



THE HASHEMITE KINGDOM OF JORDAN

THE NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN

NBSAP 2024-2050



JORDAN'S 2050 NBSAP IS ALIGNED WITH KUNMING-MONTREAL GLOBAL BIODIVERSITY FRAMEWORK

“Nature itself is now in existential peril, its sustainability for future generations in jeopardy, and the impact on food security threatening humanity’s very existence.”

His Majesty King Abdullah II Ibn Al-Hussein

UN Summit on Biodiversity

30 September 2020

FORWARD

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NBSAP 2050 GOVERNANCE & PREPARATION TEAM

The governance structure formulated to prepare the National Biodiversity Strategy and Action Plan (NBSAP) can be described as representative, transparent, and collaborative. The National Biodiversity Committee represented the supreme decision-making and guidance platform. National technical working team representing governmental and non-governmental stakeholders concerned with biodiversity, were formulated to provide technical backstopping and input under the direct guidance and mentorship of lead experts for each thematic section of the NBSAP. This plan was prepared collectively by international lead expert and national experts in collaboration with the national technical team.

| Steering Committee | |
|---|---|
| National Biodiversity Committee chaired by HRH Princess Basma bint Ali | |
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| Mr. Anwar Elhalah | Biodiversity Monitoring Specialist |
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LIST OF ABBREVIATIONS

| | |
|----------------------|--|
| ALECSO | Arab League Educational, Cultural, and Scientific Organization |
| ASEZA | Aqaba Special Economic Zone Authority |
| AMP | Aqaba Marine Park |
| AMR | Aqaba Marine Reserve |
| BRP | Badia Restoration Program |
| CBD | Convention on Biological Diversity |
| CBO | Community-based Organization |
| CHM | Clearing House Mechanism |
| CITES | Convention on the Trade in Endangered Species |
| CSR | Corporate Social Responsibility |
| CWR | Crop Wild Relative |
| DNA | Deoxyribonucleic acid |
| EMV | Economic Modernization Vision |
| GAEAP | Gulf of Aqaba Environmental Action Plan |
| GCEP | General Corporation for Environment Protection |
| GDP | Gross Domestic Product |
| GEF | Global Environmental Facility |
| IBA | Important Bird Area |
| ICARDA | International Centre for Agricultural Research in the Dry Areas |
| IEM- JO | Integrated Ecosystem Management in the Jordan Rift Valley Project |
| IPBES | Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services |
| IUCN | International Union for the Conservation of Nature |
| JOD | Jordanian Dinar |
| JREDS | Royal Marine Conservation Society of Jordan |
| JWRP | Jordan Watershed Restoration Project |
| Kunming-Montreal GBF | Kunming-Montreal Global Biodiversity Framework |
| LMO | living modified organisms |
| NARC | National Agricultural Research Center |
| NBC | National Biodiversity Committee |
| NBSAP | National Biodiversity Strategies and Action Plan |
| NGO | Non-governmental Organization |
| NSB | National Seed Bank |
| MoA | Ministry of Agriculture |
| MoEnv | Ministry of Environment |
| MSS | Marine Science Station |
| MoW&I | Ministry of Water & Irrigation |
| OECD | Other Effective Area-Based Conservation Measures |
| PDTRA | Petra Development Tourism Regional Authority |
| RBG | Royal Botanic Garden |
| RSCN | Royal Society for the Conservation of Nature |
| SCA | Special Conservation Area |
| SIS | Species Information System (IUCN) |
| TOC | Theory of Change |
| UNDP | United Nations Development Plan |
| USFS | United States Forest Service |
| WWF | World Wildlife Fund |

EXECUTIVE SUMMARY

The 2019 Global Assessment Report on Biodiversity and Ecosystem Services by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) underscores the alarming decline in biodiversity, with an estimated one million species facing extinction. This crisis, driven by habitat loss, overexploitation, pollution, and climate change, severely threatens human well-being and demands immediate, decisive action.

In response, the Kunming-Montreal Global Biodiversity Framework (GBF) was adopted at the 15th Conference of the Parties to the Convention on Biological Diversity (CBD) in 2022. The GBF aims to halt biodiversity loss by 2030, ensure harmonious coexistence with nature by 2050, promote equitable benefit-sharing of biodiversity, and enhance the implementation and mainstreaming of biodiversity considerations.

Jordan's biodiversity is distinctive and unique, shaped by its diverse topography, ranging from rugged northern mountains to western lowlands, including the Earth's lowest point at the Dead Sea and vast southeastern deserts. This varied landscape, coupled with Jordan's strategic location at the crossroads of Asia, Africa, and Europe, creates a rich biogeographical diversity.

Jordan's four main biogeographic zones—the Mediterranean, Irano-Turanian, Saharo-Sindian-Nubo-Sindian, and Sahara-Sindian-Arabian—support a variety of ecosystems and habitats, from deciduous and evergreen forests to arid deserts and wetlands. The country is home to 2,531 identified plant species, with about a quarter classified as threatened, according to the IUCN Red List. Jordan's flora includes seven endemic species. The country is also home to a diversity of insect species, reptiles, birds, and mammals, with many species listed in the Red Data Book of Jordan's flora and fauna, underscoring the need for robust conservation efforts.

The Gulf of Aqaba supports a unique marine ecosystem with rich biodiversity, including 157 identified hard coral species and 504 fish species, some commercially important and endemic to the Red Sea.

Since ratifying the CBD in 1994, Jordan has developed and published two generations of National Biodiversity Strategies and Action Plans (NBSAPs), the first in 2001 and the second in 2015, each reflecting evolving scientific knowledge and global biodiversity targets. The 2050 NBSAP addresses key drivers of socio-ecosystem change—socio-political, economic, and environmental—to foster broad communication and understanding across policy sectors and society. Key socio-political drivers include protected areas, environmental security, disaster risk reduction, and hosting refugees, constituting approximately 32% of Jordan's population.

Economic drivers encompass energy, food security, and economic recovery. Jordan's energy sector heavily relies on natural gas imports, with renewable energy contributing 27% of local electricity generation in 2022. Agriculture, crucial for plant diversity, faces climate change risks impacting water resources and ecosystem resilience. The Economic Modernisation Vision (EMV) outlines a path for economic recovery, emphasizing the need for sustainable trade-offs between financial gains and socio-ecosystem resilience.

Environmental drivers include water scarcity, with Jordan facing a chronic water deficit, and the Al Badia region, representing 80% of Jordan, exemplifying biodiversity conservation challenges. Land use changes driven by population growth, urbanization, and climate change significantly impact ecosystems and natural resources.

The 2050 NBSAP identifies six underlying causes of biodiversity loss:

- **Relevance:** Low public awareness and prioritization of biodiversity.
- **Governance:** Inadequate decision-making structures and public participation.
- **Mismatched Trade-offs:** Disconnect between science and development agendas.
- **Inadequate Knowledge Management:** There is a need for a centralized biodiversity information database.
- **Lack of Systematic Financing Framework:** Inadequate valuation of biodiversity in national accounting.
- **Weaknesses in Pricing and Tenure:** Ineffective management institutions lead to overexploitation.

The vision of the 2050 NBSAP is: *“By 2050, Jordan’s biodiversity will be valued, conserved, restored, and sustainably used, supporting the national economy and benefiting present and future generations.”* Its purpose is:

- To reverse current trends in biodiversity, ecosystem, and associated ecosystem function loss.
- To recognize the existential threat to society caused by biodiversity loss and ecosystem degradation and the urgent need to act now.
- To ensure biodiversity is the cornerstone of green growth and underpins the provision of life-supporting ecosystem goods and services.
- To establish Jordan as a center of excellence for knowledge and expertise, building resilience and guiding us through future challenges of a changing climate.

Goals and strategic instruments of the 2050 NBSAP include:

Goal A: Maintain, enhance, or restore the integrity, connectivity, and resilience of Jordan's socio-ecosystems, ensuring their capacity to withstand disturbances while maintaining existing functions and controls and their capacity for future change. This includes reducing and eventually eliminating anthropogenic causes of extinction or genetic diversity loss within species, including domestic relatives, by 2050.

Strategic Instruments: Enhance ecosystem integrity, increase management capacities, promote participation, adopt cost-effective solutions, integrate ecological and regenerative farming, establish partnerships, conduct research and development, and support gender equality and women's roles.

Goal B: Restore and sustainably manage all ecosystem goods, functions, and services, equitably distributing the costs and benefits of sustainable management through robust use systems or benefit-return arrangements reflecting the opportunity or management costs of maintaining ecosystem services, supporting the achievement of the EMV by 2050.

Strategic Instruments: Implement inclusive policies, foster regional collaboration, support community-based management, develop career structures, support the EMV, and identify ecosystem-dependent aspects.

Goal C: Ensure fair and equitable sharing of monetary and non-monetary benefits from using genetic resources, digital sequence information on genetic resources, and traditional knowledge associated with genetic resources.

Strategic Instruments: Develop supportive policy frameworks, protect local knowledge, create diverse incentive mechanisms, promote research, and enhance regional and global collaboration.

Goal D: Fully fund biodiversity conservation in Jordan through domestic budgets, international funding, and private sector investments. Ensure a transparent and adaptive national policy framework that integrates biodiversity and ecosystem services into all sectors supports economic, social, and environmental resilience, and fully considers these factors within the national accounting system. Ensure the equitable and fair exchange of knowledge, skills, and data with international partners.

Strategic Instruments: Mobilize financial resources, develop green business models, prioritize ecosystem functions, build capacity in environmental economics, and establish efficient national coordination for biodiversity monitoring.

المُلخَص التنفيذي

أظهر التقرير الدولي لتقييم التنوع الحيوي وخدمات الأنظمة البيئية لعام 2019، الصادر عن الهيئة الحكومية للعلوم والسياسات في مجال التنوع الحيوي وخدمات النظم البيئية (IPBES) انحدار سريع للتنوع الحيوي، حيث تشير التقديرات بوجود مليون نوع مهدد بالانقراض ويعزى السبب في ذلك إلى فقدان البيئات الطبيعية، واستنزاف المصادر الطبيعية، والتلوث، والتغير المناخي، وستسبب هذه المهددات في التأثير على رفاهية الإنسان بشكل كبير، مما يستدعي اتخاذ إجراءات عاجلة.

استجابة لذلك، تم اعتماد الإطار العالمي للتنوع الحيوي - كونمينغ-مونتريال (GBF) في المؤتمر الخامس عشر للأطراف في اتفاقية التنوع الحيوي (CBD) عام 2022، حيث يهدف هذا الإطار إلى وقف فقدان التنوع الحيوي بحلول عام 2030، وضمان التعايش المتناغم مع الطبيعة بحلول عام 2050، وتعزيز تقاسم المنافع بشكل عادل، وتعزيز تنفيذ وإدماج التنوع الحيوي في القطاعات المختلفة.

يتميز التنوع الحيوي في الأردن بتنوعه الفريد، الذي تشكل بفعل التضاريس المتنوعة من المرتفعات الجبلية شمالاً إلى الأراضي المنخفضة غرباً التي تتضمن أخفض نقطة على سطح الأرض في البحر الميت، امتداداً لمساحات المناطق الصحراوية الواسعة في الجنوب الشرقي. هذا المشهد المتنوع، إلى جانب موقع الأردن الجغرافي دولياً الذي يتوسط ثلاث قارات رئيسية وهي آسيا وإفريقيا وأوروبا، قد ساهم في توفير مجموعة متنوعة من الأنظمة البيئية التي دعمت توفر تنوع حيوي غني من أصول مختلفة.

تم تصنيف أربعة مناطق جغرافية حيوية في الأردن تمثلت بالإقليم المتوسطي والإيرانو-طوراني، والصحراء العربية واقليم النفوذ السوداني حيث تدعم هذه الأقاليم بتنوعها الجغرافي والمناخ الذي تحتويه العديد من الأنظمة البيئية والموائل من الغابات مثل غابات الصنوبر الحلبي وغابات البلوط متساقط الأوراق والبلوط دائم الخضرة وغيرها إلى بيئات الصحراء العربية الجافة والأراضي الرطبة.

يحتوي الأردن على 2531 نوعاً نباتياً مصنفاً، تم تصنيف الربع تقريباً على أنها أنواع مهددة بالانقراض وفقاً للقائمة الحمراء لنباتات الأردن الصادرة تبعاً لمعايير تقييم القوائم الحمراء للاتحاد الدولي لصون الطبيعة، كما ويضم الأردن عدداً كبيراً من أنواع الحشرات والزواحف والبرمائيات والطيور والثدييات والأسماك، تم تصنيف 37% من ثدييات الأردن كأنواع مهددة بالانقراض في الكتاب الأحمر لثدييات الأردن مما يؤكد الحاجة إلى جهود الحفاظ على النظم البيئية الهشة مثل الغابات والموائل المائية، ولا تقتصر أهمية التنوع الحيوي على اليابسة بل ويتميز خليج العقبة وهو المنفذ البحري الوحيد للأردن بأهمية عالية خصوصاً باحتوائه على عدد من الأنظمة البيئية منها نظام الحيويد المرجانية ونظام الأعشاب البحرية ونظام القيعان التي ساهمت في توفير تنوع حيوي بحري مميز يضم ما يقارب 504 أنواع من الأسماك و 157 نوع من المرجان الصلب وغيرها العديد من الأنواع.

قامت الحكومة الأردنية تلبية لمتطلباتها الدولية ضمن اتفاقية التنوع الحيوي في عام 1994، بإصدار جيلين من استراتيجيات التنوع الحيوي وخطة العمل (NBSAPs)، كان الإصدار الأول في عام 2001 والثاني في عام 2015، حيث عكست الإستراتيجيات الوطنية السابقة المعرفة العلمية المتطورة وأهداف التنوع الحيوي العالمية.

تركز الاستراتيجية الوطنية الحالية لعام 2050 على المحركات الرئيسية لتغير النظام الاجتماعي-البيئي - الاجتماعي-السياسي، الاقتصادي والبيئي - لتعزيز التواصل والفهم الشامل عبر السياسات العامة للقطاعات والمجتمع. تشمل المحركات الاجتماعية-السياسية الرئيسية المناطق المحمية، الأمن البيئي والحد من أخطار الكوارث، واستضافة اللاجئين الذين يشكلون حوالي 32% من إجمالي سكان الأردن. أما المحركات الاقتصادية فتضمنت الطاقة والأمن الغذائي والتحديث الاقتصادي. يعتمد قطاع الطاقة في الأردن بشكل كبير على واردات الغاز الطبيعي، حيث تسهم الطاقة المتجددة بنسبة 27% من توليد الكهرباء المحلية في عام 2022. تواجه الزراعة - الضرورية للتنوع النباتي - أخطار تغير المناخ، مما يؤثر على موارد المياه ومنعة الأنظمة البيئية. كما وتحدد رؤية التحديث الاقتصادي (EMV) مسار الانتعاش الاقتصادي، مع التأكيد على الحاجة إلى مقايضات مستدامة بين المكاسب المالية ومنعة النظام البيئي. تشمل المحركات البيئية ندرة المياه، حيث يواجه الأردن عجزاً مزمناً في المياه، ومنطقة البادية التي تمثل 80% من الأردن، وهي مثال على تحديات الحفاظ على التنوع الحيوي. كما وتؤثر التغيرات المستمرة في استخدامات الأراضي الناجمة عن النمو السكاني والتضرر والتغير المناخي بشكل كبير على النظم البيئية والموارد الطبيعية.

تحدد الاستراتيجية الوطنية للتنوع الحيوي لعام 2050 ستة أسباب رئيسية لفقدان التنوع الحيوي، بما في ذلك:

- الأهمية: الوعي العام المنخفض وأولوية التنوع الحيوي.
- الحوكمة: هياكل اتخاذ القرارات غير الكافية والمشاركة العامة.
- المقايضات غير المحسوبة: الانفصال بين الأجنحة العلمية والتطويرية.
- الإدارة غير الكافية للمعرفة: الحاجة إلى قاعدة بيانات مركزية للمعلومات الخاصة بالتنوع الحيوي.
- عدم توفر إطار تمويلي منهجي ومستدام: التحديات المرتبطة بتقدير الكلف اللازمة لحماية التنوع الحيوي في الموازنات الوطنية.
- ضعف تسعير خدمات الأنظمة الإيكولوجية والحيازة: نهج إدارة المؤسسات الذي يؤدي إلى الاستغلال المفرط للموارد.

رؤية الاستراتيجية الوطنية للتنوع الحيوي لعام 2050 هي "بحلول عام 2050، سيكون التنوع الحيوي في الأردن ذا قيمة، محفوظاً، مُستعاد، ومستخدماً بشكل مستدام، داعماً للاقتصاد الوطني، ومفيداً للأجيال الحالية والمستقبلية".

الغاية والهدف الأسمى هو:

- عكس الاتجاهات الحالية في فقدان التنوع الحيوي، والنظم البيئية، وخدمات الأنظمة البيئية، والسلع والخدمات المرتبطة بها.
- الاعتراف بالتهديد الوجودي الذي تسببه خسارة التنوع الحيوي وتدهور وظائف النظام البيئي، والسلع والخدمات، والحاجة الملحة للعمل الآن.
- ضمان أن يكون التنوع الحيوي حجر الزاوية للنمو الأخضر وداعماً لتوفير السلع والخدمات البيئية الأساسية.
- تأسيس الأردن كمركز للتميز في المعرفة والخبرة، وبناء المرونة، والمساعدة في توجيهنا من خلال التحديات المستقبلية غير المتوقعة لتغير المناخ.

الأهداف العامة وأدوات الاستراتيجية الوطنية للتنوع الحيوي لعام 2050 هي كالآتي:

الهدف أ: الحفاظ على سلامة، واتصال، ومرونة جميع النظم الاجتماعية-البيئية في الأردن، بما في ذلك قدرتها على تحمل الاضطرابات مع الحفاظ على وظائفها الحالية وسيطرتها، وقدرتها على التغيير في المستقبل، مما يؤدي إلى تقليل تدريجي وإزالة نهائية للأسباب البشرية للانقراض أو فقدان التنوع الجيني داخل الأنواع، بما في ذلك أقاربها المحلية، والحفاظ على مجموعات منيعة بحلول عام 2050.

الأدوات الاستراتيجية: تعزيز سلامة النظام البيئي وزيادة قدرات الإدارة وتعزيز المشاركة وتبني حلول فعالة من حيث التكلفة ودمج التنوع الزراعي والزراعة البيئية وإقامة شراكات والبحث والتطوير ودعم المساواة بين الجنسين ودور المرأة.

الهدف ب: استعادة وإدارة جميع المنتجات والوظائف والخدمات البيئية بشكل مستدام، وتوزيع تكاليف وفوائد الإدارة المستدامة بشكل عادل من خلال نظم الاستخدام المستدام أو ترتيبات العائدات الأخرى التي تعكس تكاليف الفرصة أو الإدارة للحفاظ على إمداد مستمر من الخدمات البيئية الداعمة لتحقيق رؤية التحديث الاقتصادي (EMV) بحلول عام 2050.

الأدوات الاستراتيجية: السياسات الشاملة والتعاون الإقليمي والإدارة المجتمعية والهياكل المهنية ودعم رؤية التحديث الاقتصادي (EMV)، وتحديد الجوانب المعتمدة على النظام البيئي.

الهدف ج: المشاركة العادلة والمنصفة للفوائد النقدية وغير النقدية من استخدام الموارد الجينية، والمعلومات الرقمية عن الموارد الجينية، والمعرفة التقليدية المرتبطة بالموارد الجينية.

الأدوات الاستراتيجية: أطر السياسات الداعمة، حماية المعرفة المحلية، آليات الحوافز المتنوعة، تعزيز البحث، والتعاون الإقليمي والعالمي.

الهدف د: تمويل صون التنوع الحيوي في الأردن بالكامل من خلال الميزانيات المحلية، التمويل الدولي، والاستثمارات من القطاع الخاص. إطار سياسات وطنية شفاف وقابل للتكيف يضمن التكامل المتماسك للتنوع الحيوي والخدمات البيئية في جميع القطاعات، ودعم المرونة الاقتصادية والاجتماعية والبيئية، وأخذ هذه العوامل في الاعتبار بشكل كامل ضمن النظام المحاسبي الوطني. تبادل المعرفة والمهارات والبيانات بحرية وعدالة مع الشركاء الدوليين.

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PART I: THE GLOBAL CONTEXT – BIODIVERSITY STRATEGY AND ACTION PLANS

1.1 BIODIVERSITY STRATEGY AND ACTION PLANS

The Convention on Biological Diversity (CBD) is a multi-lateral treaty opened for signature after the Rio Earth Summit of 1992. The CBD represents the global collaborative platform fostering collective action and cooperation to promote the conservation of biodiversity, its sustainable use, and the fair and equitable sharing of benefits from commercial and other utilization of genetic resources¹. The Convention is implemented through several mechanisms, including:

- The National Biodiversity Strategies and Action Plans (NBSAPs) outline Member countries' specific goals and actions for conserving and sustainably using biological diversity in line with the strategic aims of the Convention².
- The Strategic Plan for Biodiversity 2011-2020 (the Aichi Biodiversity Targets) framed global action on biodiversity through 20 targets aimed at halting and reversing biodiversity loss by 2020.
- The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization is an international agreement that provides a framework for fairly and equitably sharing the benefits of genetic resources³.
- The Cartagena Protocol on Biosafety governs the movements of living modified organisms (LMOs) resulting from modern biotechnology from one country to another. The Protocol is based on the precautionary principle. It has three main objectives: protecting biological diversity from the potential risks of LMOs, ensuring the safe handling, transport, and use of LMOs, and promoting the fair and equitable sharing of the benefits arising from the use of LMOs⁴.

In 2019, the Global Assessment Report of Biodiversity and Ecosystem Services was issued by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)⁵ as the most comprehensive and authoritative assessment of the status and trends of biodiversity and ecosystem services worldwide. This report found that biodiversity is declining at an unprecedented rate, with an estimated one million species at risk of extinction due to several factors, including habitat loss and fragmentation, overexploitation, pollution, and climate change. The report also found that the decline of biodiversity is having a significant impact on human well-being. Therefore, it concluded that urgent action is needed to reverse biodiversity decline and protect ecosystem services. The results of this assessment report were instrumental in shaping the Kunming-Montreal Global Biodiversity Framework (GBF), which was adopted by the 15th Conference of the Parties to the Convention on Biological Diversity (CBD) in 2022.

1.2 THE KUNMING-MONTREAL GLOBAL BIODIVERSITY FRAMEWORK

The Kunming-Montreal GBF was issued as a landmark global framework for biodiversity conservation and sustainable use for 2021-2030. It replaces the Aichi Targets with some critical differences. The Kunming-Montreal GBF has a stronger focus on addressing the root causes of biodiversity loss, such as unsustainable

¹ Smallwood, J., 2019. *The Convention on Biological Diversity's objectives include conservation of biological diversity at a global level, but has it become another victim of extinction as a result of its text and strategic plan?* (Doctoral dissertation, University of Sussex).

² Sarkki, S., Niemelä, J., Tinch, R., Jäppinen, J.P., Nummelin, M., Toivonen, H. and Von Weissenberg, M., 2016. Are national biodiversity strategies and action plans appropriate for building responsibilities for mainstreaming biodiversity across policy sectors? The case of Finland. *Journal of Environmental Planning and Management*, 59(8), pp.1377-1396.

³ Buck, M. and Hamilton, C., 2011. The Nagoya Protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilization to the Convention on Biological Diversity. *Review of European Community & International Environmental Law*, 20(1), pp.47-61.

⁴ Hagen, P.E. and Weiner, J.B., 1999. The Cartagena Protocol on Biosafety: New rules for international trade in living modified organisms. *Geo. Int'l Evtl. L. Rev.*, 12, p.697.

⁵ Díaz, S.M., Settele, J., Brondízio, E., Ngo, H., Guèze, M., Agard, J., Arneith, A., Balvanera, P., Brauman, K., Butchart, S. and Chan, K., 2019. The global assessment report on biodiversity and ecosystem services: Summary for policy makers.

production and consumption patterns. In addition, it recognizes the importance of biodiversity for human well-being and sustainable development. It also includes targets on mainstreaming biodiversity into all sectors of society and mobilizing sufficient resources for implementation⁶.

The Kunming-Montreal GBF sets out a bold vision for a world living in harmony with nature by 2050 and aims to achieve four goals: i) bend the curve of biodiversity loss by 2030, ii) realize a world of living in harmony with nature by 2050, iii) fair and equitable sharing of the benefits of biodiversity and iv) means of implementation and mainstreaming of biodiversity. To achieve these goals, the Kunming-Montreal GBF sets out 23 global targets for 2030⁷, including:

- Protect at least 30% of the Earth's land and sea areas.
- Restore at least 30% of degraded ecosystems.
- Halve the introduction of invasive alien species.
- Reduce nutrient losses to the environment by at least half.
- Reduce pesticide use by at least half.
- Eliminate all forms of subsidies that are harmful to biodiversity.
- Mobilize at least \$200 billion annually in domestic and international financial resources from all sources to support the implementation of the Global Biodiversity Framework

The framework calls for catalyzing, enabling, and galvanizing urgent and transformative action by Governments, subnational and local governments, and all of society to halt and reverse biodiversity loss, achieve the outcomes it sets out in its vision, mission, goals, and targets, and thereby contribute to the three objectives of the Convention on Biological Diversity and its Protocols. Member countries (the Parties) are now required to update, revise, and align their NBSAP with the new Kunming-Montreal goals and targets.

⁶ Hughes, A.C. and Grumbine, R.E., 2023. The Kunming-Montreal Global Biodiversity Framework: what it does and does not do, and how to improve it. *Frontiers in Environmental Science*, 11, p.1281536.

⁷ Aubert, G. and Dudley, N., 2024. Progress on implementing the Kunming-Montreal Global Biodiversity Framework.

PART II JORDAN AND BIODIVERSITY

2.1 JORDAN COUNTRY PHYSICAL PROFILE

Jordan is a small country in the Middle East and is part of the West Asia region. It has a strategic location at the crossroads of Asia, Africa, and Europe, with an area of 89,342 Km², most of which is land (88,737 Km²), while 512 Km² is water, including a 27 km long coastal strip on the Gulf of Aqaba. An artificial lagoon created by Ayla in Aqaba, Jordan, spans a large area of about 16 Km. Saraya Aqaba provided an additional Km where these artificial lagoons serve as part of a luxury resort and residential project to boost tourism and economic growth in Aqaba. An artificial lagoon is a man-made water body designed for specific purposes such as recreation, tourism, or urban development. At the same time, the natural coastal area is a natural zone where land meets a sea or ocean, encompassing various ecosystems and landforms. The artificial lagoon is constructed by humans, often for specific uses and aesthetic enhancement, while the coastal area has formed through natural geological and ecological processes over time.

Jordan's climate is influenced by several factors, including its location, topography, and proximity to the Mediterranean Sea. The country's topography is diverse, with three main eco-regions.⁸:

1. The Jordan Valley is a long, narrow depression that runs along Jordan's western border until the Gulf of Aqaba. It holds the lowest point on Earth, the Dead Sea, at -421 m below sea level. A hot and dry climate with little rainfall characterizes the region. However, it is a fertile region home to several agricultural fields and is considered Jordan's basket food.
2. Mountain Heights Plateau: This region of rolling hills and mountains spans the western half of Jordan and receives more rainfall than the Jordan Valley. The increased precipitation makes the Mountain Heights Plateau more fertile, supporting a variety of vegetation and agricultural activities. Its higher elevation and diverse terrain create a distinct ecological zone within the country.
3. The Eastern Desert: Covering the eastern half of Jordan, expansive sand dunes, rocky hills, and salt flats characterize this vast desert region. The Eastern Desert comprises more than 80% of Jordan's land area. Despite its harsh conditions and arid environment, it holds significant geological and ecological value, with unique desert landscapes and adapted wildlife.

Demographically, Jordan is a constitutional monarchy with a population of 11,516,000 people, of whom young people (31.42% under 14 years of age) represent the majority (DOS, 2023). It hosts more than 3.6 million refugees, including 2.3 million Palestinian refugees registered with the United Nations Relief and Works Agency (UNRWA)⁹, around 1.36 million Syrian refugees¹⁰, and smaller groups from Iraq, Yemen, Sudan, and Somalia¹¹. Most of the Jordanian population are males (52.2%) compared to 48.8 females, with a high birth rate and a low death rate, resulting in a population growth rate of 2.0%. The unemployment rate was 22.3% in May 2023 and is higher among women (30.4%) than men (19.6%). Also, it's higher among young people (38.4%) than older people (17.3%). Several reasons contribute to the high unemployment rate, including the slow economic growth, high population growth, and the emigration of many skilled Jordanians to other countries in search of better job opportunities and livelihood status. The literacy rate is high, with over 97% of the population able to read and write.

Jordan is considered a highly urbanized country, with over 85.4% of the population living in cities. Its economy depends heavily on oil imports, tourism, agriculture, phosphate mining, textiles, and pharmaceutical industries, and it is considered a significant recipient of foreign aid. The Gross Domestic Product (GDP) is estimated to be \$47.45 billion in 2023, with a GDP per capita of US\$4,204.5. The main sectors contributing to Jordan's GDP are

⁸ Ababneh, A., Rawashdeh, A. and Nawiseh, S., 2016. The repetitiveness of biogeographical regions, vegetation types and ecotourism at Jordanian protected areas, A GIS based analysis study. *Ecology Environment Conservation*, 22(2), pp.7-17.

⁹ Where We Work | UNRWA

¹⁰ Jordan Response Plan (jrp.gov.jo)

¹¹ Country - Jordan (unhcr.org)

agriculture (4.2%), Industry (24.2%), Services (71.6%), and extractive industries such as potash, phosphate, and limestone. Despite the relatively small economy of Jordan, it has grown steadily in recent years, with a GDP of 50.9 US\$ billion in 2023¹². This slight slowdown from the 3.1% growth that the country experienced in 2022 is due to several factors, including the war in Ukraine, rising inflation, and supply chain disruptions.

Jordan is considered a regional center of relative stability, a status it has achieved through its strong political institutions, commitment to democracy and human rights, and economic resilience. Over the years, Jordan has played a constructive role in regional peace and security efforts and managed to host millions of refugees from Syria and other countries, providing them with necessities and integrating them into the Jordanian society. To date, Jordan has managed to maintain its stability, mainly due to its unwavering commitment to democracy and human rights. This commitment has bolstered Jordan's stability and instilled confidence in its future.

Nevertheless, Jordan faces significant economic challenges shortly after a slow recovery from the global COVID-19 pandemic, regional insecurity, dependence on energy imports, and a severe annual water deficit greatly exacerbated by climate change and other anthropogenic factors.

2.2 CLIMATE PROJECTIONS FOR JORDAN

2.2.1 OVERVIEW

Jordan's climate ranges from Mediterranean in the highlands to desert in the eastern and southern regions. The country experiences two long seasons: a cold, rainy winter from mid-October to late April and a hot, dry summer from June to September, with brief intermediate seasons. In the highlands, the Mediterranean climate brings moderate, dry summers and cold, rainy winters. The Badia region has a desert climate with hot summers and cold winters. The Ghor area, including the Jordan Valley, has a semi-tropical climate characterized by hot summers and warm winters. Temperature variations are significant across regions. Winter average temperatures range from 9-13°C in the highlands to 19-22°C in the deserts. In summer, the Jordan Valley can reach 38-39°C, while desert areas experience 26-29°C. Annual precipitation is low, with over 90% of the country receiving less than 200 mm, predominantly in winter. Rainfall decreases from north to south and west to east, ranging from 400-600 mm in the northern highlands to less than 50 mm in the southern deserts. Occasional light snowfall occurs in the highest areas, including Amman.

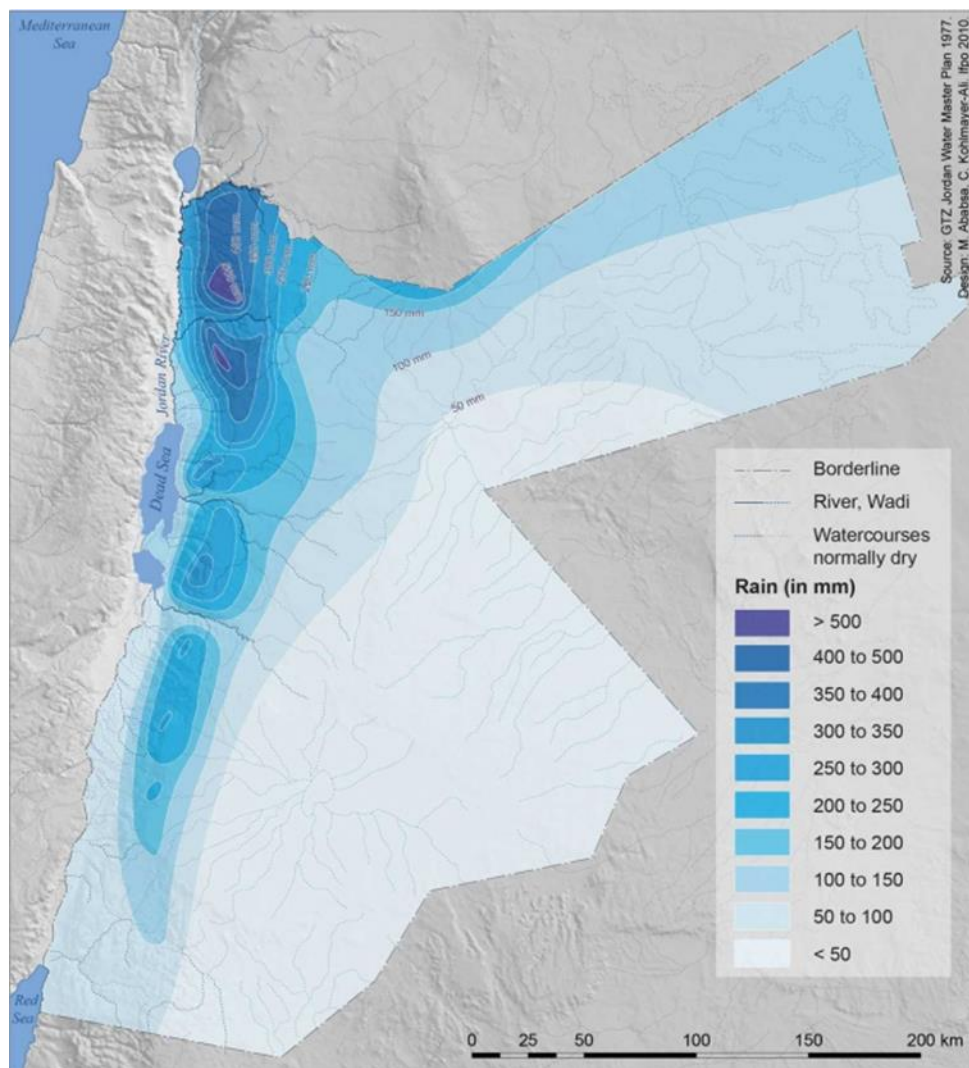
However, rainfall patterns vary significantly across the country, influenced by topography and geographic location. According to the 4th National Communication Report (4NC)¹³, rainfall distribution (Figure 1)¹⁴ The northern highlands, including the Ajloun Mountains, receive the highest annual rainfall, averaging between 400-600 mm, benefiting from the Mediterranean climate, which brings moist air masses during the winter months. In the central highlands, such as the Balqa mountains, rainfall decreases slightly, averaging between 300-600 mm annually, due to elevation and proximity to Mediterranean influence. The southern highlands, including the Moab and Sharah mountains, experience lower rainfall, ranging from 200-350 mm and 100-300 mm, respectively, due to their distance from the Mediterranean Sea and the increasing influence of desert climates. The northern part of the Jordan Rift Valley receives 300-400 mm of rainfall annually, significantly reducing to 100-200 mm north of the Dead Sea. In contrast, the southern part of the valley, including the Gulf of Aqaba, receives less than 50 mm of rainfall annually, highlighting the stark contrast in precipitation within short distances. The Badia region, characterized by a desert climate, receives minimal rainfall, generally less than 50-100 mm annually, emphasizing the arid conditions. Seasonal winds also influence Jordan's climate. The Khamsin winds from the desert can raise temperatures by up to 15°C and bring dust storms, while the Shammal winds from the north bring high daytime temperatures during summer. These climatic conditions create a challenging environment with significant temperature fluctuations and limited water resources.

¹² mpo-jor.pdf (worldbank.org)

¹³ Fourth National Communication Report to Climate Change. 2022. United Nations Development Program. Ministry of Environment.

¹⁴ ABABSA, Myriam. *Aridity In: Atlas of Jordan: History, Territories and Society* [online]. Beyrouth: Presses de l'Ifpo, 2013 (generated 14 décembre 2021). Available on the Internet: <<http://books.openedition.org/ifpo/4865>>. ISBN: 9782351594384. DOI: <https://doi.org/10.4000/books.ifpo.4865>

Figure 1: Jordan’s average rainfall



2.2.2 CLIMATE PROJECTIONS IN JORDAN

The 4NC's climate projections indicate that Jordan will face substantial climatic challenges, including increased temperatures, reduced precipitation, more frequent and severe droughts, and higher water demands. These will significantly affect the country's water resources, agriculture, and natural ecosystems. The significant changes projected for Jordan’s climate can be summarized as follows¹⁵:

1. **Warmer Climate:** The minimum air temperature is very likely to increase by up to +1.2 °C (ranging from +0.6 °C to +2.9 °C) under RCP 4.5 and by up to 2.7 °C (ranging from +2.1 °C to +4.5 °C) under RCP 8.5. Similarly, the maximum air temperature is expected to increase by 1.1 °C (ranging from +0.7 °C to +1.7 °C) under RCP 4.5 and by 3.1 °C (ranging from +2.6 °C to +3.7 °C) under RCP 8.5.
2. **Drier Climate:** The country is very likely to experience a significant reduction in precipitation, with a decrease of 15.8% (ranging from -7.1% to -31.3%) under RCP 4.5 and a more drastic reduction of 47.0% (ranging from -23.3% to -57.5%) under RCP 8.5. While some areas might see an increase in precipitation

¹⁵ Fourth National Communication Report to Climate Change. 2022. United Nations Development Program. Ministry of Environment.

- (up to 19% under RCP 4.5), the overall trend points towards a drier climate, particularly in the western part of the country. Any potential increase in rainfall will likely be confined to the southern arid zones.
3. **Decrease in Relative Humidity:** Relative humidity is projected to decrease by up to 3% (ranging from -2.5% to -3.3%) under RCP 4.5 and by 7.2% (ranging from -6.0% to -7.8%) under RCP 8.5.
 4. **Increased Drought and Water Balance Contrasts:** The severity and frequency of droughts are expected to increase, especially in the northern part of the country. Drought events could increase by up to 50% under RCP 4.5 and up to 93% under RCP 8.5. The duration of droughts is also expected to lengthen, with drought periods lasting more than three consecutive years under RCP 4.5 and more than five years under RCP 8.5.
 5. **Higher Crop Water Demands:** Potential evapotranspiration is likely to increase by up to 5.8% (ranging from +4.7% to +6.9%) under RCP 4.5 and by 11.1% (ranging from +8.1% to +15.3%) under RCP 8.5, indicating higher water requirements for crops.
 6. **Intense Precipitation and Potential Floods:** While there are no signs of an increase in heavy rain days (more than 20 mm), more intense precipitation events are probable, particularly mid-century. However, these events are projected to decrease by the end of the century, especially under RCP 8.5.
 7. **Significant Heatwaves:** The frequency of heatwave events is predicted to increase by 120% (ranging from 54% to 398% depending on location) under RCP 4.5 and about threefold (ranging from 1.5 to 9.0 times depending on location) under RCP 8.5.

2.2.3 TERRESTRIAL BIODIVERSITY AND CLIMATE CHANGE

In Jordan, ecosystems' vulnerability to climate change was assessed using mean annual temperature and precipitation rate as primary exposure parameters. Two emission scenarios (RCP 4.5 and 8.5) were projected for 2050, 2070, and 2100 intervals. The projections, normalized and categorized into five scores ranging from 1 (very low) to 5 (very high), indicated varying levels of exposure. Under the RCP 4.5 scenario for 2050, most ecosystems are expected to experience very low levels of climate change exposure. By 2070, exposure levels will increase slightly but remain low overall, with very low exposure in southwest Jordan's Acacia, sand dunes, steppe ecosystems, and some mudflat ecosystems in southeast Jordan. By 2100, moderate exposure trends are anticipated in northwestern Jordan, where forest ecosystems are concentrated. The RCP 8.5 scenario predicts a harsher exposure trend over time. In 2050, nearly all of Jordan's ecosystems will experience low exposure, with Mediterranean non-forest, deciduous oak, evergreen oak, and Aleppo pine ecosystems showing low exposure trends. Low exposure trends will prevail by 2070, with moderate exposure in forested ecosystems in northwestern Jordan, sand dune, and aquatic ecosystems. By 2100, very extreme exposure trends are expected to affect nearly all of Jordan.

Despite these projections, the exposure trends are generally acceptable, with extreme projections of RCP 8.5 in 2100 unlikely to significantly affect Jordan's ecosystems. However, indirect anthropogenic threats such as induced fires and water drainage pose risks to ecosystems and species. Research and monitoring programs are recommended for key ecosystems and species, particularly those at risk of climate change, including threatened ecosystems with small extents of occurrence, species with specialized habitat requirements, and those with narrow environmental tolerances. Ecosystems' sensitivity to climate change refers to their likelihood of being affected by or responsive to climate change. Several factors influence this sensitivity, including physiology, habitat specificity, impact levels of other stressors, temperature-sensitive species, population size, fragmentation, genetic diversity, endemism, threatened species, and phenology.

Forested ecosystems in Jordan, particularly those experiencing fires, are the most sensitive to climate change. Aleppo pine, evergreen oak, and deciduous oak are highly affected by fire, while Phoenician juniper and Acacia woodlands face water drainage threats and drought. The impact of climate change on ecosystems was determined by averaging exposure and sensitivity values. Projections indicate that forested areas in Jordan will be most impacted by climate change, followed by sand dunes, wetlands, and eastern basalt intrusion areas east of the desert. Climate change will affect ecosystems in several ways, including decreased productivity, structure and species composition changes, increased species invasion, reduced resilience, and impacts on ecosystem services. Additionally, management costs related to disturbances, such as fire management and invasive species eradication, are expected to rise. The adaptive capacity of ecosystems to cope with climate impacts depends on physical, social, political, economic, technological, and institutional capacities. Key adaptive capacity indicators include the percentage of ecosystems in conserved areas, financial resources for ecosystem conservation, availability of technology and innovation, infrastructure support, institutions dedicated to conservation, knowledge and information dissemination, and flexible decision-making and governance. Based on these criteria, the adaptive capacity of Jordan's ecosystems was assessed using a scoring system ranging from 1 (very

low) to 5 (very high). Most ecosystems in Jordan are expected to have low to moderate vulnerability, except for forested ecosystems, sand dunes, wetlands, and aquatic ecosystems, which will be highly vulnerable to climate change.¹⁶

2.3 BIODIVERSITY IN JORDAN

In alignment with the Montreal-Kunming Framework, the 2030 Jordan NBSAP does not aim to offer a comprehensive taxonomic account of the nation's diverse biodiversity. Instead, the NBSAP acknowledges the importance of all ecosystem components and focuses on creating a supportive policy environment to efficiently and effectively allocate resources (human, material, technical, financial). The goal is to enhance system resilience and halt biodiversity loss. Therefore, broad taxonomic terms such as flora and fauna or terrestrial, marine, and freshwater are used for their practical value in policy and resource allocation rather than strict taxonomic detail.

2.3.1 BIOGEOGRAPHIC ZONES IN JORDAN

The biodiversity in Jordan is distinctive and unique, resulting from the varying topography, from the rugged mountains areas in the north to the lowlands in the western regions, including the lowest point on earth, all the way to the Gulf of Aqaba in the south and the vast desert area in southeastern parts of Jordan. The location of Jordan at the junction points of three major biogeographical realms, the Palearctic, Afrotropical, and Oriental¹⁷, has also supported the existence of several species from different origins. Jordan has four main biogeographic zones.¹⁸ which are:

1. **Mediterranean:** The Highlands stretch from Irbid in the north to Ras An-Naqab in the south, with isolated areas in the southern mountains. Several steppe wadis interrupt the Mediterranean region, which is found at altitudes ranging from 50 meters below sea level (masl) to 1700 meters above sea level (masl). The climate is temperate, featuring hot, dry summers and mild, wet winters, with annual temperature minimums ranging from 5 to 10° C and mean yearly maximums from 20 to 30° C. Rainfall varies between 300 and 600 mm annually but is scattered and inconsistent. The soil is predominantly red Mediterranean (terra rosa) and yellow Mediterranean (rendzina), constituting the most fertile part of the Kingdom and supporting forest formation. This densely populated region accounts for 90% of Jordan's population. Six vegetation types exist in this zone: Deciduous oak forest (156 km²), Evergreen oak forest (157 km²), Pine Forest (18 km²), Man-made pine forests (116.3 km²), Garrigue and Batha (4,815 km²), Juniper Forest (192 km²), and Riparian vegetation (29.9 km²).
2. **Irano–Turanian:** The Irano–Turanian region features a diverse topography of plains, plateaus, and hills, with elevations ranging from 250 meters below sea level to 1700 meters above sea level. This region serves as a buffer zone, separating the Mediterranean region from the Saharo–Sindian–Arabian and Saharo–Sindian–Nubo–Sindian subzones. It is considered fragile and vulnerable to climate change and overgrazing. The climate is dry and continental, with hot summers and cold winters, where mean annual minimum temperatures range from 5 to 2° C and mean maximum yearly temperatures range from 15 to 25° C. Annual rainfall varies between 150 and 300 mm. The soils are primarily calcareous or wind-transported and support predominantly steppe vegetation. This zone has two vegetation types: steppe (11,293 km²) and riparian (38 km²).
3. **Saharo–Sindian–Nubo–Sindian:** This region extends into Jordan from the Red Sea coastal areas, originating from the tropical regions of the Arabian Peninsula and northeast Africa. It includes the Dead Sea, the lowest point on Earth at -420 meters below sea level. The landscape is mostly desert, stretching from the Lower Jordan Valley along the Rift Valley towards the country's south and then shifting

¹⁶ Eid, E. 2022. In Lit. Jordan's Fourth National Communication on Climate Change. UNDP. Ministry of Environment

¹⁷ Eid, E., & Mallon, D. (2021). Wild ungulates in Jordan: past, present, and forthcoming opportunities. *Journal of Threatened Taxa*, 13(9), 19338-19351.

¹⁸ Taifour, H., Dexter, K. G., Al-Bakri, J., Miller, A., & Neale, S. (2022). A State-of-the-Art Vegetation Map for Jordan: A New Tool for Conservation in a Biodiverse Country. *Conservation*, 2(1), 174-194.

towards Wadi Rum in the southeast along the Saudi border. It has a semi-arid climate with hot summers and mild winters, with mean annual minimum temperatures ranging from 10 to 29° C and mean annual maximum temperatures ranging from 20 to 35° C. Annual rainfall varies between 50- and 100-mm. Soils are primarily alluvial, saline, sandy, and granitic, supporting vegetation such as tropical trees, shrubs, and annual herbs. Eight vegetation types exist in this region: mudflat (297 km²), granite and sandstone shrubland (4,079 km²), riparian (4 km²), thermophilous (534 km²), saline (392 km²), sand dune (1,760 km²), acacia woodland (1,453 km²), and sandy gravel hammada vegetation with *Vachellia gerrardii* & *Artemisia judaica* (2,909.8 km²).

4. **Sahara–Sindian–Arabian:** This region covers the eastern desert, representing the largest zone in Jordan, encompassing 72% of its area. The landscape is predominantly flat, with elevations ranging from 500 to 1,350 meters above sea level, except for several small mountains and hills caused by volcanic activity. The mean annual minimum temperatures range from 15 to 29° C, while mean yearly maximum temperatures range from 25 to 40° C. Annual rainfall varies between 50 and 200 mm. The soils are clay, hamada, saline, sandy, or calcareous. This zone includes four vegetation types: mudflat vegetation (596.1 km²), gravel hammada vegetation (45,871.9 km²), runoff hammada vegetation (11,677.4 km²), and sandy gravel hammada vegetation with *Hammada scoparia* (2,408.5 km²).

2.3.2 TERRESTRIAL FLORA AND VEGETATION TYPES IN JORDAN

Due to its varied topography, ecosystems, and climate, Jordan boasts a diverse array of terrestrial plant species. At the southern tip of the Fertile Crescent—a region extending from the south of Caucasus to northern Egypt and renowned for its rich genetic diversity essential to agriculture—Jordan is home to 2,531 identified plant species. Of these, about a quarter are classified as threatened, according to the IUCN's Red List. Jordan's flowering plants include seven endemic species and around 106 near-endemics (endemic to Palestine and Syria). The country's flora also features hundreds of medicinal plants and other multipurpose species, notably over 250 taxa of Crop Wild Relative plants. Cultivated and natural forests cover a mere 0.7% of Jordan's total area, with natural forests accounting for just 0.5%. The diverse plant species are spread across 18 different vegetation types.¹⁹:

1. Gravel Hammada Vegetation
2. Sand Dune Vegetation
3. Steppe Vegetation
4. Granite and Sandstone Shrubland
5. Acacia Woodland
6. Sandy Gravel Hammada Vegetation with *Hammada scoparia*
7. Sandy Gravel Hammada Vegetation with *Vachellia gerrardii* & *Artemisia judaica*
8. Garrigue and Batha
9. Runoff Hammada Vegetation
10. Mudflat Vegetation
11. Saline Vegetation
12. Juniper Forest
13. Deciduous Oak Forest
14. Anthropogenic Pine Forest
15. Riparian Vegetation
16. Thermophilous Vegetation
17. Pine Forest
18. Evergreen Oak Forest

¹⁹ Taifour, H., Dexter, K. G., Al-Bakri, J., Miller, A., & Neale, S. (2022). A State-of-the-Art Vegetation Map for Jordan: A New Tool for Conservation in a Biodiverse Country. *Conservation*, 2(1), 174-194

Generally, the Jordanian plants are classified according to the five main subgroups of the plant kingdom:

| Ecosystems | Plant kingdom group | Subgroups/ family | Number of species |
|--------------------------|---------------------------|---|--|
| Terrestrial | Thallophyta ²⁰ | Algae | 42 species of bacillariophyta ²¹ Three species of Chrysophyta |
| | | Fungi | 132 species of mushrooms ²² 150 species of lichens ²³ |
| | | Bryophytes ²⁴ | Mosses Liverworts |
| | Pteridophyta | Ferns and their allies ²⁵ | 12 |
| | Gymnosperms ²⁶ | Cupressaceae | Two native species |
| | | Pinaceae | One |
| | Angiosperms ²⁷ | Flowering Plants | 2,531 |
| Freshwater ²⁸ | | Rotifera | 11 |
| | | Copepoda | Ten |
| | | Cladocera | Five |
| Marine | Algae ²⁹ | Green (Chlorophyta), Brown (Phaeophyta) and Red (Rhodophyta) | 33 |
| | | Phytoplankton ³⁰ | Bacillariophyceae Coscinodiscophyceae Mediophyceae Dinophyceae Coccolithophyceae Dictyochophyceae |

20 Salhab, A., 2007. A Minireview on Mushroom: Emphasis on the Wild Mushroom of Jordan (Review Articles). Jordan Medical Journal, 41(3).

21 Tavassi, M., Barinova, S. and Glassman, H., 2008. Algal communities in the polluted lower Jordan River, Israel. Israel Journal of Plant Sciences, 56(1-2), pp.111-119.

22 Salhab, A., 2007. A Minireview on Mushroom: Emphasis on the Wild Mushroom of Jordan (Review Articles). Jordan Medical Journal, 41(3).

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2.3.3 TERRESTRIAL FAUNA

The terrestrial fauna of Jordan contains two main groups: the Arthropoda and Chordata. The following provides more details on each group.

| Ecosystems | Phylum | Class | Groups | Number of species |
|---------------|--------------|-------------|------------------|-------------------|
| Terrestrial | Arthropoda | Insects | Mayflies | 11 |
| | | | Dragonflies | 47 |
| | | | Grasshoppers | 50 |
| | | | Locust | 1 |
| | | | Crickets | 2 |
| | | | Walking sticks | 1 |
| | | | Stoneflies | 3 |
| | | | Earwigs | 1 |
| | | | Cockroaches | 2 |
| | | | Mantodea | 16 |
| | | | True bugs | 33 |
| | | | Lice | 1 |
| | | | Thrips | 1 |
| | | | Darkling beetles | 14 |
| | | | Diving beetles | 25 |
| | | | Ground beetles | 55 |
| | | | Jewel beetles | 25 |
| | | | Longhorn beetle | 56 |
| | | | Ladybugs | 4 |
| | | | Click beetles | 1 |
| | | | Clown beetles | 1 |
| | | | Scarabaeidae | 5 |
| | | | Houseflies | 2 |
| | | | Mosquitoes | 20 |
| | | | Horse flies | 35 |
| | | | Robber flies | 6 |
| | | | Blow flies | 1 |
| | | | Hoverflies | 5 |
| | | | Crane fly | 1 |
| | | | Digger Bees | 1 |
| | | | Bee species | 53 |
| | | | Ants | 58 |
| | | | Wasps | 8 |
| | | Butterflies | 65 | |
| | | Moths | 12 | |
| | | Owl fly | 51 | |
| | | Caddisflies | 1 | |
| | | Crustaceans | Freshwater crab | 1 |
| | | | Fairy shrimps | 2 |
| | | | Clam shrimp | 1 |
| | | Arachnids | Spiders | 67 |
| | | | Scorpions | 19 |
| | | | Ticks | 1 |
| Mites | 9 | | | |
| Camel spiders | 1 | | | |
| Myriapods | Centipedes | 6 | | |
| | Scolopenders | 2 | | |
| | Pill bugs | 3 | | |
| Chordata | Amphibians | Toed | 1 | |
| | | Frogs | 2 | |

| Ecosystems | Phylum | Class | Groups | Number of species |
|--------------------|--------|-----------------------|-----------------|-------------------|
| | | Reptiles | Lizards | 54 |
| | | | Snakes | 36 |
| | | | Tortoise | 1 |
| | | Birds | Resident birds | 69 |
| | | | Migratory birds | 367 |
| | | Mammals ³¹ | Bats | 26 |
| | | | Insectivores | 5 |
| | | | Carnivores | 16 |
| | | | Lagomorpha | 1 |
| | | | Rodents | 24 |
| | | | Hyracoidea | 1 |
| | | | Ungulates | 7 |
| | | Freshwater fish | 15 | |
| | | Marine | Hard corals | 157 |
| | | | Soft Corals | 150 |
| Marine Sea Turtles | 4 | | | |
| Zooplanktons | 73 | | | |

2.3.4 MARINE BIODIVERSITY

2.3.4.1 MARINE BIODIVERSITY AND CLIMATE CHANGE

The climate exposure assessment for the marine environment of the Gulf of Aqaba, based on data from 2006 to 2020, examined parameters such as sea water temperature, pH, and salinity. Historical data indicated that sea temperatures in the Gulf of Aqaba averaged 23.17°C, with monthly variations between 21°C and 26°C. Projections suggest a significant increase in temperature, reaching 31.16°C by 2100. Despite this rise, temperatures remain within known ranges and are not expected to pose immediate risks. The study also noted a decrease in sea temperature with depth and found that future projections indicate a continued rise in temperature, with notable increases even at greater depths. Historical pH levels ranged from 8.29 to 8.31, with projected increases across depths, although some areas might see decreases in pH levels. Such changes could harm marine life, particularly in Jordan's only marine protected area. Salinity data showed stability over time, but projections indicate a slight decrease in salinity with depth, which could be influenced by freshwater input and evaporation rates. Specific locations, such as semi-closed ports, might experience changes due to local activities.

Sensitivity assessments indicate that marine ecosystems are highly sensitive to climate change due to their reliance on stable climate conditions. The adaptive capacity of marine ecosystems was evaluated based on criteria such as asset base, economic resources, technology, infrastructure, institutional support, and knowledge. The assessment revealed a low adaptive capacity for these ecosystems. The overall climate change risk and opportunities assessment, which combined impact and adaptive capacity scores, found that the vulnerability of marine ecosystems and biodiversity is moderate. However, the primary threats to these ecosystems stem from anthropogenic activities rather than climate change alone³².

Increased sea surface temperatures, precipitation, and elevated CO₂ concentrations in seawater particularly threaten coastal areas. Extreme weather events such as heavy rainfall or droughts in upstream areas can lead to runoff and flooding that impact coastal regions and marine life, especially in Aqaba. The northern parts of Aqaba are especially vulnerable to flash floods due to their location downstream from major wadis. Additionally, rising water temperatures could facilitate the establishment of alien species in the Gulf of Aqaba. In contrast, increased sea temperatures and CO₂ concentrations could trigger algal blooms and harm marine ecosystems and biodiversity. Ocean acidification from increased CO₂ could negatively impact coral reefs and other pH-

³¹ Eid, E., Baker, M.A. and Amr, Z., 2020. *National Red data book of mammals in Jordan*. IUCN.

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sensitive organisms, potentially leading to significant socioeconomic consequences, including property losses, reduced tourism, and diminished fisheries.

2.3.4.2 MARINE BIODIVERSITY

Overview

The Jordanian shoreline along the Gulf of Aqaba (GoA) extends 27 km, Jordan's only direct access to sea routes. Recently artificial lagoons created by developments such as Saraya Aqaba and Ayla Oasis have further extended the accessible coastline, enhancing the region's waterfront for tourism and recreation. This coastline supports essential activities as sea transport hub, artisanal fishing, tourism, and industrial development. Within Jordan's coastal stretch lies 13 km of discontinuous fringing reefs, home to unique marine and coastal ecosystems with rich biodiversity. Given the limited shoreline, all coastal activities in Jordan are concentrated within this area, leading to significant and conflicting pressures on marine resources. These pressures include tourism (hotels, resorts, and related activities), future port developments, industrial operations, a marine park, and a Marine Science Station. Such concentrated activity places continuous direct and indirect pressures on all coastal habitats, including vital coral reefs. New port developments and expansions pose severe risks to coral reef integrity. Industrial accidents and illegal activities further exacerbate the impact on this sensitive marine environment, particularly in light of ongoing and planned tourism and economic projects.

Physical Environment

The Gulf of Aqaba (GoA) is located within the Wadi Araba–Dead Sea Rift Zone, a major geological structure stretching from East Africa to South Turkey. Tectonic activity in this rift system has shaped the regional rock formations, with faults in the area primarily oriented N-S, NE-SW, and E-W. These faults contribute to the formation of wadis that transport weathered materials to alluvial fans. The gulf features Precambrian granitic rocks covered by Quaternary alluvial and shore deposits, including gravel, sand, and clay. Coral reefs in the GoA originated during the middle Pleistocene epoch and have been continuously built upon during sea level rise episodes. The stability of these reefs suggests their growth is influenced by geological and ecological factors, with the region's steep submarine slopes limiting their extension seaward.

The Gulf of Aqaba (GoA) features a deep and narrow profile, with its deepest point reaching 1,825 meters and an average depth of 800 meters. The continental slopes are among the steepest globally, with 60 to 70 percent gradients. The bathymetry includes three deep basins separated by low sills. The Aqaba area is divided into three sectors: the southern sector, known for its steep slopes and narrow fringing reefs; the western slope, with a steeper angle than the eastern slope; and the eastern sector, with a prominent linear ridge and a cone-shaped feature. The sediments are mostly black, indicating a mineral-rich composition and well-oxygenated conditions. Surface sediments are medium sand with low mud content and a low presence of calcium carbonate and organic carbon. The area has active and inactive alluvial fans, with the active zones being lower and formed by recent floods, while inactive zones are elevated. The alluvial fans, over 20,000 years old, are characterized by varying sediment sizes from coarser rocks near the canyon mouth to finer sands farther out.

Sediment sources for the beaches include longshore currents, wave scouring of alluvial fans, and flash floods. The southern coast features capes, embayments, and wide bays protected by reef flats. The sandy stretches are intermittent, with exposed beach rock cemented by calcium carbonate forming narrow strips along the shoreline. Fossil reefs from the Pleistocene epoch, shaped by sea level changes and tectonic activity, are also found here. Beach sediments along the southern Aqaba coastline mix marine calcium carbonate and siliciclastic quartz from wadi deposits. As one moves north, the beach composition shifts to finer materials and larger stones. The lack of significant beach sand accumulation poses a challenge for recreational use, with exposed beach rock creating safety hazards for visitors.

In the Gulf of Aqaba (GoA), sea level fluctuates seasonally by up to one meter, rising from December to May and falling from July to October. This variation is influenced by monsoon winds in the Indian Ocean, which affect water flow between the Indian Ocean, the Red Sea, and the GoA. Other factors include evaporation rates and water exchange through the Bab el Mandeb Strait and the Suez Canal. In 2013, the maximum sea level range relative to the global Mean Sea Level (MSL) was 154.3 cm, with a peak of 101.7 cm in December and a low of -52.6 cm in April. Sea level anomalies follow a clear annual cycle, with the lowest monthly mean anomaly of 5.0 cm occurring in June and the highest of 47.4 cm in November. Due to the narrow Straits of Tiran, the GoA experiences limited water exchange with the Red Sea, leading to long water residency times—over two years in

the upper and three years in the lower depths. Longshore tidal currents are minimal, flowing gently in easterly and westerly directions.

Wave heights and directions in Aqaba are primarily driven by wind direction, with prevailing winds from the north resulting in waves coming from the north. During winter, waves from the north-north-west are generally less than 2 meters high, occasionally exceeding this height. The summer monsoon period sees similar conditions, with waves generally under 2 meters. Tidal ranges in the GoA are very limited, with a typical range of one meter or less. Semi-diurnal tides occur with two high and two low tides every 24 hours. In 2004, the maximum sea level range was 1.42 meters, with highs reaching 0.94 meters above MSL and lows dropping to -0.48 meters below MSL. Extreme low tides, particularly in the summer, can expose reefs for up to 20 minutes, though most corals can recover if some living tissue remains intact. Currents in the northern GoA exhibit seasonal trends but are generally variable. Southerly currents dominate year-round, with a brief period of northward flow from November to January. In early February, a wind-driven Ekman circulation creates a cross-shore pattern with onshore surface currents and offshore bottom currents. In the proposed Aqaba Marine Reserve (AMR), currents are relatively weak, averaging less than five cm/s, with stronger surface currents than deeper layers. The average surface current speed is 10.3 cm/s, five times stronger than subsurface currents. These current patterns of low water exchange rates and high evaporation make the GoA susceptible to long-term pollution effects.

Chemical Environment

In the Gulf of Aqaba (GoA), sea surface temperatures range from 20.5°C in February to over 27°C in September. During summer, a strong thermocline forms, maintaining a constant temperature of 21.5°C below 200 meters. In winter, the thermocline collapses, allowing mixing between upper and lower seawater layers. Salinity in the GoA ranges from 40.3 to 41.6 psu, higher than the ocean average of 35 g/l. Vertical salinity differences are minimal between 50-150 meters, with the eastern side being less saline due to the influence of lower salinity waters from the Red Sea. High evaporation rates and lack of regular freshwater input contribute to the GoA's high salinity. Below 200 meters, salinity is relatively uniform at 40.6‰, except in areas with active seafloor rifts where brine with extremely high salinity and temperatures up to 60°C occurs.

Dissolved Oxygen (DO) is generally high in the GoA, with surface waters exhibiting lower DO in summer than in winter due to temperature and salinity variations. DO levels are near saturation (4.8–6.5 ml O₂/L) and decline gradually with depth, never dropping below 50% of saturation. The pH of GoA waters fluctuates around 8.3, typical for coral reef waters, where calcium carbonate buffers the pH. The seas are oligotrophic and exceptionally clear, with high transparency due to the lack of major terrestrial inputs. The euphotic zone extends to 77–105 meters. Nutrient concentrations increase in winter due to mixing and stratification but are low in summer due to increased primary productivity and nutrient consumption. Anthropogenic activities may affect nutrient levels through tourism or industrial impacts. Primary productivity in the GoA is low compared to other seas due to the thermocline's restriction on nutrient recycling. Chlorophyll levels peak in spring (February to May) at 0.4 mg chlorophyll a/m³, with significant primary production occurring at 200 meters due to high water transparency.

Biological Environment

The distribution of zooplankton biomass within the Gulf of Aqaba (GoA) is generally quite homogeneous. Several environmental factors can influence zooplankton production directly or indirectly through other regions. For example, air pressure can impact zooplankton biomass, as lower air pressure may lead to increased zooplankton biomass due to vertical mixing and subsequent nutrient enrichment caused by disturbance in the sea surface layer. Similarly, ocean currents have varying effects on zooplankton abundance and distribution. In the GoA, the zooplankton community larger than 150µm comprises 73 species (45 genera) across ten taxa, including Tintinnidea, Foraminifera, Trachymedusea, Thecosomata, Cladocera, Ostracoda, Copepoda, Malacostraca, Chaetognatha, and Urochordata. Holoplanktonic forms are the most abundant, making up 91.5% of the zooplankton, with Copepoda and Chaetognatha comprising over 90% of the total zooplankton biomass. Copepods alone account for 87% of the total zooplankton abundance. Seven copepod species are found in the GoA, including *Paracalanus indicus*, *Calocalanus clausi*, *Phaenna spinifera*, *Clausocalanus ferrani*, *Calanua robstior*, *Euchirella messinensis*, *Candacia tenuimana*, and *Corycaeus subullatus*.

The coral reef ecosystem of Jordan is a notable feature of its marine environment, covering a small area of approximately four km², extending along about half of the country's 27 km coastline. This ecosystem is part of the Red Sea biogeographic zone, recognized by the World Wide Fund for Nature (WWF) as a "Global 200 Eco-

Region" due to its unique marine biodiversity. The Jordanian coastline features a discontinuous series of coral reefs with two main morphological units: reef flats and outer slopes. Vertical drop-offs characterize the outer reef flats and lack the typical "spur and groove" structures in other reef formations. In the Jordanian part of the GoA, the reef flat is narrow with a vertical drop-off. The coral distribution shows a trend of increasing hard coral cover from north to south towards the Saudi Arabian border. Deeper waters (>15m below sea level) have higher coral cover than shallower waters, likely due to better protection from damaging factors affecting the shallower reef corals. The GoA contains 157 identified hard coral species, including 153 scleractinian corals, one organ pipe coral, and three fire corals. Of the scleractinian corals, 147 are zooxanthellate, hosting photosynthetic dinoflagellates. Fifteen scleractinian corals found in recent surveys are Red Sea endemics. Approximately 65% of the 23 known Red Sea endemic coral species are found in Jordan, with 9.8% of scleractinian corals recorded between 0 and 30m depth being Red Sea endemics. Some Red Sea endemics have been recently described or resurrected due to advances in integrated systematics. The proposed AMR also hosts 14 vulnerable species, 30 near-threatened species, five data deficient species, and 41 not-evaluated species, with the remaining 67 species categorized as least Concerned.

Seagrass meadows in the proposed AMR are relatively small compared to the coral reef extent, with the greatest seagrass coverage in Al-Mamlah Bay (Tala Bay). Seagrass distribution increases with depth up to 12 meters and then declines. Three seagrass species have been recorded: *Halophila stipulacea*, *Halodule uninervis*, and *Halophila ovalis*. *Halophila stipulacea* is the most common and widely distributed, with coverage ranging from 35 to 55 percent in shallower waters and 20 to 40 percent in deeper waters. Seagrass meadows provide important habitats for crustaceans and invertebrates and serve as nursery grounds for fish, with fish assemblages showing higher abundance in seagrass-dominated areas than coral reefs. The Gulf of Aqaba contains eighteen genera of benthic macroalgae, with brown algae (Phaeophyceae) showing the highest biomass and mean absolute cover. Coastal waters near industrial areas have higher brown algae coverage than areas near phosphate loading ports. Brown algae coverage is exceptionally high during spring. Occasionally, local fishermen use algae mixed with fish and flour as bait. Turf algae along the GoA coastline show higher coverage in shallower depths (around 8 meters). Areas with turf algae and low-living coral reef coverage are often located near industrial developments, while areas adjacent to public beaches have fewer turf algae and live reef cover. Turf algae coverage averages 28% of the total reef area, with bare dead coral making up 40%, suggesting a potential phase shift from coral reefs to turf algae, which could be mitigated with appropriate management actions.

Fish communities in the GoA exhibit high endemism, with about 25 species unique to the Red Sea. A total of 507 fish species comprising 18 in Chondrichthyes and 497 in Ostichthyes from 113 families have been recorded in the GoA, representing 40% of the Red Sea's known fish species. Eight families account for over 41% of the recorded species, including Wrasse (Labridae), Pomacentridae, Serranidae, Apogonidae, Blenniidae, Gobiidae, Carangidae, and Syngnathidae. Seven species are recognized as endemic, and some are commercially important. The most abundant shallow-water pelagic species are *Atherinomorous lacunosus* and *Spratelloides gracias*, while deep-sea fishes include *Ago amanuensis*, *Rhinobatos punctifer*, and *Mureanesox cereus*.

Three turtle species are recorded in the GoA, with a fourth expected. The Endangered green turtle (*Chelonia mydas*) is anticipated, while the Vulnerable loggerhead turtle (*Caretta caretta*) and the rarely encountered leatherback turtle (*Dermochelys coriacea*) have been recorded. The most common species is the hawksbill turtle (*Eretmochelys coriacea*), with the highest population observed at Black Rock near Tala Bay.

The Jordanian GoA is home to a diverse range of marine invertebrates, including gastropods, rock oysters, barnacles, and chitons. Twenty percent of mollusks, echinoderms, and some algae species may be endemic. Giant clams, *Tridacna maxima*, and *T. squamosa* are keystone species in the reef ecosystem, contributing significantly to reef growth and development. Both species are considered endangered in Jordanian waters and require protection. Sponges, members of the phylum Porifera, are the most primitive multicellular animals, many containing symbiotic algal cells. There are 72 sponge species known from the Jordanian GoA, with some species showing potential for drug development. However, no known industrial or medicinal applications exist for these sponges in Jordan.

Cnidarians in the GoA include Hydrozoa, Scyphozoa, and Anthozoa classes. Hydrozoans include 24 species from 21 genera, with *Millepora exesa* being a notable stinging coral. Scyphozoans, or jellyfish, are represented by three species from three genera. Anthozoans include scleractinian corals, major reef constructors, and host photosynthetic dinoflagellates known as zooxanthellae. In the phylum Mollusca, 645 species are recorded from the GoA, with Gastropoda being the most represented class. Important mollusks include *Coralliophila neritoidea*,

Dendropoma maxima, and *Pedum spondyloideum*. Chaetognatha, or arrow worms, include four species from two genera. Urochordata, or tunicates, are represented by around 20 species from three classes: Ascidiacea, Larvacea, and Thaliacea.

The intertidal sand fauna is categorized into macrofauna, meiofauna, and microfauna based on size. Macrofauna includes species like *Tetraclita squamosa rufotincta* and *Ostrea forskali*, while meiofauna occupy interstitial spaces, and microfauna are typically one-celled animals. Various mollusks and crustaceans are found in the rocky intertidal zone, with some species being rare along the Jordanian coast.

2.4 RED LIST SPECIES

The International Union for the Conservation of Nature (IUCN) Red List of Threatened Species is essential for directing conservation efforts and measuring progress towards preventing extinctions. In Jordan, national efforts have been conducted to identify species' status according to the IUCN Red List criteria and guidelines. The Royal Botanic Garden (RBG) has taken the lead in the red listing of Jordanian plant species and has assessed 1,983 taxa. Similarly, Eid et al. 2020 assessed the status of 85 mammalian species. The published Red Lists aim to support the creation of conservation strategies, which, in turn, will help protect Jordan's floral and faunal species diversity and serve as a reference for future studies and monitoring programs.

The RBG published the Red Data Book of Jordan's flora and assessed the status of 1,983 vascular plant species, representing 78 % of the Jordanian flora¹¹ One hundred fifty-five species were Not Applicable in (IUCN) to the Red List criteria, as they were unresolved, misapplied, or did not exist in IUCN's Species Information System (SIS). One species, *Salvia fruticosa*, was assessed Regionally. Of the 1,983 plant species studied in volumes one and two, conservation assessments were completed for 1828 species. A total of 221 plants have been recorded as Critically Endangered (CR), 275 are Endangered (EN), 96 are Vulnerable (VU), and 39 are Near Threatened. (NT), 1189 are of Least Concern (LC). Seven are Data Deficient (DD), while the remaining 155 plants were found to be Not Applicable (NA) in the IUCN Red List assessment, as they were unresolved, misapplied, or not grown in nature as wild plants. Most threatened species are found in the most vulnerable ecosystems, such as forests, especially in the north, and freshwater ecosystems, especially in Jordan Rift Valley, highlighting the need for priority interventions within these two ecosystems.

The Red Data Book of mammals in Jordan identified 33 threatened species (39%) out of the 85 assessed species, including 10 Critically Endangered, 20 Endangered, and 3 Vulnerable. In addition, five (6%) were Near Threatened, three (3%) were Data Deficient, 38 were Least Concern, and six were Regionally Extinct, representing 7% of the assessed species.

2.5 GENETIC DIVERSITY

Genetic diversity is the diversity in DNA sequences and traits within species, which allows populations to adapt, evolve, and survive over time and the term has been. Therefore, genetic diversity is the foundation of species and ecosystem diversity, though it has often been neglected. It is essential to conserve "diversity within species, between species and of ecosystems" equally, as set out in the 1992 CBD. This has important policy and operational implications regarding managing species, habitats, populations, and ecosystems in spatial and numerical terms, which will need to be factored into policy considerations with an explicit understanding that managing genetic diversity also requires maintaining the processes that act upon the individual and populations—furthermore, *ex-situ* measures. In contrast, important genetic conservation tools are only an emergency stopgap measure.

This greater understanding of the importance of genetic diversity highlights the need to mainstream biodiversity conservation management across all sectors and to reduce human activities' impact as much as practicable and at a national level. Genetic diversity is, therefore, central to the support of all life on Earth, present in individuals. Still, it must be maintained at the ecosystem level to ensure sufficient diversity for all life to adapt to future change. Such considerations also highlight the need to manage genetic diversity across borders and within conflict situations, illustrating the existential nature of continued regional conflicts in a time of global uncertainty due to climate change.

Jordan has high levels of genetic diversity due to several factors, including its diverse landscape, with a variety of habitats from mountains to lowlands and deserts, and its location at a crossroads between Europe, Asia, and

Africa, which has led to the mixing of genes from different populations and biogeographical domains. In addition, Jordan has been a member of the Commission on Genetic Resources for Food and Agriculture (FAO) since April 12, 1989. The Commission is dedicated to conserving biodiversity for food and agriculture and promoting its sustainable use for food security, human well-being, and global development for current and future generations. It monitors the status of genetic resources and the actions countries take to implement its instruments, assessing their impact at the national level. Indicators have been developed to track the implementation of the Global Plans of Action, and a set of targets and indicators has been created to improve and measure the conservation, use, and development of genetic resources. These indicators are also used for national reporting on Target 2.5 of the Sustainable Development Goals. The Commission leads the development and promotion of international targets and indicators for specific sectors of genetic resources for food and agriculture, aiming to achieve coherence, enhance cooperation among relevant international forums and organizations, and reduce the reporting burden on countries. The Commission and FAO work closely with the Biodiversity Indicators Partnership. Jordan is committed to regularly reporting on the status of its genetic resources and relevant SDGs, with the National Agricultural Research Center (NARC) serving as the focal point for the CGRFA.

The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) was adopted by the Thirty-First Session of the Conference of the Food and Agriculture Organization (FAO) of the United Nations on November 3, 2001. The CBD is the first partner to the International Treaty. Since adopting the Nagoya Protocol, the Governing Body has called on Contracting Parties to ensure that any legislative, administrative, or policy measures taken to implement the Treaty and the CBD or its Nagoya Protocol are consistent and mutually supportive. The Treaty has three pillars similar to the Convention on Biological Diversity (CBD): conservation, sustainable utilization, fair access, and resource-sharing. However, the Treaty focuses explicitly on plant genetic resources for food and agriculture (PGRFA), which includes farmer's varieties (local landraces), crop wild relatives, and wild food plants. The Treaty aims to:

- Recognize the enormous contribution of farmers to the diversity of crops that feed the world Establish a global system to provide farmers, plant breeders, and scientists with access to plant genetic materials.
- Ensure that recipients share the benefits derived from using these genetic materials.

Jordan ratified this treaty on May 30, 2002, with the National Agricultural Research Center (NARC) as the focal point. The National Seed Bank of Jordan Database was established in 1993 as a Visual FoxPro application primarily designed for the ICARDA gene bank. It has since been flexibly redesigned and programmed, allowing easy adaptation to the national seed bank. A new database was recently adopted for the seed bank in cooperation with Crop Trust. To develop the work of documentation programs according to global updates in the field of documentation, the international plant gene bank information management system (GRIN-GLOBAL) was installed at the NARC seed bank.

While the inclusion of genetic diversity in the 2050 NBSAP marks an important advance in the management of biodiversity, it is still important to note that a wealth of crop wild relatives exist in Jordan in part due to the location at the southern end of what is popularly known as the Fertile Crescent, this crescent hosts habitats of 2 Vavilov's Centers of origin; The Mediterranean basin and Asia Minor. A crescent-shaped region spanning from the southern Caucasus in the north to Jordan in the south. Due to the specific climatic, geophysical, and biological characteristics, the area is believed to be a cradle of cultivation; the first region where settled farming began and led to the development of agriculture and domestication to another wealth of local landraces or farmer's varieties.

These crops' wild relatives and landraces are essential for crop improvement and can help ensure our food supply's long-term security. Therefore, the National Agricultural Research Center (NARC), in its National Seed Bank, works to conserve, characterize, and utilize CWR native to Jordan. Examples of crop wild relatives are enormous; for example, Jordan is part of the center of origin of wheat, barley, chickpeas, lentils, lettuce, carrot, pistachio, olive, and many others. As per wheat gene pool is represented by several species, including the cultivated durum (*Triticum durum*), the old wheat (*T. monococcum*), the wild einkorn (*T. beoticum*, poulard wheat), *T. turgidum* wild relatives (*T. dicoccoides*, *T. Urartu* and *Aegliops spp.*). Wild wheat is the ancestor of modern bread wheat and is found in many habitats of Jordan. The importance of crop wild relatives is the presence of the stress tolerance genes of biotic and abiotic stresses; such genes are transferrable to cultivated high-producing varieties that simultaneously enable high production and stress tolerance.

In addition, two old and improved cultivars (*Hordeum vulgare*) and wild barley (*Hordeum spontaneum*) can be found in Jordan. Wild barley is the ancestor of modern barley and is found in the mountains and deserts of Jordan. It is considered resistant to drought and can grow in harsh conditions. Wild lentil (*Lens culinaris* subsp. *orientalis*) is the ancestor of modern lentils and is found in the mountains and deserts of Jordan; it is a nutritious food source and a good source of nitrogen for the soil. Moreover, the wild almond (*Prunus dulcis* subsp. *fuscata*) is the ancestor of modern almond almonds. It is found in the mountains of Jordan and is considered a valuable source of food and oil. Wild olive (*Olea europaea* var. *sylvestris*) is a source of oil and wood. It is regarded as the ancestor of modern olive and is found in the mountains and deserts of Jordan. Finally, the wild fig (*Ficus carica* subsp. *sylvestris*) is the ancestor of the modern fig and is found in the mountains of Jordan. It is used as a source of food.

Jordan established seed banks to conserve the genetic diversity of Jordan's flora in 1993 by the National Seed Bank of Jordan NARC mandated to collect, preserve, characterize, and make available Plant genetic resources for food and agriculture of Jordan on top of which wild relatives and local landraces (details in 2.3.3) and 2003 by RBG seed bank that was established to conserve the general flora currently and currently holds over 6 million seeds where the collection includes research, education, and conservation efforts.

2.6 HISTORY OF BIODIVERSITY CONSERVATION IN JORDAN

The formal history of nature conservation in Jordan dates back to 1922, when the first conservation act was passed to preserve Jordan's forest and rangelands. Legal mechanisms to conserve biodiversity strengthened when the Government of Jordan, through the Ministry of Agriculture, issued the first hunting law in 1934. In 1956, the concept of game species was first introduced, and in 1965, his Majesty the late King Hussein ordered the development of a comprehensive outline for nature conservation in Jordan. In 1966, the regulations on guns used for hunting were issued. In the same year, the Royal Jordanian Hunting Club was reborn as the Royal Society for the Conservation of Nature (RSCN) and given a de facto role in hunting control. At the time, all hunting and shooting were forbidden without a license (which cost JOD 5 per year), and the RSCN committee set hunting seasons and bag limits for all game species. In addition, using automatic weapons, nets and traps, mechanical vehicles, and spotlights for hunting were prohibited. In 1973, the government amended the Agricultural Law to incorporate a Wildlife Conservation Law and delegated the RSCN to implement this, which was, in turn, given authority to issue and administer hunting licenses and impose fines for non-compliance with the hunting laws in a move that gave statutory powers to civil society organization.

In 1974, a mission was initiated through the World Wildlife Fund (WWF) and the IUCN, which aimed to give palpable assistance to Jordanian conservation efforts. The mission was followed by a project funded by the IUCN and the WWF and executed in 1977-78. In 1975, the University of Jordan restricted access to 900m along the Marine Science Station (MSS) coastline south of the ferryboat terminal 1975. Still, the restriction was practiced purely for research and monitoring programs. In 1977, a study funded by the Arab League Educational, Cultural, and Scientific Organization (ALECSO) aiming to understand the feasibility of establishing a marine park in the proposed south coast tourist area and recommended a marine park and environmental management zone to be established between the MSS to incorporate the existing marine strict access area and the coast guard station.

In 1979, a report on Jordan's network of protected areas was published, with twelve sites proposed for conservation. Six of the proposed sites have been designated as nature reserves, and five of them are entirely run and managed by the RSCN: Shaumari Wildlife Reserve, Azraq Wetland Reserve, Ajloun Forest Reserve, Mujib Nature Reserve, and Dana Biosphere Reserve. RSCN established the Wadi Rum Protected Area, managed by the Aqaba Special Economic Zone Authority (ASEZA). Many of the protected areas proposed in 1979 have been seriously degraded due to population growth and several developmental activities. Therefore, RSCN, in consultation with the General Corporation for Environment Protection (GCEP), now the Ministry of Environment, and with assistance from the IUCN and a fund from the Global Environment Facility (GEF), carried out the first review of the proposed nature reserves network during 1997-2000. RSCN used IUCN international standards to evaluate and update the list of the proposed sites (National Protected Area Report 2007), where four additional sites were proposed in addition to the original 1974 report totaling 16 protected areas. In 2005, a second review of the proposed nature reserves in the Jordan Valley was carried out through the preparations for the Integrated Ecosystem Management in the Jordan Rift Valley Project (IEM- JO). Accordingly, four more protected areas and seven Special Conservation Areas (SCA) have been proposed for establishment along the Jordan Rift Valley by RSCN.

In 1980, the Ministry of Municipal Affairs established the Environmental Protection Department. This department has expanded to be the GCEP (now the Ministry of Environment) in response to the ratification of the CBD by the government of Jordan. One of the main mechanisms that has supported nature conservation in Jordan is the Agriculture Law (Number 44, 2002), which includes a series of articles addressing the sustainable use of natural resources, including genetic diversity and the protection of wildlife species inside and outside their natural habitats. The Ministry of Agriculture also mandated that the RSCN enforce wildlife protection and hunting control regulations. The Ministry has recently been developing its technical capacities for biodiversity protection in an increasing trend of recognition of the modern approaches to tackling ecosystem management and biodiversity conservation. The strategic roles of the two ministries often overlap, and a concerted effort is required to ensure synergy, complementarity, and coordination. This strategy addresses the need to enhance inter-ministerial dialogue and coordination toward a more effective program on biodiversity through policy efficiency, conformity, and collaborative governance.

In 1992, the Aqaba Regional Authority, through the IUCN, conducted a study that suggested that the proposed marine reserve should include the coastal strip extending from the Marine Science Station (MSS) to the Naval Force Command and the area extending from the old phosphate port. In 1996, the Authority began implementing the Gulf of Aqaba Environmental Action Plan (GAEAP) project, which aimed to “contain the current deterioration and prevent further environmental degradation of the coast of the Gulf of Aqaba, its coral reefs, and its ecosystem.” In July 1997, the Board of Directors of ARA issued Decision No. (5) aiming to establish a marine park on the coastal strip extending approximately 7km from the MSS to the Public Security Officers Club on the southern shore. The marine park was renamed the Aqaba Marine Park (AMP) in 1999.

The ASEZA was established in 2000 and supported by a special law (Number 32, 2000) which mandates the Authority to implement its autonomous legal systems and regulations, including environmental protection and biodiversity conservation provisions. ASEZA enjoys its own set of bylaws addressing environmental protection and environmental impact assessment and a special bylaw addressing the Wadi Rum Protected Area. Although the ASEZA represents a success story in applying a decentralized approach towards environmental protection, it entails several strategic and operational challenges related to aligning its regional legal arrangements with the national setting. Further, the autonomous setup is often constrained by the potential for conflicts of interest in balancing the development agendas with the conservation obligation. This strategy calls for initiating a strategic dialogue between ASEZA and the Ministry of Environment on the national alignment of ASEZA’s environmental legislations and facilitating knowledge exchange, reciprocal support, and collaboration.

The Ministry of Environment in Jordan was officially established in 2003 according to the interim Environmental Law (Number 1, 2003). Two important bylaws were issued in 2005: The Bylaw on Protected Areas and National Parks (Number 29, 2005) and Environmental Impact Assessment (Number 37, 2005).

In 2008, the RBG was established in Jordan as an entity dedicated to the conservation and research of Jordanian flora in Tell Ar-Rumman, north of Amman. The Royal Department for Environmental Protection was established in 2006 to improve the quality of Jordan’s environment through proper and effective enforcement of environmental legislation, enhancing cooperation with and between relevant authorities, and increasing national support and advocacy for environmental issues. In the same year, environmental law number 52 (2006) was issued to aid the Ministry of Environment with the national mandate and authority over environmental management and protection while obliging all official and civic constituencies to adhere to the legislations, bylaws, regulations, and decisions associated with the implementation of the Law. In 2008, Al Ma'wa for Nature and Wildlife was established as a civic organization dedicated to protecting and rehabilitating wildlife in Jordan. Through a partnership between the Princess Alia Foundation and Four Paws in 2011, Al Ma'wa established two centers devoted to wildlife welfare.

The Environmental Protection Law was issued in 2017. It is the official legal mechanism mandating the Ministry of Environment in Jordan to protect the environment, including ecosystems and biodiversity. The same year, Petra was added to the protected areas network. In 2018, the Government of Jordan declared two nature reserves: Burqu’s protected area and Al-Dahek’s protected area.

On June 3rd, 2020, His Majesty King Abdullah II ibn Al Hussein gave his directive to declare the Aqaba Marine Park (AMP) as a national Marine Reserve called the Aqaba Marine Reserve (AMR). Accordingly, ASEZA has started the process to declare the site following significant steps, including i) adding the reserve to the network of Jordan protected areas (MOE, 2006), ii) preparing the designation file, iii) declaring the site by the cabinet, and iv) prepare the management plan (Board of Commissioners No. 38 (2020)) to declare the AMR. This process

concluded with the Cabinet of Jordan's official declaration of the AMR in December 2020. The AMR area is 2.8 km² and supports conserving around 3% of the Jordanian Territorial water.

2.6.1 IN-SITU CONSERVATION IN JORDAN

Jordan has adopted several approaches to implement *in-situ* conservation as follows:

2.6.1.1 PROTECTED AREAS

Jordan has established and managed twelve protected areas, including a single marine reserve. The following table defines these areas.

Table 1: Protected areas in Jordan

| # | Protected Areas ³³ | Year of Establishment | Area (Km ²) | Management Authority |
|----|-------------------------------|-----------------------|-------------------------|----------------------|
| 1 | Shaumari Wildlife Reserve | 1975 | 22 | RSCN |
| 2 | Azraq Wetland Reserve | 1975 | 12 | RSCN |
| 3 | Mujib Biosphere Reserve | 1987 | 212 | RSCN |
| 4 | Ajloun Forest Reserve | 1989 | 12 | RSCN |
| 5 | Dana Biosphere Reserve | 1993 | 292 | RSCN |
| 6 | Wadi Rum Protected Area | 1996 | 729 | ASEZA |
| 7 | Dibeen Forest Reserve | 2004 | 8.5 | RSCN |
| 8 | Yarmouk Protected Area | 2010 | 20.5 | RSCN |
| 9 | Fifa Protected Area | 2011 | 26 | RSCN |
| 10 | Burqu' Protected Area | 2018 | 906 | RSCN |
| 11 | Dahek Nature Reserve | 2018 | 265 | RSCN |
| 12 | Aqaba Marine Reserve | 2020 | 2.8 | ASEZA |

2.6.1.2 SPECIAL CONSERVATION AREAS

The Special Conservation Areas concept was developed in 2008, after the Integrated Ecosystems Management in the Jordan Valley, where Al-Khayof in Salt was the first site declared by the Ministry of Environment in 2009. Despite the efforts to establish several sites to increase the percentages of the conserved areas, only a limited number have been established with effective management.

Table 2: Special Conservation Areas of Jordan

| # | Special Conservation Areas ³⁴ | Year of Establishment | Area (Km ²) | Management Authority |
|---|--|-----------------------|-------------------------|------------------------------|
| 1 | Aqaba Birds Observatory | 1987 | 0.62 | RSCN/ ASEZA |
| 2 | Royal Botanic Garden | 2008 | 1.8 | RBG |
| 3 | Al-Khayof | 2009 | 20 | Ministry of Environment |
| 4 | Al Shua'la | 2011 | 20 | RSCN |
| 5 | Al Ma'wa for Nature and Wildlife | 2011 | 1 | Princess Alia Foundation |
| 6 | Wadi Gharaba | 2018 | 5 | Jordan Birdwatch Association |

2.6.1.3 HIMA AREAS

Hima is a traditional conservation system used by Bedouins to organize grazing and keep lands protected and conserved. Essentially, *Hima* is an agreement for managing common pool resources property. A single Hima site was established in Jordan at the Bani Hashem community in the Zarqa area. It aims to demonstrate a local

²⁴ Taifour, H. 2017. Jordan Plant Red List. Vol. 2. Royal Botanic Garden, Jordan.
Eid et al, 2013

³⁴ Eid et al, 2013

community's ability to protect and manage their land resources, sustainably use their natural resources, and provide socio-economic growth. This site was selected in an agreement between the community and the Ministry of Agriculture, where 15 Km² of public forestland in the industrializing Zarqa river basin area was selected. After a year of protection since 2012, this site showed a successful recovery of plant species where 36 native plant species were recorded.

2.6.1.4 RANGELANDS IN JORDAN

Rangeland reserves are important in Jordan's in-situ conservation and ecological restoration programs. The Agricultural Law No. 13 (2015) has defined rangelands as the “*state land registered as range and other state land assigned for this purpose [and] the lands that are registered in the name of the treasury of the Kingdom and any other lands of the state where the average annual rainfall is less than (200mm)*”. Currently, there are 27 governmental range reserves covering a total area of about 8,000 Km² and nine cooperative range reserves covering a total area of about 1,100 Km².

Rangelands in Jordan are found in the steppe areas in the southern and middle highlands in the western parts of the country. They can also be found in the areas located between the highlands and the eastern desert, which occupy about 68% of Jordan. The primary ecosystem types are native grasslands, shrublands, and woodlands (MoA, updated Rangeland Strategy, 2013).

2.6.1.5 RESTORATION AND REHABILITATION PROGRAMS IN JORDAN

One of Jordan's most ambitious restoration initiatives is the Badia Restoration Program (BRP), overseen by the Ministry of Environment. This extensive environmental rehabilitation effort, funded by the United Nations Compensation Commission (UNCC), seeks to restore the degraded rangelands of the Jordanian Badia, which were damaged during the First Gulf War. The program focuses on enhancing biodiversity, improving ecosystem services, and supporting sustainable livelihoods for local communities. The BRP aims to rehabilitate 1.2 million hectares of degraded rangelands in the Badia region, constituting about 68% of the country's land area. The program employs various techniques for rangeland restoration, including seeding with native plants, constructing water harvesting structures, and promoting sustainable grazing practices.

Another significant restoration effort in Jordan is the Jordan Watershed Restoration Project (JWRP), a collaboration between the United States Forest Service (USFS) and the International Centre for Agricultural Research in the Dry Areas (ICARDA). The JWRP aims to restore a degraded watershed in the Jordan Valley—a critical water source for the country—through techniques such as planting native trees, building terraces, and restoring watercourses.

The conservation and management of the Badia rangelands represent a vast ecosystem with the potential to deliver significant biodiversity and ecosystem function gains.

Additionally, the Azraq Wetlands Reserve initiated a restoration program in 1993 to address severe habitat loss due to the over-exploitation of water resources. This program was designed to halt the degradation of aquatic ecosystems in the oasis and restore as much of the wetlands as possible to a natural or near-natural condition, thereby maintaining the biological diversity of this unique wetland ecosystem. Despite these efforts, less than 7% of the original wetlands have been restored.

Beyond these large-scale programs, numerous smaller-scale restoration initiatives are conducted by local communities and non-governmental organizations (NGOs). These initiatives target restoring specific areas, such as forests, wetlands, or coastal habitats.

2.6.2 EX-SITU CONSERVATION IN JORDAN

Jordan has an established history of *ex-situ* conservation, with some of the earliest attempts by RSCN to reintroduce several species, including the Arabian oryx (*Oryx leucoryx*) and the Arabian sand gazelle (*Gazella marica*) in 1978³⁵ as well as the onager (*Equus hemionus onager*) in 1983 in Shumari Wildlife Reserve. The RSCN

³⁵ Eid and Mallon, 2021

ex-situ programs have expanded to other areas where the roe deer (*Capreolus capreolus*) was reintroduced in 1988 and released to Ajloun Forest Reserve in 2006, and the Nubian Ibex (*Capra nubiana*) which was reintroduced in 1989 and released to Mujib Biosphere Reserve in 1997. Al Mawa for Nature and Conservation, a refuge for confiscated animals providing proper rehabilitation and veterinary care to release native animals to the wild in Jordan, was established in 2011.

Regarding *ex-situ* conservation programs for floral species, the National Agricultural Center of Jordan (NARC) was established in 1975, part of which the National Seed Bank of Jordan was established in 1993 as part of the building of NARC and started its collection missions and repatriation of old collected seeds by 1996. As per the national efforts, since its establishment, the National Seed Bank of Jordan has been collecting conserving plant genetic resources for food and agriculture (local landraces, crop wild relatives, and wild food plants) for their high importance in food security and part of a total collection that targets the whole flora of Jordan, the Seed Bank conserves about 5000 seed accessions, the oldest seed collection goes back to 1927 of a wheat landrace collection, such accessions as whole that are made available to local and overseas plant breeders and all research and restorations purposes as per the up to date legal frameworks applied locally and as per the implications of the international conventions and treaties.

Jordan is in the second phase of establishing a new National Seed Bank Facility near NARC with larger capacities and diverse facilities to explore and conserve such central national plant heritage and wealth. The herbarium of the National Seed Bank contains around 3000 precious historical specimens (part of which are type specimens) amongst around 5000 specimens of its collections; the oldest specimens go back to 1886; such historical specimens were put online under the virtual herbarium of the Royal Botanic Garden as part of a collaboration agreement between the two institutes. The mandate of the herbarium at NARC is to carry out floral surveys and vegetation studies, confirm taxa of seeds conserved in the Seed Bank, set conservation priorities, and extend services to various local and overseas organizations.

By 2020, as per their understanding of the vital need to have a well-developed seed bank facility that enables capacity and research toward conservation and utilization of our national heritage of flora for the current use and future generations, a concept that is supported by Jordan royal court and in particular His Majesty the King, with determination and enthusiasm from the headquarter of the NARC and the Hashemite University, the latter has undertaken to fund amounted to 3 million JDs for the establishment of the National Seed Bank of Jordan in the National Agricultural Research Center (NARC) in a separate building to be managed by the expertise of the Directorate of biodiversity at NARC, the upcoming facility will be a state of the art that supports the role of the kingdom as a hub of conservation, exchange, and research of plant genetic resources.

Coordination and management of the seed accessions, as well as the associated herbarium specimens, passport data, and associated information, are all done through a well-developed and up-to-date database system that used to be through Visual FoxPro application primarily designed for the ICARDA and by 2019 adopted GRIN-Global (GG) that is a software suite and enables gene banks to store and manage information associated with plant genetic resources (or germplasm) and deliver that information globally on the internet.

The RBG of Jordan, established in 2008, has launched a native plant nursery, a seed bank, and a national herbarium linked to a National Virtual Herbarium.

2.6.3 ADDITIONAL PROTECTION MEASURES

2.6.3.1 RAMSAR SITES

The Ramsar Convention on Wetlands of International Importance, Especially as Waterfowl Habitat, is an International Treaty for the conservation and sustainable use of wetlands. It is a framework for international cooperation for the preservation and wise use of wetlands and their resources. The convention has three main pillars:

- Wise use: The convention defines wise use as "the maintenance of the ecological character of wetlands, achieved through the implementation of ecosystem approaches, within the context of sustainable development."
- Site designation: The convention requires contracting parties to designate suitable wetlands for the List of Wetlands of International Importance, also known as the Ramsar List. Over 2,400 Ramsar sites worldwide cover over 2.5 million square kilometers.

- International cooperation: The convention encourages contracting parties to cooperate on the conservation and wise use of transboundary wetlands, shared wetland systems, and shared species.

In Jordan, two Ramsar sites have been declared: the Azraq Wetland Reserve and the Fifa Protected Area. The Azraq reserve was declared because it fulfilled criteria 1b, 1d, 2a, 2b, 2c, and 3b. Fifa was declared because it met criteria 1, 2, and 3.

2.6.3.2 IMPORTANT BIRD AREAS

Important Bird Areas (IBAs) are sites identified using an internationally agreed set of criteria as being globally important for conserving bird populations. They are identified and documented by BirdLife International, a global partnership of conservation organizations, and its partners in over 200 countries and territories. IBAs are selected based on their importance for one or more of the following criteria:

- They hold significant numbers of one or more globally threatened, restricted-range, or congregation bird species³⁶.
- They are key sites for the conservation of biome-restricted assemblages of bird species.
- They support significant components of migratory bird species' breeding, wintering, or staging populations.
- They regularly hold significant numbers of congregatory bird species.

As of November 2023, there are over 13,000 IBAs worldwide, covering about 7% of the terrestrial and 2% of the global sea area. IBAs are found in every country and territory in the world, and they support a wide range of bird species, from migratory species like the Arctic tern to resident species like the Hawaiian honeycreeper. Jordan, due to its location on the Red Sea – Rift Valley Palearctic flyway, has significant importance for migratory birds, in particular migratory soaring birds, which was reflected in establishing a Flyway Facility in Jordan in collaboration with BirdLife International and the RSCN as part of a UNDP-GEF multi-country project.

Jordan counts 18 zones,³⁷ Identified as "Important Bird Areas" for conserving biodiversity with an area of 5,503 km². These were identified based on 6 Globally threatened species (A1 criterion), 7 Biome-restricted species (A3 criterion), 2 Restricted-range species (A2 criterion), and 4 Congregatory species (A4 criterion).

Table 3: Important Bird Areas of Jordan

| # | Site name | IBA Criteria |
|----|---------------------------------------|-----------------------------|
| 1 | Ajloun forests and northern highlands | A1, B2, B3 |
| 2 | Aqaba coast and mountains | A4iv, B1iv, B2, B3 |
| 3 | Azraq oasis | A1, A3, A4i, A4iii, B1i, B2 |
| 4 | Burqu' and Eastern Badia | A3, B2, B3 |
| 5 | Dana and Southern Highlands | A1, A2, A3, B1iv, B2, B3 |
| 6 | Dibbin Forest | A3 |
| 7 | Hima Basin - Rum | A3, B2, B3 |
| 8 | Irbid - Mafraq plains | A1, B2 |
| 9 | Khirbat al Samra (sewage works) | A4i, B1i, B1iv, B2 |
| 10 | Madaba - Hisban | B2 |
| 11 | Maghtas - Sweimeh | B1i, B1iv, B2, B3 |
| 12 | Northern Jordan Valley (North Ghor) | B1i, B1iv, B2 |
| 13 | Petra | A1, A2, B1iv, B2, B3 |
| 14 | Qa' Khanna | B1i |
| 15 | Shaumari | A3, A4i, B1i, B2 |
| 16 | Wadi Araba | B2, B3 |
| 17 | Wadi Mujib | A1, A3, B1iv, B2, B3 |
| 18 | Wadi Yarmuk | B2 |

³⁶ Congregatory species – species that gather in large numbers at specific sites at some stage in their life cycle for feeding, breeding or resting during migration. Mainly consisting of water birds.

³⁷ <https://datazone.birdlife.org/country/jordan/ibas>

PART III: UPDATING THE NBSAP

3.1 JORDAN: A STATE PARTY TO THE CONVENTION ON BIOLOGICAL DIVERSITY

The Government of Jordan ratified the CBD in 1994. In addition, it has ratified the Cartagena Protocol in 2004 and the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization in 2014. The Ministry of Environment, through the Nature Protection Directorate, was designated as the focal point for managing the CBD and the protocols issued by the Secretariat. The Ministry of Environment and its partners contributed to many achievements, including developing the National Biodiversity Strategy and Action Plans (NBSAPs), supporting the establishment of protected areas and special conservation sites, developing policy and regulations, and raising awareness and education.

3.2 BACKGROUND ON JORDAN'S NBSAPS

The NBSAP is intended to align a member state's biodiversity conservation with the Kunming-Montreal Framework's global goals and targets. It allows Member states to set priorities, develop national strategies, and determine realistic national targets within the broad framework of the CBD. The Jordan NBSAP is created through a participatory process that involves all relevant stakeholders, including government agencies, civil society organizations, local communities, and the private sector. NBSAPs are living documents that should be subject to periodic review and updating to reflect new information and knowledge, as well as changing national priorities and circumstances.

Since ratifying the Convention, the Ministry of Environment in Jordan has developed and published two NBSAPs in line with the CBD. The first report was created in 2001 with a vision of *"Jordan has an important role to play in conservation and sustainable use of biological resources to improve quality of life and economic prosperity locally and globally, that agree with the teachings and beliefs of Islam on the obligation for man to maintain balanced relations with the other elements of creation."* Five strategic goals were approved to achieve the vision, and these are:

1. Conserve biodiversity and sustainably use biological resources.
2. Improve our understanding of ecosystems and resource management.
3. sustainably managing natural resources.
4. Maintain or develop incentives and legislation to support biodiversity conservation and the sustainable use of biological resources.
5. Partnership with other countries to implement CBD aims.

Several mechanisms were proposed for implementing the 2001 NBSAP, such as the production of an annual national report on policies, activities, and plans aimed at implementing the Strategy, building institutional capacity for the General Corporation for Environment Protection (GCEP - now the Ministry of Environment) to implement the Strategy, coordinating the implementation of national and international elements of the NBSAP through a permanent Inter-departmental Biodiversity Steering Committee and National Unit for Biodiversity, encouraging non-government participation in the implementation of the strategy, regular reporting on the status of biodiversity and revision of the Strategy after an initial implementation phase of five years.

The 2001 NBSAP was updated in 2015 to reflect the latest scientific knowledge and to align with the global Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets. The development of the Jordan 2015 NBSAP was a participatory process involving workshops and consultations with all relevant stakeholders, including government organizations, civil society organizations, local communities, and the private sector.

The Jordan 2015 NBSAP vision for 2020 was “*biodiversity of Jordan is valued for its national heritage vitality, conserved for the well-being and enjoyment of people, and sustainably used for the benefits of current and future generations.*” Five strategic goals were identified:

1. Good governance and mainstreaming.
2. Reduction of human-induced pressures (on biodiversity).
3. Conservation of protected areas, priority species, and genetic resources.
4. Ecosystems services and climate change.
5. Knowledge management and monitoring.

Under each strategic goal, the NBSAP sets out several specific targets and actions. Despite the significant contribution provided by the 2015 NBSAP to the conservation and sustainable use of biological diversity in Jordan, challenges remain that need to be addressed, such as the impacts of climate change, habitat loss and fragmentation, and overexploitation of natural resources and the degradation of ecosystems due to the competing demands of economic development. The government of Jordan is committed to addressing these challenges and implementing the CBD through Jordan’s NBSAP to achieve its vision of a Jordan where biodiversity is valued, conserved, restored, and sustainably used for the benefit of current and future generations. Member states are now compelled to revise their NBSAPs in line with the Kunming-Montreal GBF as part of an ongoing, iterative, and adaptive process of conserving biodiversity.

3.3 SYSTEM DRIVERS

The 2050 NBSAP identifies the key drivers of socio-ecosystem change as the critical areas for intervention. It identifies these drivers in terms that are readily recognizable to all policy sectors, decision-makers, and planners as the socio-political, economic, and environmental drivers. Identifying the drivers of change allows us to understand the complexity within a socio-ecosystem, to understand scale issues, including temporal scales, and to determine the optimum interventions to bring about a desired change. Lastly, it allows broad communication across policy sectors, disciplines, interests, and society, creating a shared understanding of our world. The key drivers of change and those that are likely to endure within the lifetime of this NBSAP are:

1. **Socio-political Drivers:** factors across institutional environments, policy frameworks, regulatory structures, land tenure systems, education, healthcare, security, international relations, training capacities, media influence, and public awareness play pivotal roles. The following represents examples of the socio-political drivers.
 - **Protected Areas:** Jordan's system of protected areas possesses distinctive features, particularly regarding institutional arrangements and governance. Historically, it has evolved from a traditional conservation approach focused on safeguarding significant biodiversity hotspots.
 - **Environmental Security and Disaster Risk Reduction:** Regional experience indicates that past policy decisions and technical interventions often had delayed impacts that were not fully understood then. In many cases, responses to the effects of climate change on socio-ecosystems were inadequate and sometimes worsened the severity and scale of these impacts. There is increasing evidence that the loss of system resilience—whether it affects agriculture, livestock grazing, or water availability—has been a significant driver linked closely with socio-political factors. These factors have contributed to political and social conflicts in the region on a larger geopolitical scale.
 - **Hosting Refugees:** Jordan has played a critical role for refugees across the region since its inception. Currently, Jordan's population stands at approximately 11,516,000 million people, with refugees making up about 32% of this total. This demographic includes roughly 2.3 million Palestinian refugees registered with the United Nations Relief and Works Agency (UNRWA), around 1.36 million Syrian refugees, and smaller groups from Iraq, Yemen, Sudan, and Somalia. Jordan's policy framework reflects a solid commitment to refugees, incorporating them into national healthcare and educational systems and permitting Syrian refugees to work in specific sectors. These inclusive policies underscore Jordan's significant contribution to regional humanitarian efforts despite the strain on its economy and limited natural resources caused by the influx of refugees.

2. **Economic Drivers:** Examples of economic drivers encompass markets, pricing mechanisms, financial systems, energy dynamics, infrastructure development, and more. These factors play pivotal roles in shaping economic landscapes and influencing decision-making processes.
 - **Energy:** Jordan's energy sector heavily relies on imported natural gas, while the rapid adoption of renewable energy has already contributed to 27% of local electricity generation as of 2022³⁸. Balancing increasing energy demands, ensuring energy security, and transitioning to sustainable energy production will require making difficult trade-offs between preserving ecosystem resilience and meeting current and future energy needs.
 - **Food security and agriculture:** Jordan lies at the southwestern end of the Fertile Crescent³⁹ and, as such, is an essential area for plant diversity. Furthermore, agriculture faces significant risks due to climate change. Agriculture is the largest consumer of water resources and likely has the most significant impact on the ecosystem's ability to recharge groundwater resources. Efficiencies in agricultural production may not necessarily translate into ecosystem resilience. They may increase vulnerability and risks.
 - **Economic Recovery:** Globally, the world economy is recovering from recent shocks such as the COVID-19 pandemic, the war in Ukraine, the challenges of decarbonizing economies, commodity price shocks resulting from these factors, and increasing catastrophic weather events on food supplies. Jordan has set out the path to recovery in the Economic Modernisation Vision, which sets out a bold vision for Jordan's economic recovery. While the NBSAP will support the long-term recovery envisioned in the Economic Modernization Vision (EMV), there will also be trade-offs between shorter-term financial gains and socio-ecosystem resilience.
3. **Environmental Drivers:** Environmental drivers include climate change impacts, rainfall patterns, temperature fluctuations, and other ecological variables. These elements profoundly influence natural systems, biodiversity, and human activities, shaping environmental policies and adaptation strategies.
 - **Water:** Jordan is a water-stressed country, with a chronic water balance deficit of 17%; the demand exceeds renewable resources by 178 MCM/year⁴⁰. The loss of water provisioning ecosystem services from the system represents an existential threat to society and the economy. Technology alone is unlikely to provide all of the answers. The relationships between biodiversity and water provisioning are complex and multi-faceted. A critical part of this relationship is understanding that water provisioning for various human needs affects biodiversity, and the loss of biodiversity from the system affects the ability to continue recharging, storing, and providing water.
 - **Al Badia:** The *Badia* region constitutes approximately 80% of Jordan⁴¹. In many ways, it epitomizes both the complexity and the challenges of conserving biodiversity. Climate, geography, geology, and the biological components of the system create the culture and identity of the people who live there with their dependence on the biological diversity (the grazing and their livestock) as well as being a living surface that facilitates groundwater recharge.
 - **Land use:** Land use changes in Jordan have been significant in recent decades, driven by several factors, including population growth, urbanization, economic development, and climate change. These changes have profoundly impacted the country's ecosystems, natural resources, and agricultural productivity.

In 2015, the Jordan NBSAP identified five underlying causes resulting in the loss of biodiversity, which are still relevant today, to varying degrees, and the 2050 NBSAP has differentiated a sixth underlying cause:

- **Relevance:** It is essential to separate a lack of awareness of biodiversity within the general population of the Jordanian public, including policy and decision-makers and rural communities who may be aware of the importance and values of ecosystem goods and services but are unable or excluded from its sustainable management and use. In this instance, awareness refers to the low priority of biodiversity in the overarching set of national values and patriotic principles.

³⁸ https://www.memr.gov.jo/ebv4.0/root_storage/en/eb_list_page/annual_report_2022.pdf

³⁹ Kelley, C. P., Mohtadi, S., Cane, M. A., Seager, R., & Kushnir, Y. (2015). Climate change in the Fertile Crescent and implications of the recent Syrian drought. *Proceedings of the national Academy of Sciences*, 112(11), 3241-3246.

⁴⁰ MWI, Facts & Figures of Jordan's Water Sector, 2022)

⁴¹ <http://www.badiafund.gov.jo/en/node/310>

- **Governance:** The decision-making structures about biodiversity have been poorly established until recently. Public participation, including civil society, local communities, and private sectors, remains below accepted standards; however, an essential strategic improvement was initiated by instituting the National Biodiversity Committee (NBC) in 2005, which is gradually becoming an active platform for improved involvement of civil society in the decision-making process regarding biodiversity. The general public culture for governance in Jordan, and, to a lesser extent, in the environment sector, does not always support sound governance principles and applications.
- **Mismatched trade-offs:** A disconnection between science and development agendas often leads to poor trade-offs between short-term development objectives and longer-term resilience. Sound decision-making should be evidence-based. Biodiversity-related knowledge in Jordan is well advanced and is considered among the pioneering examples at the regional level. Nonetheless, the level of investment and support given to this vital sector is still below the required levels.
- **Inadequate knowledge management:** The Ministry of Environment has established a clearing house mechanism (CHM) on biodiversity to establish a centralized and well-harmonized national database of biodiversity information accessible to the public and available to support decision-making about conservation and development projects of relevance. This strategy includes a strong emphasis on the enhancement of knowledge management frameworks and the strengthening of knowledge sharing and collaboration.
- **Lack of systematic financing framework:** The failure to adequately price or value biodiversity and other ecosystem goods and services within the national accounting framework will consistently result in these essential goods and services being replaced or neglected and an overall constraint on national government investment in biodiversity.
- **Weaknesses in pricing and tenure of biodiversity resources:** Experiences from several countries have demonstrated that pricing and tenure can significantly affect biodiversity. Furthermore, the shortcomings of the management institutions most often result in overexploitation and consequent loss of biodiversity. Weak or perverse pricing mechanisms can undervalue biological resources, leading to resource overexploitation or replacement with land-use systems that produce more tangible short-term economic benefits.

3.4 DIRECT THREATS TO BIODIVERSITY

The identified systemic drivers pose direct threats to biological components and ecological processes, largely unchanged since the development of the 2015 NBSAP. These drivers manifest in significant inequalities and inefficiencies within the system:

- **Habitat destruction:** occurs through neglect, competing land uses, wasteful practices, and lack of policy conformity. This leads to converting resilient, species-rich ecosystems into vulnerable, species-depauperate systems. Causes include poorly planned urbanization, intensified grazing, unregulated tourism, infrastructure development, mining, over-abstraction of water, ineffective protected area management, and pollution from domestic, industrial, and agricultural sources. For example, Jordan witnessed 423 induced fires in its forested regions between 2007 and 2014, impacting 24,628 trees and degrading nine km² of land (Jordan's State of Environment Report, 2016). Furthermore, extensive cutting of 763 trees, predominantly oaks, occurred in the Dibeen pine forest from 2008 to 2014.
- **The invasion of alien and exotic species** and genetic and living-modified organisms (LMOs) threatens biodiversity. Non-native invasive species disrupt ecosystems, while biotechnological advances, though potentially beneficial for economic development, also carry risks, particularly for Jordan's role as a genetic resource center crucial for national and global food security. The Ministry of Environment addresses this through strategies outlined in the Black Book on invasive alien plant species, highlighting actions to mitigate their environmental and socioeconomic impacts.
- **Overexploitation, persecution, wildlife trade, and diseases** exacerbate biodiversity loss. Weak enforcement of conservation laws, limited awareness, and economic pressures drive habitat loss and species decline. Sustainable management policies are essential to mitigate these threats, especially in combating illegal wildlife trade and preventing disease transmission between wildlife and livestock.
- The pressures from **hosting refugees** highlight Jordan's commitment to international obligations and human rights. While Jordan upholds these values, hosting large refugee populations strains natural resources, from water scarcity to competition over grazing lands with local livestock herds.

The underlying causes of biodiversity loss, identified in the 2015 NBSAP, persist. These include inadequate public awareness, governance challenges such as weak law enforcement, misaligned development priorities, scientific integration gaps, knowledge management inefficiencies, and insufficient financing frameworks. Addressing these challenges requires strengthening governance structures, informed decision-making based on scientific evidence, enhancing public awareness, and developing sustainable financing mechanisms. Jordan's efforts in biodiversity conservation must navigate these complexities to ensure its ecosystems' resilience and long-term sustainability.

3.5 THE NATIONAL STRATEGIC AND LEGAL FRAMEWORKS FOR BIODIVERSITY

Three primary legal frameworks govern biodiversity in Jordan. The Environment Protection Law (Number 52, 2006) grants the Ministry of Environment national authority over environmental management. This law mandates adherence to environmental regulations by all official and civic bodies and designates the Ministry as the focal point for environmental matters domestically and internationally. Among its responsibilities, the Ministry oversees biodiversity protection, ecosystem sustainability, and genetic resources management. However, enhancing the Ministry's technical, human, logistical, and financial capacities remains crucial for effectively guiding national biodiversity programs and supporting stakeholders.

The Ministry has enacted two bylaws: the Bylaw on Protected Areas and National Parks (Number 29, 2005) and the Bylaw on Environmental Impact Assessment (Number 37, 2005). These aim to strengthen biodiversity safeguards and management tools, with ongoing revisions to enhance legal frameworks further. Notably, the Royal Society for the Conservation of Nature (RSCN) implements the Protected Areas and National Parks Bylaw, leveraging its extensive experience in nature conservation since the 1960s, albeit facing challenges in expanding protected areas and integrating community interests. Two supporting legal instruments were published, including genetic resource access and benefit sharing bylaw No. 20 for 2021, and the Biosafety regulations.

The Ministry of Agriculture, under its Agriculture Law (Number 13, 2015), historically mandates wildlife, forest, and rangeland protection alongside genetic resource conservation. This law tasked RSCN with enforcing wildlife protection and hunting regulations, as both ministries aim to harmonize their overlapping roles for more effective biodiversity management.

A third legal framework is embodied by the Aqaba Special Economic Zone Authority (ASEZA), established in 2000 under Law Number 32. ASEZA has autonomy in environmental protection and biodiversity conservation through specific bylaws, including those governing the Wadi Rum Protected Area. Despite its decentralized success, ASEZA faces challenges aligning regional legislation with national mandates, necessitating strategic dialogue with the Ministry of Environment to ensure coherence in environmental policies and practices.

3.6 ALIGNMENT, CONFORMITY, AND SYNERGIES

This NBSAP has been crafted within the EMV framework, serving as Jordan's primary national policy document to influence key factors affecting biodiversity gains or losses. It aims to bolster Jordan's economic and social resilience by ensuring that ecosystems continue to provide vital goods and services. Aligned with the National Climate Change Policy, which spans 2022 to 2050, the NBSAP complements energy, transport, industrial processes, and product use efforts.

The NBSAP focuses directly on sectors like agriculture, forestry, and land use, outlining strategic actions for systemic resilience. It emphasizes creating an enabling environment through legal frameworks, technology development, financing mechanisms, and community engagement (including women and youth), fostering collaborative efforts that amplify positive outcomes beyond individual actions.

Building on insights from the National Green Growth Plan (2017), the NBSAP shares objectives such as reducing greenhouse gas emissions while enhancing biodiversity, ecosystem services, economic growth, and social development. It charts pathways specifically addressing biological components within these systems. As climate change increasingly impacts all sectors of Jordan's economy and society, these foundational policies—EMV, Climate Change Policy, Green Growth Plan, and NBSAP—are poised to guide and ensure resilience, efficiency, and effectiveness across all policy domains.

3.7 SYNTHESIS WITH CBD PROVISIONS AND OBLIGATIONS

The update of the NBSAP is an essential part of the global effort to develop and implement the Global Biodiversity Strategy 2020-2050. NBSAPs are primary tools for implementing the Convention on Biological Diversity (CBD) at the national level, as mandated by Article 6. This article obliges countries to formulate a national biodiversity strategy that integrates biodiversity considerations into all sectors that impact it, positively or negatively. National biodiversity strategies outline how countries plan to achieve the CBD's objectives within their contexts, including action plans detailing steps toward these goals. Articles 26 and 10(a) of the Convention reinforce Article 6 by requiring parties to report on their implementation efforts and consider biodiversity conservation in national decision-making processes.

The Global Biodiversity Strategy 2011-2020, known for its Aichi Targets adopted in Nagoya, Japan, in 2010, emphasized the need for countries to develop robust policy instruments dedicated to biodiversity. Despite global efforts, reports like the Global Assessment Report of Biodiversity and Ecosystem Services (2019) highlight alarming biodiversity declines unprecedented in human history. The Kunming-Montreal Global Biodiversity Framework builds upon the Strategic Plan for Biodiversity 2011-2020, aiming to catalyze transformative action by 2030 to halt and reverse biodiversity loss. Aligned with the 2030 Agenda for Sustainable Development, this framework sets ambitious goals to ensure societies live in harmony with nature by 2050.

Member countries (Parties) are now tasked with updating their NBSAPs to align with the new Kunming-Montreal goals and targets, emphasizing urgent and broad-based actions across governmental, sub-national, and societal levels to achieve the Convention's objectives effectively.

3.8 STRATEGIC REFLECTIONS ON THE 2050 NBSAP

The Kunming-Montreal GBF represents a move from a conventional conservation approach that might usually frame biodiversity loss regarding threats and protection. Strategic planning implies a more in-depth understanding of the overall system, the connectivity, and the importance of adaptive management in seeking new and maybe quite different solutions. The Kunming-Montreal GBF identifies five key drivers of change in order of priority:

1. Changes in land use.
2. Direct exploitation of organisms.
3. Climate change.
4. Pollution.
5. Invasion of alien species.

In developing the 2050 NBSAP, Jordan recognizes these strategic directions and seeks to translate them into the national policy direction. In particular, the 2050 NBSAP:

- Recognises that it is essential to invest in people, in particular, in our people, to nurture and educate future generations who will not have to face a dichotomy of choice between a healthy ecosystem or livelihood prosperity but understand that these are one goal.
- Recognises that it is essential to invest strategically and that nature-based solutions may provide cost-effective solutions with multiple benefits.
- Policy conformity is efficient and cost-effective. Sustainability needs to be determined economically, socially, and ecologically. Failure to do so may transfer costs and create inefficiencies within the national accounting system; avoided costs may be more efficient and sustainable.
- Removing harmful subsidies and perverse incentives can provide economies and efficiencies.
- Affecting positive change in other policy and institutional sectors can have multiple economic, social, and ecological benefits, avoided costs, and essential future use options.
- The resilience of socio-ecosystems must underpin economic policy to continue providing life-supporting goods and services.

The development of NBSAPs has been an iterative and progressive process, learning from the challenges of previous implementation to increase efficiency and impact. The strategic approaches developed in the Kunming-Montreal GBF have been reflected in the national priorities; the most notable strategic adaptations in the GBF are:

- An acceptance of longer timeframes to affect systemic changes. The Kunming-Montreal GBF provides a ten-year (to 2030) planning period within a thirty-year (2050) strategic horizon. Planning for the next ten years while not losing sight of the longer-term strategic objectives.
- Reflecting the growing awareness of managing (and conserving) biodiversity in production landscapes and the importance of land management outside the traditional protected areas approach, placing considerable emphasis on connectivity and the use of Other Effective Area-based Conservation Measures (OECM) as a means to conserve biodiversity, necessitating a recognition or mainstreaming of biodiversity into other sector policies and activities and production landscapes.
- An explicit recognition that increasing the allocation of financial resources for biodiversity conservation is essential. However, of equal importance and effect, the removal of subsidies, perverse incentives policies, and regulatory instruments that remove value from biodiversity within a market economy can have a profound and cost-effective impact on the status of biodiversity.
- Effective biodiversity conservation and socio-ecosystem resilience requires a whole of government response. The ecosystem's health, including the status of biodiversity, should be of concern to all sectors of the economy, government, and society. Policy conformity leads to greater efficiency in government. Collaborative governance and policy cohesion avoid discounting ecosystem goods and services or deflecting the costs to other sectors. Sound environmental policies can create economic efficiencies.
- The dynamic nature of socio-ecosystems and the complex and unpredictable interaction between the system drivers result in high levels of uncertainty. Investing long-term in people is necessary to achieve effective biodiversity conservation by building the capacity for learning and self-organization to adapt to change.
- Larger inequalities and inconsistencies in society and governance, such as gender inequalities and access to justice and information, may profoundly impact biodiversity and ecological resilience.

3.9 STRATEGIC DIRECTIONS TOWARDS AN IMPROVED NBSAP GLOBAL ALIGNMENT

The development of National Biodiversity Strategies and Action Plans (NBSAPs) has evolved through iterative processes, learning from past challenges to enhance efficiency and effectiveness. The strategic approaches outlined in the Kunming-Montreal Global Biodiversity Framework (GBF) have significantly influenced national priorities, with key adaptations including:

- **Longer Timeframes for Systemic Changes:** The Kunming-Montreal GBF introduces a ten-year planning period (to 2030) within a broader thirty-year strategic horizon (to 2050). This approach balances short-term actions with long-term objectives, ensuring sustained focus on strategic biodiversity conservation goals.
- **Integration in Production Landscapes:** Emphasizing biodiversity conservation beyond traditional protected areas, the GBF stresses the importance of managing biodiversity in production landscapes and utilizing Other Effective Area-Based Conservation Measures (OECMs). This necessitates mainstreaming biodiversity considerations into sectoral policies and activities within production landscapes.
- **Financial Resource Allocation and Subsidy Reform:** The GBF advocates for increased financial resources for biodiversity conservation. Equally crucial is the removal of subsidies, perverse incentives, and regulatory frameworks that devalue biodiversity within market economies. These reforms can have profound and cost-effective impacts on biodiversity conservation efforts.
- **Whole-of-Government Approach:** Effective biodiversity conservation and socio-ecosystem resilience require coordinated responses across all sectors of government and society. Policies that ensure coherence and collaboration among different sectors enhance efficiency and prevent the externalization of costs related to ecosystem services. Sound environmental policies can also generate economic efficiencies.
- **Adaptive Capacity and Learning:** Given the dynamic nature of socio-ecosystems and the uncertainties surrounding system drivers, long-term investments in human capital are crucial. Building capacity for learning and adaptive management within communities and institutions enhances resilience and fosters effective biodiversity conservation.

- Addressing Inequalities and Governance Issues: Social inequalities, gender disparities, and barriers to justice and information access can significantly impact biodiversity and ecological resilience. Addressing these issues is integral to achieving equitable and sustainable biodiversity outcomes.

3.10 THEORY OF CHANGE

The Theory of Change (TOC) serves as a critical tool in identifying the causal pathways from interventions to long-term impacts and goals within the framework of the National Biodiversity Strategy and Action Plan (NBSAP). It aims to provide a structured depiction of how strategic actions will lead to desired outcomes, considering the complexity and unpredictability of the socio-ecological system. Here's how the TOC for the Jordanian NBSAP is articulated:

1. **Causal Links and Evidence:** It identifies specific causal links between outputs (interventions) and outcomes (desired changes), supported by evidence. For example, investing in academia and higher education will produce future professionals equipped to address climate challenges and biodiversity management.
2. **Causal Pathways and Indicators:** The TOC describes the pathways through which interventions are expected to exert their effects. It identifies indicators to monitor progress and validate these pathways over time. This involves explicit assumptions about barriers, enablers, and indicators of success in achieving biodiversity conservation goals.
3. **Complexity and Adaptive Challenges:** Acknowledging the system's complexity, the TOC recognizes adaptive challenges in implementing collaborative governance across stakeholders with diverse priorities. It aims to overcome these challenges by integrating biodiversity considerations into production landscapes and internalizing management costs through sustainable use systems.
4. **Strategic Areas:** The TOC clusters strategic actions into four areas:
 - **Spatial Management:** Enhancing protected areas, connectivity, and ecosystem integrity.
 - **Motivational Management:** Internalizing costs and benefits, devolving authority, and fostering effective biodiversity management.
 - **Enabling Framework:** Creating regulatory frameworks for good governance.
 - **Financial and Resource Capacities:** Ensuring sufficient financing and human resources to support adaptive management and learning.
5. **Outputs and Systemic Goals:** It aims to produce outputs that ensure spatial coherence in biodiversity management, integrate biodiversity into economic and livelihood interests, and utilize nature-based solutions across policy sectors. This approach seeks to reduce policy conflicts and promote collaborative governance while ensuring equitable benefits from genetic resources and enhancing national financing efficiency.
6. **Investment in People and Education:** Recognizing the dynamic nature of socio-ecosystems, the TOC emphasizes long-term investments in education and capacity building. This includes preparing future generations to innovate and adapt to emerging challenges beyond operational paradigms.
7. **Temporal Aspects and Uncertainty:** Given the complexity and non-linear interactions within the system, forecasting outcomes remains challenging and inherently risky. The strategy mitigates this by investing in human capital capable of navigating evolving socio-ecological dynamics and fostering adaptive responses to change.

Overall, the TOC for Jordan's NBSAP underscores a strategic approach to systemic transformation in biodiversity conservation. By addressing causal pathways, enhancing governance frameworks, and investing in education and capacity building, the strategy aims to achieve sustainable outcomes amidst evolving environmental challenges.

Figure 2: NBSAP 2050 Theory of Change

Inputs 2030 NBSAP Actions

Spatial integrity inputs:

- Ecosystem integrity and connectivity
- Integrated biodiversity/ ecosystem management
- Cost-effective ecological solutions
- Integrated agrobiodiversity
- International partnerships
- Sustainable career structures
- Research and development
- Gender equality

Sustainable use inputs:

- Policies and regulatory instruments
- Regional collaboration
- Community-based natural resource management
- Sustainable career structures
- Cost-effective and resilient ecological approaches
- Ecosystem goods and services support EMV (Economic Modernization Vision)

Access & benefit sharing inputs:

- Supportive policy and regulatory framework
- Protect local and indigenous knowledge
- Wise use of biodiversity is incentivised
- Promote biodiversity, ecosystem and Green Economy research
- Cordial and transparent regional and global collaboration
- Research and development

Biodiversity financing, policy & capacity inputs:

- Mobilise sufficient financial and material resources
- Regional hub resource
- National coordination system for biodiversity monitoring and information
- Periodic assessments of the level of threat
- Promote Green Investment
- Remove perverse incentives

Outputs Awareness, social learning & adaptive management



Functionally efficient spatial and temporal plan (protected areas, corridors, agro-ecological systems...)



Key ecosystem functions protected (water provisioning, carbon sequestration, flood prevention, etc...)



Cost-effective inclusive and equitable management



Rural livelihood sustainability



Economic efficiency through avoidance, multi-benefit solutions, diversity (e.g. bio-engineering, planning gains)



Protection of intellectual property



Equitable access to global benefits



Qualified & skilled workforce



Supportive economic and fiscal instruments (multiple benefit subsidies – cascade, avoidance & removal of perverse incentives, avoidance of discounting ecosystem functions...)

Intermediate Outcomes

Spatial integrity & resilience

Equitable & efficient governance

Reduced management costs

Transparent & secure investment environment

Coherent & supportive policy

Human resources capacities necessary to meet challenges

Assumptions & Drivers

Assumption: 1.5°C target is met

Driver: Regional security & conflicts

Driver: Global markets

Assumption: Current climate models are robust

Assumption: Political, economic and market responses to environmental degradation are rational

Assumption: Current economic development & climate trajectories do not reach critical tipping points in next 10 years

Long Term Outcomes (2030)

Spatial coherence

Scale, representation, connectivity & integration

Economic coherence

Avoided future costs of ecosystem degradation

Direct benefits to economic growth & cost-effective nature-based solutions to climate change

Policy coherence

Policy, regulatory & planning framework is responsive & adaptive

Decision-making framework gives whole system resilience equal or greater weight than short term gains

Ecosystem resilience is mainstreamed across all policy sectors

Social coherence

Continued ecosystem services contribute to the quality of life

Cultural identity and practices

Long term Impacts (2050)

Jordan NBSAP Vision

Jordan's biodiversity is valued, effectively conserved, sustainably used, supporting the national economy and the wealth of both present and future generations.



Goal A

The integrity, connectivity and resilience of all Jordan's socio-ecosystems including their capacity to undergo disturbance while maintaining both their existing functions and controls and their capacity for future change are maintained, enhanced, or restored resulting in a progressive reduction, and eventual removal of, the anthropogenic causes of extinction or the loss of genetic diversity within species, including their domestic relatives, and the maintenance of resilient populations by 2050.

Goal B

All ecosystem goods, functions and services are restored and sustainably managed and the costs and benefits of sustainable management are equitably distributed through robust sustainable use systems or other benefit return arrangements which reflect the opportunity or management costs of maintaining an uninterrupted supply of ecosystem services supporting the achievement of the EMV by 2050.

Goal C

Fair and equitable sharing of monetary and non-monetary benefits from the utilization of genetic resources, and digital sequence information on genetic resources, and of traditional knowledge associated with genetic resources.

Goal D

Biodiversity conservation is fully funded through budget support, international funding mechanisms and the private sector with a free and fair transfer of knowledge, skills, and data between Jordan and international partners. National policy formulation is coherent, adaptive and conforming across all sectors towards economic, social and environmental resilience within a transparent regional and national policy and planning framework in which biodiversity and the whole range of ecosystem goods and services, are fully considered within the national accounting system.

PART IV: THE 2050 STRATEGY AND 2030 ACTION PLAN

4.1 NBSAP, A DYNAMIC POLICY TOOL

A stated that the NBSAP is the principal instrument for implementing the CBD nationally. As the Convention requires, each signatory country (Party) has to develop an NBSAP or equivalent instrument by its particular conditions and capabilities.

Article 6 of the CBD requires the Parties to:

- a) Develop national strategies, plans, or programs for the conservation and sustainable use of biological diversity or adapt existing strategies, plans, or programs which shall reflect, among other things, the measures set out in this Convention relevant to the Contracting Party concerned.
- b) Integrate the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programs, and policies as far as possible and appropriate.

In essence, the NBSAP consists of several parts:

- The goals or vision, which is an aspirational description of Jordan's future vision for its biodiversity resources vis a range of values, such as societal, economic, and ecological, which all contribute to the system's resilience to continue supporting life.
- A strategy that describes how the means, actions, activities, and resources will achieve the ends or goals.
- Agreed targets are effective waypoints on indicators that will be used to inform the system managers. These targets serve two functions:
 - i. Firstly, they represent a metric by which the system and its management can be held accountable. They measure the performance of the system and its constituent parts and serve as a transparent measure to report to other Parties an indication of how well the country is progressing towards the agreed goals.
 - ii. The second function is equally important, perhaps more so, because the targets provide a feedback mechanism for adaptive management. Planners and managers can make plausible forecasts of where the system will be after ten years of implementing the strategy and actions. Any deviation from the expected targets allows planners and managers to determine whether this is because there were incorrect assumptions about how the system works or stated actions have not been carried out (e.g., due to a lack of resources, insufficient capacities, lack of competence, etc.). Either way, corrective measures can be taken to put the system back on track.

The NBSAP serves a strategic function, bringing together different components, sectors, sector policies, etc., towards a common purpose. It guides decision-making and the inevitable trade-offs that come with making decisions. The strategy should ensure that any such trade-offs do not come at the cost of reduced resilience within the system; this should be a fundamental principle. Therefore, viewing the strategy, actions, and targets as a dynamic national policy instrument, not just a means to report to the CBD Secretariat, is essential.

4.2 GUIDING PRINCIPLES

1. **Respect and Care for the Community of Life:** Human beings and communities are integral parts of ecosystems, where all life forms deserve respect and preservation.
2. **Cooperative Governance:** All governmental institutions must collaborate for the collective benefit of the country.
3. **Ecosystem Approach to Protected Areas Management:** Protected areas will be managed as complex ecological systems and, where applicable, as complex socio-ecological systems. The focus will be on maintaining ecosystem functions and ecological processes and supporting rural livelihoods. Decisions will explicitly consider the impacts of management interventions on ecological patterns, processes, and dependent livelihoods at landscape scales.
4. **Evidence-Based Management:** Policy formulation and implementation will prioritize evidence-based approaches, incorporating scientific data, research findings, and local knowledge where appropriate while adhering to the precautionary principle in cases of scientific uncertainty regarding potential environmental impacts.

5. **Precautionary Principle:** Actions will avoid severe or irreversible harm in situations lacking scientific certainty about potential negative environmental impacts. Sustainable resource use may enhance biodiversity conservation, emphasizing that non-use can pose risks. Thus, the precautionary principle should guide decisions but not unconditionally prohibit resource use.
6. **Sustainability and Carrying Capacity:** Resource utilization and development will be within the ecological and national capacity to support and sustain these activities indefinitely.
7. **Maintenance of Future Options:** Production and consumption patterns will safeguard natural ecosystems' regenerative capacities, human rights, and well-being, preserving options for future generations.
8. **Valuing Ecosystem Goods and Services:** The tangible and intangible values of ecosystem goods and services will be universally recognized and integrated into development frameworks and policies.
9. **Enforcement and Effective Control:** Implementation of strategies requires robust enforcement mechanisms involving state institutions, civil society, and private sectors, ensuring compliance through adequate resources and regulatory frameworks.
10. **Policy Integration:** Ecosystem management will be interdisciplinary, integrating multiple functions and uses across policy domains to harmonize with the National Biodiversity Strategy and Action Plan.
11. **Adaptive Management and Complexity:** Recognizing biodiversity management's complexity, strategies will embrace adaptive management principles, fostering continuous improvement, innovation, and resilience to socio-ecological changes.
12. **Accountability:** Fairness, transparency, and accountability will guide policy formulation, adoption, and implementation.
13. **Subsidiarity:** Decision-making and responsibility will be decentralized to the most effective governance levels, promoting local empowerment and participation.
14. **Inter-generational Equity:** Management practices will ensure equitable access to natural and cultural heritage within national boundaries, preserving biodiversity for present and future generations.
15. **Biodiversity and Rural People:** Acknowledging biodiversity's importance to rural livelihoods, sustainable use strategies will support biodiversity conservation while benefiting local communities, particularly through the protected areas system.
16. **Costs and Benefits of Biodiversity Management:** Sustainable management is most effective when local stakeholders perceive benefits outweigh costs, ensuring community engagement in resource management.
17. **Traditional Use Regimes:** Traditional institutions will be involved in co-management and sustainable use of biodiversity, respecting traditional knowledge and maintaining ecosystem integrity.
18. **Role of Women:** Women's contributions to biodiversity management and dependence on natural resources in rural contexts will be recognized and supported.
19. **Agricultural Biodiversity**⁴²: Genetic diversity conservation, including crop wild relatives, landraces, and traditional farming systems, will safeguard cultural heritage and ensure food security through genetic reserve and on-farm conservation practices.

⁴² A landrace is a dynamic population(s) of a cultivated plant that has historical origin, distinct identity and lacks formal crop improvement, as well as often being genetically diverse, locally adapted and associated with traditional farming systems." (Camacho Villa et al., 2005. Plant Genetic Resource: Characterization and Utilization 3(3): 373-384.

4.3 THE 2050 VISION & PURPOSE

2050 NBSAP Vision

By 2050, Jordan’s biodiversity will be valued, effectively conserved, restored, and sustainably used, supporting the national economy and the wealth of both present and future generations.

Purpose

- *To reverse the current trends in biodiversity loss, ecosystems, and associated ecosystem function, goods, and services.*
- *Recognize the existential threat to society caused by the loss of biodiversity and concomitant degradation of ecosystem function, goods, and services, as well as the urgent need to act now.*
- *To ensure that biodiversity is the cornerstone of green growth and underpins the provision of life-supporting ecosystem goods and services.*
- *To establish Jordan as a center of excellence for knowledge and expertise, building resilience and helping to guide us through the uncertain and unpredictable future challenges of a changing climate.*

4.4 THE 2050 STRATEGIC GOALS

The 2050 NBSAP is comprised of four mutually supporting strategic goals. This approach explicitly recognizes that all life depends upon the socio-ecosystem's capacity to undergo disturbance while maintaining its existing functions and controls and its capacity for future change.⁴³ Furthermore, resilience is the system's ability to buffer or absorb shocks and its capacity for learning and self-organization to adapt to change.⁴⁴ These four strategic goals are as follows:

- Maintaining or rebuilding the integrity of the socio-ecosystem, its components, its scale needs, and sustainable management.
- Ensuring that the benefits from wise management of the socio-ecosystem equitably reflect the costs of wise management and provide a robust and competitive motivation for conserving biodiversity.
- Ensuring that the building blocks of life, the genetic material that makes up biodiversity, serve a public good and that benefits are returned to those with a legitimate claim.
- Ensuring that the material, financial, and human resources are available nationally to meet future challenges confidently.

| Goal | Strategic Instruments |
|---|--|
| <p>Goal A: The integrity, connectivity, and resilience of all of Jordan’s socio-ecosystems, including their capacity to undergo disturbance while maintaining both their existing functions and controls and their capacity for future change, are maintained, enhanced, or restored, resulting in a progressive reduction, and eventual removal of, the</p> | <p>Strategic Instrument A1: Ecosystem integrity and connectivity.</p> <p>Strategic Instrument A2: Increased and integrated biodiversity/ ecosystem management capacities in the various institutions that manage land use.</p> <p>Strategic Instrument A3: Greater participation of all government and society, including building awareness and capacities of legal authorities (e.g., Courts, police, rangers, customs, border controls, etc.) and civil society, non-governmental organizations, and the national media.</p> <p>Strategic Instrument A4: Cost-effective ecological solutions to land management challenges (e.g., water provisioning, flood mitigation,</p> |

⁴³ Gunderson, L.H. (2000). Ecological resilience – in theory and application. Annual Review of Ecology and Systematics 31, 425-439.

⁴⁴ Gunderson, L.H. and Holling, C.S. Eds. (2002). Panarchy: Understanding transformations in human and natural systems. Washington, DC. Island Press.

| Goal | Strategic Instruments |
|---|---|
| <p>anthropogenic causes of extinction or the loss of genetic diversity within species, including their domestic relatives, and the maintenance of resilient populations by 2050.</p> | <p>agricultural pollution, drought, infrastructure protection, rangeland degradation, agricultural pollution, etc.).</p> <p>Strategic Instrument A5: Integrate agrobiodiversity, particularly ecological and regenerative farming approaches, landraces, and locally developed varieties, into farming systems, including establishing genetic reserves or other conservation mechanisms for wild crop relatives.</p> <p>Strategic Instrument A6: Partnerships with international institutions involved in plant conservation to effectively share information, resources, and the costs and benefits of plant genetic conservation.</p> <p>Strategic Instrument A7: Sustainable career structures and the capacity to provide highly trained and motivated environmental conservation managers in all fields of ecosystem management.</p> <p>Strategic Instrument A8: Research and development capacities within Jordan’s academic and research institutions to find new, innovative, and sustainable solutions to address the challenges of environmental degradation and biodiversity loss.</p> <p>Strategic Instrument A9: Policies that promote and support gender equality in the workforce through equal access to employment and education opportunities.</p> <p>Strategic Instrument A10: Policies recognizing women’s important role in managing biodiversity and rural circumstances.</p> |
| <p>Goal B: All ecosystem goods, functions, and services are restored and sustainably managed, and the costs and benefits of sustainable management are equitably distributed through robust, sustainable use systems or other benefit return arrangements that reflect the opportunity or management costs of maintaining an uninterrupted supply of ecosystem services supporting the achievement of the EMV by 2050.</p> | <p>Strategic Instrument B1: Policies and regulatory instruments that:</p> <ul style="list-style-type: none"> • Provide for inclusive government and the engagement of local communities in the conservation management of biodiversity resources. • Recognize the role of local communities in the stewardship of biodiversity resources and support their effective and sustainable management. • Recognize that tenure may be the most critical factor affecting their sustainability when biodiversity resources are utilized. • Promote green investment in all sectors of the economy and ensure that those closest to the resources, particularly women, can equitably share the economic and security benefits of the green economy. • Seek to remove perverse incentives and market distortions, such as inappropriate subsidies or other financial incentives, which may remove value from or undermine the sustainable use of biodiversity and other ecosystem components. <p>Strategic Instrument B2: Regional collaboration in research, trade, transboundary resources and ecosystems, shared ecological challenges, and promoting peace and security.</p> <p>Strategic Instrument B3: Community-based natural resource management and other joint pool resource management opportunities that internalize the costs and benefits of sustainable biodiversity management.</p> <p>Strategic Instrument B4: Sustainable career structure and the capacity to provide highly trained and motivated environmental conservation managers</p> |

| Goal | Strategic Instruments |
|---|--|
| | <p>in all fields of ecosystem management to meet future employment needs, making Jordan a world leader in environmental management.</p> <p>Strategic Instrument B5: Jordan’s Economic Modernization Vision is supported and strengthened by identifying cost-effective and resilient ecological approaches such as bio-engineering, water provisioning, etc.</p> <p>Strategic Instrument B6: The EMV's aspects that must be underpinned by ecosystem goods and services (and undermined if the ecosystem functionality is lost) are identified for near-future planning purposes.</p> |
| <p>Goal C: Fair and equitable sharing of monetary and non-monetary benefits from using genetic resources, digital sequence information on genetic resources, and traditional knowledge associated with genetic resources.</p> | <p>Strategic Instrument C1: Develop a supportive policy and regulatory framework that maintains sufficient controls without constraining innovation and ensures the utilization of genetic resources and digital sequence information on genetic resources.</p> <p>Strategic Instrument C2: Protect local knowledge and the interests of the custodians of any such cultural, material, intellectual knowledge, intellectual property, and any legitimate benefits resulting from the future use options of such knowledge or intellectual property.</p> <p>Strategic Instrument C3: Recognize that the wise use of biodiversity is incentivized when the benefits of sustainable management balance the costs, including opportunity costs, received by those who incur the costs. Therefore, a policy and regulatory framework should provide diverse incentive mechanisms such as direct use, compensation, payment for ecosystem services, and, in some circumstances, alternative livelihoods. Correspondingly, policies, regulations, and perverse incentives that remove or reduce the value of biodiversity or subsidize actions and activities likely to damage ecosystems and biodiversity or harm the communities that depend on these resources should be reduced to create a level playing field.</p> <p>Strategic Instrument C4: Promote biodiversity, ecosystem, and Green Economy research and allow information sharing and sound management of such data.</p> <p>Strategic Instrument C5: Promote cordial and transparent regional and global collaboration on all aspects of biodiversity and, in particular, promote peace, gender equality, and greater understanding and empathy.</p> <p>Strategic Instrument C6: Develop genetic conservation research and development capacities within Jordanian Academic Institutions.</p> |
| <p>Goal D: Biodiversity conservation in Jordan is fully funded through domestic budgets, international funding, and private sector investments. A transparent and adaptive national policy framework ensures coherent integration of biodiversity and ecosystem services into all sectors, supporting economic, social, and environmental resilience and fully considering these factors within the national accounting system. Knowledge,</p> | <p>Strategic Instrument D1: Mobilize sufficient financial and material resources by:</p> <ul style="list-style-type: none"> • Recognizing Jordan’s unique role in the region both as an innovator and through its hosting of refugees and ensuring this is reflected in global financing, particularly north-south knowledge transfer and funding. • Mobilize domestic funding for the sustainable management of biodiversity resources, including mainstreaming biodiversity and ecosystem maintenance in all sector budgets. • Developing Green Business models in line with the EMV. • Building the capacity for financial planning to support Jordan’s specially protected areas. • Identifying and prioritizing (by threat level, extent, and urgency) all ecosystem functions in Jordan. |

| Goal | Strategic Instruments |
|--|---|
| <p>skills, and data are equitably and fairly exchanged with international partners.</p> | <ul style="list-style-type: none"> • Build Jordan's capacity for environmental economics and establish Jordan as a center of excellence and a regional hub in all aspects of environmental economics. <p>Strategic Instrument D2: Develop Jordan as a regional hub resource for including biodiversity and ecosystem health in disaster risk reduction and regional security.</p> <p>Strategic Instrument D3: Build on the existing arrangements to develop a functionally efficient, cost-effective national coordination system for biodiversity monitoring and information sharing to inform adaptive management (based on the CHM), including the involvement of public participation and “citizen science” and social media.</p> <p>Strategic Instrument D4: Provide periodic assessments of the threat level at the national and site levels to be published on the CHM.</p> <p>Strategic Instrument D5: Policies and regulatory instruments that:</p> <ul style="list-style-type: none"> • Promote green investment in all sectors of the economy and ensure that those closest to the resources, particularly women, can equitably share the economic and security benefits of the green economy. • Seek to remove perverse incentives and market distortions, such as inappropriate subsidies or other financial incentives, which may remove value from or undermine the sustainable use of biodiversity and other ecosystem components. |

4.5 THE 2030 STRATEGIC ACTION PLAN

4.5.1 GOAL A STRATEGIC DIRECTION & INSTRUMENTS

Goal A, “spatial and protected areas,” is directed at the ex-situ conservation of biodiversity; as such, it is mainly about the spatial management of Jordan to conserve biodiversity. This involves a mix of spatial planning (including coastal and marine), designations, policies, capacities, and technical and operational approaches. Jordan has significant areas of territory that might be considered wilderness. Yet, humanity has been part of these landscapes for so long that historically, they have been part of the evolutionary processes that have shaped the landscapes and their biological components that we now value and seek to conserve. Jordan recognizes the importance of strict IUCN Category I and II protected areas. However, it is also important to realize that a range of territorial measures will be needed to include the scale and diversity of Jordan’s ecosystems and biodiversity if sufficient quantity and structural diversity are to be managed sustainably. Jordan recognizes that the costs of strict protection fall primarily on the state budget. Therefore, only the most vulnerable sites require such protective measures. The national and global goals can be achieved more cost-effectively in terms of extent, function, and quality of management across much larger areas through other effective area-based conservation measures. Whether through strict protection or the changes in how the land and marine environment is managed and used, Jordan recognizes that many uses that are non-consumptive of biodiversity at the individual level are consumptive at the ecosystem level. Specific uses that are consumptive of individuals are non-consumptive at the ecosystem level. The primary concern is that the use of biodiversity is sustainable at the level of the ecosystem.

To achieve this, strategic and integrated planning is a prerequisite. While the Ministry of Environment remains the primary authority and responsible agency for biodiversity, all sectors bear responsibility and have authority over components of the socio-ecosystem and its functions, such as migratory routes, water provisioning, soil, and carbon sequestration, to name but a few, which affect biodiversity.

Therefore, all sectors must recognize their responsibilities and the opportunities to carry out their statutory duties. They must not just exploit the demand for ecosystem goods and services but actively and progressively maintain the socio-ecosystem's ability to continue to supply ecosystem goods and services and incorporate and use natural processes as viable and cost-effective management solutions.

This is a long-term multi-sector and multi-disciplinary vision. It involves the spatial planning within Jordan and the organization and management arrangements within Jordan's border. It will need sectors such as, among other things, agriculture, water, and infrastructure to build the skills and expertise to capitalize and use ecosystem functions within their operational processes; it will mean that agencies may encounter situations for which solutions lie outside the current way of operation, and possibly, thinking and applying existing procedures and understanding does not provide the solution needed. Therefore, Jordan will build these capacities for the future through education, training, and research within our academic institutions to meet these challenges, not with trepidation, but with confidence and a sense of purpose.

Building these capacities within our institutions to manage and utilize the ecosystem sustainably and without losing biological diversity will require investment in education and training, especially in training young people to be future decision-makers, managers, and leaders. This will give Jordan a comparative advantage of leading progressive, nature-based, sustainable solutions to life's challenges in a rapidly changing climate.

Lastly, such an approach will require a supportive policy and regulatory environment. It will require policy conformity and coherence across all sectors in the national interests and close collaboration with regional and global partners.

Goal A Strategic Instruments:

Strategic Instrument A1: Ecosystem integrity and connectivity, including their natural processes and their adaptive potential, their capacity to undergo disturbance while maintaining both their existing functions and controls and their capacity for future change, are maintained through mainstreaming ecosystem resilience and biodiversity within the national land use planning framework, institutions and policies affecting land use, coastal areas and the marine environment.

Strategic Instrument A2: Increased and integrated biodiversity/ ecosystem management capacities in a diversity of institutions tasked with managing land use (e.g., MoA, MoW&I, Municipalities, ASEZA, PETRA) and higher education/ academic institutions to effectively conserve biodiversity and capitalize on the benefits of ecosystem goods and services in supporting social and economic resilience.

Strategic Instrument A3: Greater participation of all of government and society, including building awareness and capacities of legal authorities (e.g., Courts, police, rangers, customs, and border controls, etc.) and civil society, non-governmental organizations, and the national media to effectively conserve biodiversity and capitalize on the benefits of ecosystem goods and services in supporting social and economic resilience through a whole of government, whole of society approach.

Strategic Instrument A4: Cost-effective ecological solutions to land management challenges (e.g., water provisioning, flood mitigation, agricultural pollution, drought, infrastructure protection, rangeland degradation, agricultural pollution, etc.). These include restoring ecosystem functions using natural processes and native species (bio-engineering, agro-biodiversity, ecological-agriculture, etc.) to support ecosystem-based land use planning. Utilizing ecological processes and nature-based solutions will exploit efficiencies, provide multiple benefits, and increase resilience.

Strategic Instrument A5: Integrating agrobiodiversity, particularly ecological and regenerative farming approaches, landraces, and locally developed varieties into farming systems, including establishing genetic reserves or other conservation mechanisms for crop wild relatives and maintaining farming systems that promote genetic and structural diversity.

Strategic Instrument A6: Partnerships with international institutions involved in plant conservation to effectively share information, resources, and the costs and benefits of plant (and less-well-studied groups such as fungi and soil biodiversity) genetic conservation.

Strategic Instrument A7: Sustainable career structures and the capacity to provide highly trained and motivated environmental conservation managers in all fields of ecosystem management to meet future employment needs, making Jordan a world leader in environmental management.

Strategic Instrument A8: Research and development capacities within Jordan's academic and research institutions to find new, innovative, and sustainable solutions to address the challenges of environmental degradation and biodiversity loss.

Strategic Instrument A9: Policies that promote and support gender equality in the workforce through equal access to employment and education opportunities.

Strategic Instrument A10: Policies that recognize the important role played by women in the management of biodiversity and rural circumstances because women often have a high dependency on biodiversity and other natural resources for their livelihood security and its sustainable management is of fundamental and practical concern to them, ensure that they have equality in planning, decision-making and the equitable distribution of the costs and benefits of wise management.

4.5.2 GOAL B STRATEGIC DIRECTION & INSTRUMENTS

Goal B, "sustainable use and development," is directed at the in situ conservation of biodiversity, recognizing that use, given the right conditions, can improve the conservation status of a species or an ecosystem. Of equal weight, it explicitly acknowledges that sustainable use of ecosystems and the biological components that comprise their living parts can provide significant economic development and livelihood opportunities, especially in rural areas, as well as contribute to the social and cultural identities of communities with historical solid lineages which may contribute to regional or national identity.

However, this may equally apply when the benefits of wise management are externalized from a system. This should create the framework for innovative approaches to return value to those who manage the resource and bear the costs through practices such as payment for ecosystem services. Sustainable use can be an important tool in freeing conservation resources to conserve uneconomic natural systems.

Importantly, this goal should relate to those areas and resources outside the more strictly protected areas (Category I and II). However, sustainable use may still apply in these categories, such as where eco-tourism is practiced, where there are traditional human migration patterns, etc. Establishing sustainable use regimes is a long-term goal and requires changes in governance approaches. For instance, pasture may become the sustainable use of plant communities with multiple benefits such as soil building, sequestration of carbon as organic soil carbon, groundwater recharge, and the maintenance of future use options of a range of different plant genomes, as well as the production of livestock and the continuation of a cultural identity and societies which have existed alongside these biodiversity resources for millennia.

Sustainable use can provide considerable economic and social development opportunities, especially in marginalized rural communities. It can also offer downstream benefits to more developed areas through ecosystem provisioning services.

For biodiversity conservation management, protecting, utilizing, or abandoning a resource or resource can provide a reasonable basis for determining policies. Based upon the premise that a resource can be used, and that utilization can, under favourable conditions, contribute to a resource's sustainable management and conservation status. Failure to protect or sustainably use a resource can led to its abandonment through over-exploitation, neglect, or replacement.

Sustainable use of biodiversity resources is complex and necessitates a principled approach to solving complex and often non-rule-based problems rather than imposing a fixed set of technologies, policies, and practices. Sustainable use of biodiversity is as much about sustainable communities as it is about ecology. As an effective biodiversity conservation tool, sustainable use is best achieved through good governance and respect, particularly in respecting each individual's values on biodiversity and its use, which are "consumptive" or "non-consumptive," the principal aim being sustainability itself.

This strategy explicitly seeks to avoid the risk of abandoning any biodiversity resources.

Goal B Strategic Instruments:

Strategic Instrument B1: Policies and regulatory instruments that:

- Provide for inclusive government and the engagement of local communities in the conservation management of biodiversity resources.
- Recognise the role of local communities in the stewardship of biodiversity resources and support their effective and sustainable management.
- Recognise that tenure may be the most critical factor affecting their sustainability when biodiversity resources are utilized. Tenure, or rights, may be vested in the state, the community, or the individual, but open-access resource use systems are rarely sustainable.
- Promote green investment in all sectors of the economy and ensure that those closest to the resources, particularly women, can equitably share the economic and security benefits of the green economy.
- Seek to remove perverse incentives and market distortions, such as inappropriate subsidies or other financial incentives, which may remove value from or undermine the sustainable use of biodiversity and other ecosystem components.

Strategic Instrument B2: Regional collaboration in research, trade, transboundary resources and ecosystems, shared ecological challenges, and promoting peace and security.

Strategic Instrument B3: Community-based natural resource management and other joint pool resource management opportunities that internalize the costs and benefits of sustainable biodiversity management, including external support to communities to restore ecosystems and their functionality, are recognized, legitimized, and supported through national policies and regulation.

Strategic Instrument B4: Sustainable career structure and the capacity to provide highly trained and motivated environmental conservation managers in all fields of ecosystem management to meet future employment needs, making Jordan a world leader in environmental management.

Strategic Instrument B5: Jordan's Economic Modernization Vision is supported and strengthened by identifying cost-effective and resilient ecological approaches such as bio-engineering, water provisioning, etc.

Strategic Instrument B6: For near-future planning purposes, the EMV's aspects that will need to be underpinned by ecosystem goods and services (and undermined if the ecosystem functionality is lost) are identified.

4.5.3 GOAL C STRATEGIC DIRECTION & INSTRUMENTS

Linking benefit to wise management is a fundamental principle underpinning this goal. It primarily relates to the policy and regulatory framework surrounding the use of genetic resources and not the in-situ conservation management of those resources. As such, it should focus on the bundle of rights and responsibilities that determine ownership or tenure and not seek to determine the type of use.

An assumption in this case should be that use per se is sustainable. However, inequalities and inefficiencies within the institutional, policy, and regulatory framework that determine the strength and security of ownership or tenure will undermine the quality of any management regime.

Benefits are not always realized by those closest to the resource who bear the management and opportunity costs of conserving genetic diversity. Therefore, a primary policy objective should ensure that benefits are returned to those closest to the resource, who have the legitimacy of tenure and bear the direct and opportunity costs of wise biodiversity management.

While financial benefits are likely to have the most significant impact on the quality of management, it is also important to remember that other non-pecuniary benefits can and do provide a strong motivation for wise management. Spiritual, cultural, and recreational benefits, such as the security and ability to determine future directions and self-sufficiency, are critical motivating factors.

An important challenge of any equitable benefit-sharing approach is recognizing ownership of biodiversity. While modern governments, legal frameworks, and markets readily recognize single-state and private ownership, common property systems are less well-defined spatially, numerically, and legally. Therefore, any

access and benefit sharing will need to be supported by a range of peripheral, complementary, and subsidiary policies and regulations.

Goal C Strategic Instruments:

Strategic Instrument C1: Develop a supportive policy and regulatory framework that maintains sufficient controls without constraining innovation and ensures the utilization of genetic resources and digital sequence information on genetic resources.

Strategic Instrument C2: Protect local and indigenous knowledge and the interests of the custodians of any such cultural, material, intellectual knowledge, intellectual property, and any legitimate benefits resulting from the future use options of such knowledge or intellectual property.

Strategic Instrument C3: Recognise that the wise use of biodiversity is incentivized when the benefits balance the costs of sustainable management, including opportunity costs, are received by those who incur the costs. Therefore, a policy and regulatory framework should provide diverse incentive mechanisms such as direct use, compensation, payment for ecosystem services, and, in some circumstances, alternative livelihoods. Correspondingly, policies, regulations, and perverse incentives that remove or reduce the value of biodiversity or subsidize actions and activities likely to damage ecosystems and biodiversity or harm the communities that depend on these resources should be reduced to create a level playing field.

Strategic Instrument C4: Promote biodiversity, ecosystem, and Green Economy research and allow information sharing and sound management of such data.

Strategic Instrument C5: Promote cordial and transparent regional and global collaboration on all aspects of biodiversity and, in particular, to promote peace, gender equality, and greater understanding and empathy.

Strategic Instrument C6: Develop genetic conservation research and development capacities within Jordanian Academic Institutions.

4.5.4 GOAL D STRATEGIC DIRECTION & INSTRUMENTS

The NBSAP should align with and support Jordan's Economic Modernization Vision. Within the scope of the Economic Modernization Vision, the purpose of the NBSAP should be to ensure that the social, political, economic, and environmental trade-offs protect the future against the present claims. Land and resource use patterns and economic development do not discount the socio-ecosystems' ability to continue providing life-supporting ecosystem goods and services, the existing functions and controls, and their *capacity for future change*.

The EMV places considerable emphasis on regulating ecosystem goods and services with technology and market forces, resulting in a demand-led planning forecast. Shortly, it is unclear to what extent the ecosystem supply of natural processes, goods, and services will support this. Therefore, the NBSAP will, to some extent, provide the framework for these decision-making trade-offs.

The EMV has two pillars: economic growth and quality of life. The NBSAP should provide the stability of a third pillar to the economic vision: an ecosystem resilience pillar. To achieve this, it will be necessary to focus on four areas of policy and development:

They are building human resource capacities through education and training and ensuring equitable access to education, particularly **for women**. The scientists, managers, and green entrepreneurs will come from Jordan's Universities, and there must be investment in the environmental sciences and humanities to provide ecological managers, bio-technicians, agriculturalists, bio-engineers, and all manner of novel and innovative skills necessary to support a green and resilient economy.

Resilience needs to be built through **policy conformity**. Ecosystem goods and services are difficult to monetize and more challenging to account for. Within the national accounting ecosystem functions, the goods and services it produces are frequently discounted or deferred to other sectors—a private good transferred to a

public cost and the transfer of expenses across sectors. Therefore, coherent policies that account for the benefits of ecosystem resilience and the costs of losing these life support services are a cornerstone to achieving this goal.

Evidence-based policy and decision-making require transparent and accurate data sharing. The pace of change directly affects the rate at which the socio-ecosystem degrades and loses its resilience. Cost-effective and transparent data collection and sharing are fundamental principles that allow management at different scales to be more effective, efficient, and responsive to change.

International relationships are critical. Biodiversity loss is a collective action challenge that will need local, national, regional, and global collaboration on a scale never seen before. Collaboration on biodiversity conservation and the cooperation on inequalities and inefficiencies create the conditions that drive environmental degradation. Jordan will continue to be a team player, working with international partners, attracting international funding, and providing qualified and experienced decision-makers on the world stage.

Goal D Strategic Instruments:

Strategic Instrument D1: Mobilise sufficient financial and material resources by:

- Recognizing Jordan's unique role in the region as an innovator by hosting refugees and ensuring this is reflected in global financing, particularly north-south knowledge transfer and funding.
- Mobilize domestic funding for the sustainable management of biodiversity resources, including mainstreaming biodiversity and ecosystem maintenance in all sector budgets.
- Developing Green Business models in line with the EMV.
- Building the capacity for financial planning to support Jordan's specially protected areas.
- Identifying and prioritizing (by threat level, extent, and urgency) all ecosystem functions in Jordan.
- Build Jordan's capacity for environmental economics and establish Jordan as a center of excellence and a regional hub in all aspects of environmental economics.

Strategic Instrument D2: Develop Jordan as a regional hub resource for including biodiversity and ecosystem health in disaster risk reduction and regional security.

Strategic Instrument D3: Build on the existing arrangements to develop a functionally efficient, cost-effective national coordination system for biodiversity monitoring and information sharing to inform adaptive management (based on the CHM), including the involvement of public participation and "citizen science" and social media.

Strategic Instrument D4: Provide periodic assessments of the threat level at the national and site levels to be published on the CHM.

Strategic Instrument D5: Policies and regulatory instruments that:

- Promote green investment in all sectors of the economy and ensure that those closest to the resources, particularly women, can equitably share the economic and security benefits of the green economy.
- Seek to remove perverse incentives and market distortions, such as inappropriate subsidies or other financial incentives, which may remove value from or undermine the sustainable use of biodiversity and other ecosystem components.

Table 4 Matrix of National Targets, KPIs, and Strategic Actions

PART V: NBSAP IMPLEMENTATION

5.1 GOVERNANCE

The act or process of governing biodiversity in Jordan is complex and should be viewed through two separate lenses. That is, traditional collective norms and agreements, such as *hema*⁴⁵, which has evolved over time through consensus and necessity to manage common property resources and to protect *usufruct* rights without internal conflict, of what may loosely be termed *the* community, but in fact would have been a defined membership with internal controls and rules with a general aim of equitably sharing the common goods and services.

The second and parallel system is more recent and in common with many other countries, has grown out of a perceived need to regulate hunting and later, to establish reserved areas for the purpose of protecting wildlife. This formalised system, in the sense that it is embedded in modern government through a set of normative policies, Laws and regulations as well as institutional responsibilities, is more recent and generally takes precedent over traditional systems for the simple reasons that it is more easily recognised by the state and vests ownership of common property resources in a single state or private ownership which are easier to define in Law. State ownership often being a simplistic solution to complex, collectively owned or fugitive resource. Whereas common properties are more nuanced and harder to recognise and legitimise.

While traditional systems may value biodiversity for its utilitarian values, modern formalised systems may place other, less tangible values, such as aesthetic or existence values, over the rights to use. Both approaches have legitimacy and merit, but often they can create a conflict and dissonance between historical rights to use a resource and a real or perceived need to protect it. The critical point is that both systems have the sustainability of biodiversity resources at their heart.

Jordan's formal system of biodiversity conservation is deeply rooted in the development of its protected areas system which, while highly regarded internationally, has grown over time as a result of opportunity rather than a predetermined strategic systemic plan.

This protected areas system, which includes the rangelands, has served Jordan well and created an arguably unique governance system in relation to the biodiversity protected areas in the establishment of the RSCN, a non-state actor with substantive regulatory and enforcement powers as well as more globally common approach which vested the management of biodiversity in state institutions such as the MoE and the MoA. However, the needs of the system and the challenges it faces are arguably fast outgrowing these longstanding governance arrangements as our collective understanding of the importance of biodiversity expands to include a broader range of values fundamental to the support of life and livelihoods.

Similarly, the drivers of change and biodiversity loss are also changing as we understand the impacts of anthropogenic climate change, the need to ensure food security, the persistence of man-made chemicals and the expanding and consumptive demands of society.

A third and equally important aspect is the changing face of the institutional and management needs of the system as new players enter the field in the form of relatively newly appointed authorities with territorial responsibilities and the need to conserve biodiversity within production processes such as agriculture or consumptive processes such as tourism...etc.

Jordan recognises this dynamic process not so much as a threat, but as an urgent opportunity to modernise the whole of government and society's approach to the act or process of governing the countries biodiversity with the explicit goal of sustainability and resilience across all of societies values and interests. This includes rationalising the authority and responsibility for biodiversity which, overtime, has become dispersed across a

⁴⁵ There are other informal, traditional resource use systems, *hema* is the most widely recognised and even where these systems don't exist, it is possible to establish a unity of interests in order to manage a common good or resource.

range of institutions and agencies reducing the regulatory and management effectiveness and creating inefficiencies and inequalities within the system.

To this end, Jordan will embark on a modernisation of the entire governance approach and system. Nominally led by the MoE it will utilise the existing democratic institutions and structures to ensure the broadest possible participation of society in determining the future shape of governance, keeping what is good and works and changing what is inefficient, ineffective or creates inequalities.

This NBSAP does not predetermine the outcome of this democratic process, but sets a timeframe until 2030 and a set of guiding principles already set out in the NBSAP by which the process will proceed. In addition to those principles the process will:

- Institutionally separate the policy and regulatory role from the management functions to avoid any conflicts of interest.
- Ensure that the *de facto* responsibility and *de jure* authority for the day to day sustainable management of biodiversity are delegated or devolved to the appropriate level.
- Recognise that financial resources are finite and therefore approaches which serve to internalise the costs and benefits are likely to prove more sustainable against a range of values and over time.
- Ensures that the human rights and in particular, the role of women, hitherto undervalued within the existing governance system, are a fundamental foundation for the good governance of biodiversity.
- Recognise that there is an increasing complexity within the system as new emerging players, delegated authorities, civil society, non-governmental organisations and the private and commercial sector, enter the field. Therefore, any governance system has to be flexible, to recognise the important role of these groups and must be inclusive of their voice and provide a platform for their participation.
- Biodiversity is not an abstract concept but the very basis of all life on Earth. Therefore, biodiversity conservation by whatever form, is of primary interest to all sectors of society and the economy and must be mainstreamed into their policies and operational activities.
- Conservation of ecosystems is of higher priority than the stability of individual species populations. The ultimate criterion of sustainability is the persistence of the species. Species populations can be regarded as being sustainably used when their genetic and demographic characteristics under exploitation do not affect the population.

With this purpose in mind, Jordan will seek financial assistance for the necessary resources to embark on this democratic reform process of the national governance of biodiversity. This exercise will take place over time, cognisant that there are risks in changing any system. It will involve the broadest of institutional, technical, political, legal, operational and civil society participation specifically commissioned for the purpose of describing the future governance.

5.2 FINANCING

Jordan recognizes that funding for biodiversity conservation cannot be solely reliant on the government budget and necessitates substantial external financial assistance to implement the NBSAP effectively. Consultations for the 2050 NBSAP highlighted that the national budget typically covers recurrent costs, leaving limited resources for capital investments within the system. Moreover, available conservation funds are dispersed across various institutional, donor, and non-state actor platforms, complicating transparency in expenditure and funding priorities. Effective biodiversity financing hinges on addressing two critical questions:

1. What is the required funding to adequately support all actions in the NBSAP until 2030?
2. What is the current expenditure on biodiversity conservation?

The disparity between these figures will determine the funding gap. Given the diverse institutional landscape and sectoral interests, accurately gauging these figures remains a significant challenge. One of the principal strategies outlined in the 2050 NBSAP is to enhance economic and financial analysis capabilities within Jordan's conservation sector. However, developing these skills will require time, and the immediate task is to quantify financial needs against available resources precisely.

The Biofin Programme presents a crucial opportunity for Jordan to bolster these capacities, assess financial requirements, and establish a comprehensive financial plan for biodiversity conservation management. To achieve this, a Technical Working Group (TWG) will be established with the following objectives:

- Forecasting financial needs until 2030.
- Evaluating historical expenditures over the past 5–10 years and projecting future spending.
- Formulating a financial strategy to address gaps, aligning with NBSAP work programs, and securing financing sources (governmental, donor agencies, NGOs, private sector, revenues, etc.) through 2030.

This approach will create a dynamic dashboard for real-time biodiversity conservation financing that is accessible via the CHM. Additionally, the TWG will identify and quantify subsidies and market incentives detrimental to biodiversity, collaborating with relevant sectors and the Ministry of Finance to develop policies that phase out or reform these measures by 2030, ensuring fairness and effectiveness.

Substantial financial assistance opportunities exist at the grassroots level for organizations capable of accessing them. Efforts will focus on securing funding from appropriate donors to build capacity within academic institutions, NGOs, and civil society groups. This initiative aims to enhance their ability to identify funding sources, respond to calls for proposals, develop successful projects, and effectively manage grants, leveraging resources available through platforms like <https://fire.biofin.org/> and other small grant funds.

5.3 MONITORING

Jordan will adhere to the monitoring framework provided by the Secretariat for its national reporting, assessing the performance and impact of the Jordan National Biodiversity Strategy and Action Plan (NBSAP) through locally defined targets aligned with the global Monitoring and Evaluation (M&E) framework. Additionally, Jordan boasts a vibrant tradition of citizen engagement in biodiversity conservation through non-governmental democratic bodies such as the Royal Botanic Garden, the Royal Society for the Conservation of Nature, and the Royal Marine Conservation Society of Jordan. Moreover, Jordanian academic institutions have cultivated and guided generations of highly qualified environmental experts.

Jordan aims to leverage this extensive public participation and intellectual capital by establishing a National Systematic Biodiversity Monitoring Program (NSBMP) with dual objectives:

1. Foster widespread and participatory biodiversity monitoring at the systemic level.
2. Facilitate national and local adaptive management, recognizing the critical role of monitoring, evaluation, and adaptive management in addressing complex, dynamic socio-ecosystems characterized by high uncertainty and unpredictability.

This initiative is a long-term endeavor projected to extend beyond 2030, evolving alongside technological advancements, societal changes, and emerging biodiversity challenges. Recognizing the prohibitive nature of building and maintaining such a system from scratch, Jordan plans to develop components incrementally and seek external funding as necessary.

The NSBMP aims to establish a transparent and participatory platform accessible to governments and society, providing biodiversity data through the National Clearing House Mechanism (CHM). Oversight will primarily rest with the Ministry of Environment (MoE), supported by a multidisciplinary expert panel ensuring guidance, quality assurance, transparency, and accountability. The goal is to establish a durable and cost-effective program for tracking key indicators of the overall health of critical socio-ecosystem components over time. Key features of the NSBMP include:

1. Identification of components requiring monitoring.
2. Establishment of straightforward, robust data collection protocols.

3. Periodic monitoring of agreed biological indicators.
4. Tracking key ecosystem drivers (e.g., budget allocation to protected areas, visitor numbers, water quality, pesticide and fertilizer use) using existing statistical methods (e.g., sales receipts, license purchases, tax receipts).

The NSBMP will:

1. Enable long-term system surveillance, facilitating early detection of emerging changes.
2. Ensure accountability by assessing the implementation of actions outlined in the NBSAP and their resource adequacy.
3. Support adaptive management by evaluating the effectiveness of strategies and understanding system responses.

Citizen engagement forms a cornerstone of the NSBMP. Leveraging Jordan's active civil society involvement in biodiversity, the program will engage schools, visitors to protected areas, local communities, and businesses in periodic events such as annual biodiversity counts and participatory threat assessments. Emphasis will be placed on public accessibility of data and knowledge through the CHM, encouraging Jordanians to take an active role in safeguarding their ecosystem's long-term health and fostering a sense of responsibility and stewardship. The NSBMP prioritizes practical utility over charismatic or symbolic value in selecting indicators, ensuring scientific rigor through expert oversight and broad participation facilitated by technology and social media engagement across Jordanian society.

ANNEXES

Annex 1 Phytogeographical Zones of Jordan⁸

| Biogeographic Region | Figures | | Vegetation Type | Figures | | Description |
|----------------------|----------------------|--------------------|-------------------------|----------------------|--------------------|--|
| | Area Km ² | % of Jordan's area | | Area Km ² | % of Jordan's area | |
| Mediterranean | 5,426 | 6% | Deciduous Oak Forest | 156 | 0.18% | It is found at lower altitudes and is typically dominated by <i>Quercus ithaburensis</i> , which mainly grows on red or brown soil of hard limestone parental rock. These forests are located in the northern and western parts of the country and are particularly common in Irbid Governorate. |
| | | | Evergreen Oak Forest | 157 | 0.18% | It is found at higher altitudes of more than 700m and is typically dominated by <i>Quercus coccifera</i> . These forests are located in the northern and western parts of the country and are particularly common in the Ajloun Governorate. It grows on red soil (<i>Terra Rossa</i>) of hard limestone parental rock. Still, it grows on calcareous or yellow (Rendzina) soil of soft limestone parental rock soft limestone parental rock soil as secondary growth, replacing the Aleppo pine forest. |
| | | | Pine Forest | 18 | 0.02% | It is dominated by the Aleppo pine (<i>Pinus halepensis</i>) and reaches a climax in some places, with the trees exceeding 15 meters in height. This forest vegetation usually occurs naturally at high altitudes, mostly over 700m, where Rendzina and calcareous soils are present. In some places, the pine trees are replaced by <i>Quercus coccifera</i> because of the degradation of the primary vegetation, forming a secondary succession. |
| | | | Artificial pine forests | 116.3 | 0.13% | Humans have planted artificial trees, typically for recreational or environmental purposes. Artificial trees are a popular choice for artificial forests because they are fast-growing and relatively easy to care for. They are also known for improving soil quality and preventing erosion. |
| | | | Garrigue and Batha | 4815 | 5.4% | It occurs in degraded areas of the Mediterranean region that do not support forests under the current physical and climatic conditions. It can be found in many parts of Amman and Irbid. This vegetation is |

| Biogeographic Region | Figures | | Vegetation Type | Figures | | Description |
|------------------------|----------------------|--------------------|---------------------------|----------------------|--------------------|---|
| | Area Km ² | % of Jordan's area | | Area Km ² | % of Jordan's area | |
| | | | | | | mainly represented by <i>Sarcopoterium spinosum</i> , among other small shrubs. |
| | | | Juniper Forest | 192 | 0.22% | It occurs only in the sandstone rock formation in the southern mountainous areas of Jordan, usually at high altitudes over 1,000m. It is dominated by the Phoenician Juniper (<i>Juniperus phoenicia</i>) associated with Cypresses trees (<i>Cupressus sempervirens</i>). |
| | | | Riparian Vegetation | 29.9 | 0.32% | This vegetation can be found in three biogeographical regions. It occurs in the Rift Valley region's canyons, rivers, and wadis and differs depending on the edaphic and climatic conditions. Northern Jordan, trees of <i>Platanus orientalis</i> , <i>Populus euphratica</i> , <i>Tamarix palaestina</i> , and <i>Salix</i> spp. are associated with <i>Phragmites australis</i> , <i>Nerium oleander</i> , and <i>Arundo donax</i> shrubs. Still, in the southern parts, <i>Populus euphratica</i> , <i>Dalbergia sissoo</i> , and <i>Phoenix dactylifera</i> trees are associated with the same shrubs found in the north, plus <i>Myrtus communis</i> . On the banks of the Jordan River, trees of <i>Populus euphratica</i> populate the area closest to the water. |
| Irano–Turanian | 12,820 | 13% | Steppe Vegetation | 11293 | 12.6% | It represents a transition between the mesic and xeric areas or, in other words, a buffer that separates the Arabian desert from the Mediterranean biogeographical regions. It is confined to the Irano-Turanian region, and all remaining steppe forests that contain the <i>Pistacia atlantica</i> are in the south of Jordan at Beer Ad-Dabghat and Beer Khdad. However, species such as <i>Retama raetam</i> , <i>Ziziphus lotus</i> , <i>Z. nummularia</i> , and <i>Ferula communis</i> can be observed in the northern parts. |
| | | | Riparian Vegetation | 38 | 0.04 | See above |
| | | | | | | |
| Saharo–Sindian–Arabian | 59,988 | 68% | Mudflat Vegetation | 596 | 0.67% | See above |
| | | | Gravel Hammada Vegetation | 45,871 | 51.3% | Most of Jordan's eastern desert is covered with gravel hammada. In this type of vegetation, only desert annuals generally grow. |
| | | | Runoff Hammada Vegetation | 11,677 | 13.1% | It is formed from the desert shrubs belonging to the families Asteraceae and Chenopodiaceae and occurs sporadically next to and within the wadi beds in the eastern desert of Jordan. |

| Biogeographic Region | Figures | | Vegetation Type | Figures | | Description |
|-----------------------------|----------------------|--------------------|---|----------------------|--------------------|--|
| | Area Km ² | % of Jordan's area | | Area Km ² | % of Jordan's area | |
| | | | Sandy Gravel Hammada with <i>Hammada scoparia</i> | 2408.9 | 2.7% | The dominant species are <i>Hammada scoparia</i> |
| Saharo-Sindian-Nubo-Sindian | 10,584 | 12% | Mudflat Vegetation | 297 | 0.3% | See above |
| | | | Granite and Sandstone Shrubland | 4,079 | 4.6% | It contains rock crevices and fissures that allow for water accumulation and support the germination of endemic and rare Mediterranean species to flourish, such as the endemic shrub to Jordan and <i>Daphne mucronata</i> subsp. <i>linearifolia</i> . |
| | | | Riparian Vegetation | 4 | 0.01% | See above |
| | | | Thermophilous Vegetation | 534 | 0.59% | It occurs in the Jordan Valley in areas surrounding the Dead Sea. It is severely degraded and fragmented due to expanding farming and agricultural lands. |
| | | | Saline Vegetation | 392 | 0.44% | It occurs near the Dead Sea, along the Jordan Valley, and some parts of the eastern desert. It is dominated by <i>Tamarix</i> trees that tolerate high salt levels and <i>Atriplex</i> spp shrubs. |
| | | | Sand Dune Vegetation | 1,760 | 1.97% | it is considered very sparse and can be found in Wadi Rum and Wadi Araba in southern Jordan. Large sand dunes are frequently much better vegetated by <i>Haloxylon persicum</i> than the surrounding plains or sand flats vegetated by <i>Hammada salicornica</i> , <i>Haloxylon persicum</i> , <i>Caroxylon tetrandrum</i> , and <i>Anabasis articulata</i> . |
| | | | Acacia Woodland | 1,453 | 1.6% | This vegetation is confined to Wadi Araba, Wadi Al-Yutum, and Wadi Rum. It is characterized by scattered <i>Vachellia</i> sp. trees, which get denser at the mountain base's hard rocks and form pure stands of Acacia woodlands. Other associated species exist, including desert semi-shrubs like <i>Anabasis articulata</i> , <i>Hammada salicornica</i> , and <i>Retama raetam</i> . |
| | | | Sandy Gravel Hammada with <i>Vachellia gerrardii</i> and <i>Artemisia judaica</i> | 2,065 | 2.3% | Species of <i>Vachellia gerrardii</i> and <i>Artemisia judaica</i> dominate it, |

⁸Taifour et al., 2022. "A State-of-the-Art Vegetation Map for Jordan: A New Tool for Conservation in a Biodiverse Country" Conservation 2, no. 1: 174-194. <https://doi.org/10.3390/conservation201>