a crucial role in the mixed farming setups across the Jordan Valley, particularly in both the Israeli and Palestinian regions. In the Israeli sector, Kibbutzim and Moshavim were reported to rear 10,200 cattle for both dairy and beef purposes in 2022. Meanwhile, a significant portion of Palestinian farmers engage in livestock production within mixed farming systems or through semi-nomadic practices. In the Jordanian segment of the valley, livestock production holds economic significance, supported by the cultivation of fodder crops like clover and trefoil, as well as dairy product manufacturing. However, there is a lack of statistical data available regarding livestock production systems in this area.

In Jordan, industrial farming is emerging through initiatives led by entrepreneurs and large family farm conglomerates, particularly in the Middle Section of the Jordan Valley. However, many other farmers encounter challenges due to fragmented farm units and limited turnover, hindering their ability to adopt

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and implement advanced technologies. In Palestine, industrial farming primarily occurs within illegal Israeli settlements and through Palestinian entrepreneurial ventures. Various forms of agricultural practices, such as organic, ecological, bio-dynamic, and conservation agriculture, are distinguished among entrepreneurial, cooperative, and family farms based on ownership structure and economic objectives.

In terms of exports, the Jordan Valley serves as Jordan's primary agricultural production hub. Nationally, Jordan's agricultural exports are predominantly directed to the United Kingdom, The Netherlands, Canada, Germany, and France, with smaller volumes reaching Saudi Arabia and the Gulf States. This export comprises approximately one million tons of fruits and vegetables, with vegetables, particularly tomatoes, accounting for about 85% of the total. Additionally, Jordan exports cattle mainly to the Gulf Region.

Israel stands as a significant exporter of agricultural products and technologies. However, the Jordan Valley plays a minor role in Israel's agricultural production, as the majority originates from the central and western regions of the country.

In Palestine, total annual exports amounted to approximately 1200 million USD in 2020. The agricultural sector currently contributes around 4.5% to Palestine's GDP, a decline from 13% in 1993, with the Jordan Valley playing a relatively modest role. This decline is largely attributed to increased transport restrictions, agricultural land seizures, and limited control over the majority of agricultural lands situated in Area C, the area under the control of the Israeli Government.

2.5 Tourism

The Jordan Valley boasts significant potential for tourism, offering a plethora of historical, scenic, and religious attractions. Contributing between 7% and 14% to the economies of the three countries it spans, tourism in the Jordan Valley is intricately tied to its unique geographic, historical, religious, cultural, and archaeological features. Tourist destinations range from health and spa retreats to natural landscapes and cultural heritage sites, including religious landmarks. Many international travelers incorporate a visit to the Jordan Valley into their vacation plans, while citizens of the riparian countries often choose it as a weekend or holiday destination.

Despite its potential, tourism infrastructure in the Jordan Valley remains relatively underdeveloped. However, opportunities for recreation, thematic site visits, and guided tours are immense. The valley hosts a distinctive array of attractions, including archaeological and biblical sites, such as the revered Jordan River. Its diverse flora and fauna thrive due to the region's unique geological and climatic conditions. Further development prospects include activities like hiking or biking along the Jordan River and Dead Sea Trails, camping, rock climbing, and boating. Religious tourism, such as Islamic pilgrimage tours, also holds promise.

Realizing the tourism potential of the Jordan Valley requires the riparian states to establish a supportive policy environment through collaborative efforts. Given the region's sensitivity to political tensions, it's crucial to mitigate conflicts that could deter tourists. Political instability can significantly impact tourist

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numbers, as safety concerns influence traveler preferences. Recent socio-political developments in the Middle East have tarnished the Jordan Valley's reputation as a diverse and secure tourist destination.

Key sites within the Jordan Valley attract significant visitor numbers annually. The Baptism Site in Jordan sees around 80,000 foreign tourists yearly, while Mount Nebo welcomes approximately 400,000 foreign visitors and 2,000 Jordanian nationals annually. The Dead Sea in Jordan attracts around 20,000 foreign visitors and 7,000 locals per year. Jericho, the primary urban center in the Palestinian part of the region, records approximately 1.1 million daily visits and hosts 34,000 hotel guests annually. However, tourism in the Palestinian part faces complexities due to restricted access and reliance on tourist operators from neighboring Israel.

2.6 Industry

Except for the Israeli sector, industrial development in the Jordan Valley remains relatively limited. In Jordan, the agricultural sector is intertwined with industries providing support for greenhouses, on-farm water management equipment, and agricultural inputs. Similarly, in the Palestinian region, agro-industrial connections are underdeveloped, with weak forward linkages as products are often sold directly to consumers or urban suppliers with processing capabilities.

Israel's agricultural sector, on the other hand, has established robust backward and forward linkages facilitated by the organizational structures of Kibbutzim. The economic scale of Kibbutz farms has enabled mechanization of farm operations and investment in processing capacities for primary products through clusters of Kibbutzim.

Agricultural advancements in the Jordan Valley have primarily been associated with the service sector, with minimal contribution to industrial progress. Advanced water management equipment is typically imported from countries like Israel, India, and Europe, leveraging their comparative advantage in water-saving technologies and wastewater treatment. Although Jordan holds a prominent position in phosphate and potash fertilizer production, the manufacturing plants are situated in Aqaba due to logistical advantages. However, agricultural processing industries remain underdeveloped in the Jordan Valley, focusing mainly on the production of fresh fruits and vegetables for local consumption or export.

In Palestine, key industrial activities are concentrated in Jericho, encompassing sectors such as aluminum windows and doors, brick manufacturing, clothing, ironworks, meat processing, metal fabrication, plastic packaging, tile production, tanneries, and wooden furniture.

Additional industrial sites within the study area include small-scale stone quarries, cement production facilities, manufacturing of pumps, tubes, pipes, textiles, leather goods, furniture, paper products, printing services, chemical production, metalworks, mechanical and electrical equipment, and transportation services.

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3. Future Challenges

The Jordan Valley is faced with formidable challenges, notably water scarcity exacerbated by overexploitation, escalating demand, and inefficient practices. Climate change compounds these issues, placing additional strain on water resources, particularly impacting agriculture, the valley's primary economic pillar. Persistent infrastructure challenges further hinder transportation and vital services. Nonetheless, prospects for agricultural innovation, enhanced water management, tourism, and industrial development present opportunities for growth.

Community-based adaptation efforts in the Jordan Valley encounter various obstacles, ranging from limited resource access and infrastructure constraints to social and economic barriers, as well as political and regulatory challenges, compounded by a lack of awareness. Addressing these challenges requires comprehensive approaches encompassing infrastructure enhancement, adequate funding, community involvement, and collaborative partnerships.

The institutional challenge involves enhancing collaboration among pertinent bodies such as JVA, WAJ, IWA, and PWA, alongside drainage authorities, municipalities, and other relevant ministries. These entities serve as overseers and regulators in the Jordan Valley. Enhancements are needed in various domains, including water data collection and management, water infrastructure planning, storage and distribution operations, IT and wireless data transfer, as well as economic and land use planning, along with associated support services. Achieving this necessitates better coordination and cooperation among stakeholders engaged in water management to foster a more efficient and advantageous water economy.

Enhancing the tourism sector and preserving cultural heritage in the Lower Jordan Basin presents a significant challenge. The primary objective is to safeguard the intrinsic cultural values of the Basin while also stimulating economic growth and job creation in the region. Addressing tourism-related challenges, as outlined in the Palestinian National Strategic Master Plan, involves improving the enforcement and revision of existing laws and regulations, crafting urban plans with a distinct tourism development perspective, increasing archaeological research efforts, enhancing the management of natural and cultural heritage, developing tourism products and infrastructure, and bolstering fund management capabilities.

One of the key challenges in the Jordan Valley is to restore the ecological integrity of the Jordan Valley, and the role of the Jordan River as a source of water to be conveyed to the Dead Sea. Enhancing ecosystems and biodiversity protection in the Lower Jordan River poses significant challenges, particularly in establishing a robust legal, management, and information framework to facilitate adequate allocation, management, and enforcement of nature conservation efforts. Additionally, a key objective is to restore the natural function of the Lower Jordan River as a water conduit in the valley, ensuring continuous flow within the river for as long as possible. This rehabilitation initiative involves implementing measures to achieve at least one minor flood per year, with a flow rate of approximately 2050 m3/sec. Furthermore, to revive the original habitats of the river, the riverbed must be widened to around 50-70 meters in the north and at least 30 meters in the south, with floodplains on both sides.

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In the realm of sustainable water management, the primary challenge lies in addressing water scarcity issues within the Jordan Valley. This entails establishing a sustainable water supply system capable of meeting both current and future domestic and agricultural water needs while safeguarding water resources for future generations and environmental preservation. Achieving this necessitates implementing an Integrated Water Resources Management framework for the entire (Lower) Jordan River, facilitated by international cooperation among Israel, Jordan, and Palestine. Adequate water management tools, such as WEAP, are essential to ensure a sustainable water supply, enhance baseflow, and rehabilitate the ecological integrity of the Jordan River. A key associated challenge is attaining full wastewater treatment within the study area and maximizing its reuse for agricultural purposes. This initiative aims to mitigate public health risks and bolster the agricultural sector. It requires the development of a comprehensive technical and financial plan, inclusive of designs and tender documents, for the comprehensive collection, treatment, and reuse of locally generated wastewater flows, encompassing domestic, industrial (particularly olive oil wastewater in Jordan), and manure management. Mitigating water scarcity necessitates multifaceted solutions, including desalination initiatives, wastewater treatment and reuse programs, enhanced water management practices, conservation efforts, infrastructure modernization, policy reforms, and public awareness campaigns. Effective implementation hinges on robust collaboration among governments, communities, and international organizations.

Another key challenge is to maintain total agricultural water demands at the same level as today, with the exception of Palestine which is currently heavily underdeveloped in terms of agriculture.

Despite all the above mentioned challenges, the Jordan Valley offers a range of ecological opportunities to bolster environmental sustainability and conservation efforts:

- **Preservation of Biodiversity:** The Jordan Valley boasts a rich array of plant and animal species, many uniquely adapted to its arid environment. Conservation endeavors can safeguard vital habitats, rehabilitate degraded ecosystems, and protect endangered species. Collaboration among governmental bodies, non-governmental organizations (NGOs), and local residents is crucial for promoting biodiversity conservation and bolstering ecosystem resilience. The introduction of agroecological approaches can enhance ecological integrity while improving food security. For example, the Israeli fish farmers in the northern Jordan Valley are exploring methods of fish farming which would strengthen natural habitats and improve fish farming yields.
- **Sustainable Water Management:** Effective water management practices are essential for preserving freshwater ecosystems and maintaining ecological equilibrium in the Jordan Valley. Implementing measures like efficient irrigation methods, treated wastewater reuse, improved water governance and rainwater harvesting can curb water consumption and minimize environmental harm. Restoring natural river flows and wetlands can enhance water quality, biodiversity, and the health of aquatic habitats.
- **Rehabilitation of Degraded Landscapes:** Land degradation, stemming from soil erosion and unsustainable land practices, poses a significant challenge in the Jordan Valley. Ecological restoration initiatives, including afforestation and soil conservation efforts, can revitalize degraded landscapes, enrich soil fertility, and combat desertification. Community-driven projects can engage local stakeholders in sustainable land management practices.

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- **Promotion of Sustainable Agriculture:** Embracing sustainable farming methods can mitigate environmental degradation, soil degradation, water scarcity, and bolster ecological resilience in the Jordan Valley. Organic farming, agroecological techniques, and integrated pest management can minimize chemical inputs, conserve soil health, and protect biodiversity. Agroforestry systems, combining tree cultivation with agricultural activities, offer additional benefits such as improved soil quality and wildlife habitat preservation.
- **Development of Renewable Energy Sources:** Scaling up renewable energy infrastructure can curb greenhouse gas emissions, address climate change, and reduce dependence on fossil fuels. Installing solar panels, wind turbines, and other clean energy technologies can yield sustainable electricity while minimizing environmental impact. Agrivoltaics offers the JV, the opportunity to benefit from precious agricultural land twice, once for farming and once for energy production. To maximize the renewable energy potential in the valley, energy transmission grids must be designed to evacuate renewable energy from distributed power stations (wind and solar). Current centralized grids are not easily adapted to this purpose whereas mini-grids and even cross-border mini-grids may provide more efficient solutions. Integrating renewable energy projects into landscape planning can optimize land usage and uphold ecological connectivity.
- **Ecotourism and Nature-Based Recreation:** Ecotourism initiatives play a vital role in promoting environmental awareness, backing conservation endeavors, and providing livelihood alternatives for local communities. Establishing nature reserves, eco-trails, and wildlife viewing areas can showcase the natural splendor and biodiversity of the region while encouraging responsible tourism practices. Educational programs can engage visitors in conservation efforts and foster a deeper appreciation for the environment.

Harnessing these ecological opportunities enables stakeholders in the Jordan Valley to advance environmental sustainability, bolster ecosystem resilience, and foster the well-being of both people and nature. Collaborative efforts among governmental bodies, conservation groups, academia, and local communities are indispensable for realizing the full potential of these initiatives and striking a harmonious balance between human development and ecological preservation.

Despite the very different socio-economic and political circumstances between Palestinians, Israelis and Jordanians, all three territories face a number of common challenges including climate change and the resulting decrease in precipitation, the increased urbanization and resulting competition with agricultural lands and natural landscapes, increased populations causing environmental degradation and stress on resources, most importantly, water, energy and biodiversity.

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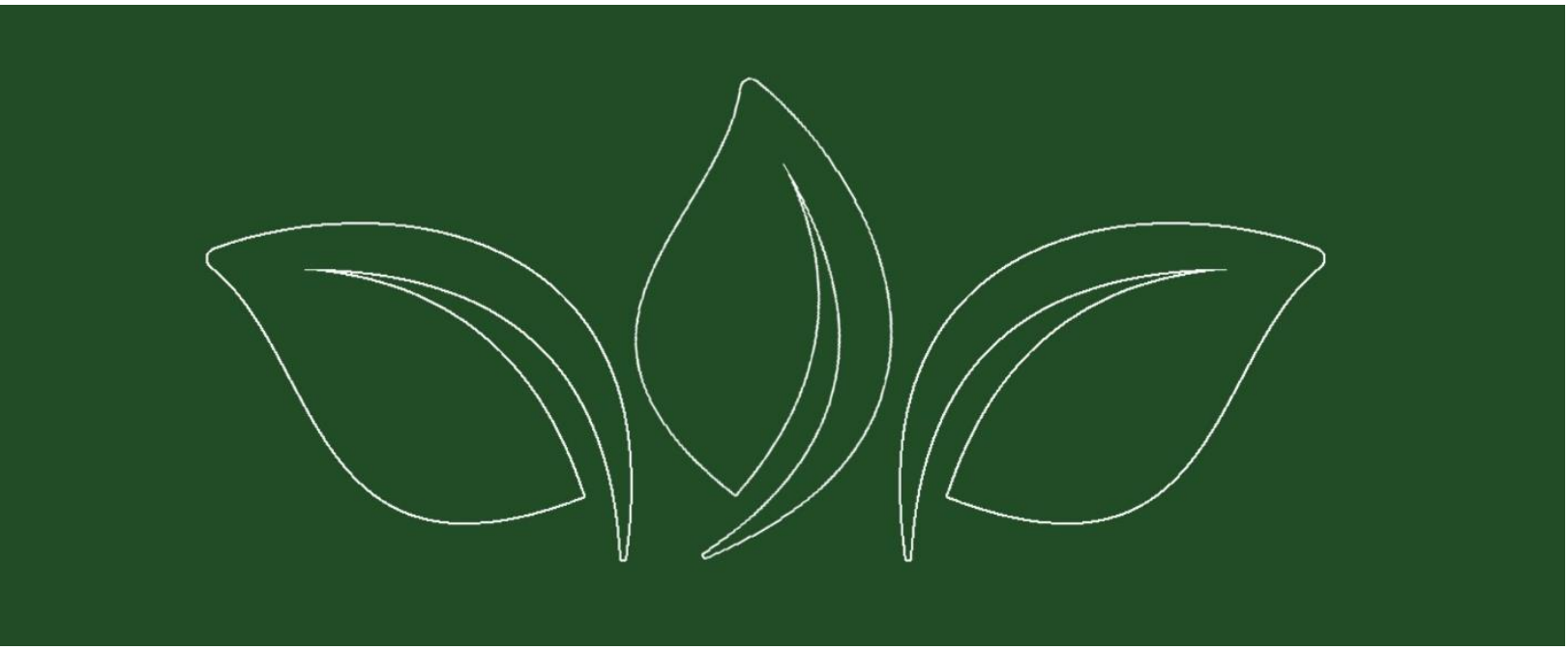
Project Coordinator

Project Partners



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