National Biodiversity Strategy

and Action Plan for the State of Palestine

2022

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List of Abbreviations

AAUJ	Arab American University of Jenin
ABS	Access and Benefit Sharing
ABT	Aichi Biodiversity Target
ACSAD	Arab Center for Studies of Arid Lands and Desertification
ALECSO	Arab League Educational, Cultural and Scientific Organization
ANU	An-Najah National University
ARIJ	Applied Research Institute of Jerusalem
ATG	Alternative Tourism Group
BERC	Biodiversity and Environmental Research Center
BGCI	Botanic Gardens Conservation International
BI	Birdlife International
BISS	Biodiversity Information Science and Standards
BRC	Biotechnology Research Center
BU	Bethlehem University
BZU	Birzeit University
CAM	Complementary and Alternative Medicine
CAMRE	Council of Arab Ministers Responsible for Environment
CBD	Convention on Biodiversity
CCD	Convention to Combat Desertification
CEPA	Communication, Education and Public Awareness Strategy
CEPF	Critical Ecosystem Partnership Fund
CHM	Clearing House Mechanism
CITES	Convention of International Trade in Endangered Species
COP	Conference of the Parties
CMS	Convention on Migratory Species
CSO	Civil society organization
EDPs	European Development Partners
EE	Environmental Education
EEC	Environmental Education Center
EIA	Environmental Impact Assessment
EQA	Environment Quality Authority
EU	European Union
FAO	Food and Agriculture Organization
GBF	Global Biodiversity Framework
GBIF	Global Biodiversity Information Facility
GBO	The Global Biodiversity Outlook
GCF	Green Climate Fund
GEF	Global Environment Facility
GMO	Genetically Modified Organisms
GTI	Global Taxonomy Initiative
HSF	Hanns Seidel Foundation
IAS	Invasive Alien Species
IBAs	Important Bird Areas

ICARDA	International Center for Agricultural Research in the Dry Areas
ICCA	International Congress and Convention Association
IPAs	Important Plant Areas
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IUCN	International Union for Conservation of Nature
IWMI	International Water Management Institution
JSCs	Joint Service Councils (deal with waste)
KBAs	Key Biodiversity Areas
LBSAP	Local Biodiversity Strategy and Action Plan
LMOs	Living Modified Organism
M&E	Monitoring and Evaluation
MDC	MAAN Development Center
MEA	Multilateral Environmental Agreement
MENA	Middle East and North Africa
METAP	Mediterranean Environmental and Technical Assistance Program
MINFO	Ministry of Information
MOA	Ministry of Agriculture
MOE	Ministry of Education
MOH	Ministry of Health
MOHER	Ministry of Higher Education and Research
MOI	Ministry of Interior
MOJ	Ministry of Justice
MOL	Ministry of Labor
MOLG	Ministry of Local Government
MOPAD	Ministry of Planning and Administrative Development (newer name)
MOPIC	Ministry of Planning and International Cooperation (older)
MOPLH	Ministry of Public Labor and Housing
MOTA	Ministry of Tourism and Antiquities
MOWA	Ministry of Women Affairs
NAP	National Adaptation Plan to Climate Change
NARC	National Agricultural Research Station
NBC	National Biosafety Committee
NBOC	National Biodiversity Oversight Committee
NBSAP	National Biodiversity Strategy and Action Plan
NCCCA	National Committee for Climate Change Adaptation
NDCs	Nationally Determined Contributions
NEPTO	Network of Experiential Palestinian Tourism Organizations
NGOs	Non-Governmental Organizations
NPA	National Policy Agenda 2017-2022 – Putting Citizens First
NRs	Nature Reserves
NSP	National Spatial Plan
NSSWM	National Strategy for Solid Waste Management
OECD	Organisation for Economic Co-operation and Development
OECM	Other Effective Area Conservation Measures

OPT	Occupied Palestinian Territories
PA	Protected Area
PAN	Protected Area Network
PARC	Palestinian Agricultural Relief Committee
PCBS	Palestinian Central Bureau of Statistics
PCC	Pioneer Consultancy Center for Sustainable Development
PENRA	Palestinian Energy and Natural Resources Authority
PFIU	Palestinian Food Industries Union
PGBC	Palestine Green Building Council
PIALES	Palestinian Institute for Arid Land and Environmental Studies
PIBS	Palestine Institute for Biodiversity and Sustainability
PMNH	Palestine Museum of Natural History
PMR	Plant Micro-Reserve
PNA	Palestinian National Authority (now the State of Palestine)
PNARC	Palestinian National Agricultural Research Center
PNBC	Palestine National Biodiversity Committee
PSCP	Palestinian Society for Consumer Protection
PSI	Palestinian Standard Institute
PWA	Palestinian Water Authority
PWLS	Palestine Wildlife Society
RE	Renewable Energy
ROF	Result-Oriented Framework 2018-2020
ROWA	IUCN Regional Office for West Asia
RSCN	Royal Society for Conservation of Nature (Jordan)
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice
SDGs	Sustainable Development Goals
SEPA	Swedish Environmental Protection Agency
SP	The State of Palestine
TBCA	Trans-Boundary Conservation Area
TDWG	Taxonomic Databases Working Group
TEEB	The Economics of Ecosystems and Biodiversity
UNDP	United Nations Development Programme
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNRWA	The United Nations Relief and Works Agency
WCMC	World Conservation Monitoring Centre
WHO	World Health Organization
WTO	World Trade Organization
WWF	World Wildlife Fund

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Executive Summary

The National Biodiversity Strategy and Action Plan (NBSAP) for Palestine must deal with the five main global threats: climate change, over-exploitation, habitat destruction, invasive species, and pollution, while enhancing the benefits to people from nature. In addition, we need to deal with a fifth threat to our environment: decades' long Israeli occupation and colonization. More recently, the COVID-19 pandemic has highlighted issues of inequality and need to build reslient communities which adds to the urgency of this project. There have been positive developments, as articulated in the 6th National Report to the Convention on Biological Diversity (CBD) of SP. It is believed possible to use the opportunity of building a Biodiversity Strategy and Action Plan that contributes to making genuine and lasting transformations in the Palestinian society and its interaction with the environment. To identify and achieve sustainable human development targets that respect and protect the environment requires maximum participation and support from all sectors of the Palestinian society. This includes central government, local authorities, NGOs, CSOs, academia, religious organizations, media, and the general public. There is a pressing need over the next ten years for commitment across the world to identify and finance conservation initiatives that halt, mitigate and provide adaptations to climate change. This is particularly important for developing countries. By producing this document, Palestinians show they can be leaders in both conservation and achieving environmental justice.

One important milestone in raising global awareness and organizing action in defense of the planet was the creation of the Convention on Biological Diversity (CBD) in 1992. The Convention was inspired by the world community's growing commitment to sustainable development. It represents a dramatic step forward in the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the use of genetic resources. The Convention brought nations together to identify best practices to address the main threats to biodiversity caused by climate change, overexploitation of resources, pollution, habitat destruction, and the negative consequences of invasive alien species. SP became a signatory to the Convention in 2015 and provided a submission to its 5th National Report but has since been excluded from major funding under the Convention. In 2021, SP provided its 6th National CBD Report noting some progress but also significant challenges. This is in line with most countries. The key areas globally identified for the failure to achieve the CBD's approved Aichi Targets to 2020 (or even the UN SDGs, see Arab Sustainable Development Report, and UN ESCWA) are: 1) Inadequate national policy responses, 2) Funding shortages, 3) Science–policy knowledge gaps, and 4) Weak review processes. For SP, the 6th National Report showed these and other challenges (primarily the occupation). Indeed, most countries fell short of meeting the Aichi Targets. Additionally, SP is a signatory to the United Nations Framework Convention on Climate Change. Another key set of targets are those set in the UN Sustainable Development Goals.

The first National Biodiversity Strategy and Action Plan (NBSAP) for SP was made in 1999. Its production coincided with adoption of an environmental law passed by the newly created Palestinian Authority. This NBSAP revision is a collective project that has involved the Environment Quality Authority (EQA) and Bethlehem University and has been assisted by the widest range possible of stakeholders. The project took place in two stages:

1) Submitting Palestine's contribution to the 6th National CBD Report. This showed the progress made by SP in meeting the 2020 Aichi Targets. The contribution to the 6th National Report describes how Palestinians have responded to the challenging targets in spite of the negative consequences of the five main global threats and over five decades of Israeli occupation.

2) Secondly, producing an NBSAP that will "galvanize urgent and transformative action by Governments and all communities, civil society, and businesses, to achieve the outcomes it sets out in its vision, mission, goals and targets, and thereby to contribute to the objectives of the Convention on Biological Diversity, its

Protocols, and other biodiversity related multilateral agreements, processes and instruments" (October 2021 – November 2022)

The post-2020 CBD framework: within the post-2020 frameworks of the Biodiversity Convention, the global community recognizes:

- Ecosystems and their biodiversity underpin the global economy and human well-being and need to be valued and protected,
- Damage to global ecosystem services and biodiversity is acute and accelerating (five major threats globally: climate change, overexploitation, pollution, habitat destruction, and invasive alien species; and a sixth local threat; Israeli occupation/colonization),
- Ecosystem damage carries economic and social dimensions and costs,
- Growing demand from an expanding population is a key cause of biodiversity loss,
- Investing in ecological infrastructure can offer greater returns than man-made alternatives and thus contribute to econmic stability,

Creating the NBSAP included over forty capacity-building workshops and associated activities that were used to assist in preparation of the strategy and action plan draft. Training was delivered on GIS, remote sensing and other forms of data recording. This included the collection and cataloguing of available cartographic, cognitive data and technical documentation. All information gathered has been archived and will be uploaded to a central CHM. The new NBSAP offers a vision of sustainable development and ecologically balanced communities in SP. It also provides a road map and set of outcomes that will contribute to global efforts to conserve our shared planet.

We used six guiding principles to produce this updated NBSAP:

1) The most important principle was grassroots involvement. While all levels of society have been involved in feeding into the planning and managing of natural resources, particular attention was given to participation by local communities. The intention was to ensure shared benefits from, and fair access to SP's rich biodiversity.

2) Relying on post 2020 CBD frameworks coupled with the experience of other countries and local knowledge to create a strategy tailored for SP, and a practical and realistic plan for its implementation. The aim is to move beyond GDP indicators to measures of well-being, both in terms of human welfare and balanced ecosystems.

3) Empowerment through capacity building. Building human capacity requires restructuring educational systems at all levels. The role of schools and universities is to help young people become citizens who have respect for themselves, for others and for the environment in which they live in.

4) Respect for others and for the natural world leads to sustainability and coexistence with each other and with nature. Respect leads to caring, empathy, and collaboration both within bounded entities and across borders. Respect involves preserving Palestinian culture and the natural heritage of SP.

5) In addition to new technology, we have used indigenous knowledge, practices, and value systems. Through this, traditional means of production, cultural practices and forms of joint organization were drawn upon. This includes collaboration, support), and self-sustenance, resilience, and persistence).

6) Environmental justice is an absolute right: every human being is entitled to clean air, clean water, and a healthy environment.

Based on the preliminary work articulated in the 6th National Report to the Convention on Biological Diversity and supplemented by the literature reviews, workshops and interviews undertaken in the formulation of this document, the situation in SP can be summarized as following:

Diagnosis: Like other developing countries, SP suffers from the common global threats of climate change, pollution, invasive alien species, habitat destruction and overexploitation of natural resources. The

problems associated with these issues are compounded by Israelicolonial occupation. Nevertheless, environmental education, research, and conservation efforts taking place across SP are positive actions. However, these actions are not sufficientl and cannot significantly stem the environmental deterioration currently taking place.

Therapy: The intention behind producing this National Biodiversity Strategy and Action Plan is to create a template within which the Palestinian society can be radically transformed. Accordingly, urban and rural communities can live in ecological harmony with the land and resources of SP. To achieve this, full participation and effort from **every** sector of our society: governmental institutions, local authorities, NGOs, CSOs, academia, religious communities, media, and the general public. The NBSAP provides an entry point and a means by which capacity building can be undertaken. Action will come about through increasing awareness and building abilities at all levels from the individual to the institutional. Appropriately focused agency will bring about participation in the economic, social, and political elements that provide the basis for an ecologically sustainable society. The NBSAP provides a means to leverage funds for SP from bilateral and multilateral sources earmarked for biodiversity and conservation initiatives. The strategy and plan will also provide the means to identify projects to assist with mitigation and future adaptation to climate change.

Prognosis: With the implementation of the strategy and action plan:

1) SP would develop into a socially stable and economically successful society living in harmony with its natural environment,

2) The public would have greater awareness of environmental issues and through this have a deeper connection with the land and nature. More food with a low carbon footprint would be sustainably produced, thus contributing to greater food security.

The vision, mission, strategic goals and objectives of SP's 2022 NBSAP:

VISION: By 2050 human and natural communities will be coexisting in harmony, where biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy Palestinian environment and delivering benefits essential for all people.

MISSION: NBSAP of SP sets parameters, conditions, and programs to 2030, to be revisited every five years thereafter to achieve the vision stated via participatory strategic planning and implementation, capacity building, mainstreaming, and bridging science-policy-practice gaps.

Strategic Goals (4), Objectives (6), Milestones (17), and Targets (17) were set up from which 76 specific action plans were formulated collectively.

Goal A. Increase protection and conservation measures to halt the decline and minimize loss of habitats and species.

Objective A1: The integrity and connectivity of ecosystems are enhanced, with an increase of at least 15 per cent in Palestine, supporting healthy and resilient populations of all species: the rate of extinctions is reduced at least tenfold, the risk of species extinction across all taxonomic and functional groups is halved, and genetic diversity of wild and domesticated species is safeguarded, with at least 90 per cent of genetic diversity within all species maintained.

Objective A2: Reducing the six major threats in SP that affect biodiversity (Climate Change, Habitat Destruction, Pollution, Overexploitation, Invasive Alien Species, Israeli Colonization)

Goal B. Enhance ecosystem services (nature's contribution to people) and equitable benefit sharing.

Objective B1. Nature's contributions to people are valued, maintained or enhanced through conservation and sustainable use, supporting the global development agenda with a substantial increase in both monetary and non-monetary benefits shared equitably.

Goal C. Mainstreaming and valorizing biodiversity conservation at all levels of society in an inclusive and participatory manner.

Objective C1: Develop programs for capacity building, knowledge generation, and knowledge dissemination (awareness).

Goal D. Improved governance, partnerships, and resource mobilization.

Objective D1: Bridging science-policy/procedure gaps,

Objective D2: Mobilize enough resources (financial and otherwise) to achieve the Mission.

The new NBSAP lays out 17 targets under these objectives with attendant action plans (total 76, annex 1). Each action plan was stated using SMART criteria (who will deliver them, timelines, indicators etc and even potential funding sources, and notes on implementation). The lay out of the NBSAP report follows recommended structure based on CBD guidelines. The introduction (Section 1) includes background, local and international treaties, analysis of causes and consequences of biodiversity loss, issues of ecosystem services, stakeholders, and issues of synergies. Section 2 engages iun stocktaking that helped build the NBSAP and covers such areas as threats, local isues of nature's contribution to people, conservation (including area, species, habitats), mainstreaming, gender, research, capacity building, modernization, risks, and disaster management, biosafety, sustainable production and consumption, management of species and ecosystems, and mobilizing resources. Section 3 covers the construction process of the NBSAP and Section 4 the outputs of the NBSAP. Section 5 deals with implementation and section 6 provides concluding comments. The NBSAP also includes a glossary of terms and the references.

1 Introduction

1.1 Brief background

The meeting in Stockholm in 1972 resulted in the creation of the UN Environment Program (UNEP) and the start of key conventions related to the environment, and of which the 1993 Convention on Biologic Diversity became central. Yet, the global (including SP's) environment has deteriorated since 1972 (UNEP 2020). The Global Environment Outlook is now documented by UNEP and the CBD and Millennium Ecosystem Assessment. The remedies have been explored and the literature is replete with proposed solutions, strategies, and plans (see Adams 2019; Asara et al. 2015; Howes et al. 2017; UNDP 2007).

The pressures globally and locally are intertwined with social imbalance and inequities intersecting planetary imbalances. The history of global attempts at working together to address both national and global needs related to biodiversity is summarized in Figure 1.1. The COP to the CBD is the body that provides the overall guidance and develops supporting measures for the 196 parties to implement global targets. Parties develop NBSAPs, which can be implemented through national legislations and other tools. Through regular national reports to the COP, parties identify the measures and describe the implementation of the CBD and their national targets (Xu et al. 2021).

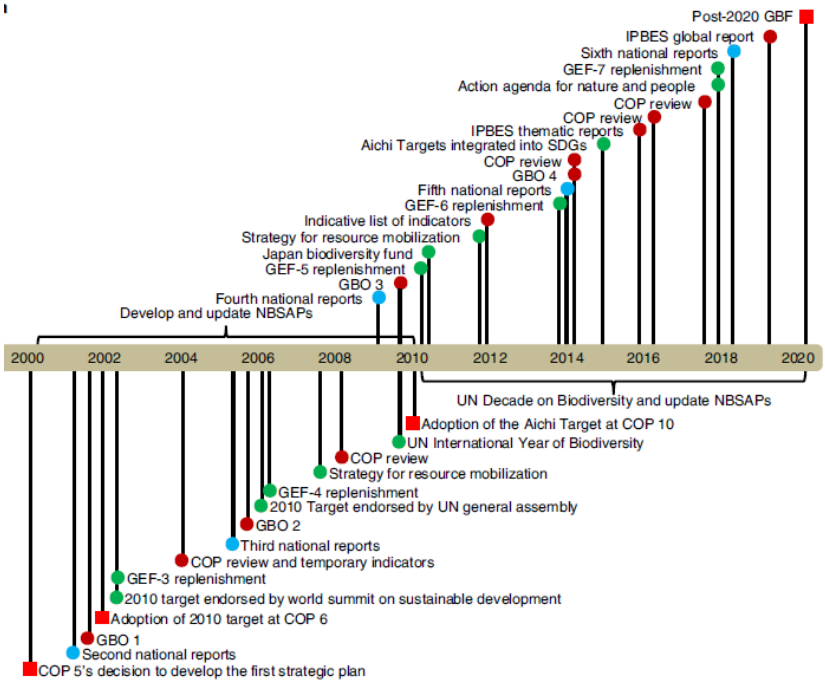


Figure 1.1 The chronology and current implementation processes of global biodiversity targets (Xu et al., 2021).

The latest Global Biodiversity Outlook (Secretariat of CBD, 2020) highlights the urgency of action globally. The five principal pressures are habitat change, overexploitation, pollution, invasive alien species, and climate change. These have an impact on human well-being and will have even more impact in the future if not addressed by societies at large. Thus, while greenhouse gases and use of fossil fuels is high in demand in several countires, the globesuffers at whole.

The situation in SP has been most recently summarized in the 6th National Report to CBD. Like other countries, environmental challenges have not been addressed adequately to meet the 2020 Aichi Targets (EQA, 2021a). In SP, the same challenges and threats are faced but these are compounded by colonial Israeli occupation.

The CBD asks parties to submit their National Biodiversity Strategies and Action Plans (NBSAP) in a manner that reflects the country's vision for biodiversity and the broad policy and institutional measures that the country will take to fulfil the objectives of the convention (see link). The national strategies should include working for positive changes to the current status and trends of biodiversity and the pressures on it. It is essential that all sectors whose activities affectbiodiversity, and those societal groups who depend on biodiversity, be brought into the NBSAP process early. This engenders a broad ownership of the NBSAP whereby all stakeholders in biodiversity are engaged in its development and implementation. It also enables 'mainstreaming' which means the integration of biodiversity into relevant legislation, plans, programs and policy, such as National Development Plans; National Strategies for Sustainable Development; Poverty Reduction Strategy Papers; Strategies to achieve the Millennium Development Goals; National Programs to Combat Desertification; National Climate Change Adaptation or Mitigation Strategies; and relevant private-sector policies.

Since the last Palestinian NBSAP was published in 1999, much has changed, including SP signing the CBD in 2015, and the CBD issuing clear directives on formulations of NBSAPs. In addition, emergance of new threats to biodiversity, new opportunities, and new and updated methodologies and data that could make for a far more effective NBSAP. Thus, a new national strategy that serves SP, taking into account local needs, international legal (convention) obligations, and actual changes in the past three decades is essential. The methodology and details stated below and the logical framework that begins with formulation of the sixth national CBD report and then the creation of the NBSAPP with a collective effort and its national adoption will help position SP at the forefront of countries that conserve and manage their local rich biodiversity.

In 2015, SP signed a number of other conventions besides CBD related to environment and biodiversity (Cartagena protocol of CBD, UNFCCC, UNFCCD, and the Basel Convention). Accession to a treaty or convention by the state carries significant legal and other obligations based on CBD guidance and decisions (e.g. decision IX/8 and decision X/2) on the NBSAPP process. This includes components and monitoring systems pertaining to thematic areas, cross-cutting issues and mainstreaming with related policies and conservation actions.

This document aims to review and renew the National Biodiversity Strategy and Action Plan (the last NBSAP was in 1999). This follows on the heels of writing the 6th NR for CBD (EQA 2021a). Both complementary tasks were done via desktop study of all relevant documents and publications, stakeholder consultation, workshops, focus groups, and comprehensive meta-analysis which has resulted in consensus of a strategy, targets and action plans going forward to 2050, with a proposed review of progress and potential adjustments every 5 years. The work focuses on conserving biodiversity (alpha level as in species biodiversity and beta level for diversity of ecosystems and habitats). The current NBSAP recognizes that managing resources under Israeli colonization and occupation and in times of conflict is particularly challenging (Grzybowski 2012; Qumsiyeh and Albardeyeh 2022).

1.2 Ecosystem Services and Nature's Contribution to People

"Biodiversity, and the benefits it provides, is fundamental to human well-being and a healthy planet. Despite ongoing efforts, biodiversity is deteriorating worldwide and this decline is projected to continue or worsen under business-as-usual scenarios. The post-2020 Global Biodiversity Framework builds on the Strategic Plan for Biodiversity 2011-2020 and sets out an ambitious plan to implement broad-based action to bring about a transformation in society's relationship with biodiversity and to ensure that, by 2050, the shared vision of living in harmony with nature is fulfilled," From CBD post 2020 Draft Framework

In the late 20th century, the conservation of biological diversity became recognized as an urgent issue for humanity. This is largely due to the scientific observation of the significant decline in biodiversity accompanying the industrialization that spread widely in the 19th and 20th centuries. Two key texts emerged from a number of preparatory meetings that rang the danger bell at the global level: publication of the Global Biodiversity Strategy and the adoption of the Convention on Biological Diversity (CBD) signed at the Earth Summit in Rio de Janeiro (both in 1992). Biodiversity is considered at various levels: species diversity, genetic diversity, and ecosystems diversity. Both human diversity and biodiversity are key to stability of human and natural communities. Yet, threats to biodiversity around the world have never been more severe than currently recorded in history. These threats come from human population expansion, misguided economic policies, rampant consumerism, and a culture of unsustainable growth, among others. Sustainability is viewed as the ability of our environment to meet both current and future needs. The benefits of biodiversity are many and discussed at length in the literature (Pimentel et al., 1997; Montgomery, 2002; Kaimowitz and Sheil, 2007). They include:

1) Ethical and moral value: it is logical to protect nature because it existed independent of humans and needs to be valued. Organisms have in such analysis an inherent right to not be wiped out.

2) Aesthetic value: Humans derive so much from the biodiversity of nature. The use of our five senses to enjoy nature is biologically ingrained in us. This aesthetic enjoyment may also include things like enjoying flowers in the spring, watching birds, taking hikes, engaging in nature sports, ecotourism, and much more.

3) Utilitarian value: SP is a key part of the Fertile Crescent where humans first developed agriculture. Traditional agriculture was sustainable as Palestinian ancestors (Canaanites) managed to cultivate an enormous variety of plants. But they also developed terracing and irrigation systems that were amazingly resilient, with some functioning terraces and dykes used for the past 5000 years. Associated with all these is a cultural heritage that is remarkable and unique. Since Palestinians are the indigenous people of Palestine, our work is what we do as the local people. The activities of the local people are here highlighted through examples from GOs, NGOs, and academia over the past five years. Studies are limited in this area but some documentation has been found about medicinal plants as a cultural heritage (Canaan, 1928; Crowfoot and Baldensperger, 1932; Ali-Shtayeh et al., 1998, 2008; Ali-Shtayeh et al., 2015; Ali-Shtayeh et al., 2016; Jamous et al., 2018; Mourad Hanna et al., 2021). In SP, research is needed on natural resource evaluation (Ignatyeva et al., 2022).

4) Ecological value: Nature and the web/network of nature evolved over billions of years provide us with oxygen and a balanced ecosystem that is sustainable.

Valuing/valorizing diversity has recently focused on the use of terms like "ecosystem services" and "nature's contribution to people" (IPBES, 2019a,b; Pascual et al., 2017; Díaz et al., 2018; Kadykalo et al., 2019; Hill et al., 2021; Faith, 2021). The constituents of well-being related to this are security, basic material for good life, health, and good social relationships (CBD, 2010a).

It is important to appreciate that conserving biodiversity gives humanity options (of incalculable value) for the future (Faith 2021). Increasingly, the World is cognizant that biodiversity valuation (ecosystem services) and conservation can only be done with collective work involving indigenous communities; a BioCultural system that includes human diversity with the rest of biodiversity (Bohensky and Maru, 2011;

ICCA, 2017; Gavin et al., 2018; McElwee et al., 2020; Reyes-García et al., 2021; see also Local Biodiversity Outlooks). As an example of the use of indigenous knowledge, see this module relating to climate change. In line with the Nagoya Protocols, indigenous peoples and local communities must have access and benefit sharing (see also: ICCA Consortium, 2017; Lorek et al., 2021; Tomany et al., 2021).

Increasingly, indigenous knowledge of value and management of ecosystems and biodiversity are recognized as key components for sustainability (Karki et al., 2017; Nakashima, D. and Krupnik, 2018; Roué and Molnar, 2017). Core principles of community-centered conservation include (Armitage et al. 2020): (a) building multilevel networks and collaborative relationships needed to co-produce conservation solutions; (b) promoting equity and recognizing the central role of women as agents of positive change in conservation efforts across scales; (c) reframing conservation action through the lens of reconciliation and redress (e.g. responding to injustices from land grabs and territorial enclosures); (d) ensuring a rights-based approach to conservation action in which community agency, access and decision making autonomy are supported; and (e) revitalizing the customary and local institutions that provide legitimate and adaptive strategies for the stewardship of biodiversity. The changes in ecosystem conditions include changes in provisioning, regulating, and supporting services that lead to better human wellbeing and preserving nature for its intrinsic value (Slingenberg et al., 2009). In many cases, countries and communities have also started to use qualitative and quantitative methods to (e)valuate ecosystem services (Ignatyeva et al., 2022). Biodiversity conservation goes hand-in-hand with poverty reduction especially in developing countries like SP (Adams et al., 2004; Sunderlin et al., 2005; Roe et al., 2012; Hubacek et al., 2017). Policies addressing threats to biodiversity including climate change issues have social impact that should be taken into consideration (Lamb et al., 2020; Vogel et al., 2021).

Value to nature and natural capital can be accounted for using the SEEA-framework as part of national accounts to inform decision-making and implementation. Integrating nature and biodiversity considerations in Environmental Fiscal Reforms is needed, as well as taxation models and fiscal incentives for achieving the three objectives of the Convention. Application of innovative digital technologies for mainstreaming biodiversity into planning, development, finance and business, in a way that protects privacy while providing citizens, the private sector and governments with access to data and information for better decision-making related to mainstreaming is possible. Businesses in all relevant economic sectors and at all levels, and especially large and transnational companies and those with the most significant impacts on biodiversity, must actively transition towards sustainable technologies and practices, including their supply, trade and value chains, demonstrating decreasing negative and increasingly net positive impacts on ecosystems and their services to people, biodiversity and human well-being and health. Institutions at all levels should incorporate biodiversity loss in their risk analyses and have increasingly net positive impacts on biodiversity, including by financing activities that can verifiably demonstrate biodiversity benefits or co-benefits.

1.3 Analysis of the causes and consequences of biodiversity loss

The Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) summarizes how human activities are responsible for the decline in species, populations, and ecosystems. GLOBIO (Global methodology for mapping human impacts on the biosphere) is a simple transparent global model measuring "impacts on biodiversity and ecosystem function of growth in human resource demand and associated infrastructure development". The global actions to address the environmental challenges that impact biodiversity are focused on three categories (Cosme et al., 2017):

1. Reduce the environmental impact of human activities
2. Redistribute income and wealth both within and between countries
3. Promote transition from a materialistic (consumerist) to a convivial, participatory, and just society.

The Arab Sustainable Development Goals points to a worrisome situation in regards to SDGs relevant to conservation. The Ecological Threat Register (ETR) grades the countries least likely to cope with the threats. SP is ranked at threat level 2. Ever since Ives (1950) warned of the capacity of the Palestinian environment to handle the upcoming pressures, the situation in the past seven decades has only become worse. National reports and strategies assert the biodiversity loss in the West Bank and Gaza. These threats to biodiversity are shared with neighboring countries in the Mediterranean area (including population explosion, urbanization, extensive use of agricultural, invasive alien species, etc; Underwood et al. 2009). They predict the future complications of climate change on biodiversity and present the issues that slow down the pace of implementation of climate change mitigation and adaptation activities, but explicit measurements to halt the rapid loss and destruction of natural habitats are not addressed.

SP's sixth national report for CBD (EQA 2021) highlighted threats that will be covered in the sections that follow (Climate Change, Overexploitation, Pollution, Habitat Destruction, Invasive Species, Israeli Colonization). It is essential that this NBSAP is in line with those threats, global priorities (Escobar, 1998; Grindle, 2004; Díez and Dwivedi. 2008), and Palestinians agendas that reflect the peculiarity of the Palestinian history along with its current political and socioeconomic condition. Palestinians understood earlyon that developing the planning process is needed, which also needs to be in line with international obligations and norms, and adapted to local circumstances including the colonial Israeli occupation.

The Palestinian environmental deterioration resulting from human activities affect human health, economics, agriculture, ecosystem integrity and biodiversity. These issues are interconnected. For example, the well documented decline of biodiversity in SP (Qumsiyeh et al., 2014; Amr et al., 2016) directly affects humans. Sometimes these affects are not obvious to the common people. For example, the increase of *Aedes albopictus* (an invasive alien species) fed by climate change and other human activities led to the spread of some viral diseases (Adawi, 2012). More industrialized agriculture using chemical fertilizers and insecticides/pesticides led to soil biota depletion and, as elsewhere in the world, produces unsustainable agriculture. But climate change and habitat loss are especially worrisome in the region, being part of the Eastern Mediterranean hotspot (Brooks et al., 2002) which is focused on coniferous-scleropyllous-broad leaf forests (BirdLife, 2017). This means that loss in the region is considered a global loss. As another example, Laban (2018) recommends that risks from threats should be imbedded in development and their impact looked at in different areas (Table 1.1), and connected to the planning process.

The NBSAP needs to deal with the five major global threats (**Climate Change, Habitat Destruction, Pollution, Invasive Alien Species, and Overexploitation**) plus the local one in SP (Israeli **Colonization/Occupation and Political Instability**). There is a need for tailored responses (action plans, activities, targets) to regional, national, and local situations which also link directly to global/international strategies, agendas, and policies as adopted by international conventions. Transboundary and regional issues should be taken into consideration in strategy actions (Mason et al., 2020; Perrings and Halkos, 2012). In fact, there could be transboundary protected areas that increase cooperation (Sandwith et al., 2001).

1.4 National constitutional, legal and institutional frameworks

Jordanian laws on the environment were applied in the West Bank while Egyptian laws were applied in Gaza after the 1949 truce and until 1967. The Second Israeli Military Order designated immediately after the occupation in 1967 that all water resources were to be "state owned by Israel" (UNEP, 2003). The Palestine National Authority (PNA) did attempt to legislate on issues of water and other natural resources via the water law signed by the late President Yasser Arafat on 17 July 2002. The Oslo Accords was basically kept in suspension, though not fulfilled. The Wye River Memorandum stipulated that reserves worth more than 3% of the West Bank and Gaza were to be handed over to the Palestinian Authority. This was not done. Nevertheless, as part of these agreements, the two parties agreed to protect the environment in compliance with International standards, conduct EIA, protect soil and other natural resources, etc.

(UNEP, 2003). As early as January 1995, the Applied Research Institute of Jerusalem (ARIJ) and the Environmental Law Institute (Washington DC) drafted an environmental law for consideration by the nascent PNA (Amra, 1998). In 1995, the environmental planning directorate (EPD) was established within the Ministry of Planning and International Cooperation (MOPIC). In December 1996, the Palestinian Environment Authority was created and it was elevated to the Ministry of Environmental Affairs (MOEA) in 1998. A Presidential Decree in June 2002 created the Environmental Quality Authority (EQA) as a successor to the MOEA. The EQA mandate derives from the abovementioned law in addition to the national environment strategy (Amra, 1998).

In 1995-1996, the Ministry of Planning and International Cooperation developed an Emergency Natural Resources Protection Plan to counter environmental concerns resulting from the development of the newly established State. According to this plan, Gaza and the West Bank were divided into three regions according to their environmental sensitivity (high, medium and low). These regions were divide based on field studies for their importance in terms of biodiversity, protected areas, water resources, agricultural land and landscape preservation (Amra, 1998). The aim of this plan was to direct all forms of development away from environmentally sensitive to the least sensitive areas.

The NBSAP of 1999 coincided with publication of the environmental law for SP. Yet even as early as 2005, the EQA started to address the gaps in the law and especially where needed to comply with newly signed international conventions (most signed from 2005 onward). That is why a decision was made in 2020 to review all international treaties (signed ones for obligations, and unsigned ones for benefit and responsibility if signed) and also to review local laws and regulations to ensure concordance and proper implementation relating to the environment in general, including biodiversity. This also included harmonization of local laws with signed agreements as well as considering signing additional conventions.

In 2010, the EQA developed a three-year strategy for 2011-2013 that identified and prioritized objectives for itself and for the Palestinian environment as a whole (EQA, 2010). The EQA identified 48 specific objectives, of which seven related to legal issues: issuing legal and other directives; issuing information bulletins and statistical and other data information; building human capacity at EQA; documenting Israeli violations of the Palestinian Environment; founding an environmental information center which issues regular reports; reviewing and modernizing the Palestinian Environmental Laws; reviewing and evaluating institutional structures related to the environment.

The 2017-2022 National Policy Agenda focuses on democracy and putting citizens first. It is people-centered but mild resource allocation and scarce information on the environment are obstacles found (SP, 2016a). The document has three Pillars: the first is Path to Independence, and the second is Governmental Reform, while the third is Sustainable Development. Under the third pillar, there is a section on Resilient Communities. This section contains five policies related to ensuring a better environment.

The environmental law for the year 1999 needs updating and was reconsidered in 2022. The EQA is the main body responsible for translating knowledge to policies, in cooperation with other governmental agencies, NGOs and academia. Significant progress has occurred between 2015 and 2020 but it is anticipated that much more will be done in 2021-2022, driven by four current projects: revision of the 1999 NBSAP for SP (2021-2022), a national biosafety plan (completed 2022), revision and updating of local environmental laws in compliance and harmonization with signed conventions and signing other international conventions (2022-3), and the assessment and strengthening program for a national network of protected areas (2021-2). However, there has been little integration of biodiversity values inthe mainstream society.

The General Directorate of Environmental Resources is the main body responsible for preparation of studies on biodiversity (Fauna and Flora), and cooperates in conserving protected areas. One important function of EQA is to monitor those NGOs which are related to environmental issues through the Law of Charitable Organizations and National Authorities for the year 2000. Environmental inspectors serve as law enforcement officers, with legal power to implement the Environmental Law. Other sections as the Marine

& Coastal Environment and Water Quality are involved with monitoring such resources. The General Directorate for Environmental Awareness and Education within the EQA works mostly with schools but can be expanded to areas like university education. Other activities include summer camps for school students, walking in nature trails and identifying plants and birds. A number of other publications were issued such as "Garden is a Friend of the Environment" stories for school children with an emphasis on environmental concepts and a national strategy for environmental education. In general, the EQA suffers from a lack of human and financial resources to perform its overwhelming duties under the current stressful political conditions.

Through the Agriculture Law for the year 2003, the Ministry of Agriculture is responsible for implementing Article 9 of Section 1 of this Law, which states: "The Ministry in cooperation with other competent authorities shall develop nature reserves management plan and conserve all plants and living organisms living in protected areas". Two other relevant laws are the Forest and Afforestation and the Rangelands Bylaws. A draft law for protected areas was prepared in 2005 in which it is stated that "The Ministry is the authorized authority for protecting targeted areas for the purpose of protection and includes nature reserves, protected areas, national parks and the natural heritage".

The Vice Minister of Natural Resources of the MOA is responsible for three administrative units: General Directorate of Irrigation and Agricultural Water, General Directorate of Agricultural Land, and General Directorate of Forests, Rangelands and Wildlife. The latter Directorate is the main body responsible for managing nature reserves and protected areas. This Directorate includes four divisions or departments: Forestry, Nature Reserves, Rangelands, and Nurseries [data from MOA interviews]. The Directorate of Forests, Rangelands and Wildlife has offices in all governorates of the West Bank. 40 rangers are responsible for inspecting and patroling the protected areas and the natural forests all over the areas under the jurisdiction of the MOA. Out of the 18 protected areas that were handed over to the Palestinian Authority in accordance to the Oslo Agreement (see section 6), only eight are under actual Palestinian control, less than 15 sq. km. The remaining 10 are within area C or overlapped areas.

Environmental Impact Assessment

There is a debate among environmental policymakers about the degree of using voluntary self-control (market driven or "carrot" approaches) and/or regulatory approaches ("stick approach") (Segerson and Miceli, 1998; Khanna, 2001). An EIA procedure needs to be carried out by qualified individuals and institutions and needs to include the participation of the local community (see Catley et al., 2007). A public role for the private sector in environmental protection is possible but requires leadership and structure (Haufler, 2013). This is a large field unexplored in the context of SP and requiring some research. Certainly, there are major issues that cannot be addressed without involving the private sector such as the effect of stone quarries on the environment (Hanieh et al., 2014; Al-Joulani and Salah, 2014). SP must develop a reasonable strategy that combines both the carrot and stick approaches. But, in either case, a study of the impact of any new projects and a reevaluation of existing private sector projects is necessary. The first and most obvious step is performing Environmental Impact Assessment (EIA). The Palestinian law (1999 law #7) requires all construction or major projects with impact on the environment to get an EIA. The policies issued for EIAs (EQA 2013) need updating to take into account proper methods and to have qualified firms do these (Glasson and Therivel, 2019; Mandelik et al., 2005). It would be good to reform the process based on the updated international standards (e.g. Glasson and Therivel, 2019). Environmental Impact Assessments (EIAs) are detailed studies used to evaluate the environmental impact of a proposed project or development taking into consideration the inter-related socio-economic, cultural and human health impacts, and to lead policy and planning decisions that ensure environmental protection and sustainability (Glasson et al. 1999; Modak and Biswas, 1999). The data and information collected and analyzed then need to be taken into consideration by decision-makers, planning authorities, and stakeholders.

As in other countries, there are Palestinian laws relating to environmental issues that impact biodiversity and there are requirements for conducting EIAs for certain projects. The Palestinian Environmental Law

(PEL) was approved by the PLC on 6 June 1999 and signed by the Palestinian president 28 December 1999. It states that the Palestinian National Authority (PNA) has the right and responsibility to study and assess any project to approve or decline the project and to monitor it for environmental impact and to manage and protect natural resources. It should protect the environment and public health and welfare. It should protect and take actions in conserving any endemic or endangered species. It has the right to conserve ecologically sensitive areas. Other relevant laws are the Palestinian Local Government Law No. 1 of 1997, the Industrial Estates and Free Industrial Zones Law No. 10 of 1998, the Natural Resources Law No. 1 of 1999, the Palestinian Water Law No. 3 of 2002, and the Protection of Animal Wealth Law No. 8 of 1998. The authority to issue the laws was derived from signing the Oslo I (1993) and Oslo II (1995) agreements between the PLO and the Israeli occupation authorities which were supposed to be interim arrangements pending the conclusion of negotiations on final status issues which include statehood, borders, security, refugees, and Jerusalem. As part of these agreements, the two parties agreed to protect the environment in compliance with international standards, conduct EIAs, protect soil and other natural resources, etc. (UNEP, 2003).

The areas of information gathered in the EIA studies should include: land use, landscape and visual quality, geology, topography and soil, hydrology, water quality and waste water treatment plans, air quality and climate, terrestrial and aquatic ecology, fauna and flora, transportation, noise, socio-economic impacts, and the interrelationship between those. Doing such studies will create the underlying data for action in specific areas, and not just in approving or rejecting or modifying certain projects but in policy-making and planning nationally.

Finally, it is noted that there is some debate about whether some nations are able to advance their regulatory and enforcement standards to protect their environment in an increasingly globalized system (Vogel, 1997). Challenges discussed earlier of advancing laws and regulations essentially under the Israeli thumb of occupation, the challenge is compounded (Qumsiyeh and Albardeiya, 2022). And while the apartheid wall was deemed illegal by the ICC (2003), it continues to be built and to have a negative impact on the environment. Regulatory and legal frameworks in SP are being updated.

1.5 Internationally binding agreements

There are many Conventions and Treaties related to biodiversity and these are excellent frameworks for developing NBSAPs. There are six biodiversity related conventions, including the Convention on Biological Diversity (CBD), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on Migratory Species (CMS), International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), Ramsar Convention on Wetlands, and World Heritage Convention, and there are others that are connected to this issue (TEEB, 2009). SP signed more than 42 international conventions and treaties since 2014. Here are some relevant conventions signed and ratified by SP:

Convention on Biological Diversity (CBD) and **Subsequent Protocols (Cartagena):** The CBD reflects the global community's growing commitment to sustainable development. It is an international agreement sponsored by the United Nations, and it is the international legal instrument that aims to conserve and preserve biological diversity and ensure the sustainable use of its components and the fair and equitable sharing of benefits arising from the use of genetic resources in it. The agreement has set some measures that the signatory parties must take, such as: conserving biological diversity, cooperating with other countries, developing and preparing national strategies for conserving biodiversity and its sustainable use, engaging in scientific research and training, and promoting education and raising awareness. In addition to developing and adopting incentives to preserve and sustain biodiversity and developing the necessary legislation. The agreement reflects its commitment to achieve a balance between the need to preserve biological diversity and the reasons for development as part of national and international interest in sustainable development.

United Nations Convention to Combat Desertification: This agreement aims to unite global efforts to combat and reduce desertification, as well as to stop land degradation and mitigate the effects of drought in arid lands, and to address the multiple causes and effects of desertification and land degradation, to support the fight against poverty and attain sustainable development. The agreement requires signatory countries to encourage good governance practices and take measures towards strengthening decentralization, developing land and tenure systems, and enhancing the role of women, farmers and herders. In addition, the agreement requires developed countries to assist developing countries in implementing plans and strategies to combat desertification. The agreement has an implementation mechanism, which is a global mechanism that aims to increase the efficient management of the available financial resources. The ultimate objective of the Convention is to combat desertification and mitigate the effects of drought in arid lands, and it is concerned with the need to address the overlapping, multiple causes and effects of desertification, land degradation and drought in an integrated and sustainable manner.

Vienna Convention for the Protection of the Ozone Layer and **the Montreal Protocol on Substances that Deplete the Ozone Layer:** Parties to the agreement (adopted in 1985) are to take appropriate measures in order to protect human health and the environment from the harmful effects that result or are likely to result from human activities that alter the Ozone Layer. The agreement and its complementary protocol aim to reduce the emission of greenhouse gases to a level that does not negatively affect the ability of natural ecosystems to adapt and maintain these gases (sinks and reservoirs) and to increase green cover to absorb the emission of greenhouse gases, and to develop environmentally-friendly technologies to reduce greenhouse gas emissions. The agreement aims to raise the ability of countries to adapt to climate change.

United Nations Framework Convention on Climate Change (UNFCCC): UNFCCC aims to strengthen the global response to meet the threat of climate change in the context of sustainable development and efforts to eradicate poverty. This includes controlling the increase in the global average temperature, increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience, and reducing greenhouse gas emissions, including making finance flows consistent with this pathway towards low greenhouse gas emissions and climate-resilient development. SP, as a party to this Convention, should work through its strategy on mitigation climate change and its negative impacts and future adaptation actions including seeking the funding needed to increase the ability of the Palestinian communities to help lower the emissions that lead to climate change In addition, to pushing for effective environmental laws towards everything that contributes to increasing the impacts on climate change. SP, as a developed country, should continue taking the lead by undertaking economy-wide absolute emission reduction targets and continue enhancing its mitigation efforts, and over time be encouraged to move towards economy-wide emission reduction or limitation targets in the light of national circumstances. For more details see the section 2.1 on climate change.

International agreements to which SP may become a party

SP is an Observer in IPBES and is considering joining several global treaties (Table 1.1).

Table 1.1 Arranging priorities for accession to the International Agreements to which SP has not yet joined. Significance to sign: 10 = very important to 1 = not important (EQA, 2021a)

Agreement Name	Significance to sign	Notes
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	9	It is possible to join this Treaty after amending Palestinian law to promote greater protection of living organisms
Convention on Wetlands (RAMSAR) 1971	9	To sign the agreement, more active preparation is needed

CMS (Convention on Migratory Species) - Bonn	8	Preparations are being made to sign this, after completing the work on the national biodiversity strategy
Agreement on the Conservation of African-Eurasian Migratory Waterbirds	8	This should be signed after signing the Ramsar Convention (above) and implementing those Convention's obligations
Nagoya Protocol on Access and benefit sharing 2010, Japan	7	To sign this Protocol, more active preparation is needed
The Convention for the Protection of the Mediterranean Sea Against Pollution (Barcelona Convention)	7	In the event that SP obtains complete administration of the Palestinian coast , this Convention should be signed
Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, Aarhus, 1998	6	The principles, strategies and directives contained in this Convention can be implemented without actual accession to it
International Treaty on Plant Genetic Resources for Food and Agriculture	6	Suggest joining after two years to give time to prepare
Kyoto Protocol - greenhouse gas emission reductions	5	
Protocol Concerning Cooperation in Combating Pollution of the Mediterranean Sea by Oil and Other Harmful Substances in Cases of Emergency	5	Needs to be further assessed and evaluated
Espoo Convention on Environmental Impact Assessment in a Transboundary Context, Espoo, 1991	5	
Convention on Fishing and Conservation of Living Resources of the High Seas	4	
Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter	4	
Geneva Protocol (Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare)	3	
Convention on the Protection and Use of Transboundary Watercourses and International Lakes (ECE Water Convention), Helsinki, 1992	3	
Convention on the Transboundary Effects of Industrial Accidents, Helsinki, 1992	3	
FAO International Code of Conduct on the Distribution and Use of Pesticides, Rome, 1985	3	
International Plant Protection Convention	2	
International Convention for the Prevention of Pollution from Ships	1	

Commented [AA1]: After two years of what time frame… should be changed to "This treaty should be joined after a preparation period of minimum\maximum two years"

While SP needs to develop better plans for managing its resources, a big impediment to the implementation of the many existing plans (e.g. for water resources) or to comply with signed international treaties is the fact that the State essentially has no control over most of its natural resources due to the Israeli occupation. The report by the UNEP (2003) made over 100 recommendations to address the environment in SP, and seven of them dealt with natural resources (1, 2, 3, 4, 21, 23, 31, 40), However, none could be implemented without having sovereignty over land and resources. Furthermore, the Israeli occupation is one of the main causes of habitat destruction which is leading to a decline in biodiversity of SP. There are many ways how Israeli occupation affects Palestinian nature and natural resources (ARIJ, 2007, 2015a).

Some Conventions may have a negative impact on biodiversity is noted, for example World Trade Organization (WTO) and regional trade agreements (Slingenberg et al., 2009). The Paris Economic Agreement (annex to the Oslo Accords, which were supposed to be temporary) and the continuation of the Israeli occupation continue to be negative for all aspects of Palestinian "sustainable development" (Naqib 2003; Zagha and Zomlot 2004; Khalidi 2019). However, according to Oxfam (2019), "a new, rights-based, human-centred and principled approach, grounded in international law, is still possible **and must be urgently progressed**". A reevaluation of existing international conventions and agreements signed by SP from an environmental standpoint can and should be done.

1.6 Stakeholders

The human element is the foundation of work on environmental issues in any country. Developing our human resources is critical for successful development in any society. In strategic planning related to stakeholders, using different tools (Fauna and Flora International, 2017), ranging from identifying who are the stakeholders and their roles, to assessment of relationships, positions, interests, and needs is examined. In the past few decades, there has been a rethinking of the old structures where environmental conservation was vested in governments. In the developing world this old model had proved a failure due to many factors, including government malfeasance, misfeasance, or nonfeasance under the previous top-down model (Brandon et al., 1998). The alternative model is community-based natural resource management. This model has been seen in operation at Wadi Al-Mujib Nature Reserve in Jordan and certainly this could be a model worth looking into in areas like Wadi Al-Quff. However, "the institutional landscape should be approached as carefully as the ecological landscape" if biodiversity conservation is to be successful.

In SP, **capacity-building** is critical. The Palestinian Ministry of Education and Higher Education has identified national priorities in terms of capacity-building for higher education. The list includes life sciences, environmental biology, and, in agricultural sciences, forestry and fisheries. Developing human resources under occupation is difficult but pinning all obstacles on the occupation isn't sound and much could and should be done to eventually live in a democratic and sustainable society.

There is a general lack of jobs which in SP that makes many individuals with environmental experiences seek to work in any area where they feel they can make a living. A study commissioned by UNESCO and the Ministry of Education and Higher Education showed the poor output in Research and Development (R&D) and highlighted these human elements, (Qumsiyeh and Isaac, 2012). In the aforementioned study, recommendations were made including an upgrade in education, devoting more resources to R&D including establishing and funding existing and needed specialized centers, and explaining to the general public the value of research. Some recommendations were followed, including allocation of money to specialized centers that exist in some universities, but they were in areas like nanotechnology and health and not in areas like biodiversity and organic agriculture (especially permaculture that protects the environment). In this NBSAP and after interviewing the many stakeholders, it is also noted that there is a significant lack of understanding of these issues and availability of funding for developing human resources at specialized academic centers in areas that contribute to environment and sustainability. Some of the efforts to address this "human capital deficit" are discussed in following pages.

Actors in this area have been identified by others (e.g. by Heinrich-Böll-Stiftung) and a stakeholder database was established for the 6th NR) and then expanded on for the benefit of the NBSAP.

Governmental Institutions

The environment and biodiversity conservation is a cross-sectoral area involving many government ministries (Table 1.2).

Table 1.2 Key governmental entities concerned with nature protection.

Ministry or Authority	Current Roles relevant to environmental issues
Environmental Quality Authority	Planning and policies for environmental protections; approval/rejection of projects that could impact the environment following an EIA study
Ministry of Agriculture	Management of national parks, protected areas and forest areas
Ministry of Finance and Planning	Seeking funds from potential donors; overall planning of Palestinian Development. Initiated National Development Strategy which includes environmental issues
Ministry of Local Government	Coordinates involvement of local communities in projects and initiatives related to protected areas; control of feral dogs and cats; local projects
Ministry of Health (through Department of Environmental Health)	Addresses and monitors environmental issues related to human health.
Ministry of Tourism and Antiquities	Encouragement and marketing of ecotourism locally and internationally; management of areas with archeological value
Ministry of Education	Education for awareness on environmental issues in schools (curricular and extracurricular)
Ministry of Women Affairs	Ensures mainstreaming of gender in environment issues (current focus on water and solid waste management). Signed MOU with EQA
Ministry of Culture	Promotes protection in the local communities and integrates protected areas in the network of cultural areas; may also be involved in museums and educational initiatives considering cultural and natural heritage
Ministry of National Economy	Provides funds to execute activities and projects related to protected areas and biodiversity.
Ministry of Interior	Law enforcement of environmental and agricultural laws.
Palestinian Central Bureau of Statistics	Signed MOU with EQA 2013. Works to enhance and consolidate the cooperation and exchange of data and information, implements specialized environmental surveys, builds central administrative records, and updates, develops and computerizes common interest statistics
Custom Authority	Signed MOU with EQA 2014. Enhances cooperation in controlling solid and hazardous waste smuggling and IAS entrance

Political and Moral Guidance Commission	Signed MOU with EQA 2014. Works to enhance cooperation in environmental awareness of the youth, and conducts studies, reports, and reinforces the concepts of environmental protection.

NGOs and CSOs

Non-governmental organizations (NGOs) proliferated in SP after 1967 because of the defeat of Arab regimes in 1967 forcing remaining Palestinians, both in the areas occupied in 1948 and those occupied in 1967, to develop self-reliance mechanisms to cope with Israeli occupation (Qumsiyeh and Isaac, 2012). Initially there were few NGOs dealing with the environment or sustainability issues in SP. NGOs at a global level, however, were of high significance (World Wildlife Fund, International Union of Conservation of Nature, Greenpeace, etc.). Such global NGOs were even significant in contributing to development of International environmental laws and treaties (Tarlock, 1992).

In 2012, the Palestinian Authority's Ministry of the Interior registered 2,245 NGOs in SP. Still today, few are focused on environmental, agriculture and water resources and conservation issues. Some 64 Palestinian NGOs state they deal with environmental issues (Majdalani Azzeh 2012). Many active ones are in the Bethlehem District. More NGOs need to be established in other areas like Gaza which suffers from isolation and neglect, and more NGOs should become inclusive of women and youth. Organizations with more proactive agendas seem to have a better understanding of the relative importance of different environmental stakeholders when compared to reactive, defensive, and accommodative groups (Henriques and Sadorsky, 1999). In the case of SP, there are some efforts at being proactive but most NGOs are trying to make it in difficult economic situations and their agendas are driven by donor desires rather than cohesively fitting into a national agenda for conservation.

Another problem is the lack of cooperation between NGOs working in similar fields. An attempt to rectify this came with the establishment of a network called the Palestinian Environmental NGOs Network (PENGON). PENGON is a partner with Friends of Earth-Palestine. The aim is to "serve Palestinian environmental issues by coordinating endeavors between the member organizations, strengthening and building the efficiency within each organization, and enhancing relations within the Network as well as with other organizations domestically and abroad, such as local government agencies and international environmental organizations and advocacy groups". Missions of these NGOs vary from public awareness and education to multiple tasks that cover most of subject matters related to biodiversity and conservation. All these 11 NGOs have an interest in public awareness and this is a part of their mission and objectives. On the other hand, training and capacity building was the least category of interest among the local NGOs. Some of the listed NGOs stated in their mission and objectives several tasks on which their performance and annual reports did not reflect. The NGO Development Center (NDC) has updated the NGO sector strategy.

The EQA and academia work in collaboration with NGOs (such as the Biodiversity and Environment Research Center, MAAN Development Center, Palestine Wildlife Society, and Applied Research Institute-Jerusalem, among others) to reach out to schools to integrate some concepts of environmental education both in classrooms and in extracurricular activities. Work from some of those groups to help the Ministry of Education change its curriculum has had limited success. The 9th grade in class syllabus "Health and Environment in our Life" includes some good concepts like better managing resources like water and waste reducing and recycling. The NGOs contacted have stated their positive impact onenvironmental clubs and other environmental initiatives at schools. Environmental clubs are indeed now found in many schools in SP. There are more of those in private schools than in public schools (e.g. in Bethlehem all private schools have an environment club while only a small fraction of public schools have them). This is largely due to the lack of support and encouragement. Some schools started environmental magazines and/or newsletters focused on the environment, such as at the Evangelical Lutheran Schools (Environment Education Center). Many folded because of lack of funds but these initiatives could be supported to increase outreach and

imprint conservation and environmental issues among school children. Awareness is also evident via the formation of new formal (such as NGOs) and informal (such as a speleology club) groups since the last National Report. For example, there is a new NGO called Nature Palestine and there is an informal network that started in 2019 called Palestine Action for the Planet.

While there are lines of communications and sometimes coordination between various NGOs, there is far too much division, with many NGOs doing duplicated and inefficient effort that would benefit from better coordination. This can and perhaps should be done as a matter of priority under guidance by EQA and incentivization by donors.

Academia and other educational institutions (museums and botanic gardens):

The major period of species descriptions and the golden age of biology related to nature and biodiversity was in the 19th century. Globally there has been a reduction in both facilities and personnel in high quality research in biodiversity. A lack of well-maintained natural history collections and taxonomists globally hampers biodiversity exploration and hence conservation (Paknia et al, 2015). Issues on water and environment courses are taught in five universities and only 2.5% of Masters students studied environmental sciences (Isaac et al., 2019) but this has been growing over the years). PMNH/PIBS engaged in hundreds of educational activities relating to biodiversity (see palestinenature.org/education). Many universities conducted environmental education and some even have specialized institutes such as Bethlehem University. Furthermore, there are many undergraduate programs related to environmental sciences in Palestinian universities. For example, Al-Najah University has established undergraduate programs related to the environment. Hebron University offers a B.Sc. program in Environmental Science and Technology, while Al Quds University has a program in Earth & Environmental Sciences, with courses dealing with biodiversity. And Bethlehem University is launching a bachelor program in Biodiversity and Sustainability.

There are also many programs and courses in higher education related to environment in SP. At Birzeit University, two graduate programs are offered: Water and Environmental Sciences and Water and Environmental Engineering, and especially vital course in Conservation Biology and Environmental Legislations & Ethics. Similarly, the graduate program at Hebron University offers several environmental courses: Wildlife Management, Conservation & Monitoring of Natural Resources, and Economics of Environmental Resources and Forest Improvement & Development. Efforts should be invested in upgrading these courses, by training, inviting visiting professors from countries with experience, exchange programs for students, and more programs (Masters and PhDs) need to be incorporated into our universities.

The biotechnology field and its biosafety in SP is still in its early developmental stages, with as yet only minor efforts to catch up with the rapidly developing area of biotechnology, especially in the fields of food, medicine and agriculture. However, several universities have recently established graduate and undergraduate biotechnology/genetic engineering programs (Unpublished, Palestine Biosafety Assessment Report 2021, EQA). There is a plan to introduce a master program in biodiversity and sustainability at Bethlehem University. Botanical gardens and museums of natural history can also have a role in research, education and conservation of biodiversity (Qumsiyeh, 2017 Qumsiyeh et al., 2017; Breman et al., 2021; Spencer and Cross, 2017).

1.7 Synergies and Potential

The post-2020 Guidelines Working Groups continued to work in ways that strengthen the original (Aichi) system, including in areas of synergy between CBD and other Conventions, and also promoted synergy related to the SDGs as well as national targets (CBD, 2021). A biodiversity synergy workshop with Sustainable Development Goals SDGs was held in Amman, Jordan, in August 2016 with participation of all Palestinian stakeholders, organized by UNEP and IUCN. All projects from 2012 and their synergies

were recorded during this workshop and through synergies questionnaires distributed back-to-back with the workshop to other stakeholders including NGOs, research institutes and universities (EQA 2016c). In that study, they identified synergies and actions between Aichi targets and SDGs.

The UNEP report (2012) analyzed the potential for enhancing synergies between the biodiversity-related conventions and attempted to develop a set of practical options for realizing synergies built around four selected key areas primarily at global (Multilateral Environmental Agreements, MEAs) level and informing and supporting MEA processes at the regional and national levels. Key benefits from synergies between the biodiversity-related Conventions at the national level include enhanced cooperation across sectors (e.g. water, agriculture, forests), reduced burden of national reporting, more efficient use of financial resources, more efficient drawing on existing national expertise, and increased consistency between national positions. The Data Reporting Tool for MEAs (DaRT) is also a tool supporting parties to effectively use synergies in the field of knowledge and information management for national reporting to biodiversity-related conventions.

The key areas for synergy according to the report (UNEP 2012) and their relevance to SP include

1. **The science-policy interface**: The Intergovernmental Science – Policy Platform on Biodiversity and Ecosystem Services (IPBES) is established and provides a forum for many stakeholders, including the biodiversity-related MEAs, to cooperate. The scientific advisory bodies to the biodiversity-related Conventions report to the respective Conference of the Parties, with the exception of the Ramsar Scientific and Technical Review Panel, which reports to the Standing Committee, and the advisory institutions of the World Heritage Convention, which report to the World Heritage Committee.
2. **National Biodiversity Strategies and Action Plans (NBSAPs)** and the national implementation of the Strategic Plan for Biodiversity 2011-2020 and the post 2020 guidelines: Two of the relevant areas to SP's new NBSAP are a) Adjustment of the Strategic Plans of biodiversity-related Conventions in the light of the Strategic Plan for Biodiversity 2011-2020, as appropriate; and b) Integration of Convention-specific targets, objectives and commitments into the NBSAPs, through cooperation in the national NBSAP processes.
3. **National reporting:** The national reporting systems of the biodiversity-related Conventions have evolved in most cases over several decades, independently of each other (note that national reporting to the ITPGRFA has not been established yet). Mandated by the governing bodies, the national report formats are highly specific and, in some cases, closely linked to strategic planning documents. Synergies in national reporting by SP to the six biodiversity-related Conventions would be possible, thereby saving resources and ensuring compliance and affective operations. In the early 2000s, UNEP-assisted **pilot projects** took place in four developing countries: Assessing the possibility of linking national reporting to the State of the Environment reporting process (Ghana); Identifying common information modules and using this as a basis for developing a modular approach to national reporting (Indonesia); Exploring potential regional support mechanisms for national information management and reporting (Panama); Assessing the potential for producing a consolidated national report responding to the needs of several conventions (Seychelles). A more recent UNEP/GEF project was on Piloting Integrated Processes and Approaches to Facilitate National Reporting to Rio Conventions (CBD, UNCCD and UNFCCC). The **'FNR_Rio' project** aims to (a) develop integrated approaches to data collection/analysis and information management of relevance to the three Rio Conventions at the national level; (b) increase synergies in the process of reporting to the three Conventions without compromising relevant COP decisions; and (c) contribute to improved overall planning and decision-making processes at the country level related to the implementation of these three Conventions. The project works through six pilot countries: Afghanistan, Eritrea, Lao PDR, Liberia, Mauritius and Palau. The **key obstacles at the national level** can be summarized as follows (Parsons, 2009): in many countries, the data and information needed for reporting across the Conventions might be scattered and not easily available; in many

countries, a lack of coordination and cooperation between national focal points in charge of national reporting can be observed (Chik, 2009) but there are tools to help.

4. **Capacity-building:** The CBD in its preamble notes "the urgent need to develop scientific, technical and institutional capacities to provide the basic understanding upon which to plan and implement appropriate measures". The UNEP Governing Council, at its 23rd session in 2005, adopted the Bali Strategic Plan for Technology Support and Capacity-Building

A cross-sectoral strategy by the Palestinian Government 2017-2022 was developed and shared with key stakeholders, with committed resources and experts to increase environmental awareness and find funds to work on and conserve the environment (EQA 2017b).

National Strategies that are or should be cross-sectoral. In the second half of 2016, SP prepared the Palestinian Development Plan for the years 2017-2022, which consists of the national policy agenda 2017-2022, 18 sectoral strategies and 3 cross-sectoral strategies. The National Policy Agenda, as the supreme political document of SP, would guide the programs, interventions and policies of the Government, the private sector and civil society. It defines the priorities of SP in three main axes:

The first axis: the road to independence
First national priority: The embodiment of the independent state and decolonization
Second National Priority: National Unity
Third national priority: Strengthening the international standing of SP

The second axis: reform and improving the quality of public services
Fourth National Priority: Citizen-responsive government
Fifth National Priority: Effective government

The third axis: sustainable development
Sixth National Priority: Achieving economic independence
Seventh National Priority: Social justice and the rule of law
Eighth National Priority: Quality and inclusive education for all.
Ninth National Priority: Quality and comprehensive health care that is accessible to all
Tenth National Priority: A resilient and developed society

In the context of the Government's endeavors to provide better services to citizens and strengthen the link between the national policy agenda, sectoral and cross-sectoral strategies and budget preparation procedures, there are eight main sectoral issues:

1. Development by clusters: The Council of Ministers adopted the development approach by clusters in order to benefit from the competitive advantage of each governorate, and to effectively utilize the capabilities and resources available to the governorates.
2. New development priorities: updating strategies provides an opportunity to review and modify sectoral priorities and take into account the current government agenda and priorities in them, as well as add new priorities to the sector, as well as modify existing priorities
3. Results of the mid-term review: The mid-term review conducted by the General Secretariat of the Council of Ministers provides information on the status of the implementation of the national policy agenda and sectoral and cross-sectoral strategies, and the progress of work towards achieving its objectives.
4. Geographical dimension: Sectoral and cross-sectoral strategies should better reflect the gaps and differentiation between regions (including Gaza and Jerusalem)
5. Realistic strategies: Sectoral strategies and results and their targeting for the next three years should be more realistic, clearly defined and measurable.

6. Improving service delivery: Strategies must deal with the issue of improving the quality of services and providing them to citizens, and there is a need for the strategies to provide goals, results and targets to further improve the quality of services provided to citizens.
7. Cross-sectoral issues: Sectoral strategies should consider cross-sectoral issues particularly gender, youth and environment.
8. Harmonization with treaties and the international development agenda: SP has acceded to many international treaties and conventions on human rights, in addition to its commitment to work on implementing international agendas for sustainable development. Therefore, the obligations of SP must be taken into consideration in the process of updating sectoral and cross-sectoral strategies.

Twenty sectors are to be considered in building synergies and cross-sectoral plans together with the Environment: Education, Agriculture, Health, International relations, Justice, Culture and Heritage, Employment/Labor, Energy, Local Government, Housing, Transportation, Social Protection/Services, Communications and Information Technology, Security, Public Finance Management, National Economy, Tourism and Antiquity, Water and Waste Water, Youth, Women.

The weaknesses of the 2020 Aichi targets were somewhat addressed in the post-2020 goals (CBD, 2021; Xu et al., 2021). Yet these need to be tailored to fit the Palestinian situation (Qumsiyeh and Albaradeiya, 2022).

1.8 Lessons learned from earlier stategies (Global and Palestinian)

The CBD summarized some lessons from collective NBSAPs:

- Recently developed and updated NBSAPs tend to be more strategic than the first generation of NBSAPs
- There has also been progress in emphasizing biodiversity mainstreaming
- There remains a major need to increase support for capacity development and knowledge management.

In doing this work we consulted NBSAPs from over 20 countriues and we lear ned some lessions from many of them including from **Japan** (sets out a "Centennial Plan), **UK** (25 year plan), **Ireland** (seven objectives), **Jordan** (five strategic goals and 29 national targets), **Germany** (highly participatory process with strong political support and 330 concrete targets with deadlines), **Lebanon** (ensure equal access and 13 priority areas), and **Egypt** (good vision)

There are many resources that can help nations achieve proper assessment for planning purposes (e.g. see link). With European support and building on institutional developments and mergers going back to 1957, in 1996 the Tunisian National Research Institute of Rural Engineering, Water and Forests (INRGREF) had a multi-year project funded by the EU to a) Increase the Research Excellence of INRGREF, b) Develop a Knowledge Transfer Framework, c) Support the institutional networking and institutional reputation of INRGREF, and d) Support Farm Advisory Systems' Sustainability in Tunisia.

The EU Green Deal (EUGD) aims to make Europe the first climate neutral continent in the world. But climate is not about borders, and Europe's climate action will impact Europe's neighbors in the MENA-region. The Green MENA project called on European policy-makers and authorities to include MENA in its strategies and climate agenda, specifically that:

- EU actors collaborate with MENA actors, in particular in a bottom-up and decentralized manner;
- EU diplomatic, economic, developmental and humanitarian policies for the MENA region are aligned and do not conflict with the green agenda;
- The costs of the EUGD are not relocated to other parts of the world, including the MENA region.

The 1999 NBSAP for the State of Palestine set 12 priorities considered important [see notes in brackets on progress made]:

1. Designing and setting up a system of representative **Protected Areas** [done 2022]
2. Palestinian **biodiversity surveys** and elaboration of specific, **participatory management strategies and action plans** for *in situ* conservation of threatened, endangered and rare species, genetic varieties and habitats [few surveys done]
3. Ex-situ conservation through establishment of a **gene bank and botanical garden** related to the *in situ* conservation program above for both domesticated and wild varieties [activities started after2015]
4. **Habitat restoration** with natural forests and groves, and rangelands including through the use of indigenous knowledge and the reintroduction of locally extinct endemic species [not done]
5. **Educational reform and information system** including a biodiversity information center and network [partially done]
6. Biodiversity **legislation** including various categories of protected areas [planned for 2022-23]
7. Understanding, surveying and preserving **indigenous knowledge** of biodiversity conservation [not done]
8. **Collaborative management** for conservation (both preservation and sustainable use) of biodiversity-related natural resources [not done]
9. Biotechnology (with emphasis on **bio-safety**) [Plan done in 2021-2022 but not implemented]
10. **Marine and coastal zone management** including the *mawasi* system [not done]
11. Pilot initiatives in the **sharing of economic benefits** from biodiversity conservation, (including eco-tourism) [minimal work]
12. **Desertification control** including monitoring climate change and its impact on biological diversity [plans introduced in NDCs]

For the 2022 NBSAP, we set five priorities as follows [linked to targets in brackets]:

1. Direct conservation efforts [T1-3]
2. Tackling the six major threats to biodiversity in SP [T4-11]
3. Enhance Ecosystem services [T12-13]
4. Researching, mainstreaming and valorizing biodiversity [T14-15]
5. Bridging science-policy-practice gaps [T16]
6. Mobilize resources, finances and other [T17].

The actions needed to achieve the goals, objectives targets and milestones, articulated in Section 4 and also to follow SMART criteria (who does what, where, when and how), consisted of 76 largely strategic actions, such as institutional, legislative, economic or other policy and institutional actions that will provide the enabling conditions and incentives necessary to achieve the goals or priority areas and targets of the NBSAP. Specific actions were indicative, acknowledging that approaches will need to be adapted in the light of implementation experience. The actions also considered application to sub-national entities: how the NBSAP will be implemented at state/provincial levels (particularly important for federal countries, or quasi-federal countries which devolve territorial management to these entities) and at local or municipal levels (including cities). The national strategy and action plan might be complemented by Local Biodiversity Strategy and Action Plans (LBSAPs), developed separately.

Since the latest Palestinian NBSAP, published in the year 1999, much has changed, including new threats to biodiversity and new opportunities, Updated methodologies and data are now being incorporated into

the new NBSAP for SP (due in 2022). Globally, there is an issue of weak achievement of targets as also facing SP (World Bank 2017). To implement this new NBSAP well (being realistic and achievable), it must be taken into consideration all detailed guidelines provided by CBD as well as previous strategies from the 1999 NBSAP up till date, and also incorporate other countries' experiences.

SP developed a ten-year environmental strategy for 2000–2010 and in August 2000 a National Environmental Action Plan (NEAP) for plans and projects for the three-year period 2000-2002 (Table 1.7). In 2010, an Environment Sector Strategy was published that also included a SWOT analysis (EQA, 2010). There were 48 specific recommendations for interventions listed by order of priority for the EQA and 19 to be implemented at the general environment sector level.

In 2005, the last Millennium Development Goals (MDG) were published by the Palestinian National MDG Steering Committee, led by the Ministry of Planning of the Palestinian Authority. It states that the targets for 2015 for sustainability and environmental issues will not be reached because of "lack of control over natural resources, particularly water and land, due to occupation, and early stage of environmental protection".

The main instrument for implementing the CBD, the new NBSAPs will follow COP decisions, pertaining to thematic areas, cross-cutting issues and stakeholder processes, indicating those areas that Parties have suggested should be included in NBSAPs. The main COP decisions that provide direct guidance for NBSAPs are decision IX/8 and decision X/2. Parties are encouraged to review these decisions for consolidated guidance on the NBSAP process, substance components, support systems, and monitoring and review systems. SP was not listed at CBD as having NBSAP because the NBSAP was developed in 1999 before accession to the Treaty. Even though it has been more than two decades since the 1999 NBSAP, the EQA included biodiversity planning in the environmental sector strategies.

The strategy also addressed gaps that are very essential to overcome in order to develop biodiversity and protected areas conservation. These gaps include: lack of and/or limited primary scientific data, information and documentation on biodiversity in SP, and human resources. There are very few biologists (especially marine and wildlife biologists and taxonomists, oceanographers, conservation managers, etc.,), an inadequate environmental policy and legal framework on which to base all activities for the conservation and sustainable use of biodiversity in SP, a lack of coordination among national and local stakeholder agencies in biodiversity, and inadequate awareness and commitment to biodiversity.

The objectives of the NBSAP for Palestine (1999) were as follows:

- The conservation of SP's biodiversity.
- The sustainable use of SP's biodiversity.
- The enhancement of local knowledge and skills and the improvement of people's attitudes for the conservation of biodiversity and the sustainable use of biodiversity.
- The equitable sharing of biodiversity benefits within SP.
- The development of Palestinian institutional and human resource capacity in the field of biodiversity.

Since NBSAP (1999), much has changed including new threats to biodiversity, new opportunities, and new and updated methodologies and data that could make for a far more effective NBSAP. The updated NBSAP should be revised to be aligned with CBD's post 2020 biodiversity framework, the Ramsar Convention, World Heritage Convention, CITES, CMS, and the Global Assessment of Biodiversity carried out by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

NBSAP 1999 objectives, agenda items and achievements 2000-2020 are summarized in the 6th National Report for the CBD. Clearly, many of the projects started to be implemented much later than anticipated and many are still awaiting implementation via the 2022 NBSAP. The 1999 NBSAP was immediately followed by the Palestinian Environmental Strategy 2000 which was then updated regularly (see EQA

2017b). After articulating the local situation (environmental status, political, socioeconomic, legal and institutional frameworks, driving forces, and resources) there were few specifics relating to implementation:

1. To achieve a balanced situation in which the Palestinian water rights are effectuated and the total Palestinian water demand is met under the condition that annually the total abstractions (Palestinian and Israeli) from the water resource system do not exceed the natural and artificial recharge of the water resource system.
2. To protect the quality of water resources in order to be suitable for the desired or designated uses of water. The sustainability is expressed as maximum allowable concentrations of various substances or groups of substances for particular uses of water resources.
3. Utilization of the natural resources is done in a way that is not conflicting with the environmental values that are associated with these resources. The exploitation process itself does not harm the environment or the public health.
4. Abandoned sites are rehabilitated in a sound way from the viewpoint of the environment and landscape.
5. The environmental impacts of socio-economic activities and related land use may not exceed the natural 'carrying capacity' of the land and soil.
6. Ambient noise levels should not exceed those levels that are associated with nuisance for the society or the natural environment. These levels are expressed as maximum allowable noise levels and exposure periods for different categories of receptors.
7. To reverse and prevent pollution, or risk for pollution of the shoreline and the coastal marine environmental to protect the marine ecosystems and public health and to enable a sustainable economic, recreational and touristic development of the area.
8. The sound use and conservation of nature and biodiversity, within the context of a sustainable socio-economic development of the Palestinian areas.
9. To protect and rehabilitate the landscape and aesthetic values of the living and natural environment.
10. To raise public awareness of landscape value and the importance to maintain and protect it for the future generations of Palestinians.
11. To preserve the rich cultural heritage and historic monuments for the current and future generations and to exploit this heritage for recreational purposes and tourism in a sustainable manner.

The EQA (2010) did a SWOT analysis regarding Palestinian environmental issues and these were consulted in building the NBSAP since many of them are directly related to biodiversity. Many of them were also identified in the focus groups and workshops that led to the action plans proposed in this NBSAP.

The Ministry of National Economy created a Sectoral Strategy for growing the national economy (2020) which took into consideration sustainable production and consumption (working in cooperation with the Ministry of National Economy). The 2030 six sustainable development national goals ranked the eradication of poverty first in terms of priority for individuals in SP (18 years and over 86%). In meetings held on 11-19 October 2011 in Nablus, Ramallah, and Bethlehem, SP via its Committee for the NSP presented its plan for the protection of natural resources and historic sites and agreed it in June 2012. The NSP was considered also a tool for mainstreaming the protection of natural resources. The Ministerial Cabinet approved the NSP in order to balance intended development with the protection of limited natural resources so as to ensure sustainability for future generations. It provides a framework for local and regional spatial plans. It included limits on land use and proposed that there would be high and medium sensitivity areas for agriculture, for open spaces, for forests, for biodiversity and natural conservation areas, for cultural and historical areas, and for archeological sites.

The NSP and its updates (for 2025) were supposed to be Stage 1 while Stage 2 would deal with implementation; however, that was not yet implemented. One way for implementation is to merge this with the Palestinian National Development Plan whose first key policy priority identified was "In line with the

two-state solution and on the basis of the 1967 border, establish state sovereignty and assert control over natural resources. Special attention will be paid to area C, particularly the Jordan Valley and Dead Sea Area, as well as East Jerusalem and Gaza" (MOPAD, 2014). MOPAD, EQA, MOA, and other government agencies must implement the policies they already agree to especially in terms of protection of key areas. Palestine summarized plans and strategies relating to SDG15-Life on land linked to NSP. Laban (2018) proposed different environment management and priority issues for different areas of the OPTs and these should be consulted and updated by the local actors themselves.

Recommendations and notes

Limited progress on achieving national targets and strategic objectives were noted in the 6th NR. The 1999 NBSAP had good plans and objectives but was weak in areas like setting specific targets and responsibilities and action plans. Nevertheless, SP had some progress especially in 2015-2021. After writing the cross-sectoral strategy (EQA 2017), the Palestinian Government committed resources and experts to conserve the environment. The EQA has also just engaged with IUCN and others on analysis of levels of protection in different Key Biodiversity Areas (KBAs), including a gap analysis. This project is for 2021-2022 and should result in better protection.

The 5th and 6th National CBD reports listed these recommendations:

- The existing Palestinian NBSAP is out-of-date and needs updating to meet Aichi Targets [completed in this NBSAP to meet post 2020 framework].
- More outreache programs to mainstream biodiversity issues and involving the private sector and local communities.
- Comprehensive fieldwork studies about protected areas management and conservation, populations, species numbers, distribution and dynamics in biodiversity (checklist of species) to fill the existing gaps in knowledge and remove the conflicts in data certainty among different data sources.
- Extensive work on extracting the values of ecosystem services and linkage to human livelihoods is a recommended action that helps decision-making.
- National studies should focus on genetic diversity, the amount of products from Genetically Modified Organisms (GMOs) - urgent support is needed to prepare the National Framework on Biosafety for SP to maximize the benefits and to minimize the potential threats of GMOs for biodiversity. [the National framework on Biosafety was completed in 2021]
- Some plants and bird species were investigated and identified as invasive alien species, but a comprehensive survey and assessment of the invasive alien species is urgently needed to develop a national strategy for combating and eradicating the invasive species. [the invasive alien species strategy and action plan was completed in 2022]
- Through collaboration, communication, and coordination between relevant organizations it is very important, for biodiversity conservation efforts, to determine the severity, extent and ranking of threats affecting PAs, endemic and threatened species. Mapping and ranking of the root causes leading to these threats are much needed.
- Modeling and future scenarios analysis for the impact of main biodiversity threats are highly recommended to be taken as soon as possible.
- There are gaps in existing national legislations about biodiversity, protected areas, biosafety and intellectual property rights. Therefore, immediate actions regarding declaring or updating the national legislations are required.
- Develop models of temperature and rain fall changes going forward to address potential changes due to desertification and climate change.
- If a just peace agreement is implemented and our EQA and other stakeholders have actual access to and responsibility for the natural resources of SP, much more in protection can be achieved

2 Stocktaking

2.1 Threats- Introduction

The ecological footprint website indicates that historic Palestine (they put the whole area plus the Golan as "Israel") has a significant ecological deficit (high ecological footprint per capita). However, the footprint for the Palestinian areas with suppressed and underdeveloped economy after decades of occupation is very small. For example, the water footprint for the Palestinian areas per capita is 2900 liters/day, of which 93% is internal. Meanwhile, for Israel it is 6300 liters/day, of which 82% is external (link). The total environmental situation in SP is poor (as discussed below). The major threats are classified per IUCN globally and fall unfer six major categories which arew discussed below. The key actions are to prioritize the threats and then deal with them in a way that gives maximum impact on the most urgent threats. While some authors have tried to focus on certain threats, others believe it is critical that in local areas, research and conservation efforts integrate responses to the various threats (Bonebrake et al., 2019). The global IPBES assessment actually proposes the need for massive restructuring of economies if we are to have sustainability of our ecosystems (IPBES, 2019). In planning NBSAP issues, examination of those threats especially to design workable plans is essential (Annex 1).

2.2 Threat: Climate Change

"*Conserving natural terrestrial, freshwater and marine ecosystems and restoring degraded ecosystems (including their genetic and species diversity) is essential for the overall goals of the UNFCCC because ecosystems play a key role in the global carbon cycle and in adapting to climate change, while also providing a wide range of ecosystem services that are essential for human well-being and the achievement of the Millennium Development Goals.... The resilience of biodiversity to climate change can be enhanced by reducing non-climatic stresses in combination with conservation, restoration and sustainable management strategies"* CBD, 2009

Human induced climate change will drastically affect the Arab world (Verner, 2012; Kurzom, 2012) and SP (Salem, 2010). A World Bank study shows impacts that include water resource decline will be drastic by 2040 (Sadler et al., 1988). In the West Bank and Gaza, while water demand will double, the supply will shrink dramatically (SchlÜtter, 2005). Coupling this with population growth and habitat destruction, both the World Bank (Verner, 2012) and the UN predict the situation to become unlivable (UN, 2012). The G20 emphasize that poor and vulnerable countries in particular need support in protecting the climate and adapting to the climate crisis.

The United Nations Framework Convention on Climate Change (UNFCCC) addressed the threats of climate change on human and animal life discussed at the 1992 earth summit in Rio de Janeiro, and it entered into force on 21 March 1994 (Schipper, 2006). Climate Change is the top challenge facing humanity over the next decade according to (UNESCO). The latest COP26 in Glasgow was disappointing to activists because the governments failed to take the drastic challenge seriously (Tobin & Barritt, 2021).

Climate change in countries like SP will also exacerbate conflicts over resources and will affect sustainability (Brown and Crawford, 2009; Elasha, 2010; Feitelson, et al., 2012; Mason, 2013; Mulligan et al., 2017). There is an urgency to include climate change mitigation and adaptation plans in SP due to increasing temperatures and drier climate which its negative effects can be already seen (see EQA, 2021,

6th National Report). The updated Nationally Determined Contributions (NDC) to the UNFCCC confirmed worrying global trends (UNDP, 2021).

Climate change mitigation and adaptation is not merely a technical issue but is also an issue connected to socio-political challenges that are daunting (Jarrar, 2015). In fact, what is needed in adaptation and mitigation in our region is an "environmentalism of the occupied" (Pedersen, 2018). The adaptation strategy proposed to the UNDP (Mason, 2019) is still not adopted or implemented at higher levels of the Palestinian Government or mainstreamed (see also UN-ESCWA, 2016, on the need to increase capacity to deal with this issue). Civil society organizations have also demanded that no exception is made for militarism (the military is a large contributor to climate change).

The Arab region will even receive more of the brunt of climate change than countries that actually contribute more to greenhouse emissions (Tolba and Saab, 2009; UN-ESCWA, 2017). Climate change in Palestine has had an impact on both biodiversity and agriculture (Elasha, 2010). In the last two decades, action programs and strategies proliferated in which the priority was given to the environment (MOPAD, 2014). The National Strategy, Action Programme and Integrated Financing Strategy to Combat Desertification in SP proposed "to prevent, halt and, where possible, reverse the effects and impact of desertification, land degradation and droughts, in order to contribute to poverty alleviation, improve livelihoods of people and achieve sustainable development" (EQA, 2012). The strategy identified five priority projects that should be complementary to what were identified in the NDP for the years 2011-2013, to the sum of USD 4.2 million, with the lead agency being EQA, in cooperation with other Palestinian stakeholders, including non-governmental and private sectors.

This strategy is a promising tool to improve and enhance agricultural productivity through the conservation and improvement of agricultural soil fertility (EQA, 2012). Moreover, it is considered an effective mainstreaming strategy for biodiversity and protected areas conservation and development (EQA, 2012). These were the beginnings and much more work has been done since then, especially after SP signed treaties like the CBD.

In 2010, SP, funded by the UNDP, produced the "Climate Change Adaptation Strategy and Programme of Action for the Palestinian Authority" (Mimi et al, .2010). The strategy identified three regions (case studies) as having particularly high levels of climate vulnerability: Massafer Yatta (West Bank), the easternmost areas of the Jordan River Valley (West Bank), and the Gaza Strip (UNDP, 2010). The strategy proposed a program of nine No-regrets and seven Low-regrets adaptation measures with prioritization. In 1999 NBSAP, a project for climate change mitigation, was proposed: Project 7 Combating Desertification and Coping with the Adverse Effects of Climate Change (NBSAP, 1999). Six priorities and objectives were identified by the Environment Sector Strategy (EQA, 2010), including "all measures required to cope with climate change, combat desertification and confront environmental and natural disasters are taken". The six goals are:

1. A Palestinian environment that is clean, safe and pollution free.
2. Natural environment and cultural heritage in SP that are preserved and maintained.
3. Palestinian natural resources to be managed in a sustainable manner.
4. All measures required to cope with climate change, combat desertification and confront environmental and natural disasters are taken.
5. The institutional and legal environmental framework is strong, effective as well as works in an integrated and concerted way.
6. SP is committed to international Conventions and Treaties on the environment.

Internal targets from the EQA, published in the 6th National Report to the CBD, included the following target: Target-8: "By 2022, the efficiency of environmental ecosystems to provide ecological services has raised mainly for the adaptation to climate change and for combating desertification and the proportion of carbon uptake has increased by 50 % through preservation, conservation and the rehabilitation of degraded ecosystems" (EQA, 2021).

The National Capacity Development Program (CDP) on climate change mainstreaming for the Palestinian Authority, finished in 2015 and proposed the establishment of a Palestinian National Committee for Climate Change (NCCC) with the following subcommittees (Figure 1, Tippman et al., 2015):

1. Subcommittee on 'Climate Change Data' (chaired by PWA)
2. Subcommittee on 'Policy, Planning and Legislation' (chaired by MoPAD)
3. Subcommittee on 'Adaptation and Technology Transfer' (chaired by MoA)
4. Subcommittee on 'Awareness and Capacity Building' (chaired by the Ministry of Education and Higher Education, MoE).
5. Subcommittee on 'Scientific Research' (chaired by a university)

The Palestinian Government has chosen the EQA to be the single, national entity responsible for driving implementation of the NDCs and reporting on implementation. The NCCC, on behalf of the Palestinian Government, is responsible for preparing climate-related policies, following decisions by the government, as well as monitoring implementation of policies. The EQA is responsible for coordinating implementation at the national level and between sectors. The First International Conference on Climate Change in SP was concluded in Ramallah, 2017. The final recommendations of the conference were the following:

1. To seriously work on the preparation of the Palestinian National Building Code, taking into account mitigation of climate change and the imposition of preventive measures necessary to minimize the effects of climate change.
2. Supervising the design and implementation of bond facilities and developing their design in line with climate change.
3. Civil defense plays a greater role in examining the readiness of [Palestinian] facilities for climate change.
4. Supporting environmental and developmental media in order to achieve the objectives of sustainable development, enhancing awareness and social responsibility, and integrating the efforts of civil society in addressing the phenomenon of climate change in its different dimensions.
5. Pressuring international institutions to support the natural resources of the Palestinian people guaranteed by international law.
6. Developing plans for real mitigation of greenhouse gas emissions.
7. Reducing emissions of transport by encouraging people to use public transport including the development of public transport services.
8. Providing support to the agricultural sector and encouraging farmers to continue to serve their land.
9. Minimizing the excessive use of pesticides and chemical fertilizers.
10. Combating the phenomenon of burning scrap and cars and preventing the introduction of dilapidated cars into SP.
11. Working on building a database related to climate change in SP to benefit from local information in related researches and studies.

On 17 March 2016, SP officially became the 197th party to the United Nations Framework Convention on the Climate Change (UNFCCC), and subsequently submitted its Initial National Communication Report (INCR) and Nationally Determined Contributions (NDC) to the UNFCCC. It also ratified the Paris Agreement on 22 April 2016. In the same year, EQA put together a National Adaptation Plan to Climate Change (NAP). The plan includes:

- An assessment of historic trends in climate in relation to SP
- Identification and prioritization of vulnerabilities
- Future climate-scenarios for SP
- Identification and prioritization of adaptation options, including costings
- Future developments required for SP's institutions to be able to participate in climate-modelling research
- An outline of the process for future monitoring and evaluation

The INCR highlights SP's commitment to being an active player in tackling and responding to climate change. The NAP (2016) costs a total of $3.5B, detailed as following: Agriculture ($1.2B), Water ($893M), Food ($443M), Energy ($443M), Coastal and Marine ($114M), Industry ($249M), Waste and Wastewater ($63M), Urban ($53M), Terrestrial Ecosystems ($13M), Health ($12M), Gender ($11M), and Tourism ($9M) while the estimated costs for improving the Palestinian Meteorological Office are $2M (EQA, 2016). However, comprehensive and detailed plans are needed for each sector.

Abdullah et al. (2021) proposed further cooperation between Europe and Europe's southern neighbors to deal with issues of climate changeand made the following relevant recommendations:

1. Cooperation with the Southern Neighbourhood around EGD [European Green Deal] priorities should place greater emphasis on supporting urban climate resilience.
2. Include European cities and city networks working on climate action more systematically in Green Deal Diplomacy in the Southern Neighbourhood.
3. Future programming under the ENP South could benefit from programmes that encourage whole-system thinking at the urban scale rather than ad hoc projects.
4. Support local capacity building and inclusive urban governance.
5. Empower civil society.
6. Increase EU climate funding for water, energy and food in cities, particularly funding for climate resilience.
7. Work with the private sector.
8. Mobilize research and foster innovation for building more climate-resilient urban areas in the Southern Neighbourhood.

In the Mediterranean region, it is critical to focus on three key issues that are impacted by climate change: food, water, and energy (Mohtar 2017; for agriculture see link). However, those issues are all interconnected as agriculture is mainly affected by irrigation. In fact, the impacts of climate change are assessed by the amount of water retention from crops and groundwater (Mizyed, 2009). Interestingly, Mizayeh concluded that the evapotranspiration levels will increase from 6 to 17% due to climate change, leading to severe impacts on the water available for agriculture in the West Bank.

A main obstacle to designing appropriate measures for climate change adaptation and mitigation is the lack of data on the ground, effects and measured variables (Sternberg et al., 2015). One of the risks associated with climate change is an increase of plant pests, including *Cephalica taunourinensis, Thaumetropoea wilkinsoni,* and *Tomicus destruens (Gregory et al., 2009)*. In fact, 42% of the global crop yield is lost due to fungal and bacterial pests spread because of changing climate (Chakraborty, 2005).

OTHER SECTORS:

One of the main causes of climate change is the use of solid fuels (e.g. coal), which are used residentially, in open fires and stoves for heating or cooking (Anenberg et al., 2013) and in industrial production such as for cement (Canpolat et al., 2004). For instance, global energy demand for heating is predicted to increase dramatically to 2030, and the CO2 emissions just for energy use make up around 12%, with Asia ranked at the highest level (Isaac and Vuuren, 2009). SP (SP, 2020b) developed two scenarios on emissions, but even limiting growth to the current status quo under occupation to 2040 still raises CO2 emissions significantly. Serious efforts must be made to use and develop alternative energy sources (primarily solar and wind).

The six urgent areas identified for action in the World Scientists' Warning of a Climate Emergency and its updates are: energy, atmospheric pollutants, nature, food, population and economy (Ripple et al, 2021). Bernard et al (2021) notes that: "Our current crises of climate change, biodiversity loss and cultural disenfranchisement are all rooted in the widespread degradation, destruction and commodification of land and natural resources". They recommend 1) climate restoration, not just mitigation and adaptation, 2)

stringent protection and restoration of natural systems, and 3) a restructuring of the world in ways leading to restoration and sustainability.

Finally, it is noted that mainstreaming the serious issue of climate change is essential, including reaching the next generation with tailored/well researched methods. For example, a series of short animated videos on various issues were based on earlier posters and educational programs, in a collaboration between palestinenature.org and Zoe Environment Network, Geneva.

Climate change adaptation planning has been supported and endorsed by the EQA via a National Adaptation Plan (NAP), which identifies 12 priority thematic areas (EQA, 2016). However, reviewing actual accomplishments on the ground suggests that SP was able to mitigate some decline in habitats but has not engaged in any habitat restoration activities with very few marginal exceptions (e.g. planting wild trees by the MoA in protected areas to cover denuded areas). The 6th National Report proposed measures that can be implemented to meet ABT 15 and **recommend the following for the new NBSAP:**

1. Protect and restore native vegetation on vulnerable areas and determine sites for native vegetation.
2. Prioritize highly degraded ecosystems that provide essential ecosystem services and are critical to ecological connectivity.
3. Empower sustainable land use by indigenous and local communities.
4. Enact market instruments that discourage exploitation of ecosystems.
5. Consider income generation along with restoration activities to make restoration economically viable.
6. Develop landscape management approaches with stakeholders that encourage large-scale restoration while considering the socioeconomic needs of local communities.
7. Identify and geospatially map opportunities for restoration.
8. Identify investments and insurance opportunities for restoration,
9. Emphasize restoration efforts in forests that are becoming carbon sinks.

"Historic forms of household and community coping by Palestinians in the face of climate and other hazards offer potential templates for adaptation to climate change in the OPT. However, the ongoing effects of the Israeli occupation undermine the conditions necessary to their operation, both economic – the free movement of goods and people – and political – national self-determination and democratic governance" (UNDP, 2010)

2.3 Threats: Habitat destruction and Overexploitation

Globally, habitat destruction and overexploitation are considered two of the five major drivers of biodiversity loss (Alroy, 2017; Skogen et al., 2018'; Chase et al., 2020). **Locally**, the 6th National Report summarized habitat destruction and other threats that affect our local biodiversity. There were additional studies after the 6th National Report that also involve this issue (see for example Qumsiyeh and Abusarhan, 2021). The ranking of threats in the Palestinian Environment according to the 5th and 6th national CBD report is available and seems reasonable although this could be adjusted when and if additional data becomes available (EQA, 2015; Table 1). Another report used the Delphi approach to ask some 'experts' what the main threats are, and reaching a different answer (Abdallah and Swaileh, 2011; AlHirsh et al., 2016). AlHirsh et al. (2016) used interviews with selected individuals involved in environmental issues in SP to see what are the threats that are most prominent to the majority of those individuals.

Fires: Fires affected especially the mono-culture of pine trees in our region more than other places (Israel replaced polyculture with monoculture around destroyed Palestinian villages). In the West Bank, it was noted that fires in forested protected areas contribute to decline of tree cover.

Use of Insecticide, Pesticides and Pollinators: Palestinian agriculture was developed during the Natufian period and was relatively in harmony with nature for over 10,000 years. However, the modern practices of

agriculture, especially pest control methods via chemical means, have resulted in significant environmental hazards. The introduction of pesticides came under British mandate rule, 1920-1948, and was expanded after the formation of the state of Israel in 1948. Pesticides are now used extensively in Palestinian agriculture, and this is partly due to the reduction in the land available to Palestinian agriculture, and under the mistaken belief that the use of pesticides is indispensable to increase yield (Saleh et al., 1995). Even in impoverished Gaza, there is significant pesticide use on limited land (Abu Middain, 1994) and nitrates seem to affect the health of people there (Abu Naser et al., 2007; Al-Absi, 2008). Pesticides negatively influence agricultural production long-term (Glover-Amengor and Tetteh, 2008; Kalia and Gosal, 2011) and on biodiversity (Geiger et al., 2010; Brühl et al., 2019). Agricultural practices that do not ensure agricultural biodiversity or rotate crops (i.e. monoculture and "agriculture industry") are devastating to sustainability and environmental protection (Garnett et al., 2013; Tscharntke et al., 2012; Wezel, 2014). Agricultural biodiversity websites like this http://www.bioversityinternational.org/ are now important to study and be aware of, and the MOA is key to this.

The conservation of agrobiodiversity became part of the national agenda when the MOA adopted a national policy for "promoting the conservation of Agrobiodiversity". Pollinators from various insect groups and other animals, including birds, mammals and reptiles, started to reduce, and this has lead to bad agricultural methods including the heavy use of chemicals to control pests and preventinganimals from interacting with growing plants. In this case, the life cycle of many invertebrates and vertebrates is broken, leading to a reduction in species' population numbers and becoming categorized as 'near threatened' or 'endangered'.

Urban Sprawl: In developing countries, sustainable urban policies need to be developed in ways that ensures long-term positive impacts to deal with urban sprawl. This creates an economic impact and allows for the maintenance of adequate standards of living (as in Latin America, see Coq-Huelva & Asián-Chaves, 2019). In the region, the urban population grew rapidly to now constitute 2/3rds of the population (World Bank, 2021). Urban sprawl is driven by factors like preferences for living in low density areas, progress in car manufacturing, land-use regulations, low motor fuel taxes and other policies encouraging car use which all have significant environmental, economic and social consequences and must be addressed as a sustainable development issue, connected to all these other issues. The main issue is to balance market-driven forces for ease and comfort to individuals short-term with the long-term benefit of a clean environment and rich biodiversity (OECD, 2018). Population projections (SP, 2016) reveal that the population of SP will increase from 4.7 million in 2015 to 6.9 million in 2030, and will double to reach 9.5 million in 2050.

Urban planning in a way that preserves biodiversity requires data that is reliable to measure indicators and impact (Artmann et al., 2019). In Palestinian areas, there is little urban planning (e.g. Shaheen, 2021). In 2014, SP adopted a national spatial plan and implementation initiated. The plan takes into account protected areas within KBAs for the purpose of development regulation. This is only partially effective because of the lack of Palestinian sovereignty over all the land of SP. For example, Israel exerts control over Gaza maritime zone (plus Gaza is blockaded) and Area C comprises most of the West Bank and is under Israeli civil and military control. This limits the State's ability to implement the spatial plan. Regarding the loss of habitats, there is a significant shortage of data and it has not been managed well in the past. After writing the cross-sectoral strategy (EQA 2017), the Palestinian Government committed resources and experts to conserve the environment. The EQA engaged with IUCN and others on analysis of levels of protection in different KBAs, including a gap analysis. This project is for 2021-2022 and should result in better protection. However, much depends on political developments in the next few yearsFurthermore, better management and measures to be taken to stem the loss of habitats and species should be now incorporated in the new NBSAP, and a new spatial plan going forward to 2050 is now being worked on which takes into consideration environmental needs and protection.

Data review suggests the following priorities in managing urban sprawl to enhance and preserve biodiversity:

- Data collection on urban and suburban areas to understand the relation to local biodiversity
- Environmental impact assessment planning for urban development
- Government controls to ensure proper spatial planning for urban and suburban areas
- Developing clear boundaries and balances for master plans
- Balance of short-term individual interests with long-term management that makes sense for sustainable human and natural communities.

Significant growth of population is witnessed in SP, with total population jumping from less than one million in 1916 to over 13 million in 2016. Some of this is attributable to natural population increase but nearly half of it is new Jewish immigration. This is creating pressures on the environment, as evidenced in the decline in biodiversity, (Qumsiyeh et al., 2014b), e.g. a decline in frog population (Salman et al., 2014), and a change in diet of raptors like the Eagle Owl (Amr et al., 2016). The fact that between the river Jordan and the Mediterranean, there are now over 12 million people with over 3 million cars has also created a large problem with air pollution and increased lead pollution is already evident (Tal, 2002; Safi et al., 2006).

There is increased population density coupled with Israel's restriction on Bedouin communities and this causes Bedouins to overuse the shrinking areas that they are allowed to use. Jahhalin, for example, moved from Negev to the Jordan Valley in 1948, then to Jerusalem eastern hills in 1967, and soon will be moved to Aizarya. This results in overgrazing in the few remaining open areas (ARIJ 2015). In Gaza, there are limitations on fishermen going out to sea beyond a very small 3 nautical mile area. The restrictions result in overfishing and, combined with the environmental impact of exploring for and extracting gas, there is a significant threat to Mediterranean biodiversity.

There is also significant hunting of wildlife including via nets and traps and even guns by locals and visitors to SP (Yom-Tov, 2003). Illegal hunting has decimated the areas like Wadi Gaza (Abd Rabou et al., 2007, 2015; AlHirsh, 2016). This is especially harmful in protected areas in many parts of SP (e.g. Wadi Al-Quff, see Qumsiyeh et al., 2016). But also, infrastructure development needs to take into account the cutting down of forests and the impact on wildlife continuity, whether this is for road building (Achiron-Frumkin 2013) or for the building of the segregation barrier deep inside the West Bank that have damaged the environment as well as being, against international law (International Court of Justice ruling 2004).

A UN report on Gaza in 2012 stated that the territory might not be habitable within by 2020 (UN, 2012) and this is indeed the case now. Overexplotation and habitat destruction in Gaza has left little natural areas or green cover beyond the very limited cultivated areas/

2.4 Threat: Invasive Alien Species

Invasive alien (non-indigenous) species are defined as non-native species of flora and fauna whose introduction can pose a threat to local biodiversity (Bax, 2001). Invasive alien species are the second most destructive human influence on biodiversity after direct habitat destruction by humans (Schmitz and Simberloff, 1997; Walker and Steffen 1997). This not only affects local environments (Simberloff, 1996; Parker et al., 1999) but also threatens agriculture (Mack et al. 2000; Pimentel et al. 2000). Nearly half a million species have been reported as invasive worldwide (Pimental et al., 2001 see also global invasive species database). The term "invasive" is used for the most aggressive of these species as they grow and reproduce rapidly, causing major disturbances to nature in areas in which they are present. Positive interactions among non-native species have the potential to disrupt ecosystems by amplifying invasions and can occur via indirect mechanisms (Adams et al., 2003). The invasiveness threat has increased because both ease of transportation and human habitat destruction open many opportunities for invasive alien species to establish themselves around the world. In fact, these invasive species are now considered the second most important threat to biodiversity after direct habitat destruction by humans (Kettunen et al., 2009; UNEP-WCMC 2015).

There is still some debate on the issue of whether increased local biodiversity protects from invasive alien species or not, and how best to deal with this phenomenon (Levine, 2000), including how climate change could be a key factor of increasing invasiveness around the world (Ziska and Dukes, 2014). Climate change could be a key factor for increasing invasiveness around the world (Dangles et al., 2008; Hellman et al., 2008). Moreover, the influence of invasive alien species is not limited to the macro-scale; they also affect the diversity and success of diseases by disrupting previously stable communities and can drive local species to extinction through genetic hybridization. Invasive alien species in historic Palestine varied between groups, and they keep increasing and currently include 2 mammals, 18 birds, 2 reptiles, 27 fish, 50 vascular plants, 19 freshwater snails, 33 land snails, and over 200 insects (Roll et al., 2007a, 2007b, 2008, 2009; Dufour-Dror, 2012).

Within the SP,there are 50 invasive plant species of which the most aggressively invasive ones are *Acacia saligna*, *Ailanthus altissima*, *Conyza bonariensis*, *Oxalis pes-caprae*, *Ambrosia confertiflora*, *Ricinus communis*, *Nicotiana glauca*, *Prosopis juliflora* and *Solanum elaeagnifoliu*. Nine invasive bird species are reported in SP and four of them are detected in the West Bank: Indian Silverbill *Lonchura malabarica*, Common Myna *Acridotheres tristis*, Monk Parakeet *Myiopsitta monachus* and Rose-ringed Parakeet *Pisttacula krameri*. Most species have been deliberately brought in captivity and subsequently released or escaped. For example, the Common Myna were introduced in 1997 after a group of birds escaped from the Park Hayarkon area in Tel Aviv (Handal and Qumsiyeh 2021).

Amongst mammals, the house mouse, black rat, and coypu are noted. Fish have been introduced unintentionally and intentionally for various reasons to many regions (Roll et al., 2007b). In Historic Palestine, 27 introduced species are found in the Jordan Basin, Sea of Galilee, and the coastal plain rivers. Of these 27, 10 are invasive alien species: *Oncorhynchus mykiss*, *Salmo trutta*, *Hypophthalmichthys molitrix*, *Gambusia affinis*, *Poecilia velifera*, *Xiphophorus hellerii*, *Liza ramada*, *Mugil cephalus*, *Oreochromis aureus* and *Tilapia zillii*, which have established themselves in the Jordan River Basin within fishponds and some of them have penetrated to the river itself (Roll et al., 2007b). According to Lowe et al., (2000) two of these 10 species are considered aggressively invasive: Brown trout, *Salmo trutta* and the Rainbow trout, *Oncorhynchus mykiss*.

There are around 33 introduced species of freshwater and land snails within SP, of which 19 are considered invasive. The majority of snails have been introduced via import of seedlings and aquaria fishes (Roll et al., 2009). Some invasive land snails such as *Cornu aspersum*, *Eobania vermiculata* and *Rumina decollate* have been observed in the West Bank. Moreover, these two freshwater snails are among the most invasive: *Pseudoplotia scabra* and *Planorbella duryi* (Handal et al., in preparation). Furthermore, *Prietocella barbara* was detected in a shipment of Red Cabbage to the Gaza Strip (Vaisman & Mienis, 2016a, 2016b). Another invasive alien species found in the Gaza Strip is *Novisuccinea ovalis*, recorded during the occupation by Israel (1967-2005) (Vaisman & Mienis, 2016a, 2016b).

Among the invasive alien species within the West Bank and Gaza Strip is the prevalence of the Red Palm Weevil, *Rhynchophorus ferrugineus*, which has led to a devastating loss in crops (Kehat, 1999; Abd Rabou & Radwan, 2017). Other studies have revealed the existence of 26 invasive alien insects associated with Eucalyptus trees which were introduced from various countries (Mendel & Protasov, 2019). One of the most invasive species, with high impact upon public health, is the Asian Tiger Mosquito, *Aedes albopictus* (Adawi, 2012). Another study recorded the presence in SP the Western Conifer Seed Bug *Leptoglossus occidentalis* (Handal & Qumsiyeh, 2019). *Paratrechina longicornis*, *Rhynchophorus ferrugineus and Deroplax silphoides* have also been shown to be within SP (Handal, 2017; Handal and Qumsiyeh, 2019).

The invasive alien species in SP are expanding both in number of species and in the scale of their proliferation. The sole restrictions on the import of invasive alien species into the country are those of the Ministry of Agriculture, but Israel remains the authority in charge of borders (EQA, 2015). There are ongoing studies on the issue of invasive flora and fauna in the State Palestine. However, very few control

measures have been developed and implemented. Based on the study submitted 2022 on IAS, it is recommended:

1. More capacity building and educational activities, formal and informal, for research into IAS.
2. Implement surveillance and early warning mechanisms, including dissemination and response
3. Develop and implement awareness campaigns on invasive alien species. This includes school curricular and extra-curricular activities, billboards, workshops and the use of social and mainstream media. Campaigns should integrate also with existing programs like protected area management.
4. Strengthen legislation related to IAS and work with relevant authorities (Ministries of Agriculture, EQA, local councils, etc.) to stop the spread of and to eradicate invasive alien species.
5. Cross-sectoral work to stop invasive alien species (local and national governments, NGOs, academia, private sector)
6. Regional cooperation is imperative.

2.5 Threat: Pollution

According to the latest available estimate (SP 2020a), SP annually produces 7103 tons of hazardous waste (6.4% of total waste) of which 1420 tons are hazardous medical waste. In the early 2000s, the average general waste production per person was 0.94 kg/capita/day, with an increase of about 1% per capita per year, but waste in urban areas is nearly double that of rural areas (Al- Khatib et al., 2007). Moreover:

- Idhna, within the Hebron District, is a major site for e-waste recycling, of which the majority is illegally transported from Israel, and it has significant health impacts (Khlaif and Qumsiyeh, 2017).
- Agricultural lands are loaded with toxic wastes dumped on Palestinian lands by illegal Israeli colonial settlements.
- Waste from the Barqan industrial settlement impacts the natural resources of the nearby valley as well as on human health (Hammad and Qumsiyeh, 2013).
- There are thousands of tons of waste due to successive wars on the Gaza strip and from building destruction generally, which is polluted with depleted uranium and white phosphorus that reaches the Mediterranean Sea via rainwater.
- Waste water is dumped on some significant and supposedly protected areas like Wadi Qana, Wadi Nar, Wadi Far'a (Bathan), and around Salfit (EQA, 2015) and into the Mediterranean Sea where it is highly damaging to the environment (Akram and Cheslow, 2016).

The National Strategy for Solid Waste Management (NSSWM 2017-2022). The plan addresses the appropriate treatment of all hazardous waste (including industrial, medical, agriculture, -etc.). Under the MoLG, there is a general directorate of Joint Services Councils (JSCs). These JSCs work to manage solid waste and their actions are described in detail in the Solid Waste Management Strategy (MoLG, 2016). Due to the problems in the SWM field within SP, Saadeh et al, (2019) conducted a study on 12 JSCs which revealed that only two of them have acquired a Public-Private Partnership (PPP) contract for the management and operation of the transfer station and the sanitary landfill. Also, these two JSCs are currently making arrangements and implementing studies for future PPPs on waste-to-energy, biowaste management and recycling projects. Data from MoLG indicates that the percentage of solid waste that is dumped in a sanitary manner out of the total waste produced in 2019 was about 98%. This percentage is expected to reach 100% in 2023. According to the data from the EQA and the MoLG, the percentage of hazardous waste that is treated, out of the total waste produced, reached only 2% in 2019, and it is expected to reach 10% by 2023. Sewage management in the SP is critical. In Gaza, a great amount of sewage flows untreated to the Mediterranean Sea (Ashour et al., 2009). Thus, sewage treatment facilities such as in Rafah facilitated by ICRC is a great step (ARIJ, 2016). Furthermore, some aquatic plants can be used to improve water purification; for example, *Azolla sp.* can be used to treat sewage and remove nutrients (Costa et al.,

1999). According to UNEP (2003), 70% of solid waste in SP is organic waste which can be reduced via composting to generate fertilizers (Al-Khatib et al., 2010).

Since SP is a developing country, it has several obstacles in its solid and liquid waste management (Talahmeh, 2005). The political situation is also one of the main factors which hinder the development of proper measures for sanitary disposal of solid wastes, in spite of having strategic and action plans in place (Ministry of Environmental Affairs, 2001; Musleh and Giacaman, 2001). Leackage from random dumps may contaminate the groundwater, which is the primary drinking water source. Moreover, most dumpsites are not fenced and easily accessible by stray animals, waste scavengers, and children. This is a disaster, as medical waste is disposed of in the same dumps without proper segregation and treatment which places people and animals accessing those dumps at at risk of infection from various diseases. While some new landfills were established, for example the Al-Minya landfill to serve the south of the West Bank, these are inadequate for societal needs and leakage from solid waste dump sites is not adequately addressed (ARIJ, 2016; MoLG, 2016).

Limited recycling initiatives have been put into practice in the West Bank in the past. These initiatives were mostly privately owned and focused mainly on metals, paper, and glass recycling. Metals and glass were locally utilized, whereas other items such as automobile scrap were sold to Israeli firms for utilization in Israel (EQA, 2005). Unfortunately, poor children are hired to scavenge the waste for insignificant pay. Some projects have been carried out in the West Bank; for example, the Save the Children organization conducted a project between 1999 and 2001, aiming to improve sanitation and environmental health in needy urban and rural communities to support the newly established JSC in both Anabta village (Tulkarem district) and Dura village (Hebron district, southern West Bank) (Abu-Eisheh et al., 2002).

The Ministry of Local Government (MoLG) has overall responsibilities for municipal SWM, and operations are covered by municipalities and Joint Services Councils for Solid Waste Management (JSCSWM). But the EQA has a key role to play in oversight and policy work as noted in NSSWM. The strategic objectives of the current NSSWM are:

- A modern and effective legislative and organizational framework for SWM.
- Strong implementing institutions.
- Effective and environmentally safe management of SW services.
- Financial sustainability and efficient SWM services and activities.
- Appropriate treatment and inventory of medical, hazardous and special waste.
- A growing participation of the private sector in SWM.
- A more participating and aware public.
- Effective information and monitoring systems.

There is a real crisis in logistics and financing for proper solid waste disposal in SP (Abu Thaher, 2005). The majority of solid waste disposed of in Palestinian areas like Nablus is organic which indicates a great potential for resource utilization such as for composting/fertilizer generation. But, as in many developing countries, management of such solid wastes significantly lags behind.

The situation for sewage management in SP is critical. In Gaza, a significant portion of the sewage flows untreated to the Mediterranean Sea (Ashour et al., 2009) but improvements are happening (xxx).Waste management is impacted mainly by Israeli occupation of Gaza (Caniato et al., 2016).

An updated National Action Plan (NAP) for the prevention of pollution of the Mediterranean Sea from land-based sources in SP has been formulated by E 16) and the drafting process of the plan was implemented in four stages: NAP legal basis, Midterm baseline assessment (wastewater, marine area, and solid waste), Identification of gaps in enforcement of laws, policies and regulations, in addition to NAP Operational Targets.

Regular compost, vermicompost (worm fertilizer), and biochar can be developed as a byproduct (Alkobaisy et al., 2021; Garg et al., 2006; Lehmann, 2007; Wang et al., 2018). There are many other ways to manage agriculture and farming activities in bio-friendly ways (Ravindran et al., 2020). Campaigns and activities revive the spirit of volunteerism and promote local-community-supported solutions to big problems. These initiatives are tackling the solid waste issue through different approaches and means, all of which are inspiring. They can be placed in the following categories: volunteer groups leading awareness and cleanup campaigns in both rural and urban areas; initiatives and enterprises on recycling paper/cardboard and plastic, as well as engineers producing building materials from construction waste and the rubbles of destroyed building; individuals or start-ups conducting entrepreneurship projects and creating mobile applications and platforms for material recycling and reuse; artists initiating projects for upcycling of all sorts of materials; individuals and groups raising awareness through blogs and other social media..

2.6 Threat: Colonial occupation and conflict

In addition to the five major threats discussed above the situation in SP has one more major local threat, which is the presence of the Israeli colonial occupation. In 2005, the last Millennium Development Goals (MDG) were published by the Palestinian National MDG Steering Committee, led by the Ministry of Planning of the Palestinian Authority. In its remarkable honesty, it states that the targets for 2015 for sustainability and environmental issues will not be reached because of: "lack of control over natural resources, particularly water and land, due to occupation, and early stage of environmental protection."

Historically, SP suffers from a number of challenges related to colonialism, before and after 1948 (Tal 2002; Boast 2012). The Israeli actions toward water sources have been catastrophic for nature biodiversity since the creation of the "State of Israel", starting from drying out the al Hula wetlands which eradicated life there, and not ending with the Red Sea - Dead Sea Canal project. The latter is a prime environmental problem and should not have been implemented. Its impact in SP will be most acutely felt in the unnatural "replenishment" of the Dead Sea while leaving the Jordan Valley essentially dry and with continued environmental deterioration. Some work was done on this, but much more research needs to be done and the summary of these are beyond the scope of this report. The challenges are articulated in the 6th National CBD report and in other published works (UNEP, 2003; Elmusa, 1998; Messerschmid and Selby, 2015; Baalousha, 2006; UN, 2012; Rudolph and Kurian, 2022).

Planning at all stages is hampered, from environmental regulations implementation (Qumsiyeh and Albaradeiyeh, in press) to even simple waste management. For example, efforts of the PNA to get Israel to agree, to waste water and solid waste facilities' which Israel refuses to authorize unless Palestinians agree to take in colonial settlement waste, from illegal settlements as per international law (Tal, 2002). The Israeli occupation is one of causes of habitat destruction leading to a decline in the biodiversity of SP. shows the many ways Israeli occupation affects the Palestinian nature and natural resources (ARIJ, 2007, 2015). All those listed have led to habitat loss and fragmentation, although there have been efforts by local NGOs and the Government to increase awareness amongst Palestinians.

The UNEP report (2003) identified the following as key effects of the occupation:

1. Direct degradation arising from military operations;
2. Increasing of human population pressure on natural systems from high population growth and the long-lasting refugee crisis;
3. Rapid growth of Israeli settlements and supporting roads in areas where land is already scarce;
4. Restrictions on communications, movement and access, limiting implementation of environmental management measures;
5. Construction of separation fence and wall that effectively block movement of terrestrial fauna, and cut the natural ecological corridors;
6. Threats from solid waste and wastewater pollution;
7. Clearing of land of vegetation by Israel for security purposes and as a result of other causes.

The development of the State of Israel and its occupation of the 1967 areas emphasized settlement building, military security, territorial security and demographic security but does not mention environmental security (Tal, 2002; Newman, 2009). Article 49 of the Fourth Geneva Convention (to which Israel is a signatory) clearly states that, "The Occupying Power shall not deport or transfer parts of its own civilian population into the territory it occupies". Between 1993 and 2000, the population of settlers in the occupied areas doubled to over 450,000 and today stands at 900,000. Israeli colonies in the occupied areas were intended for security and control. Thus, most land confiscation and colonial settlement activity was intentionally concentrated on the high grounds on hills and mountains (Benvenisti, 2002). Due to this peculiar arrangement, a runoff of wastewater, pollution from industrial colonists in declared "industrial zones", and soil erosion have directly impacted Palestinian communities located in the lower areas adjacent to these colonies. The UN Commission on Human Rights documented these negative effect in 2000 and the situation only got worse since. Palestinian sources estimate that at least 200 Israeli factories operate in the West Bank. Some of the products are identifiable, but detailed information on quantities produced, labor, and waste generated are not available. The environmental impact is illustrated by reports on the Barqan industrial settlement (Hammad and Qumsiyeh, 2013). Israel's ongoing construction of nearly 760 km of apartheid segregation barrier (walls and fences) since 2003 has already uprooted 1.5 million trees. Other infrastructure includes over 1500 kilometers of settler roads, most separated from existing (and often dilapidated) Palestinian road systems. There is accumulating evidence that Israel's use of substances like white phosphorous in the SP is harmful to human health and the environment (Human Rights Watch, 2009; Special Rapporteur on Human Rights in the Occupied Palestinian Territories, 2009).

Israeli colonies were planned for security and ideological reasons and thus built on hilltops dotting the Palestinian landscape, to fit into a pattern so as to control both the natural resources and the native Palestinian population (Benvenisti, 2002; Weizman, 2012). Thus, there was no forethought on environmental sustainability or clear ideas to ensure population harmony with natural resources and the environment (ARIJ, 2015). We find that there are settlements in every Palestinian district, and facilities such as sewage treatment plants are not made available to the local Palestinian population. Untreated sewage water is discharged and in most cases, this discharge directly goes to the areas inhabited or farmed by Palestinians (ARIJ, 2002; Newman, 2009).

The occupation of the West Bank and Gaza by Israel in 1967 also opened up a window of opportunity for Israeli industries to escape the rejection by communities in which they existed. Many of the highest polluting companies simply moved, and actually were provided with tax incentives, to the West Bank and Gaza where Israeli Government regulations were more lax. There, the companies only faced the opposition of native Palestinians who had no realistic way to stop them. For example, Gishuri Industries, a manufacturer of pesticides and fertilizers which faced significant court setbacks in its original plant in Kfar Saba, was moved to an area adjacent to Tulkarm inside the West Bank in 1987. Significant pollution from this and other companies in this area has damaged citrus and vineyards (ARIJ, 2015). The first research on genotoxicity in SP showed significant impact of the Barqan Industrial settlement on Palestinians of Burqeen village (Hammad and Qumsiyeh, 2013).

Israel has also built an extensive network of so-called "by-pass" roads in the occupied areas. These roads stretched for 340 km in 2000 and now have increased significantly. They bypass native Palestinian towns and are used to serve Jewish settlements. Large tracts of lands are confiscated to build these roads, which include 75 meters on either side of the roads as "safety buffers". Trees and hills and any standing structure within the 75 meters on both sides are bulldozed and the areas are declared closed military zones to Palestinians.

There are many other issues where the occupation can affect sustainable development and protection of the environment (see MOPAD 2014 for a summary). There is a significant theft of natural resources in contradiction of the 4th Geneva Convention. The cost of occupation even without counting natural resourses is in the billions annually. The disparity between settlers and natives in land control, economy,

and access is also compounded by disparity in use of other natural resources especially water.The issue of water is the most significant and will be even more going forward (Gasteyer *et al.*, 2012; Al-Haq 2013). Cooperation with long-term occupiers/colonizers in waste management should not lead to normalization and strengthening of the status quo of occupation by treating the waste from settlers in "joint facilities" (see e.g. Barak, 2012).

The confiscation of **land** for settlements is a major threat to Palestinian nature reserves. One of the most important examples is the confiscation of Ras Imweis and six adjacent areas, one of which is called Nahal Shilo, located northwest of Ramallah. Cases of destruction and distortion of nature reserves in the occupied West Bank for the implementation of various Israeli colonial projects is an integral part of Israeli practice. Israel has exploited the term "Nature Reserve", for example in the Bethlehem Governorate when Har Homa settlement was established in 1997 on Abu Ghneim Mountain, which was considered one of the largest forests in Bethlehem.

Israel has also given freedom to Israeli corporations to benefit from Palestinian natural resources including land (Longobardo, 2016). For example, Israeli stone quarries are built in the occupied West Bank Mountains, harming the environment and depriving locals of a key resource (Abdallah and de Leeuw, 2020). There is also pillage of the Dead Sea resources. For example, within two decades of its launch in 1988, the annual global sales of Ahava, an Israeli cosmetics company which uses minerals from the Dead Sea, had reached almost $150m (£95m). The company has been the target of boycott campaigns. Meanwhile, Palestinians are prevented from using the Dead Sea area for tourism (Abu-Baker and Farah, 2020; Al-Haq, 2012; Popperl, 2018).

The USGS (2010) estimates there are a mean of 1.7 billion barrels of recoverable oil and a mean of 122 trillion cubic feet of recoverable gas in the Levant basin (overlapping Lebanon, Jordan, State of Palestine, and Israel). Palestinians have no control over their legally protected oil and gas resources which are now explored and utilized for Israel. Israel actually placed fishing restrictions on local people partly to keep them away from these resources (Ismail et al., 2013). There are significant conservation challenges in relation to exploration and utilization of hydrocarbon resources (Mazor et al., 2018).

The occupation also threatens cultural heritage/cultural resources (Rjoob, 2009). These can be considered a resource but are also important for a developed national and cultural identity that can empower people to act, including for protection of their lands and other natural resources.

To summarize, there is significant theft of natural resources from the occupied Palestinian territories (land, water, stone, oil, gas, etc.), and significant restriction by the occupying State on the use of any remaining natural resources. However, action on the environment can also be used as a form of resistance (Al-Butmeh et al., 2019; Qumsiyeh., 2021; Qumsiyeh and Abusarhan 2020; Qumsiyeh and AlBardeya, 2022).

2.7 Nature's Contribution to People

ABT14 deals with these issues and the post 2020 guidelines give them more weight, largely because the other ABTs did not progress well and needed to include a more participatory and people-oriented approach. There is yet much to learn in terms of how to achieve conservation using this angle. Information alone is not sufficient and taking practical steps to empower communities and individuals to achieve results is key to the process (Knight et al., 2006).

Kaimowitz and Sheil (2007) showed that, in developing countries, people rely on wild resources for 20-30% of their income, and 20% of their consumed protein. This is especially relevant for poor people who rely on biodiversity as a natural resource (Vira and Kontoleon, 2010). Therefore, as a part of a strategy for biodiversity loss, Thomas (2011) suggests that the best way to conserve biodiversity is to work with local organizations. **Ecosystem services** (also ecosystem goods and services) are the "*benefits people obtain from ecosystems [including] provisioning services such as food, water, timber, and fibre; regulating*

services such as the regulation of climate, floods, disease, wastes, and water quality; cultural services such as recreation, aesthetic enjoyment, and spiritual fulfillment; and supporting services such as soil formation, photosynthesis, and nutrient cycling" (CBD, 2009). However, the definition and scope of ecosystem services is flexible and context-based and should be tailored to particular circumstances (Fisher et. al., 2009). And while CBD pre-2020 (e.g. CBD 2016) and post 2020 both emphasize connectivity of biodiversity conservation to ecosystem services, there is very limited progress in this area (Prip, 2018). There are many evaluation methods for ecosystem services each with its advantages and disadvantages (CBD, 2009).

The key vision that drives or should drive environmental conservation **in SP** as elsewhere should be a vision of a sustainable human population in a sustainable diverse natural environment. This is not an easy task and it has generated significant discussions in the literature (Escobar, 1998; Coscieme et al., 2020; Pasqual et al., 2021).

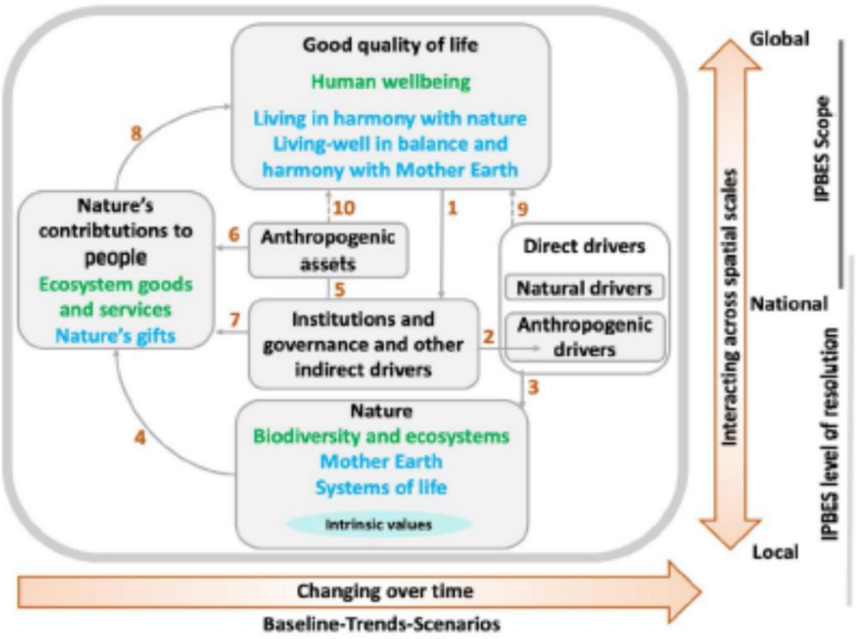


Figure 2.1 Rationale for a conceptual framework involving people and nature (IPBES, 2015).

Since the industrial revolution, the sustainability of ecosystems around the world has eroded due to human activity that causes habitat loss and environmental degradation. In the last few decades and especially with the growing realization of global human induced climate change, there have been increased awareness and efforts focused on environmental conservation and at least attempts to halt destruction and mitigate effects, including efforts towards reversal of human induced habitat changes.

Economic and social concerns constitute two key factors of viability in conservation efforts around the world. The level of GDP is directly correlated with environmental concern (Mills and Waite, 2009). The 13 million Palestinians around the world are now dispersed in many countries, with 7 million being refugees

or displaced people. While 6.2 million Palestinians still live in historic Palestine, nearly 30% of them are internally displaced or recognized as refugees. The GDP of Palestinians is 1/8th that of Israelis, who share with them the space of historic Palestine, and this disparity is exacerbated by the cyclical uprisings against the occupation (Hever 2010). This has an impact on the environment and R&D (Qumsiyeh and Isaac, 2012). For example, according to UNEP (2003), the GDP of SPwhich grew at 6% in 1999 however, shrunk by 6.5% in 2000 due to Israeli measures in response to the 2000 uprising. Furthermore, the GDP growth in SPfailed to keep pace with the rate of population increase (MOPAD, 2014).

It is incumbent on SP to build a comprehensive conservation strategy that takes into account all stakeholders and all relevant activities (research, setting priorities, laws, action, and implementation) and that these follow a set timeline.

How Social Factors Affect Conservation

Since SP is a developing country, it has several obstacles and hindrances in its current solid waste management (SWM) field. The main goals behind recycling are to minimize the quantity of landfilled waste, to provide raw materials, and to sustain the environment for future generations. The successful implementation of a recycling program depends on the active participation of the public. Kattoua et al. (2019) have examined the main barriers that hinder the achievement of a local recycling program in Ramallah and Al-Bireh district of SP. They have detected that the main barriers preventing the public from participating in the local recycling system are: lack of: awareness, official recycling programs, information on the process of separation and storage, municipal authorities' encouragement, available facilities in the municipality or nearby capacity of existing facilities, and knowledge on waste segregation processes.

Disincentives come from issues like penalties for pollution and implementation of both local laws and signed international Agreements and Conventions that should hinder locals from engaging in harmful practices. There is a review of local laws and regulations of signed Conventions, along with the initiative for signing new Conventions Generally, the review shows good correspondence (data forthcoming) but the issue of enforcement remains weak. Since the 5th NR (EQA 2015), there has been increased enforcement with creation and deployment of the Green Police (as an executive force) who work closely with the EQA. Response times have improved over the past three years. For example, there was confiscation of over 200 wild animals from hunters and from pet shops, which are then sent to animal rehabilitation centers such as in PIBS-BU.

Incentives are a different issue and need further development. For example, Jerusalem District Electricity Company Ltd has developed (bureaucratically) complicated regulations for installing solar panels. Any solar power which is generated in excess of need is used by the Electric Company which then provides some credit for it. However, there are no incentives or disincentives to reduce the use of plastics. There remains personal education and personal incentives or institutional issues that need extra work too. For example, the permaculture farms producing organic eco-friendly produce do it as an internally incentivized process. Progress is assessed as insufficient because the Stateof Palestine faces an ongoing decline of farmland and forests due to Israeli occupation, which could affect the target if land of high biodiversity value is halved. This strongly suggests that positive incentives must be developed more effectively.

Another example of issues of incentives is that a factory in Hebron started recycling tyres to produce floor matting for use in places like children's playgrounds. However, there was a lack of demand and the factory shut down. In the future, it would be beneficial to increase campaigns of awareness (see ABT1) to include such issues.

There has to be benefit sharing from conservation and biodiversity. Görlach et al. (2011) summarized the potential economic benefits from environmental conservation efforts (if successful) in SP. Though this benefit assessment was mostly based on little data collected on the ground, it highlights the significant potential financial impact of saving our environment. Here are some examples:

- Air: If air pollution is cut by 50%, modeling suggests premature mortality could decline by 220 and morbidity by 440 per year. Monetary benefit could be of 68 million euros per year.
- Water: Improved access to water services could significantly improve the quality of life for 1.2 million Palestinians. Improved wastewater treatment (perhaps concomitant with reduction of wastewater in general) could have significant impacts on biodiversity, groundwater quality, and human health.
- Waste: Reducing solid waste would have significant impact on air quality, environmental health, human economy, and biodiversity.

The use of plants and animals for humans is a field that needs much more examination as it directly relates to environmental conservation, especially in terms of sustainable use of resources. In SP, as elsewhere, there is an interest in ethnobotany and ethnozoology (Ali-Shtayeh and Jamous, 2006; Ali-Shtayeh et al., 2014).

Poverty reduction and environmental conservation are directly linked and developing countries are not able properly conserve the environment without tackling poverty (Adams et al., 2004). Furthermore, it is possible to use socioeconomic incentives at the periphery of protected areas or even allow managed use of natural resources as a form of poverty reduction, which also incentivizes local people to protect their environment (Sunderlin et al., 2005). Reform and strengthening governmental agencies, especially in regard to enforcement of laws, helps, including allocating resources for implementing laws and policies; (no law or policy should be issued or revised without clear mechanisms of implementation) (see Esty and Porter, 2005). This also includes more informed spatial planning and clarification of responsibilities. As a second step, development of management plans that use ecosystem approaches and take areas like social, cultural and economics into consideration is needed (Adams et al., 2004).

Modern conservation philosophy argues that the local buy-in is critical for success of conservation efforts. SP certainly needs to think strategically about how people around protected areas are to benefit from protection. There are models in nearby areas, for example the way that the Royal Society for Conservation of Nature worked with local communities to ensure active buy-in via direct benefit from things like ecotourism and environmentally sensitive agriculture.

Religious attitudes can be of potential use to promote environmental awareness and conservation. Religious clerics (Muslim and Christian) can introduce many concepts of conservation and environmental practices into their Friday and Sunday sermons. Islamic teachings are full of orders and events that encourage conservation as the concept of "Al Himma", to save water, clean the environment, and many others. Similarly in Christianity, the cultural mandate in Genesis encourages responsible stewardship of resources. In SP, the Holy Land, with so many religious connections and about a million devout pilgrims per year, it is incumbent upon policy-makers and stakeholders to research ways to reach out to those who are religious with the message of environmental conservation.

Tourism

As a destination, SP has much to offer in addition to religious and historical sites, and there is a significant interest to go beyond pilgrimage to alternative tourism (Isaac, 2010b). Local interest in promoting alternative tourism has increased, particularly during the COVID-19 pandemic (PCBS 2021). SP generally has unique and promising rich landscapes and wildlife habitats and ecosystems which are very important for developing ecotourism. A conference on development of eco-tourism in SP was held on 8 November 2007 by the Centre for Cultural Heritage Preservation (CCHP) in partnership with Bethlehem University. 2017 was designated as the International Year of Sustainable Tourism Development. Sustainable tourism includes ecotourism which, if structured properly (Lee and Jan 2015; Stephen and Neil, 1999), can help economically (Isaac, 2010a, b, c; Quttaineh, 2015 ; Tabash, 2017), help conserve biodiversity (Qumsiyeh and Handal, 2018), and, help reverse negative trends in world development and contribute significantly to the global Millennium Development Goals (Bricker et al., 2012). In SP several existing initiatives try to do

that (e.g. http://phtrail.ps; http://atg.ps/ https://bit.ly/2Zsj2b2; Szepesi 2012; Hanns Seidel Foundation, 2021).

According to Ghrouf (2010), popular destinations for ecotourism are the Southern Jordan Valley, the Dead Sea, Mount of Temptation, and Ain Fashkha. However, lack of tourism investment, poor publicity, and lack of sovereignty over these areas inhibit the continued development of eco-tourism in theState of Palestine. A Master thesis from Al-Quds University suggested the need for evaluating destinations of ecotourism in terms of certain indicators (gleaned from talking to presumed local experts). Yet, in SP not one person is yet qualified or trained professionally in ecotourism as a field. Much can be done to develop the tourism sector in SP in general but most of it is dependent on having sovereignty and political stability which is not forthcoming as long as the conflict and occupation continues. Most natural sites are under Israeli control in historic Palestine and in most of the occupied territories (see section 3.2 on protected areas). Thus, it is not surprising that, like religious tourism, the nascent sector of ecotourism is also mostly dominated by Israel (Ministry of National Economy 2013; see also http://www.ecotourism.org.il/).

However, even under occupation, development is possible, for example, having qualified human resources and structured programs that cater to different forms of tourism including ecotourism. The largest alternative tourism in SP today is not ecotourism but political tourism, including 'dark tourism' which is tourism of troubled spots and areas where dark human history happened, like in Deir Yassin and visits to refugee camps (see Isaac, 2010a). However, some very hopeful signs that some things can be done even under occupation and not just in areas of dark tourism and recruitment of international solidarity activists can be seen. For example, interest in walking and hiking through nature has increased in the past two years. Some books published regarding these such as (Szepesi, 2012) with attendant website. Additionally, the Palestinian Heritage Trail offers a model of community-based tourism that could be expanded and adopted elsewhere through the country.

Agricultural tourism can also be promoted because SP is rich in agricultural traditions and history being part of the Fertile Crescent where humans first developed domestication of plants and animals

In 2013, the EQA signed an agreement with the Ministry of Women's Affairs to deepen relationships that enhance environmental conservation (including biodiversity). The "Cross-Sectoral National **Gender** Strategy: Promoting Gender Equality and Equity" is a strategy that was set for the three years of 2011 to 2013 and its main goals were to eliminate discrimination associated with gender, to advocate human rights in SP. Specifically, it includes "*The right to control and use resources".* The right to equal opportunities between men and women in accessing, using and controlling resources include:

1. Natural resources: land, water and wells, forests, and livestock.
2. Human resources: skills, experiences, crafts, professions (doctors, teachers, farmers).
3. Financial resources: sources of income and inheritance.
4. Material resources: infrastructure, buildings and material assistance.

Globally, literature on natural resource management shows its importance to biodiversity conservation (Jhariya et al 2021; Williams 2011; De Lara and Doyen, 2008). The International Model Forest Network (IMFN) is a voluntary global community of practice whose members and supporters work toward the sustainable management of forest-based landscapes and natural resources through the Model Forest approach. A Model Forest can be described as a large-scale landscape encompassing many different land uses; a specific partnership-based approach to sustainable forest management; and a long-term process that adheres to a broad set of principles to promote sustainability https://imfn.net

Adaptive management of natural resources accroding to Williams (2011):

1- *The natural resource system being managed is dynamic, changing through time in response to environmental conditions and management actions that vary through time. These factors can influence resource status and the ecological processes by which resource changes are realized.*

2- *Environmental variation is only partially predictable, and sometimes is unrecognizable. Variation in environmental conditions induces stochasticity in biological and ecological processes, which leads in turn to unpredictability in system behaviors.*
3- *The resource system is subjected to periodic and potential management interventions that potentially vary over time. Management actions influence system behaviors either directly or indirectly, by altering system states such as resource size, or influencing ecological processes such as mortality and movement, or altering vital rates such as reproduction and recruitment rates.*
4- *Effective management is limited by uncertainty about the nature of resource processes and the influence of management on them.*

Locally, areas under sustainable management (ABT7) were reviewed in the 6th NR. The work done in central planning and management on this were partially effective. The National Agricultural Sector Strategy (MoA 2016, 2020) "Resilience and Development" 2014 – 2016 identified four strategic objectives for 2014–2016:

1) Ensure farmers' resilience and attachment to their land, while fulfilling the contribution of the agriculture sector in providing essentials for the development of SP;

2) Efficient and sustainable management of natural resources;

3) Enhanced agricultural production, productivity and competitiveness, as well as enhanced contribution of agriculture to food security;

4) The agriculture sector has effective and efficient capacities, institutional frameworks, legal environment, infrastructure and agricultural services.

Yet, continued Israeli occupation has had and could have more negative ramifications as many agricultural lands in SP are being developed by Israeli agriculture that is industrialized, and sustainable management of these lands become difficult without sovereignty. Finally, the new national spatial plan being worked on, if implemented, would allow SP to comply with the SDGs and with all the ABTs here, along withnew plans being formulated by CBD, mainly re the post-2020 global biodiversity framework and to comply with other planned Conventions.

Historic Palestine had access to both the Red Sea and the Mediterranean Sea. As the envisioned Palestinian stateincludes only 22% of historic Palestine (West Bank and Gaza Strip). The existing data on use of these resources were summarized in 6th NR (ABT6). The marine ecosystem of the coast of Gaza is suffering from overfishing and pollution (see also ABT 8). Part of the issue is the blockade of Gaza and ongoing Israeli violations of signed agreements and international law. The Palestinian Government has essentially no access to manage this issue under occupation.

Equitable benefit from nature must be ensured via proper distribution of wealth and benefits (Buchs, 2021) and this is important for conservation efforts (Tallis et al., 2008). In the region, natural resources are not equitably distributed and this is harmful for nature and for humans. A good example of this is the catastrophic situation in the Jordan Valley, devastated by Israeli exploitation, including diversion of its water and unfair exploitation of agricultural lands. This is also a transboundary issue (IPBES, 2018).

Women, youth and marginalized communities' empowerment in biodiversity conservation is critical. Proper distribution of wealth and benefits relies on increased accountability at the local and national levels, as well as labor organizing (farmers/agricultural workers' unions). It is also possible to develop ecovillages in the State ofPalestine (Weihe, 2016).

Enhancement of the use of ethnoecology and the values of bio-culture can enhance economic activities that are sustainable (e.g. agriculture tourism, increased production from permaculture, etc.) (Manzur, 2013; Toteva et al., 2021). Greater involvement of Palestinians in these areas can provide positive feedback to (both local and global) visitors to their areas, which brings additional solidarity and support. Small-scale farmers should be actively encouraged to engage in ecotourism as a way to supplement their income.

Cost benefit analysis research is needed as well as other researches related to natural resource management as it pertains to biodiversity (e.g. Becker et al., 2014; de Lara and Doyen, 2008; Dombrowsky et al., 2010). Such research should include adapting new technologies such as remote sensing and GIS to natural resource managment (Pettorelli, 2019).

Developing green economic activities like recycling, composting, local agriculture, food forests and more will help enhance the local economy and alleviate poverty (even in refugee camps and marginalized communities). Ways to do this include: lobbying the Government for recycling services, and to create community compost bins in neighborhoods and villages; building vertical gardens and rooftop gardens in apartment areas; developing homestays and local tour guide enterprises for ecotourism.

2.8 Conservation, Protected Areas, and Spatial Plans

> "As of May 2021, terrestrial coverage in Palestine (State of) is 516.8 km2 (8.4%) and marine coverage is 0.0 km2 (0.0%); national reporting shows 8.3% (504 km2)…. opportunities for the near-term include updating the WDPA with any unreported PAs, and the recognizing and reporting OECMs to the WD-OECM. In the future, focus on relatively intact areas, while addressing the elements in the following sections, could be considered when planning new PAs or OECMs. [Further] there is opportunity for Palestine (State of) to increase protection in terrestrial and marine ecoregions and pelagic provinces that have lower levels of coverage by PAs or OECMs. Ecoregions which currently have no coverage by PAs or OECMs are key areas for action." (Secretariat of the Convention on Biological Diversity, 2021)

Aichi Target 11 states that "By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes". The total area of protected areas (PAs) has grown globally. However, many challenges remain which hinder their effectiveness as critical safeguards against habitat loss and other human activities that decrease biodiversity (Chape et al., 2008). This Section will review the different categories of high biodiversity areas which include important plant areas (IPAs), important bird areas (IBAs), wetlands, and natural forests. It will also address the issue of protected areas in SP including the status of existing protected areas, proposed reserves, as well as areas of potential which could be designated as protected areas in the future. Data was obtained from several resources, including BirdLife International for the important bird areas, Radford et al. (2011) for the important plant areas, Ghattas et al. (2005) for the natural forests, and Garstecki et al. (2010) for the protected areas. Further information on the protected areas was obtained from the EQA. A cross-sectoral strategy (EQA, 2017) created by the Palestinian Government for the 2017-2022 period was developed and shared with key stakeholders, committed resources, and experts to increase awareness of environmental issues and find funds to study and conserve the environment.

The fragmented nature of the landscape in SP poses a challenge. Tabarelli et al. (2005) recommends dealing with such issues by: (1) incorporating protection measures as part of development projects; (2) protecting large areas and preventing the fragmentation of currently contiguous patches of forest; (3) managing forest edges when creating forest patches; (4) protecting gallery forests along waterways to connect isolated forest patches; (5) controlling the use of fire and the introduction of exotic plant species, and limiting the use of toxic chemicals in areas near forest patches; and (6) promoting reforestation and forest cover in critical areas of the landscape. Another major challenge for the EQA and relevant agencies in SP in implementing these steps is that there are few baseline studies which cover rich biodiversity areas, their location, distribution and what they contain. Maps of high concentrations of certain species show that the West Bank in particular has gaps, which is directly related to the lack of information or data collected in the West Bank (Levin and Shmida, 2007). Description of what we know so far is possible and then highlighting the gaps in the analysis and making recommendations for this area of work.

As noted in the sixth NR, protected areas in SP and areas of significant importance to them (like the Jordan Valley) are very limited in space. Only 9% of the land is protected in theory, and even less in practice. The first step in addressing this issue is allowing the local people to have sovereignty over their land and natural resources, i.e. ending the Israeli occupation. SP is currently engaged in developing a network of protected areas and adjusting management plans to meet the NSP and is also engaged in updating its NBSAP. This will have significant positive effects on protected areas provided SP is given sovereignty over its land and marine territories. Some areas like Wadi AlZarqa Al-Ulwi and Wadi Al-Quff (Qumsiyeh et al., 2016) could indeed be developed as biosphere reserves. UNESCO's Man and Biosphere (MAB) program had over a 50 year history of developing international cooperation related to human interaction with the biosphere. Over 700 biosphere areas in >120 countries are dedicated to conserving biodiversity, demonstrating sustainable development, and conducting research and education. The International Coordinating Council of the MAB Program was held virtually in 2020, where the Technical Guidelines for Biosphere Reserves were adopted (see https://en.unesco.org/sites/default/files/tgbr_en.pdf). The ArabMAB Network was officially launched in Amman (Jordan) in 1997. The concept has evolved over the years and now covers three functions: biodiversity conservation, sustainable development, and logistical support for research and capacity building. See UNESCO, Ecological Sciences for Sustainable Development and Bridgewater, 2016; Reed, 2016). Further, other effective area-based conservation measures (OECMs) can help save habitat and species (Hong et al. 2017; Jonas et al. 2017) and are developed via this NBSAP.

The SP benefited from many existing systems for Protected Area management. Dozens of books and resources and examples are available. For example, Natura 2000 is the largest coordinated network of protected areas in the world, stretching over 18% of the EU's land area and more than 8% of its marine territory (Natura 2000). Tools for monitoring of protected area management effectiveness can be found here. The METT template can be found on this page. The Protected Planet website here can be searched for particular protected areas including their WDPA ID.

Figure 2.2 Biodiversity and conservation benefits from PAs and OECM, and relationships to SDG (CBD website)

Commented [Ma2]: rename

A recent report on protected areas in SP, funded by a grant from the Belgian CeBios Measuring, Reporting & Verification (MRV) and expanded by IUCN/EQA/CEPF collective work on PANs in 2022, proposes:

1) **Ecosystem services and benefit sharing** (Annex II of COP Decision 14/8) can be addressed by setting biosphere reserves that take into account local needs. However, in many places this has not worked out due to bureaucracy and systems of governance that end up increasing rather than decreasing conflict over resources (Ganguly et al., 2003). There are guidelines from MAB (https://en.unesco.org/sites/default/files/tgbr_en.pdf, https://en.unesco.org/biosphere/designation, https://en.unesco.org/sites/default/files/biosphere_reserve_nomination_form_2013_en.pdf. Wadi Al-Quff area is a very good candidate for this as it is a small area with a well-developed management plan (https://environment.pna.ps/ar/files/Management%20Plan%20for%20Wadi%20Al-Quff%20Reserve.pdf)
2) **Increasing sovereignty** to give SP access to manage its nature reserves (currently many are considered area C) and utilization of international treaties and international laws to do this (Gillespie, 2007; Sands and Peel, 2012).
3) **More research and better planning**: The Sate of Palestine needs scientific data covering all areas of protected areas and potential protected areas by using the best available data collection methods on areas like geography, geology, hydrology, fauna, and flora. It is important in SP to build knowledge of

species (profiles) and threats (see this example from Australia https://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl and one including recovery plans in the USA https://ecos.fws.gov/ecp/ "In each country, the appropriate national ministry or agency should recognize the interdependence of targets to expand protected area networks that are important for biodiversity conservation (e.g. Aichi Target 11 and GSPC Target 7) and actions to prevent the extinction of known threatened species through in situ conservation of viable populations backed up by ex situ measures where appropriate (Aichi Target 12 and GSPC Targets 4, 5, 7 and 8). Failure to do so will perpetuate the current failure to achieve these targets." (Heywood, 2015). This also helps in prioritization since it is impossible to protect all threatened species. However, it is important to protect whole ecosystems rather than focus on individual species. An additional need is seen in order to perform more detailed studies on human impact on the environment caused by Palestinians or Israeli settlers (see Tal, 2002; Ginsberg, 2006; Abdallah and Swaileh, 2011; Al-Haq, 2015; Husein and Qumsiyeh, 2022).

4) **Controlling fires** through planting indigenous trees and plants and reversing the planting of fire-prone European species through the colonial fund called Jewish National Fund (Keren Keyemet LeIsrael).
5) Due to **limited resources**, it is critical to identify hotspots and key species to direct resources for conservation and to use buffer zones around protected areas with local buy-in.
6) Creating and implementing a system of **building capacity** of developing leaders who are able to take on tasks in protected area management and strategies at a local, regional, and global scale. Towards that end, a Masters program in Biodiversity and Sustainability has been established at Bethlehem University.
7) Consider using the model of **Plant Micro-Reserve** (PMR) as used in Spain and Central and Eastern Europe when it is impossible to protect large areas (Kadis et al., 2014)
8) A **new vegetation map** of Palestinian areas is needed. For history of earlier maps, see Zohary, 1947; Danin & Orshan, 1999, taking into account the shifting boundaries of the phytogeographical zones (Soto-Berelov et al., 2015). A good model for this in a neigbouring country in Taifour et al., (2022).
9) Many of the protected ares sit on transitional zones, like El Kanub for instance, whose management needs special attention
10) Restudy the area and produce **more refined PAN periodically,** starting with a revaluation in 2030.
11) **Reevaluate KBAs** using global criteria (Langhammer et al., 2007). KBAs are "sites of global significance for biodiversity conservation. They are identified using globally standard criteria and thresholds, based on the needs of biodiversity requiring safeguards at the site scale. These criteria are based on the framework of vulnerability and irreplaceability widely used in systematic conservation planning."
12) **Increase forested areas** from 4% (Ministry of Agriculture) to 6% by 2050. Alsobetter management is needed of forests in protected areas (Dudley and Philips, 2006) https://www.pcbs.gov.ps/SDGsAr.aspx?pageId=15.
13) A project to **control invasive alien species** in PAN is necessary (Foxcroft et al., 2013)
14) IUCN Red Listing is important for area conservation, for informing spatial options (e.g. identifying important plant or bird areas) and informing temporal options, for example relating to previous destruction or threat analysis Red listing ecosystems can also be incorporated (Keith, 2015).
15) There is a need to d**evelop systems of permaculture and food sovereignty** around PAN areas
16) **Upload data** on PAN work on the CBD website https://www.cbd.int/protected/implementation/actionplans/
17) **Integrate PAN into spatial planning** (Ervin et al., 2010).

By 2030, work towards the **60% target for management effectiveness** for PAN (per COP Decision X/31). There are guidelines for management (Phillips, 2002; Thomas and Middleton, 2003) and potential funding sources for PANs (IUCN, 2000; Emerton et al., 2006; European Joint Programming, 2019).

2.9 Mainstreaming: Environmental Awareness, and Activism

The CBD in Article 13 emphasized the need for Communication, Education and Public Awareness and to set up mechanisms to do this. Further, CBD's 2016 COP Decision XIII/22 included a framework for communications. Globally, there is an increased awareness of environmental issues (de Oliveira Caetano et al., 2021). But mainstreaming is still far behind, as reported by CBD globally, and is uneven (see Whitehorn et al. 2019). The CBD's main vision is "by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people''. This requires mainstreaming via education and awareness as well as activism to achieve societal behavioral change (Maynard et al., 2020).

The 1977 Tbilisi Intergovernmental Conference on environmental education identified key objectives that allow learning for behavioral change and rejected the older model that presumes that increasing awareness of environmental issues (knowledge transfer) leads to behavioral changes (Hungerford & Volk, 1990). UNESCO suggested methods for integrating environmental education in schools via project-based approaches and student-centered learning techniques as well as civic engagement (Corraliza & Berenguer, 2000; Fauville et al., 2014). There is increased emphasis on raising awareness, understanding, knowledge and changing behavior to mitigate and adapt to climate change (Ojala, 2012) in line with the 17 UN Sustainable Development Goals (SDGs).

There are many benefits to community involvement in conservation efforts (Heywood et al., 2018):

1. **A better understanding of local and historic context:** Local communities often have a wealth of information which can be utilized to improve species recovery outcomes. Involving local communities in the planning phases of a species recovery program can help to better identify the causes of species decline and identify management interventions that will work in the local situation.
2. **Financial costs can be reduced:** Often conservation projects are under-resourced but can require a large labour force to carry them out, e.g. for removal of invasive or competitive species.
3. **Communities can provide continued monitoring:** Whether through a formal or informal approach that involves payment or not, local communities will often be the best-placed people to carry out monitoring following species recovery interventions. In addition to scientific measurements, that can either be taken by the core project team or by local communities trained in monitoring techniques (see Chapter 12), local communities can help by informing project managers of an increased prevalence of threats, e.g. from fire, theft or extreme weather conditions. This will help to keep the project on track, even if project managers are located far from the site
4. **Communities can act as long-term custodians/protectors**: Involvement of communities in species recovery planning and actions can lead to a heightened sense of responsibility, ownership or custodianship of the species or habitats involved. This often leads to people independently taking measures to continue to protect or improve the status of the species of interest, beyond the timeframe of the original project, acting as the "front-line" protection for the species.
5. **Threats can be reduced**: In some cases, humans pose the biggest threat to species survival. Through awareness raising, involvement of communities in project activities, or provision of alternatives or incentives to relieve pressure on wild populations, a greater understanding of the negative impact of human activities and the importance of **conservation can be achieved, which can reduce the prevalence of threats.**

Formal education

The Ministry of Education (2016) Sector Strategic Plan to 2022 states, "Education can present people with skills to participate in constructing and keeping cities more sustainable and more resilient in times of disasters. Education is also key to full understanding and reduction of the impact of climate change, especially at the local level. Education and training optimizes skills and

capacities necessary for supporting sustainable livelihood means, preserving natural resources and biodiversity, particularly in environments at risk. The Ministry of Education and Higher Education gives special attention to environmental issues. In cooperation with PCBS, it makes a full biennial periodical survey of the educational environment in schools, preschools, universities and other higher education institutions. It also provides green and environment-friendly schools buildings. It uses clean energy and grows the lands owned by education facilities. It also promotes students attitudes towards hygiene and gives environmental issues enough room in the curricula." Specific to biodiversity, the Strategy calls for "Understanding biodiversity and its relationship to human well-being needs to be included in basic educational programs and promoted through public media. Reports pointed to the possibility of providing a broader share for the public and decision-makers to recognize the role and value of biodiversity, and that the steps necessary to preserve biodiversity can be done through education and more effective dissemination of scientific knowledge"

The number of higher education institutions in SP has reached 52: 35 in the West Bank and 17 in the Gaza Strip. The number of students who enrolled in the academic year 2019/2018 is 60,290: 35,019 female and 24,281 male. The number of higher education institutions reached 17 universities, 17 intermediate university colleges, and 18 undergraduate colleges. Yet, education in SP has many challenges (Birzeit University, 2021). At graduate levels, while there are many programs and universities that offer some courses related to environment (see Section 1.6 on stakeholders), there are really no formal programs which focus on biodiversity, sustainability, and/or climate change. There is now talk of a package of programs (Diploma, Bachelor and Masters) in these topics at Bethlehem University. Yet, it must be cognizant that having formal programs by itself is not sufficient. These programs need to be linked to society (ecosystem services) and enhance the civic engagement of students (Hurtado, 2007; Gilmanshina et al., 2018).

A review of the existing curriculum should be done to ensure it fits with societal needs in relation to environmental conservation and biodiversity, especially to comply with signed Agreements and international Conventions as well as synergies and cross-sectoral issues already identified in national strategies including this NBSAP.

Informal Programs

The Sixth National Report lists activities in environmental awareness and education done by GOs, NGOs/CSOs, and academic centers. In the briefing above of achievements and in the report itself, this area is actually considered the best in early achievements towards the AICHI targets. Awareness is also evident by increased social media and popular media (like magazines and articles) involvement and public awareness (see Table below). It is also evident by the growing number of workshops, summer camps, hikes, and other activities that relate to environmental awareness. Extracurricular programs globally indeed can help in sustainable development (Kosarikov and Davydova, 2021).

Table 2.1: Selected webpage sites for environmental media for public awareness and education.

Afaq Al Be'a wa Al Tanmia	http://www.maan-ctr.org/magazine/
Afaq Khadra'	http://www.raya.ps/ar/raya-programs/924607.html?episode=4401
Alternative Tourism Journal	http://atg.ps/
Auja Eco Center	http://www.aujaecocenter.org/
Environmental Discussions	http://www.wattan.tv/wattan-tv/81324.html
Eye on the Environment	http://www.wattan.tv/wattan-tv/87218.html
Mahmiyat	http://Mahmiyat.ps
Nature reserves in Palestine	https://www.youtube.com/watch?v=rcach-xMB_Q
Network for Experiential Palestine Tourism Group (NEPTO)	http://www.nepto.ps/

PENGON	http://www.pengon.org/en/environmental-unit/enviroment-database
Palestine Institute for Biodiversity and Sustainability	http://www.palestinenature.org
Shaqa'eq Al No'man	http://www.maanctr.org/magazine/Archive/Issue52/Friends.php
This Week in Palestine	http://thisweekinpalestine.com/

Ecotourism can also act as an environmental awareness activity (Ramírez and Santana, 2019; Hanns Seidel Foundation, 2021; Szepesi, 2012).

The General Directorate for Environmental Awareness and Education within the EQA is responsible for integrating environmental concepts and the development of Palestinian curricula. The EQA (2014) developed the National Strategy for Environmental Awareness and Education for the years 2014-2020. In this strategy, three main objectives were identified as:

a) creation of active and successful environmental media capable of upgrading the level of environmental awareness,

b) introducing integrated and creative educational curricula and activities, and

c) enhancing modern concepts of environmental values and practices.

Significant achievements 2015-2021 (from the 6th NR CBD):

1) 400 Environmental Clubs were established in schools across the West Bank and they communicate with each other via social media (Facebook). These school clubs are supported and encouraged to develop small environmentally-friendly projects such as biogas, gardens, water reuse, etc.

2) Educational videos were prepared (9 by EQA, >12 by PIBS-BU, etc.) catering to school students on subjects such as climate change, alternative energy, biodiversity, water issues, desertification, and pollution.

3) Summer camps for school students focusing on the environment were done by the EQA and by academia (e.g. PIBS-BU) and by NGOs (e.g. EEC).

4) Pamphlets and brochures were produced: by PIBS, by EQA, and by MOA.

5) Curriculum development by the MOE incorporated many elements of environmental awareness and conservation issues. There has been also some examination of curricula related to EE (Karama, 2016). Extracurricular activities also seem to produce a significant effect (Weibert et al., 2017).

6) Many universities and NGOs (e.g. Qattan) hosted science festivals that include environmental awareness activities.

7) Hundreds of workshops were organized to raise awareness on environmental issues. Some were done at the organizations sponsoring them (NGOs, Academia, GOs) and some were done in communities such as at community centers and at schools. Some examples are:

- http://www.wildlife-pal.org/article/107/Enhancing-Environmental-Awareness-among-Palestinian
- https://www.lutheranworld.org/news/palestine-teaching-youth-how-care-earth
- https://www.swim-h2020.eu/17-18-september-2017-ramallah-swim-h2020-sm-training-on-education-for-sustainable-development-esd/
- https://www.hebron.edu/index.php/en/news-archive-3/5180-news-6-5-013-4en.html
- https://www.uri.org/uri-story/20110805-environmental-workshop-youth-palestine

- http://english.pnn.ps/2018/11/20/environmental-conference-a-crime-against-the-environment-is-a-crime-against-a-human-being/

8) Formal education at colleges and universities: There are dozens of programs in universities and colleges that either include environmental education as part of formal courses (e.g. in biology Bachelor degrees) or in separate specialized programs (like the Environmental Sciences programs at Birzeit and PPU). But a complete overhaul of existing and weak programs is needed (Isaac et al., 2019). Programs should especially connect to needs of society and nature (Lieblein et al., 2012)

9) Environmental media/PR efforts: These include dissemination via mainstream and social media and in other ways things like audios, videos, articles, memes, ideas etc. Media outlets like آفاق البيئة والتنمية and the "This Week in Palestine" magazine highlight major environmental topics. There are also at least 25 Facebook pages that actively post on topics relating to the environment (including biodiversity) in SP.

- https://www.cleantechloops.com/environmental-awareness-palestine/
- https://journals.aserspublishing.eu/jemt/article/view/408

10) Research articles: Using Scholar.google.com with keywords Biodiversity + Palestine/State of Palestine showed that in 2009-2014 there were 4480 scholarly articles on this topic, while this number nearly doubled to 8190 in 2015-2021. These articles act as awareness-raising, bringing SP's biodiversity into local, regional, and global prominence and thus enhancing conservation.

11) Campaigns and targeted projects: A number of these were instituted in SP that produced tangible results on the ground in terms of behavioral change (education/awareness). Here are some examples:

- https://palestine.actionaid.org/news/2020/palestinian-youth-lead-actions-climate-change
- https://www.anera.org/blog/anera-environment-empower-palestine/
- https://www.bankofpalestine.com/en/about/news/706
- https://minorityrights.org/trends2019/palestine/
- https://www.yesprograms.org/stories/naddf-awareness-campaign-better-environment-palestine
- https://2014-2019.switchmed.eu/en/country-hubs/palestine/actions/Palestine%20is%20shifting%20towards%20more%20sustainable%20lifestyles.html?c=policy&q=palestine
- https://www.jica.go.jp/english/publications/j-world/1810_03.html
- https://www.buildpalestine.com/2021/08/30/challenges-and-opportunities-for-environmental-startups-in-palestine/
- https://www.enabel.be/content/enabel-palestinian-territory
- https://www.facebook.com/eliehfb

12) Visits to educational facilities: Educational facilities related to environment and biodiversity include permaculture farms, museums of natural history, botanical gardens, etc.

- https://www.earthisland.org/journal/index.php/articles/entry/green_activism_in_palestine/

13) In 2016, the EQA recommended the designation of a national flower, the Faquoa (*Iris hayenae*), and a national bird, the Palestine Sunbird (*Cinnyris osea*). The Ministerial Committee/Cabinet adopted a Resolution regarding this matter. This increased awareness not only of those two species but also of the importance of protecting biodiversity in general. This was evident by our surveys of both stakeholders and the general public about the importance of designating and knowledge about national species.

Taken together, all these movements and actions suggest there has been progress towards the earlier environmental education and awareness targets related to NBSAP. A survey done in 2006 showed that 78% of Palestinians are concerned about the environment and 84% consider the mismanagement of environmental affairs as the main reason for the deterioration of the environment. In 2021, and as part of

building the 6th NR for CBD, PIBS conducted a public survey to estimate the public's general knowledge regarding biodiversity and protected areas in SP. Based upon a survey of 50 people, 46% claimed to have great knowledge regarding biodiversity, 50% claimed to have mediocre knowledge, and 4% claimed to have no knowledge regarding biodiversity at all. When asked about the possible ways to increase environmental awareness in SP, the two most popular answers were 1) introducing more environmental-related curriculums in schools and universities, and 2) discussing environmental topics and issues on media platforms. More on extracurricular activities being done for women and youth and community at large are found in the three Sections that follow.

Ancillary facilities: Museums and eco gardens can also play a critical role in providing extracurricular activities that lead to behavior change among visitors (Hall and Sutter, 2019; Qumsiyeh, 2017; Qumsiyeh et al., 2017). Natural History Museums are significant sources of environmental education (Dillon, 2003; Krishtalka and Humphrey, 2000). That is why developing additional museums like PMNH and in other locations in SP and strengthening their role in education are important (see http://palestinenature.org). The same importance is also given to botanical gardens in raising environmental awareness. There are small gardens trying to become botanical gardens housing some native flora: in EEC, PMNH (Bethlehem University), BERC, at Al Najah University, and at Birzeit University (associated with both its Biology Department and the Palestine Museum). The latter Institute published a list of local plants found at the garden (authored by Jamil Harb).

There is controversy about the use of zoos in education, concerning environmental conservation. In SP, there are three small zoos: in Qalqilya, Gaza, and Beit Sahour. One zoo in Khan Younis was recently closed and the last remaining 15 animals there rescued by an international organization called Four Paws (see link).

Strategies and action plans: A national strategy for environmental education and awareness exists (EQA, 2014). The strategies and associated plans outlined in it were:

1) Effective and efficient environmental media: This includes strengthening media outlets in environmental issues including education new capacity building; use of social and mainstream media; highlighting new initiatives and innovations, exposing Israeli crimes against the environment; inclusion of environment in university courses such as those in media and social sciences.

2) Curricular and extra-curricular educational programs strengthened and expanded. This includes expanding curriculum offered, improving them towards investigative journalism, teacher development, community participation in education, merging education with environmentalism, enhancing school and university environmental initiatives, pre-school projects of environmental awareness.

3) Society develops principles and practices related to environment. This includes ensuring civic participation, recycling/reducing/reusing activities, enhancement of social initiatives, promotion and inclusion of those in local and international conferences, exchange of expertise locally and globally, women and youth engagement and empowerment, increased awareness in ecotourism, increased public awareness of Israeli impact on the environment, institutionalization of EEA, increased knowledge of climate change in society, involvement of political leaders and other,

The EQA has received funds from Sweden through the Swedish agency for international cooperation SIDA to implement a three-year program titled “Strengthening Palestinian Environmental Action Program”, aiming to contribute to the implementation of the Palestinian Environmental Action Program. The overall objective of the program is to improve the protection of the environment in SP and support the EQA to improve/fulfill its role as the lead and regulatory institution in the sector. The program includes four strategic objectives: i) Improved environmental governance; ii) Improved capacity to manage environmental pollution; iii) Improved capacity for natural resource protection; and iv) Improved public awareness and flow of information (EQA, 2020).

Selected Recommendations:

1. Establishing centers of biodiversity conservation concerned with particular areas including protected areas (e.g. see biologicaldiversity.org).
2. Highlighting "heroes" of conservation, for example: Najla & zero waste and البحر النا and Initiative for Biogas in Tulkarem.
3. Mobilizing youth networks to protect the environment (e.g. see -- الشبكة الشبابية الفلسطينية للتغير البيئي الجناح التفاعلي لمجلة افاق البيئة والتنمية and Sharek Youth Forum and Zimam and Juthour.
4. Greater publication at national and regional levels of the excellent online magazine مجلة افاق البيئة والتنمية
5. Expanding citizen science activities that provide exciting opportunities for people to engage, have fun, but also contribute to biodiversity knowledge and conservation (Dickinson et al., 2010; Tweddle et al., 2012; Galbraith et al., 2016; Steven, 2017; Soteropoulos et al., 2021).
6. Developing new diplomas, BS, MS, and Doctorate programs related to biodiversity and sustainability
7. Developing better structured extracurricular activities, including mobile educational centers, mobile applications, use of social media, etc.
8. Mobilizing and enhancing the work of networks like PENGON and Palestine Action for the Planet and Gastivists.
9. Expanding the number of projects that produce good materials and pamphlets, (often funded by international agencies) that have produced good material and pamphlets' such as this guide to ethical consumption in Palestine
10. Mobilizing institutions that work on sectoral issues to connect their issues to biodiversity. Examples are: https://www.phg.org , https://reform.ps/, https://www.aman-palestine.org, and https://hmccenter.weebly.com/
11. Setting up NGOS that focus on particular area conservation. Like this in Lincoln https://lincolnconservation.org/
12. Designating more species as 'national', for example a national mammal, a national butterfly, etc.

2.10 Mainstreaming: Youth Engagement

Nations and powerful organizations (such as CBD, COP) around the world that aim to protect and conserve the environment, biodiversity and indigenous peoples believe that youth is the major power tool to change the world towards sustainable environment and conservation (Kaukonen, 2014; Calara, 2020; Morar and Peterlicean, 2012).

Youth and future generations are the ones whose livelihoods are and will be most impacted. Engaging these generations with right environmental education awareness, in workshops and also in decision-making by governmental organizations, NGOs, and national organizations help to develop the seeds of environmental protection, conservation and sustainability for their future.

This example of an effort to engage young people directly, and to listen and consider the barriers that they encounter and the tools and resources they need to engage effectively, offers a snapshot of the path ahead (InterGens, 2021).

The EQA 2020 proposed actions to promote behaviors associated with environment preservation and increase public environmental awareness. Specifically:

a) Create environmental clubs, b) Complete the integration of environmental education into curricula at different levels of education, c) Activate the instruments of environmental media, d) Organize environmental awareness campaigns targeting different social segments, e) Establish a national center for environmental training and education purposes, f) Develop a plan to promote environment-friendly initiatives.

Environmental Activism Directed (mostly) at youth: The Global Youth Biodiversity Network (GYBN) is an international network of youth organizations and individuals from all over the world whose common goal is to prevent the loss of biodiversity. Gallagher and Myers (2016) articulated principles of environmental activism that emphasized the need for grassroot campaigns that work in conjunction with other tools (legal, regulatory, etc.) to effect biodiversity conservation. The successes of movements is variable and nuanced. A good example of this is the very partial and minimal success achieved by activists from around the world, including the global south, at COP26 for climate change in November 2021.

There are social media websites on Facebook that relate to biodiversity and conservation in SP which can be particularly useful for engaging youth.

2.11 Mainstreaming: Gender issues / Women's engagement

Gender mainstreaming and women's engagement should be at the center of an inclusive strategy of sustainability and biodiversity conservation, to ensure both equity and improve community-based conservation outcomes (Ogra, 2012; Poor et al., 2021). Stressed resources and inequality increase gender-based violence and cause further misallocation of natural resources, depriving women of benefit sharing (Wen, 2021). Women take the lead in the most successful conservation efforts (Aijazi and Basu, 2021). Progress in areas of sustainability, conservation, and development are relevant to the lives of women and their social and economic roles which remain dependent upon the sustainability of local and natural resources (Al-Azzawi, 2013). Also, the traditional knowledge of women is important in guaranteeing food security and conserving biological diversity (Deda, 2004) and related conservation, development and livelihood concerns.

In order to respond to women's needs and aspirations as key stakeholders in sustainability and biodiversity conservation, participation is required at all levels of programs, policies and other actions at sub-national, national, regional and international levels (Alvarez and Lovera, 2016).

> "Success will depend on ensuring greater gender equality and empowerment of women and girls, reducing inequalities, greater access to education, employing rights-based approaches, and addressing the full range of indirect drivers of biodiversity loss, as identified by the *Global Assessment Report on Biodiversity and Ecosystem Services* issued by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services [IPBES 2019], including those not directly addressed by the goals and targets of the Framework, such as demography, conflict and epidemics, including in the context of the 2030 Agenda for Sustainable Development." CBD post 2020 Framework

Although there has been a broad acknowledgment that women's local and traditional knowledge is fundamental to guarantee food security and conserve biological diversity, few women are represented at the managerial and decision-making level of environmental movements and organizations (Deda and Rubian, 2004) including in SP. Disconnection between international rhetoric and on-the-ground practice as it relates to gender and community-oriented wildlife conservation should be addressed by increased opportunities for professional capacity-building among project supervisors and staff members, coupled with increased collaboration between social and natural scientists (Ogra, 2012). The United Nations, its agencies and Agreements have long promoted the full and effective participation of women in decision-making processes.

In 2013, the EQA signed an Agreement with the Ministry of Women Affairs to ensure women participate fully in environmental issues. Such participation should be empirically grounded to ensure gender-mainstreaming practices (Ogra, 2012), , gender equity and equality in practice on the ground and ensures representation of women at the managerial and decision-making levels (Deda P., 2004). The "Cross-Sectoral National Gender Strategy: Promoting Gender Equality and Equity" is a strategy that was set for the three years of 2011 to 2013 and its main goals were to eliminate discrimination associated with gender,

and to advocate human rights in SP (UN Women, 2011). Specifically, it refers to "*The right to control and use resources"*. The right to equal opportunities between men and women in accessing, using and controlling resources includes:

1. Natural resources: land, water and wells, forests, and livestock.
2. Human resources: skills, experiences, crafts, professions (e.g. doctors, teachers, farmers).
3. Financial resources: sources of income and inheritance.
4. Material resources: infrastructure, buildings and material assistance.

Gender considerations in West Asia are critical because women are more connected to the land and are custodians of its cultural heritage which relate to agrobiodiversity (Abdelali-Martini et al., 2008)

Recommendations based on literature review

1. Women's empowerment is critical for biodiversity conservation and better natural resource management (Al-Azzawi 2013; Abdelali-Martini et al. 2008), and it begins with capacity-building and mainstreaming biodiversity with women in empowering ways. In many areas they are far more effective, for example when women are empowered in areas of agriculture and ethnoecology; (they are far more protective of cultural and natural heritage). The same can be said for developing green economic activities like recycling, composting, local agriculture, food forests and more. This will help enhance local economy and alleviate poverty (even in refugee camps and marginalized communities).
2. Empowering women should be rights-based (Ferre, 2021): "The right to food, right to a safe and clean environment, right to education, sexual and reproductive rights, etc.) [This includes] access to resources (land, water, seeds), assets (training, services, transport, finance, markets) and institutions (local to global, formal and informal)."
3. Engaging women in environmental restoration initiatives (e.g. rangeland rehabilitation, reforestation using multiple-use trees such as olives and date palms, etc.) to provide short-term and long-term employment while enhancing the environment and biodiversity. (West Bank and Gaza Environment Priorities Note P169628)
4. Revisiting the Ministry of Women Affairs 2013 Agreement with the EQA in ways that enhance biodiversity conservation (see Padmanabhan, 2011).
5. Establishing formal networks of women's groups and relevant organizations to link all national actors and improve inter-organizational and cross-disciplinary cooperation and collaboration in promoting and facilitating gender mainstreaming. (Alvarez, I. and Lovera, S., 2016)
6. In work with local communities near protected areas, women's unions, women's cooperatives, and others should be engaged in all stages of conservation from planning to actual protection to ecosystem services.
7. In considering ecosystem services (benefits from natural resources including biodiversity), gender equity must be ensured(Lau, 2020).
8. Women in SP must be involved actively in all policy deliberations and implementations (Goldschmidt et al., 2015; Hasso, 2005; Richter-Devroe, 2008).
9. Gender issues are critical also in poverty alleviation in relation to biodiversity (Bechtel, 2010).
10. Framing conservation action through the lens of reconciliation and redress, focusing on the gendered impacts of injustices relating to biodiversity - such as land grabs and territorial enclosures (Armitage et al., 2020). Providing capacity-building on women's rights in order to implement this restoration, reconciliation and redress.
11. Gender mainstreaming (GM) can improve community-oriented conservation outcomes because gender roles often shape values, knowledge, use, and access/control of environmental resources. As such, NGOs and other groups are advised to set specific gender mainstreaming policies (Ogra, 2012b)
12. Strengthening research on gender issues related to biodiversity conservation (Liu et al., 2017) including environmental education research (Gough and Whitehouse, 2019).

13. Financial flows should be directed with a strong consideration of women's potential contributions towards addressing the underlying causes of ecosystem degradation and away from merely general incentivized actions (Alvarez and Lovera, 2016).

2.12 Genetic Resources, Agriculture and Agrobiodiversity

"Agriculture increasingly faces new shocks, stresses and risk drivers from a variety of sources, including: more frequent and extreme climatic events, biodiversity erosion, new diseases, climate change, natural resource degradation, an ageing farm population, seasonal labour shortages, food safety scares and commodity price volatility." (FAO, 2021; see also Stone & Rahimifard, 2018)

Agricultural biodiversity encompasses the variety and variability of animals, plants and micro-organisms which are necessary to sustain key functions of the agro-ecosystem, its structure and processes for, and in support of, food production and food security (FAO, 1999). Agricultural biodiversity provides not only food and income but also raw materials for clothing, shelter, medicines, breeding new varieties, and performs other services such as maintenance of soil fertility and biota, and soil and water conservation, all of which are essential to human survival (CBD).

The production of crops and livestock is a major driver of biodiversity loss, occupying 50% of the global habitable land surface (Ritchie, 2019). Some 75% of plant genetic diversity has been lost as farmers worldwide have left their multiple local varieties and landraces for genetically uniform, high-yielding varieties; 30% of livestock breeds are at risk of extinction; today 75% of the world's food is generated from only 12 plants and five animal species (FAO). Agriculture increasingly faces new shocks, stresses and risk drivers from a variety of sources, including: more frequent and extreme climatic events, biodiversity erosion, new diseases, climate change, natural resource degradation, an ageing farm population, seasonal labour shortages, food safety scares and commodity price volatility. (FAO 2021; see also Stone & Rahimifard, 2018).

The objectives of the agrobiodiversity strategies are to promote the positive effects and mitigate the negative impacts of the agricultural practice on ~~the~~ biological diversity, the conservation and sustainable use of genetic resources and the scientifically sound use and equatible sharing of resources.

Uniqueness of Palestine

- SP is part of the Fertile Crescent where domestication of crops, 'agriculture', was first developed around 10,000 years ago (Preece et al., 2017).
- SP's local fauna and flora have several endemic species, and the preservation and protection of genetic resources and agro-biodiversity is essential and crucial. This is especially important because of the presence of many wild species that are ancestors of domesticated species.
- For plants, endemic species are preserved in gene banks, used in scientific research and exploited for the development of crop cultivars in agriculture. The preservation and protection of this germplasm is of national, regional and global value and importance.
- For animal diversity, preserving both wild animal diversity as well as domestic animal diversity (genetic resources) are of priority as part of the State of Palestine's natural and human heritage and for utilitarian purposes.
- SP has an increasing population that requires more food to meet its required needs.
- The unique and difficult political situation in SP has led to an increase in population density and migration to cities at the expense of agricultural land~~s~~. This necessitates clear and urgent strategies and priorities for agricultural diversity and the greening of the countryside and cities in order to overcome threats to crop production and animal farming and its sustainability.
- Very few studies and research existed in this field in SP (ICARDA, 2005), but here are now more recent publications, projects, new institutions and activities.
- There is added urgency as the eastern Mediterranean is projected to suffer from extreme weather events, higher average atmospheric temperatures, reduced precipitation and limited water resources (IPCC Sixth Assessment Report); this is already having a negative impact on agriculture and is projected to become worse in the near future.

The updated MOA (2020) Strategic Goals for the Agriculture Sector

1) Increased resilience and steadfastness of Palestinian farmers on their land.

2) Self-sustenance in food production and disengagement from the Israeli food supply system.

3) Natural and agricultural resources managed in sustainable ways including adaptation to climate change.

4) Enhance production, productivity, and competitiveness of the agricultural sector.

5) Farmers have access to support services that meet their needs in quality, quantity, time, and cost.

6) Having a legal environment for the sector that is efficient and effective.

Yet, the strategy and actions still contained little in terms of things that can help protect biodiversity like reducing/eliminating chemical pesticides and reducing the use of chemical fertilizers.

The (Arabic) new MoA (2020) program reiterated the same points noted above and added some targets to 2023 such as: increasing the irrigated agricultural area by 37% from the current area; Increasing the amount of irrigation water by about 2.8 million cubic meters; increasing the amount of plant production by 25-30% of the current production; cultivating 180,000 fruit tree seedlings; and increasing agricultural areas by about 5000 dunums.

SP has not as yet signed the Nagoya Protocol (2010) but it will be very important to do so. In particular, research and other benefits should be extended to the public (Marden et al., 2021). However, there are individual and local initiatives to study genetic resources for domesticated plants (e.g. Abuzayed et al., 2018; Al-Atawneh et al., 2008; Alimari et al., 2017; Abu-Qaoud, 2015; Al-Fares and Abu-Qaoud, 2012; Ali-Shtayeh et al., 2017; Barazani et al., 2008b; Basheer-Salimia et al., 2013, 2014; Franklin et al., 2020; Konvalina et al., 2012; Sawalha et al., 2008). Israeli scientists have published hundreds of papers related to the local genetic resources of SP which they have expropriated (search genetic resources Israel in scholar.google.come to see the listing). There are far fewer works related to animal genetic resources (e.g. Badran, 2011; Agossou and Koluman, 2017). While more studies are needed on local varieties and their conservation, the issue of valuation and use of genetic resources in SP as elsewhere remains underutilized (Gepts, 2006; Oberthür and Rosendal, 2013), especially in regards to local indigenous people such as Palestinians (Aguilar, 2001; Roa et al.. 2016).

Current Palestinian laws do not include any article related to the Nagoya Protocol on access to and benefit sharing of genetic resources. However, there are currently two related consultancies done for the EQA: To begin with isbiosafety, and the second is the review of the environmental law in SP. One of the outputs of the latter is the recommendation to ratify the Nagoya Protocol. The results of the two consultancies will be included in this NBSAP.

Decree-Law No. (14) of 2018 regarding the amendment of the Agriculture for SP Law No. (2) of 2003, as amended, includes: Chapter II on agricultural genetic resources states in Article (27) that agricultural genetic resources shall be deemed to be a property of the State and shall be subject to the principle of national sovereignty. The State shall also respect the individual property rights of the common local strains. In Article (28) it says that, in coordination with other competent authorities, the Ministry shall conserve the agricultural biodiversity and use it in conformity with the public policy in the following manner: 1) by listing the local genetic strains and origins, 2) by preserving and protecting genes and genetic origins, and 3) by the adoption of particular sources and mechanisms to reproduce genetic origins and strains.

While we don't have a national action plan to protect and preserve traditional practices and knowledge related to nature, there is a new cultural heritage law adopted 2018 which regulates and protects both tangible and intangible cultural heritage in line with article 8j of the Convention. There is strong support in the local population to protect their identity and their natural and cultural heritage, and this has a strong advantage in protecting biodiversity. For example, there are projects which bring together traditional knowledge and nature conservation such as turathna.palestinenature.org. Today, the population is struggling to uphold this indispensable heritage due to the ongoing occupation activities such as removal from the land, increased refugee population, gentrification, and deterioration of the natural environment. The new NBSAP being worked on now will highlight this area and develop action plans related to use of traditional knowledge.

The following recommendations relating to the development of a national forest genetic resources programme were made by FAO (2004):

1. Countries with significant forest resources need to consider developing a national strategy for the conservation of forest genetic resources.

2. The national strategy needs to be elaborated in accordance with perceived and known international and national needs, as well as institutional and financial capabilities.

3. Take conservation of forest genetic resources into greater consideration in the planning of new protected areas.

4. Improve linkages and coordination between government departments involved in conservation and management of forest genetic resources

5. Undertake an inventory of forest tree species.

Other issues for consideration

1) **There will be updates of the national agricultural strategies** to include issues of biodiversity in general and agrobiodiversity/genetic resources in particular. Many countries have separate national plans for agricultural biodiversity (including prokaryotes, animals, and plants). They usually include in situ and ex situ conservation of agrobiodiversity. It is essential to learn from other successful strategies in order to build and develop a specific strategy for agrobiodiversity which meets the specific environmental, political and economic conditions in SP (Garnett et al., 2013; Tscharntke et al., 2012; Wezel, 2014).

2) **Conserve Soil.** It is essential to conserve soil health and microbial diversity as a cornerstone for sustainable agriculture. For details on how to conserve and replenish soils see link and published works like Wachira et al. (2014), Tibbett et al (2020), Bach et al. (2020). Chemical fertilizers have affected the soil quality and have caused a lot of environmental problems (Han et al., 2014; Min et al., 2016). Loss of soil quality is associated with soil organic matter (SOM). The reduction in SOM might be due to continuous cropping without rotations, frequent soil tillage, and massive use of both chemical fertilizers and non-selective pesticides (Pane et al., 2015). It is suggested that the application of organic fertilizers can increase soil fertility and crop productivity by reducing the leaching of nutrients and supplying nutrients to plants. The chemical and biological stability of organic fertilizers has a high potential for improving agronomic systems in most tropical and subtropical soils since they are generally poor in organic matter.

Supporting the application of organic fertilizers in Palestinian soils is advised, this is due to itspotential to stimulate plant growth and increase yields, with minimal harmful risks to the environment. To reduce the chemical fertilizers' harmful effects on soils, various types of organic fertilizers/organic soil amendments can be used to restore and replenish what has been taken by plants, without affecting soil microorganisms. For instance, biochar is a fine-grained, highly porous charcoal substance that can be used as a soil amendment (Hunt et al., 2010). Other organic substances that can be used as soil amendments are compost and vermicompost. The first is an organic fertilizer derived from the breakdown of a wide variety of crop wastes or animal wastes (manure) or other wastes (Roy et al., 2006). The second is a byproduct of worm casting, which involves worms eating organic waste from places like homes (kitchens), greenhouses, tree leaves, cardboard and paper, through secreting and extracting these organic wastes within the digestive worm system (Alkobaisy et al., 2021).

Assessing microbial and other organismal biodiversity in the soil is needed (which determines soil richness). Modern techniques also allow the use of metagenomics (DNA barcoding). "Domestic breeds, although genetically pure for a certain number of characters, are actually 'populations' with a significant degree of genetic variability and therefore different genotypes, represent similar manifestations of characters. Accordingly, different phenotypes may correspond to the same genotype, and vice versa" (Trisorio, 2013). On this issue, there is also a Soil Biodiversity Observation Network (Soil BON) which has extremely valuable data on this issue. Maintaining traditional agricultural practices, such as terraces with stone walls, can increase yields and help mitigate issues like climate change and other disasters by increasing carbon sequestration, increase livestock production, and reduce the impacts of soil erosion, run-off, landslides, floods and droughts (Assandri et al., 2018; Sayej, 1999).

3) **Preserve biodiversity in the agroecosystem** for regional and global needs. This can be done by using seedbanks, valorizing the diversity of crops and landraces, and emphasizing Baladi seeds and seedlings. There needs to be a participatory approach to genetic resource management (Friis-Hansen and Sthapit, 2000). The background and rational for conserving genetic resources and local breeds, especially of domesticated animals and plants, need to be articulated clearly and disseminated to a wide audience (mainstreaming).

4) Reduce the use of pesticides, herbicides and antibiotics. There exists historic and current excessive use of agrochemicals in farming crops in SP which has resulted in serious short- and long-term detrimental impacts on soil, environment, animal and human health. Antibiotic residues also affect soil microbial

community structure and activity, and induce the generation and spread of antibiotic resistant microorganisms and resistance genes.

5) **Ensure habitat diversity in farmlands**. This is critical**.** The EU strategy, for example, calls for bringing nature back to the farmland and classifying farmland areas into three categories: those with a high proportion of semi-natural vegetation, those with a mosaic of low intensity agriculture and natural and structural elements, and those supporting rare species or a high proportion of European or world populations.

6) E**ncourage the use of home gardens** to enhance agrobiodiversity. Examples in SP include rooftops in refugee camps and backyards, and even hanging gardens on walls.

7) **Build on traditional farming practices and local knowledge,** built over millennia by peasants and farmers, to enhance agrobiodiversity for food security/sovereignty (Thrupp, 2000) and use sustainable intensification.

8) **Develop knowledge and practices of agrobiodiversity for climate change mitigation and adaptation strategies** (Kotschi, 2006).

9) **Apply current sustainability models,** which so far have been implemented sporadically in SP and need expanding (see GEF 2020).

10) **Develop agroforestry** and other forms of expanding crops that support local economies (see ICARDA, 2005; Mazid et al., 2014, 2018; Amri, 2006). For example, as expected, olive groves have more biodiversity than agricultural fields (Awad and Attum, 2017).

11) **Encourage the expansion and development of fair trade practices and organic produce** e.g. http://palestinefairtrade.org/, https://zaytoun.uk/plant-a-tree/

12) **Expand dryland traditional agricultural systems** (Tesdell et al., 2019, 2020). Intercropping of olive and almond trees is traditionally used to maximize land and water resources. This has benefits in terms of positive agroecological, economic and logistical aspects.

13) **Challenge Israel's segregation policies** including the apartheid wall, settlement expansion, excessive road building, settler violence against peasants and farmers, pollution from settlements, prevention of access to farmland, and destruction of Palestinian green-technology infrastructure (water harvesting, solar energy, terracing) which have negative impacts on agrobiodiversity in general, mainly for Palestinian and also for Israeli environments and populations as a whole (Isaac and Hrimat, 2005; Reynolds, 2015).

14) **Conserve crop genetic resources** especially relatives of Palestinian crops (Valderrábano et al., 2018). They should be either conserved in their natural habitat or be collected and stored in gene banks or botanical gardens which are for protecting the agrobiodiversity system in SP (Engels and Ebert, 2021). Farmers can also be involved in identifying potential landraces and engage in efforts to collect, test and protect them in co-ordination with scientists and farmers' cooperatives.

15) **Ensure protection of the very limited forests remaining in SP** (estimated at 10,000 hectares by FAO, 2020) and expand them with natural tree cover.

16) **Encourage domestication of some wild plants/cultivation to increase food productions** including Bituminaria bituminosa, Medicago arborea cross, some Lotus species, Cicer, and Astragalus among others.

17) **Encourage community gardens** (like at palestinenature.org) and community activities (like https://olivebranchgardeningclub.blogspot.com/) and individual actions (like this from Majd Salsaa https://youtu.be/7mdtXROE1as).

18) **Consider growing seaweed for human and animal food and fisheries development in Gaza,** although this must be studied for sustainability and impact on environment,

19) **Provide support for subsistence farmers who produce small-scale food.** Local knowledge and culture are integral parts of agrobiodiversity management (FAO) https://www.fao.org/3/y5956e/Y5956E03.htm

20) **Establish new centers to preserve genetic resources** especially plants for food from the area of the Fertile Crescent including SP (Gepts, 2006; Damania, 2008). Barazani et al. (2008a) proposed ranking based on 7 characteristics: distribution range in the country; abundance; rarity of the growing habitats; endemism; red number index—representing imminent threat of extinction; availability of samples in Israeli collections, and genetic relationship to cultivated crops.

21) **Maintain genetic resources** so as to help in maintaining agrobiodiversity (Andersen, 2016; Engels and Ebert, 2021; and see the Section on agrobiodiversity).

22) **Take advantage of new opportunities for research in plant molecular technologies** including the use of DNA barcoding for phylogenetic and population genetic studies (Mosa et al., 2019) and even genome editing and selection that can help grow more food (Hickey et al., 2019). (See also the Section below on issues of genetically modified organisms.)

23) **Take into account in local planning that adaptation to climate change may impact negatively on local genetic resources** and address those effects (Hoffmann, 2010).

24) **Recognise that agroecology and sustainable/regenerative agricultural practices and systems could potentially be of great importance to ensure the effectiveness of protected areas and biodiversity conservation in SP.** Much of SP's natural and cultural landscape is shaped by agricultural practices which have been ongoing for thousands of years, most notably stone terracing (*sanasil*) and the cultivation of olive trees, almonds, fruits, and other crops which tend to be drought resistant. For this reason, agroecology could be considered as a methodology in its own right to protect and increase biodiversity in SP because, compared with other methods, it creates an incentive for human communities to protect the natural environment because of the potential of agricultural production to be economically profitable. However, the method of agriculture must be implemented according to sustainable, agroecological practices in order to protect and restore biodiversity, and not conventional chemical-based systems which rely on monocultures and the reduction of biodiversity.

The 6th NR summarized available work on preserving agrobiodiversity and concluded that, "This is certainly important but is less developed in our part of the world even as it is a critical part-, being the earliest to domesticate plants and animals (Al-Atawneh et al., 2008). There are plans, though not implemented, related to development of agrobiodiversity in dry areas in our region (ICARDA, 2005)."

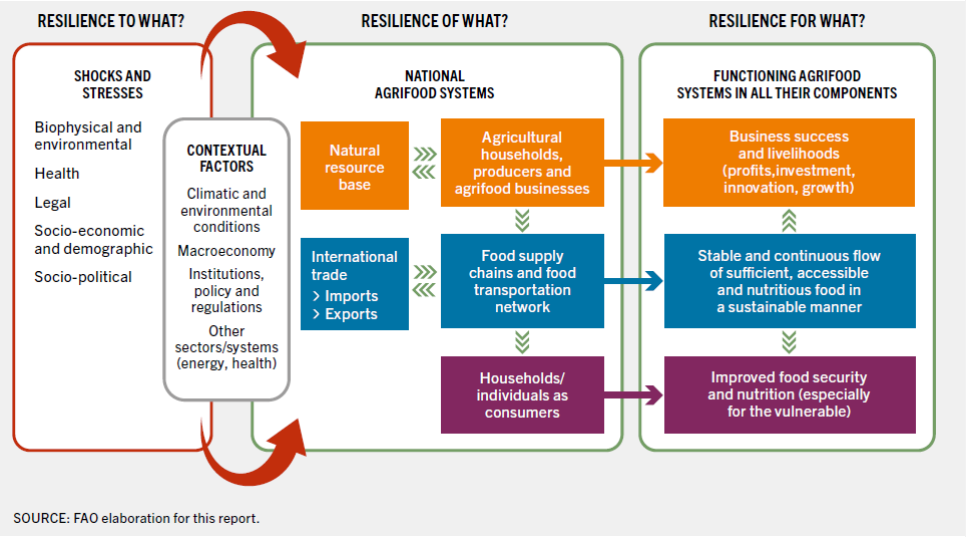


Figure 2.3 Conceptual framework for agri-food systems' resilience analysis (FAO, 2021)

2.13 Research and capacity building

The COP of CBD, in decision XIII/27 invited parties to develop indicators and use scientifically sound data for reporting and assessing progress in the achievement of national targets. But, as noted by CBD (2021), "*Unfortunately, systematic data collection and measurements were incomplete, and there are inconsistencies in data formats presented across the national reports. Many Parties took broad approaches, often at the ecosystem level, to report qualitative progress made towards the national targets, but often without reference to available taxonomic data. The lack of baseline values and quantitative and standardized data for practical use often hampered concrete assessments of changes in biodiversity. This is one of the major weaknesses in many assessments and derived measures taken by Parties in relation to implementation of the national biodiversity strategies and action plans (NBSAPs)*." In Article 18, the CBD addresses the need for technical and scientific cooperation (also see CBD 2016) and proceeded to set up mechanisms for effecting such cooperation (see https://www.cbd.int/biobridge/).

Relevant performance monitoring indicators of the Global Taxonomy Initiative (GTI) are suggested in the CBD but can be adjusted at the national or institutional level as appropriate to be consistent with the indicators associated with the post-2020 global biodiversity framework (CBD 2021). See also the detailed discussion of indicators globally and nationally at the Biodiversity Indicators Partnership (BIP www.bipindicators.net), a global initiative to promote the development and delivery of biodiversity indicators.

The Global Biodiversity Outlook (GBO-5) released in 2020 also points to major capacity imbalances and gaps in research knowledge related to biodiversity, and limited application of biodiversity knowledge to decision-making processes. Liu et al. (2011) analyzed trends of research in biodiversity globally (to 2009), seeing significant growth in interest in research related to conservation especially after the 1990s. The most important journals with relevant publications were Biological Conservation, Journal of Soil and Water Conservation, Conservation Biology, and Biodiversity and Conservation. Education and conservation aren't possible if enough quality research on areas like the status of the environment, key indicator species,

priorities of conservation and so on aren't done. The landscape of biodiversity research is equally challenged to meet the needs of conservation. Fazey et al. (2020) stated that current global systems of knowledge generation and dissemination are failing societal needs, including environmental areas, and that "future systems will need to be much more collaborative, open, diverse, egalitarian, and able to work with values and systemic issues", Based on Wyborn et al. (2021), the set of principles that researchers should follow to tie biodiversity conservation to societal needs include:

1. Revisit biodiversity narratives by challenging conceptualizations that exclude diversity and entrench the separation of humans, cultures, economies, and societies from nature.
2. Focus on the relationships between the Anthropocene, biodiversity, and culture by considering humanity and biodiversity as tied together in specific contexts.
3. Focus on nature and economies by better accounting for the interacting structures of economic and financial systems as core drivers of biodiversity loss.
4. Enable transformative biodiversity research and action by reconfiguring relationships between human and nonhuman communities in and through science, policy, and practice.

As for SP, the status of research is rather poor in general, with even more limited research on environmental issues, biodiversity, and sustainability (Qumsiyeh and Isaac, 2012; Qumsiyeh and Amr, 2017; EQA, 2021). For example, up until 2018, there have only been 675 publications on Environmental Science, compared to the 1,479 published on Medicine (Issac et al., 2019). Further, many of the publications done in the Palestinian areas are published in pirate (unreputable) journals (see Macháček and Srholec, 2021). SP (2020) included in its strategic plans a large section related to education and research with a vision of higher education and scientific research contributing to building a society of knowledge and creativity. They set five strategic objectives (notes on those relevant to environment and biodiversity given below):

Strategic Objective One: Improving the quality and levels of higher education outputs. This included introducing new programs that help sustainable development, capacity building for academic staff at universities and research institutions, and finding relevant resources for both sectoral and cross-sectoral action plans for higher education (including the new programs).

Strategic Objective Two: Facilitate safe, inclusive and equitable enrollment into the programs.

Strategic Objective Three: Upgrading the level of scientific research and ensuring its effectiveness in sustainable development. Under this objective, the Government proposed to elevate research to become of high quality, higher quantity, and of applicability to local needs as well as find resources locally, regionally and globally to fund this. One of the indicators was to increase applied research outputs from 782 in 2019 to 1456 by 2023.

Strategic Objective Four: Improving technical education in terms of quantity and quality.

Strategic Objective Five: Reform and develop education administration and governance and ensure its sustainability.

Challenges identified by the Government in advancing education include lack of resources, poor economic family situations (which impacts on e.g. access to online learning), among others. It is notable that the above included no discussion of connectivity to a sustainable Palestinian environment. In fact, existing programs for agriculture and for all sciences only contributed to 5% and 6.2% respectively of higher education graduates.

It is critical, though, both to articulate the logic behind the need for data gathering in biodiversity monitoring and to collect real data that serve conservation efforts. Thus, Lindenmeyer et al. (2012) recommends the following:

1. Coordinating activities among different biodiversity monitoring programs, including mapping what monitoring is being done where and identifying efficiencies and synergies among programs.

2. Improving objective setting, experimental and statistical design, and statistical analyses of monitoring datasets (including the use of recent innovations like occupancy, presence and detection modelling).

3. Developing, implementing and maintaining data collection protocols and data standards, including improving data storage, data accessibility and registers of datasets.

4. Improving reporting of data and results from monitoring programs, particularly in a form that is useful for management.

5. Brokering partnerships which are fundamental to the success of monitoring programs.

6. Fostering appropriate institutional and scientific cultures to ensure that monitoring programs are maintained in the long-term, including assisting with succession planning as the project champions retire and new project leaders are sought.

7. Assessing the cost-effectiveness of expenditure on biodiversity conservation.

8. Advocating for increased levels of targeted funding for biodiversity monitoring.

Anton et al. (2010) summarizes the 12 priorities needed to integrate ecosystem service approaches into biodiversity conservation policy, and some of those relates to research such as *"Quantify the role of biodiversity, including uncharismatic and speciose groups of organisms such as invertebrates, lower plants and fungi, in ecosystem function and service provision"* and *"Develop improved methods for the integrated assessment of ecosystem services at different spatial and temporal scales, including methods for: (i) investigating interactions between the demand and supply of multiple ecosystem services; (ii) upscaling and downscaling; and (iii) integrating valuation processes and results in impact assessments and models."*

For example, the National Agriculture Research Station (NARC) could be vitalized and used more effectively, including along with other institutions:

1. The NARC new structure (2021) encourages participatory research, including with academia and NGOs, and regionally and globally (also to leverage Masters student research).
2. The NARC plan and the updated National Strategy 2021-2023 for the agricultural sector should more clearly address environmental issues in depth and address the need for climate change mitigation and adaptation.
3. It is critical that the strategy for agricultural interventions follow sustainable practices based on meticulous research. While the current research strategy is reasonable, it is far too general and much more detail needs to be incorporated. It should follow S.M.A.R.T criteria.
4. The Ministry of Agriculture should work better with the Environment Quality Authority to ensure the protection of certain areas from urban sprawl and agricultural development (the protected areas/nature reserves as also adopted in the national spatial plan).
5. There is a great need for capacity-building in applied research methodologies and practices in SP. Studies show poor quality research, research published in low impact journals, and redundant and low quality "survey" work rather than rigorous, controlled research.
6. Environmental Impact Assessments of agricultural projects, including land reclamations, should be coordinated and managed better between the EQA (main responsibility) and MoA.
7. Sources of funding should be identified.
8. Performance-based standards should be made stronger for human resources at both the MoA and NARC.
9. More GIS and Remote Sensing technology should be incorporated into agriculture planning, with environmental impacts included.
10. Encourage MoA to utilize the EQA's CHM

11. Invasive alien species should be taken into account.

Recommendations

1. Institutionalize research through collaboration locally, regionally, and globally (see Qumsiyeh and Amr, 2017). The EQA and funders can leverage this.
2. Better directed research funding. Funding does explain most of the current knowledge in biodiversity used for conservation (Ahrends et al., 2011). However, this should be performance-based and be relevant to societal and environmental needs related to sustainability and biodiversity. Cross-cutting research is also important (see the example below from the ALARM project http://www.alarmproject.net/research_modules.php).
3. Utilization of museums and other collections: natural history museums, herbaria, and living collections (like botanical gardens) can be of significance for research, education, and conservation (Qumsiyeh, 2017; and Qumsiyeh and Amr, 2017). There are different types of collections relevant to biodiversity, including agrobiodiversity, that aid in conservation and research:
    a. Taxonomic collections (e.g. preserved insect collections, herbaria for flora, and stores of bacterial and yeast cultures),
    b. Patented collections (natural strains, engineered and subject to genetic improvement on which there are patent claims),
    c. Working collections (e.g. strains isolated and studied throughout the period of their use),
    d. Collections of service (taxonomic collections available to provide maintenance services, identifications, etc.),
    e. Collections for specific application areas (e.g. plant pathology, food, environment), and which may possibly help maintaining biodiversity and its reintroduction).

    Each of these collections help in conservation and valorization and have guidelines for maintenance systems. Usually there are curators in charge of the fixed collections who help in specimen management, cataloging, preservations, loaning, etc.
4. Reprioritization towards monitoring biodiversity and sustainability (environment, biodiversity, health, education) (Pearson et al., 2011; Qumsiyeh, 2017) including in the little studied areas like invertebrates (Davis et al., 2018) and climate change adaptation and mitigation (Sternberg et al., 2015). A staged approach is also useful, for example in 2022-2027 focusing on reviving explorative field research on the distribution, abundance, ecology, and threats and then in 2027-2035 focusing on ecosystem services research (always linking research with conservation).
5. Developing a centralized research hub linked to the clearing house mechanism (CHM) to exchange information, and seek support via groups like http://www.scientists4palestine.com/ . For research, digital data is becoming more important (Nelson and Ellis, 2019). See Section 3.8 on databases.
6. Institutional systems created should be more comprehensive, looking at biodiversity areas rather than single species or single areas such as education, etc. (Clement et al., 2013). Environmental research done in SP region still suffers from a lack of an interdisciplinary approach (Amir, 1987) and collaboration (whether global, regional or local) (Barber et al., 2014; Prathapan et al., 2018).
7. The importance of applied research: research should be connecting people to nature (Velasco et. al, 2015). Some research should focus on issues of changing behavior such as education research and understanding socio-political situations. This is research in anthropology and sociology (Pfund et. al, 2006; Sandbrook et. al, 2013).
8. Biodiversity research has been found to be biased towards large vertebrates and there is a significant need for studies that are even across taxa (Donaldson et. al, 2016; Tydecks et al., 2018; Hochkirch et al., 2021). Hochkirch et al. (2021) recommends an eight-point strategy to deal with this deficit: 1) Revive Explorative Field Research, 2) Link Taxonomy Information to Conservation Information, 3) Improve Global Collection of Spatial Biodiversity Data, 4) Map Spatial Threat Data, 5) Automate Pre-assessments, 6) Facilitate Knowledge Transfer, 7) Create Biodiversity Monitoring Programs for Lesser-Known Taxa, and 8) Provide Funding Mechanisms to Fill Knowledge Gaps.

9. There needs to be research on ecosystem services including on a) how, when and where are ecosystem services co-produced by social–ecological systems; b) who benefits from the provision of ecosystem services; and c) what are the best practices for the governance of ecosystem services (Bennet et al., 2015)
10. Bridging the science-policy gap that can be done with inclusiveness and democracy in planning research (Knight et al., 2008; Neßhöver et al., 2013; Sutherland et al., 2011, 2012; Young et al,. 2014; IPBES 2017, 2019). Biodiversity scientists should also be involved in all decision-making and policy formulations at the national level. However, countries are working to enlarge this from a science-policy dialogue to a trialogue of science-policy-practice (BESNet, 2021).
    There needs to be significant growth in human capacity related to biodiversity research (Miloslavich et al., 2019; Fan et al., 2020)., A significant increase in the number of academic positions in biodiversity, in particular within specific highly vulnerable sub-fields (see below), and new fellowships and study programs in the field of biodiversity. There are training programs and facilities that can grow human capacity, including the potential to add new programs at higher educational institutions (see Section 2.2.3 on education). Capacity-building can be done by both local and international groups. Global capacity-building in areas of research can come from many sources: including the CBD, IPBES https://ipbes.net/capacity-building-mandate, International Barcode of Life (iBOL), Global Biodiversity Information Facility (GBIF), ASEAN Centre for Biodiversity http://chm.aseanbiodiversity.org/, and the Consortium of European Taxonomic Facilities (CETAF). (**Summary:** Research should be built on the most advanced available tools like molecular biology, database management tools, remote sensing and modeling. Research should also take into account socio-economic-political considerations (Mehring et al., 2017). It is also noted that much research in the region has been done by "parachute scientists" (quick research by people from abroad). It is believed that local scientific capacity can and should be expanded in developing countries like SP using these modern and western tools and knowledge to build local innovative capacity (Barber et al., 2014).

2.14 Modernization: Databases, Portals, GIS and Remote Sensing

Informatics has dramatically altered taxonomic working practices and workflows, and directly supported biodiversity research (Nelson and Ellis, 2019). Notable changes include how scientists are collaborating on taxonomic revisions (e.g. Scratchpads) and publishing linked, discoverable and reusable taxonomic data (e.g. Pensoft Journals). Vast amounts of biodiversity data are already aggregated through the GBIF, and genetic sequence information collated by the DNA Data Bank of Japan (DDBJ), the European Molecular Biology Laboratory (EMBL), GenBank and the International Barcode of Life (iBOL), as well as species morphological data aggregated by e.g. MorphoBank and TraitBank. Since the development of computerized data input, software and hardware, systematic biologists (taxonomists) started taking advantage of this technology by compiling data in computers (biodiversity informatics really commenced in the 1970s). Scientists collecting data on biodiversity now deposit them in scientific portals to facilitate communication with other scientists, but do so only based on proper identification and standardized taxonomic identification and naming (Sarkar, 2007). However, there are significant gaps in environmental data collated in such ways, including in fauna, flora, soil fertility and much more (UNEP, 2020).

Tropical and Mediterranean biodiversity is disproportionately sensitive to land-use and climate change (Newbold et al., 2020). Hence, the need for accumulating biodiversity data is urgent. Globally and locally, there are biodiversity data but it is uneven in its spatial, temporal, and topical coverage and is unorganized. Furthermore, unlike the climate change framework, there is no widely accepted system or set of measures to assess biodiversity (Scholes et al., 2008).

The largest portals that combine government and other sources of information are:

1. Group on Earth Observation (GEO): "*GEO is a voluntary partnership of governments and organizations that envisions 'a future wherein decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations and information.' ... Together, the GEO community is creating a Global Earth Observation System of Systems (GEOSS) that will link Earth observation resources world-wide across multiple Societal Benefit Areas - Biodiversity and Ecosystem Sustainability, Disaster Resilience, Energy and Mineral Resources Management, Food Security and Sustainable Agriculture, Infrastructure & Transportation Management, Public Health Surveillance, Sustainable Urban Development, Water Resources Management - and make those resources available for better informed decision-making*" (see https://www.earthobservations.org , http://www.geoportal.org/ and Gerard et al., 2012)
2. Global Biodiversity Information Facility (GBIF). Palestinians have entered some records for biodiversity in the GBIF. As of 2021, there were 251,877 occurrences and 300 datasets about Palestine (https://www.gbif.org/country/PS/summary), However, most of these are not by local actors, and are mostly museums or other older records.
3. **Symbiota** (Promoting bio-collaboration): "*web tools [that] strive to integrate biological community knowledge and data in order to synthesize a network of databases and tools that will aid in increasing our overall environmental comprehension*." http://symbiota.org/docs/
4. **Predicts database**: A dataset of 3,250,404 measurements, collated from 26,114 sampling locations in 94 countries and representing 47,044 species (Hudson et al., 2016).
5. **The European Biodiversity Observation Network** (EBONE) is a European contribution on terrestrial monitoring to GEO BON, the Group on Earth Observations Biodiversity Observation Network (Gerard et al., 2015).

There are also specialized portals for data gathering:

- https://www.europlusmed.org/node/129 A database of flora of Europe and the Mediterranean region.
- http://speciesplus.net/ Species+, developed by UNEP-WCMC and the CITES Secretariat, is a website designed to assist Parties with implementing CITES, CMS and other multilateral environmental agreements (MEAs). Species+ provides a centralized portal for accessing key information on species of global concern.
- http://www.fishbase.org/ Comprehensive database on ichthyology,
- http://www.herpnet.org/ Comprehensive database on herpetology.
- https://www.idigbio.org/ Database of collections of use in biodiversity research and conservation.
- https://www.flora-of-cyprus.eu/ & https://flora.org.il/ Databases for local flora.
- https://icedig.eu/ Innovation and consolidation for large-scale digitization of natural heritage (ICEDIG).
- https://biogis.huji.ac.il/ Database hosted by Hebrew University on local biodiversity.
- Botanic Gardens: e.g. Kew Gardens, London, UK: https://www.kew.org/ and https://www.kew.org/wakehurst/whats-at-wakehurst/millennium-seed-bank; Botanic Gardens Conservation International: https://www.bgci.org/
- Bird data: http://datazone.birdlife.org/home https://ebird.org/israel/home
- Wikipedia and the more specialized "Wiki Species" https://species.wikimedia.org/wiki/Main_Page

There are also informal citizen science web portals that gather non-scientific observations from anyone who has access the internet and curiosity about their surroundings. Here are two examples:

- http://www.inaturalist.org/: with over 85 million observations globally, statistical data shows 6,529 observations entered under SP up to 22 November 2021, with the majority being plants. Israel had 94,834 observations recorded (14 times as many observations as SP).
- http://www.observations.org: This aims to offer a practical and useful, free tool for all field observers around the world to record and share their plant and animal sightings. For SP, statistical

data shows 24,451 observations entered under State of Palestine up to 22 November 2021, with the majority (>18,000 observations) being birds. This is also similar to all observations recorded on that portal where 73% of them are birds. Israel had 317,490 observations recorded (13 times as many observations as SP).

The Global Taxonomy Initiative (GTI) of CBD is now well advanced but uneven and it recommends (CBD, 2021):

- Taxonomy [is] fundamental to our understanding of biodiversity and to the implementation of the post-2020 Global Biodiversity Framework [and that] further actions are needed to enable Parties to access and use the shared knowledge and tools on the ground.
- New technologies, such as digital biodiversity information, including digital specimens and descriptions, DNA barcoding, metabarcoding and whole genome sequencing, become available and affordable so as to advance taxonomy and the knowledge derived from it.
- The need for greater taxonomic capacity across broad sectors so as to implement the post-2020 Global Biodiversity Framework and relevant actions aligned with the Sustainable Development Goals.
- Further investments are needed to educate biodiversity management officials and young scientists in taxonomy skills, as well as to apply such biodiversity knowledge and tools better, and to generate more biodiversity knowledge.
- Biodiversity data [generated] can be used as indicators and to deliver key baseline data for the monitoring of the post-2020 Global Biodiversity Framework.
- To deepen technical and scientific cooperation and capacity development through the relevant GTI networks of experts and GTI national focal points, and to support Parties and communities in applying biodiversity knowledge and tools for the implementation of the post-2020 Global Biodiversity Framework.
- GIS training is increasing and EQA and other institutions increasingly invest their human capacity in this area. The work on protected area was completed and will soon be uploaded on http://geomolg.ps

"*Unfortunately, systematic data collection and measurements were incomplete, and there are inconsistencies in data formats presented across the national reports. Many Parties took broad approaches, often at the ecosystem level, to report qualitative progress made towards the national targets, but often without reference to available taxonomic data. The lack of baseline values and quantitative and standardized data for practical use often hampered concrete assessments of changes in biodiversity. This is one of the major weaknesses in many assessments and derived measures taken by Parties in relation to implementation of the national biodiversity strategies and action plans (NBSAPs)*." CBD (2021)

CBD COP Decision X/15 noted that there is a need for scientific and technical cooperation based on having Clearing-House Mechanisms (CHMs) globally and nationally. SP's CHM was updated as part of this NBSAP process https://www.cbd.int/chm/. The 6th NR noted "Biodiversity knowledge in SP advanced significantly since the 5th NR" but that there are needs for much more research and "data needs to be placed in accessible database management systems available online to be used for conservation purposes" (see also relevant Section 3.7).

Role of GIS/Remote sensing: Nowadays the advances in using Remote Sensing technology programs and connecting data through geographic information systems (GIS) help ecologists and ecosystem resource managers have access to highly accurate and valuable data. Both Remote Sensing and GIS involved in ecosystem management help to identify the current and future information needs for decision-making and to understand better the state of the environment, especially for those involved in the management of forest ecosystems, water resources, desertification and climate change. Examples of the use of GIS/remote sensing globally are many (e.g. locally, Gonzales Moreno et al., 2016: Pettorelli, 2019). Cultural and topographic

mapping can also be used for protection as, for example, happened in the case of Battir. Data can be obtained from SRMT and the Climate Change Agriculture and Food Security portal.

Recommendations based on review of available resources and databases:

1) Create a national CHM Steering Committee and organize meetings. The national CHM focal point who acts as a web manager has been trained and will work with the team of PIBS to ensure only most relevant data are entered. Workshops to be held for policy makers and other stakeholders on the subject of technical and scientific cooperation and the CHM website. Data should be used by decision-makers in informing policy (see this workshop and see research section 2.13).
2) There is a need for "new technologies, such as digital biodiversity information, including digital specimens and descriptions, DNA barcoding, metabarcoding and whole genome sequencing, to become available and affordable to advance taxonomy and the knowledge derived from it."
3) More data collection and acquisition (data mining) on biodiversity is needed, including ecosystem services in SP (see also research Section 3.7). However, these data should be standardized. There are dozens of other projects and there have been some non-profit organizations set up to standardize the use of information databases. Examples include a) Biodiversity Information Science and Standards (BISS) and b) the Biodiversity Information Standards, also known as the Taxonomic Databases Working Group (TDWG), which "is a nonprofit scientific and educational association that is affiliated with the International Union of Biological Sciences". Another area that can be placed on the CHM portal is a section that links to laws, regulations, and international agreements that are relevant to biodiversity. This can be added as links similarly to the UN portal for international agreements or these portals on multilateral treaties, party profile, or invasive alien species.
4) Most relevant and important data should be digitized and centralized in a national CHM. This includes both data collected by professionals and published in peer reviewed journals as well as data verified by professionals but collected by citizen scientists using portals like those listed above. However, the various (>20) available databases can and should be linked in a more logical fashion (Minami et al., 2012; Chawuthai et al., 2016). A good example of a CHM to emulate is the Biodiversity Information System for Europe.
5) Establishment of special thematic sections in the CHM: such as a children's section, a section on ABS and the Nagoya Protocol, a section on water or waste, a section on eco-tourism, etc.
6) Translation of the CHM into the Arabic language for better inclusion and development of a communications plan and strategy for the CHM.
7) There is also a need to coordinate South-South cooperation internationally to promote the national CHMs of partner countries.
8) Biodiversity databases for conservation purposes are better addressed at regional and collaborative levels (Halada et al., 2009). For example, in the European Union, countries are subject to regional and international instruments and must supply data via the many available networks for biodiversity (Wetzel et al., 2015).
9) Long-term maintenance of the databases/CHM should be assured via the necessary resources (human and financial) for example from the EU.
10) Global biodiversity databases need improvement by: submitting the spatially explicit data that is mandatory for scientific publications; developing a global spatial database on threats to biodiversity to facilitate IUCN Red List assessments; automating pre-assessments by integrating distribution data and spatial threat data; building capacity in taxonomy, ecology, and biodiversity monitoring in countries with high species richness or endemism; creating species monitoring programs for lesser-known taxa; and developing sufficient funding mechanisms to reduce reliance on voluntary efforts. Implementing these strategies in the post-2020 biodiversity framework will help to overcome the lack of capacity and data regarding the conservation status of biodiversity.
11) To build the CHM, there is a need to compile existing digital and analog biodiversity datasets produced by Palestinian researchers into a central collection. Once compiled, any analog data

should be digitized. This would require manual data entry work. In the case of data in a digital form, the data will have to be "cleaned" by specialists in data management. Next, the clean datasets must be brought into compliance with international biodiversity standards like the Darwin Core (https://www.tdwg.org/community/dwc) and the Dublin Core metadata standards. Next, working with the hosting institution/repository, the data should be uploaded and made available to users of that platform. Examples of major repositories include the Global Biodiversity Information Facility (GBIF) (www.gbif.org), Encyclopedia of Life (www.eol.org), and iNaturalist (https://www.inaturalist.org/), among others.

12) Link data like GBIF with local data like https://barari.org/
13) Update data on wikipedia and https://www.wikidata.org/

2.15 Risks and Disaster Management

The EQA has issued three important documents on climate change and the correlated challenges at the Palestinian level:

1) The Climate Change Adaptation Strategy (2010) and the **Climate Change National Determined Contributions (NDC)** concluded that SP will be vulnerable to the outcomes and implications of climate change including: an increase in annual average temperature between 2.2 and 5.1 degrees, a 20% drop in annual rainfall by 2050, land degradation, and desertification.

2) National Adaptation Plan to Climate Change: This document included:

- A review of historic trends in climate in relation to SP.

- Identification and prioritization of vulnerable hotspot regions.

- Future climate scenarios for SP and future developments required for State institutions to be able to participate in climate-modelling research.

- Identification and prioritization of adaptation options, including costings.

- An outline of the process for future monitoring and evaluation.

3) **SP's Initial National Communication Report to the United Nations Framework Convention on Climate Change (UNFCCC):** The Climate Change Adaptation Strategy and Program of Action for the Palestinian Authority has identified water and food security as the most vulnerable issues in SP. Under the difficult circumstances that SP faces, including political occupation, the Palestinian Authority needs to empower its expertise and capacity at the institutional level in order to address all of the issues that are linked to climate change adaptation and mitigation. It currently suffers from limited capacity, expertise, and a general limited ability to respond to these challenges. The Nationally Determined Contributions (NDC) to UNFCCC were finalized in 2020. The delivery of the climate actions described in this NDC will help achieve a number of national development and policy objectives as well reflect the country's vision for climate action and address the political commitment to climate change at a global level. These include improvements in the State's energy security, with a reduced dependence on imported electricity from Israel and increased energy reserves through development and exploitation of the Gaza Strip's gas field. Improvements in the Palestinian people's living conditions, health and environment, through better air quality, less unmanaged waste, increased food production and increased water resources are also important co-benefits. These actions will also support the implementation of sustainable development goals (SDGs).

4) An "Ecosystem-Based Disaster Risk Reduction and Climate Change Adaptation in SP" was concluded in 2018 (Laban, 2018). Its content is based on an initial desk study and two workshops with members of the National Disaster Risk Management Platform and the National Committee for Climate Change Adaptation (NCCCA). The two workshops had a dual objective: training of members in Ecosystem-based Disaster Risk Reduction (Eco-DRR) and NCCCA related concepts and approaches and initial reflections

on possible Agendas for Action in the domain of Eco-DRR and NCCCA in SP. The situation analysis and the proposed Eco-DRR and NCCCA Agendas for Action for different Eco-Geographic Zones of the country are entirely based on the reflections and considerations of the workshop participants.

SP established a number of studies and reports regarding risk mitigation for disasters like earthquakes etc. (see Melhem 2018 for earthquakes as an example). The Environment Sector Strategy (EQA 2010) includes "all measures required to cope with climate change, combat desertification and confront environmental and natural disasters are taken". The priorities identified included the normal five threats to biodiversity, the Israeli occupation and other risks.

2.16 Biosafety & GMO Issues

SP ratified the Cartagena Protocol of CBD on 2 April 2015. Yet, little work was done on this issue until 2020 when a call for a study of biosafety was issued but implementation wasdelayed to 2021 (EQA, 2021 Palestine Biosafety Assessment Report; also see EQA, 2021, 6th NR). The field of biotechnology and biosafety in SP is still in its early developmental stages, with minor efforts to catch up with this rapidly developing area, especially in the fields of food, medicine and agriculture. However, several universities have recently established graduate and undergraduate biotechnology/genetic engineering programs (EQA, 2021b).

The legal framework in SP for biosafety is fundamentally composed of: the Environmental Law No. 7 of 1999, Public Health Law No 20 of 2004, Agriculture Law No 2 of 2003, and the Palestinian Standards and Measurements Law No 6 of 2000. Other national laws just mention some food safety issues, including the Decree on the Law of Industry No. 10 of 2011, and the Consumer Protection Law No 21 of 2005.

The new consultancy (EQA, 2021b) produced a framework intended to ensure the safe use and implementation of modern biotechnology and to ensure the public health, food security, economy, and biodiversity protection, with the following specific **objectives for a national biosafety plan:**

Objective 1: To establish a regulatory regime for biosafety, including the management of the research, development and testing of GMOs and GM products, environmental release assessment, import and export, and the use of all products resulting from modern biotechnology.
Objective 2: To establish an administrative system for the management of biosafety related issues, defining clearly the mandates of National Competent Authority and stakeholders.

Objective 3: To establish a transparent decision-making system for handling notifications or requests for authorizations for activities involving GMOs (e.g. trans-boundary movement, transit, domestic use, contained use, placing on the market, and intentional release into the environment). This system should include a technical system for risk assessment and management, and specific plans for promoting access to information and public participation.

Objective 4: To establish systems for the monitoring and enforcement of biosafety measures.

Objective 5: To build and enhance the national capacity for biosafety management by developing mechanisms for promoting and facilitating public awareness, education and participation and the development of human resources for biosafety management.

The policy recommends:

To assess the potential danger for human health and environment resulting from modern biotechnology and their products, including genetically modified (GMOs/LMOs) of animals, plants and microorganisms and their products, the biosafety management targets are consistent with and regulated. The following risk classes have been specified for GMOs:

Class I: Activities with negligible risks comparable to the risk of using non-pathogenic microorganisms, or without any risk (No risk);

Class II: Activities with low risks comparable to the risk of using conventional pathogenic microorganisms (Low risk);

Class III: Activities with moderate risks comparable to the risk of using microorganisms potentially capable of spreading infections (Intermediate risk);

Class IV: Activities with grave risks comparable to the risk of using microorganisms capable of spreading very dangerous infections (High risk).

The proper safety control measures will be adopted according to different risk levels, as illustrated below.

Table 2.2 Risk levels and safety measures.

Risk Class	Safety measures
Class A (No risk)	Permitted
Class B (Low risk)	Precautionary approach
Class C (Intermediate risk)	Research and experimentation. any other uses require special permits.
Class D (High risk)	Research and testing. Excluded from any other use,

Recommendations based on EQA (2021) and other studies:

1) Possible establishment of the Palestinian National Food and Drug Authority.
2) Strengthen existing laws and regulations, taking into account the Cartagena Protocol, relevant Conventions, and local and regional systems related to biosafety. Laws and regulations are being updated regarding this and other issues (see Sections 1.4.1 and 1.4.2).
3) Create a National Biosafety Committee.
4) Implement the laws and procedures specific to the management of medical, hazardous, and solid waste, and the regulations related to radiation,
5) Regional harmonization (Alexandrova et al., 2005).

2.17 Sustainable production and consumption

There is an obvious connection between responsible production and consumption and biodiversity conservation (Leal Filho, 2020; Schroeder et al., 2019; Swain et al., 2021). There is less work on this subject **in SP** (Dajani and Isma'il, 2014; EQA, 2016; https://www.pcbs.gov.ps/SDGsAr.aspx?pageId=12; https://www.arabstates.undp.org/). There has been some good progress in the areas of consumer education, protection, safety, and responsible consumption. Some of the institutions and entities created that deal with these subjects are (after EQA 2016d) the following:

- General Administration of Consumer Protection of the Ministry of National Economy which has a laboratory for testing locally produced and imported goods.
- The Palestinian Council for Consumer Protection.
- Palestinian Standard Institute (PSI) which has accredited and issued specifications for thousands of products.
- The Customs Controllers of the Ministry of Finance.
- The Ministry of Health, which includes the Department for Water Health and modern central laboratories.

- The Pesticide Department of the Ministry of Agriculture, which is responsible for registering, monitoring and importing chemical pesticides.
- NGOs that work in the field of consumer protection, such as the Palestinian Society for Consumer Protection (PSCP) and the Palestinian Food Industries Union (PFIU).

Some of the laws and regulations relating to production and consumption include:

- Law of Consumer Protection No. (21) of 2005.
- Law on the Palestinian Specifications and Standards No. (6) of 2000.
- Law of Public Health No. (20) of 2004.
- By-LawNo. (19) of 2009 for the Palestinian Council for Consumer Protection.
- Procurement Law in 2011 reflects the United Nations Commission on International Trade Law (UNCITRAL 1994), including safety and responsibility.
- Penal Code of 1960 on safety of food products.
- Law on Natural Resources No. (1) of 1999. Article (6) under this Law provides that found natural resources within the Palestinian territories, territorial waters and its pure economic zone shall be regarded as a public property except for building materials. It shall be permissible for mining purposes, to appropriate the private lands for public benefit.

The 6th National CBD Report lists many examples of successful efforts in this area of consumption and production. Yet this still remains limited.

A report from the UNDP (2016) provides pertinent action plans for sustainable consumption and production. Here are some examples:

- Promote the use of biological control as a safe alternative to chemical pesticides.
- Prepare and implement guidelines for Biological Pest Control to preserve agricultural crops from acquiring diseases and pests.
- Protect and preserve local natural enemies already present in the local environment through conservation methods.
- Apply reinforcement measures to help increase the natural enemies already present in the local environment.
- Aid farmers to pick the pesticides that are least harmful to natural enemies.
- Recommend farmers to use biocides as a first step in a strategy to switch to a natural control system.
- Document and monitor the results of biological control used.
- Disseminate Biological Pest Control guidelines on a large scale through training workshops.
- Provide farmers with the best agricultural practices identified for the conservation of organic matter, soil quality and moisture content in soils, to minimize the deterioration and the pollution caused by agricultural activities.
- Disseminate the Manual for Agricultural Best Practices which provides better farm management, soil management, water and irrigation systems, and tilling systems and encourages the use of organic fertilizers.
- Recommend farmers to improve and maintain mulch or vegetation on the soil surface.
- Advise farmers to use acidic fertilizers due to the high alkalinity of Palestinian soil.
- Guide and assist farmers to apply the integrated management approach to control pests and use minimum tillage methods.
- Assist farmers to select the proper seeds and cultivars based on their drought-tolerant domestic characteristics.
- Recommend the use of reliable compost sources and qualified organic fertilization.
- Mentor farmers on how to adopt agricultural crop rotation systems and use farm registry logs, as well as how to conduct periodic soil and irrigation water analysis.

- Guide farmers on how to use computer programs and phone applications to control crop irrigation according to crop needs and soil moisture rates.
- Assist farmers in how to use appropriate water harvesting techniques to collect rainwater and increase soil water storage.
- Advise farmers to add non-decomposing manure and plant residues to fruit trees and vegetable crops during the best time of autumn before rainfall.
- Advise local communities on how to improve watering efficiency in their home gardens.
- Organize Sustainable Consumption and Production exhibitions.

Promote a switch to more sustainable consumption and production patterns aiming to protect the environment. Formulate policies, strategies and national plans in order to implement Sustainable Consumption and Production programs and projects. Implement projects that improve the environmental situation through:

- Conducting recycling and upcycling projects
- Implementing organic agriculture production programs
- Using renewable energy
- Conducting hydroponic projects and water desalination projects using green algae
- Conducting projects and programs to produce nanoparticles to remove pollutants and heavy metals.
- Implementing projects aiming to produce fuel through plastic waste conversion and methane gas production using organic waste
- Encouraging ecotourism initiatives
- Implementing university students graduation projects
- Increasing natural reserves protection initiatives.

Recommendations

1) The Ministry of Economy should set up systems of incentives and disincentives relating to consumption of plastics, food, paper products, energy, etc. (See also Delabre et al., 2021).

2) The Ministries of Economy, Agriculture and others should set up systems of incentives and discincentives relating to sustainable production (for example, less waste producxig processes, less gas emissions, more organic farming, composting, etc.).

3) Research is needed on existing subsidies, leading to subsidy reform. Conversely, there is a need to impose penalties/taxes on harmful practices such as using plastics.

4) Mainstreaming biodiversity (connectvity to production and consumption).

5) Strengthening governance and regulations.

6) Greening public facilities like universities and public building of governments and religious institutions (mosques and churches). For examples of tools to do this see UNEP, 2014; Sunbolt 2021.

7) Encourage fair trade and local products and shopping locally for those. For a compilation of data on this, see Dajani and Isma'il, 2014.

8) Offsets can be used in cases where biodiversity loss cannot be protected in one area by compensating for biodiversity gains in other areas (Griffiths et al., 2019).

2.18 Management of Species and Ecosystems

Management of species within ecosystems and preventing their decline has been a challenge globally (Bottrill et al., 2011; Male and Bean, 2005; Diaz et al., 2019; Ceballos et al., 2015). This failure is attributed to the lack of resources and lack of proper research and planning, or lack of proper local planning

(Sunderland et al., 2009; Toomey et al., 2017). Humans are the main cause of the massive extinction of species (Tollefson, 2019; Rounsevell et al., 2020). Efforts to manage and return species to local habitats are underway globally. For example in Jordan there was a release of Oryx, Roe Deer, Wild Ass, and Ostriches in some nature reserves. But there is still much debate about why such efforts are not making a dent in the mass extinctions happening and new frameworks are needed and are being proposed (Williams et al., 2021). For many species, part of the issue is a lack of proper data (see Section on research 3.7) which, when available, can inform the designation of hotspots and protected areas (see, for example, Haevermans et al., 2021). Part of the problem may also relate to the complexity of ecosystems and the impossible situation of focusing on one species without complete understanding of the ecosystem that sustains it (Akçakaya et al., 2020; Cadotte et al., 2011; Lyons et al., 2005; Salwasser, 2020).

The Global Biodiversity Standard (https://www.biodiversitystandard.org/) coordinated by Botanic Garden Conservation International set benchmarks and announced them at COP26, the climate conference in the UK in 2021. These included, "All land management initiatives, including habitat restoration, tree planting and agriculture initiatives, will be eligible for [global] certification. Sites will be assessed against criteria based on BGCI and Kew's 10 Golden Rules for Reforestation paper which outlines how to deliver reforestation that promotes biodiversity recovery, carbon absorption, and socio-economic benefits to local communities. To become certified, initiatives will need to: Protect existing habitats and biodiversity; Carry out interventions in appropriate areas without displacing natural biodiversity; Manage biodiversity in consultation and partnership with local communities and stakeholders; Aim to maximize biodiversity recovery through restoration and natural regeneration; Refrain from planting invasive alien species; Use native species and incorporate threatened species in planting wherever possible; Use plant material that is genetically diverse, appropriate and resilient; Implement robust monitoring, evaluation and adaptive management of biodiversity".

The 6th National Report summarizes the decline in species and habitats (e.g. of forests) which is observed in SP. There have been some plans to protect vulnerable ecosystems in SP including, for example, in the Uskar temporary pond at the buffer zone of Wadi Qana or in Wadi Quff. These efforts are limited by a number of factors including the Israeli occupation (Qumsiyeh and Abusarhan, 2021; Qumsiyeh and Albardeya, 2022).

CITES is an international agreement between governments, and its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species. SP made it a priority to sign the CITES Agreement for biodiversity conservation of the Palestinian environment. However, according to Handal et al. (2021), a total of 79 vertebrate wild animals have been found in Palestinian markets, including 59 bird species, 12 reptiles species, and 8 mammals species: 25% of the species in the CITES Appendixes.

Here is the **Global Strategy for Plant Conservation,** which Palestine also subscribes to:

Objective I: Plant diversity is well understood, documented and recognized.
Target 1: An online Flora of all known plants
Target 2: An assessment of the conservation status of all known plant species, as far as possible, to guide conservation action
Target 3: Information, research and associated outputs, and methods necessary to implement the Strategy developed and shared

Objective II: Plant diversity is urgently and effectively conserved.
Target 4: At least 15 per cent of each ecological region or vegetation type secured through effective management and/or restoration
Target 5: At least 75 per cent of the most important areas for plant diversity of each ecological region protected, with effective management in place for conserving plants and their genetic diversity

Target 6: At least 75 per cent of production lands in each sector managed sustainably, consistent with the conservation of plant diversity
Target 7: At least 75 per cent of known threatened plant species conserved in situ
Target 8: At least 75 per cent of threatened plant species in ex situ collections, preferably in the country of origin, and at least 20 per cent available for recovery and restoration programs
Target 9: 70 per cent of the genetic diversity of crops including their wild relatives and other socio-economically valuable plant species conserved, while respecting, preserving and maintaining associated indigenous and local knowledge
Target 10: Effective management plans in place to prevent new biological invasions and to manage important areas for plant diversity that are invaded

Objective III: Plant diversity is used in a sustainable and equitable manner
Target 11: No species of wild flora endangered by international trade
Target 12: All wild-harvested plant-based products sourced sustainably
Target 13: Indigenous and local knowledge, innovations and practices associated with plant resources, maintained or increased, as appropriate, to support customary use, sustainable livelihoods, local food security and health care

Objective IV: Education and awareness about plant diversity, its role in sustainable livelihoods and importance to all life on earth is promoted
Target 14: The importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness programs

Objective V: The capacities and public engagement necessary to implement the Strategy have been developed
Target 15: The number of trained people working with appropriate facilities sufficient according to national needs, to achieve the targets of this Strategy
Target 16: Institutions, networks and partnerships for plant conservation established or strengthened at national, regional and international levels to achieve the targets of this Strategy.

Summary and Recommendations

The 6th NR summarized that, "T*here is still a significant amount of data to be collected on the threatened and endangered species in Palestine. Such baseline data will help produce better management plans for these species. Limited amount of work is done to protect certain areas and certain species*". We need in Palestine to generate Red Lists for fauna, flora, and ecosystems and the IUCN provides guidelines for these. For example, pollinators are another species under threat. Their necessity exceeds their norm importance for agriculture. most flowering plants rely on pollinators and pollinators are critical for food production but also for habitat /ecosystem stability. Strategies for conservation of pollinators focus on increasing flowering plants, not using insecticides/pesticides, and incentives/disincentive packages for farmers (Garibaldi et al., 2014). The Ministry of Agriculture strategy to promote pollinators was done as a cross-sectoral strategy (MOA 2020). Other recommendations include:

1. Proper research on species occurrence, phenology, ecology and other data should be gathered for better management planning (see Section 3.7 on Research for more),
2. Ecosystems should be central to our work (see Keith, 2015).
3. For better management and conservation of ecosystems, it is a must to include all stakeholders of the area and the community, increasing their environmental awareness and desire to act with the policies and laws to conserve our ecosystems in a healthy way (Van Dyke and Lamb, 2020).
4. Overgrazing is one of the major threats that is affecting ecosystems and biodiversity and leads to desertification by decreasing the vegetation cover in some specific and important habitats; it also decreases the soil fertility and the existence of nutrients in the soil. Many mechanisms have been

identified which can reduced the effect of overgrazing in habitats of Historic Palestine (Leu et al., 2021).

5. Sign important Conventions for saving and conserving species such as CITES (see Sections 1.4.1 and 1.4.2).
6. We need to reevaluate the phytogeographic zones in Palestine because the map of Zohary of the 1940s is still used today and it is widely inaccurate. Such reevaluation (to include also ecozones) is critical for conservation mapping.
7. We can use keystone species and surrogate species to measure changes in ecosystems (Carmel and Stoller-Cavari, 2006).
8. We need to compile a strategy for plant conservation that is based on the guidelines of CBD, and similar to this one from China
9. Special programs to combat pesticides, herbicides and chemical fertilizers are needed. This helps to protect polinators and soil biota, which increases biodiversity.
10. The IUCN Red List designation has criteria for regional work (IUCN, 2012a), species (IUCN, 2012b), and ecosystem designations (Bland et al., 2016). These should be followed to the letter in our region, as we so far have no such adopted or designated Red Lists.
11. Increase programs of planting native trees which increases biodiversity. Tree planting organizations can help such as Ecosia, 1t.org, Plan Vivo.
12. **In situ conservation** must be done at both levels: a) habitats by utilization of protected area management (see Section 3.2) and b) individual species management and protection (Heywood et al., 2018). The latter is applicable in Palestine, for example in the protection of wide ranging species that have limited remaining numbers (such as gazelles, ibex, and large carnivores). In situ conservation process involves these stages: a) Inventory and assessment, b) Initial protection and monitoring, c) Establishing which species are of priority for conservation or recovery, d) Conservation and recovery planning, e) Monitoring strategy and plan, f) Consultation and review, g) Implementation, g) Aftercare.
13. **Ex situ conservation** including the use of botanic gardens, seed banks, pollen banks, field genebanks (living collections), and tissue/cell culture laboratories for short, medium or long-term storage of germplasm. Some of these are discussed under Section 3,2 on conservation of genetic resources (see also IUCN/SSC, 2013).
14. There is a possibility of survey and protection of important plants and animals that are living within altered agricultural landscapes (e.g. agroforestry systems, home gardens) that are outside natural habitats but within a species' native geographical range, called **'circa situm' conservation** (Heywood et al., 2018).
15. SP could develop a program like China's **Plant Species with Extremely Small Populations (PSESP) program.**(Wade et al. 2016)
16. Before embarking on conservation efforts, **ecogeographical data** must be collected (see International Plant Genetic Resources Institute 1997)
17. Chosen populations should cover a range of environmental conditions, space and geography, to ensure that potential restoration material can have well-matched and high genetic variation for the target environment. A thorough genetic conservation collection will cover all the ecoregions (a geographical area defined by moisture, temperature, environmental resources, and/or plant community) that the species occurs in (Heywood et al., 2018).
18. There is a need to designate some ecosystems as 'red ecosystems' (Valderrábano et al., 2021)
19. Curb trade in wildlife (see Handal et al., 2021 and https://www.traffic.org/).
20. Policies and laws should evolve and be applied in a way that can manage the ecosystems and protect species (Garmestani et al., 2020). Management (inclusive of research, conservation, and reintroduction) of species can be done both in situ and ex situ. Management of ecosystems is of course always the ultimate goal because even managing one or a group of key species would not help conservation if the ecosystem as a whole is not addressed. Elsewhere we have discussed ecosystem conservation, for example in the context of protected areas (see section 2.8).

2.19 Mobilizing Resources for Biodiversity Conservation

"All societal actors have a role to play in resource mobilization, with important roles for the public sector at all levels, as well as the private sector, including business, civil society, academia, nongovernmental organizations, charities and foundations, individuals and communities," CBD, 2020

Foreign aid for conservation efforts in developing countries has increased dramatically as has biodiversity spending (IUCN, 2012; Miller et al., 2013) and estimated expenditures on biodiversity globally are estimated at nearly $100 billion in 2020 (CBD, 2020). The recent emphasis on climate change and biodiversity, especially post-2020, has also resulted in significant potential (if fulfilled) government and private sector pledges (see https://www.leaderspledgefornature.org/). The impact has had heterogenous effects, depending on the local situation in developing countries. Priorities identified for further action in the Post-2020 Global Biodiversity Framework include:

- Attention towards three complementary components of RM – redirecting/reducing harmful use of resources; generating additional resources; and, better use of all resources.

- Enhancing synergies with finance for climate change and the SDGs;

- Mainstreaming of biodiversity across public and private sector plans and spending.

- Recognising that domestic resources will remain crucial.

- Addressing the need to integrate biodiversity comprehensively into the business and financial sectors,

- Governments leading by example, as well as creating a strong enabling framework for others to act,

- Building capacity in all its forms,

As a signatory to CBD, SP is technically eligible and has fulfilled its obigations for funding through the established mechanisms of CBD but is not getting the funding to which it is entitled to because of political considerations. SP divided its National Policy Agenda (SP 2016) into four major sectors: governance, social, economic and infrastructure. The infrastructure sector is divided into the following sub-sectors: energy, environment, housing, transportation, and water and wastewater management. It should be noted here that the environment was acknowledged in 2009 as a cross-cutting sector. With this change, an increased interest in the environment has been observed (MOPAD, 2014).

In 2012, the EQA developed a National Strategy, Action Program and Integrated Financing Strategy to Combat Desertification in the SP (EQA, 2012)**.** The overall objective of the strategy is "to prevent, halt and where possible, reverse the effects and impact of desertification, land degradation and droughts, in order to contribute to poverty alleviation, improve livelihoods of people and achieve Sustainable Development". The strategy identified five priority projects that should be complementary to what had been identified in the NDP for the years 2011-2013, to the sum of USD 4.2 million, with the EQA as the lead agency, in cooperation with other Palestinian stakeholders, including non-governmental and private sector. This strategy was a promising tool to improve and enhance agricultural productivity through the conservation and improvement of agricultural soil fertility. Moreover, it was considered an effective mainstreaming strategy for biodiversity and protected areas, conservation and development. The following four strategic objectives were defined (EQA, 2012):

- To upgrade institutional, legal and human capacities and frameworks and to create an enabling environment for sustainable use.
- To improve awareness and attitude of the stakeholders and to seek maximum participation and partnership of the affected people and the private sector.
- Conservation and sustainable use of natural resources.
- To improve mobilization, and effectiveness of financial and technical resources.

Funding agencies and groups that support environmental conservation in SP are many and some data is reviewed in the 6th NR. The Global Environment Facility (GEF; http://thegef.org/) is an international partnership committed to addressing global environmental issues. It serves as the financial mechanism for five environment-related conventions, including the CBD, and provides essential support to Parties. GEF's trust fund is replenished through pledges from Parties and development banks whilest GEF's Council allocates funding to assist eligible countries in meeting the objectives of the CBD. Guidance issued by the CBD provides operational criteria and financing priorities for the choice of GEF-funded biodiversity projects and programs. The latest adopted guidance has three key priority clusters:

1. To mainstream biodiversity across sectors as well as landscapes and seascapes;
2. To address direct drivers to protect habitats and species;
3. To further develop biodiversity policy and institutional frameworks.

Countries are eligible for funding if they have ratified the Conventions and if they are eligible to receive World Bank (IBRD and/or IDA) financing or if they are an eligible recipient of UNDP technical assistance through "targets for resource assignments from the core" (specifically TRAC-1 and/or TRAC-2). However, SP, while technically eligible, has been denied funding via this mechanism by an unfair veto from the US (for political reasons). The only grants available through GEF is the SGP (Small Grant Program). On another front, The Royal Belgian Institute of Natural Sciences (RBINS) carries out several Global Taxonomy Initiative (GTI) related activities with support of the Belgian Development Cooperation through the Capacities for Biodiversity and Sustainable Development (CEBioS) program. SP is eligible and had received several projects through this funding. There are also networks focusing on certain thematic areas, such as BIOSCAN, the Global Flora Project and participating organizations like the Group on Earth Observations Biodiversity Observation Network (GEO BON) or GBIF (dependent on their national and international research project funds).

The CBD 2020 recommendations include:

Component I: Reduce or redirect resources causing harm to biodiversity

Component II: Generate additional resources from all sources

Component III: Enhance the effectiveness and efficiency of resource use

There are a number of regional and global instruments and agreements that could be of great benefit to SP as it updates its strategy for biodiversity conservation and environmental protection in general and reallocates resources in more rational ways. Great programs exist that can be effectively used to deliver effective results in conservation efforts including GEF (GEF, 2012, 2013), Mediterranean Action Plan (MAP), the Euro-Mediterranean Partnership, Mediterranean Environmental and Technical Assistance Program (METAP), the League of Arab States: including Council of Arab Ministers Responsible for Environment (CAMRE), the Arab League Educational, Cultural and Scientific Organization (ALECSO), the Arab Center for Studies of Arid Lands and Desertification (ACSAD) and the Arab Organization for Agricultural Development (AOAD).

CBD set Financial Resources (Article 20) and Financial Mechanisms (Article 2). The information on resource moblization by CBD was updated (CBD 2020). Significant resources for biodiversity conservation especially in response to the main threats like climate change have been mobilized globally (see link). The 6th NR stated, "There are minimal financial resources [locally] and there is also a need for capacity building programs relating to biodiversity in SP. While there was improvement in this area since the 5th NR, much more is still needed. CBD is looked upon as well as other agencies to remove any political blocks on funding which would allow the State of Palestine to better preserve and protect its rich biodiversity. Such finding is also in line with the obligations and benefits that supposed to accrue to state parties to conventions such as CBD. This in turn is critical for global biodiversity because of the geographic position of SP."

Public biodiversity investments have increased significantly and for most countries they are at an average of 1.3% of GDP – ranging from 0.009 to 2.68% (Seidl et al., 2020).There are now increasing pedges for biodiversity and environment conservation especially relating to threats including climate change (link1, link2).

The National Adaptation Plan (NAP) to Climate Change proposed (EQA 2016) budgeting for adaptation to climate change that totaled $3.5 billion ($13.4 million for terrestrial ecosystems and 114 million to coastal and marine).

In its Theory of Change, The European Joint Program (2019) proposed, "The ROF (Result Oriented Framework) approach on the mainstreaming environment is in most parts applicable for 2020. However, the Intervention Logic will require a review of the direct relations between the ROF and the environmental priorities of the NPA to improve coherence as well as to mainstream the Green Deal requirements. A long-term targeted programme for capacity building of the EQA - Strengthening EQA Environmental Action Programme 2018 to 2021 - serves as one of the cornerstones for European Development Partner (EDP) support. The programme is supported by the Swedish Environmental Protection Agency (SEPA)."

Over 200 biodiversity projects have been carried out in SP. According to the IUCN-ROWA commissioned study, projects been executed within one year included 54 projects in Biodiversity and 48 projects in Awareness, Capacity-building, Training and Educational Programs (EQA, 2016).

Funders for local work include:

Government Agencies:
EQA
MOF
MOA
MOTA
NARC
MOLG

Universities and Academic Research Institutes

Local Non-Governmental Organisations
e.g Welfare Association

Global bodies
ANERA
Arab Bank for Economic Development in Africa
Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD)
Arab Fund for Economic and Social Development (AFESD)
Arcadia Fund
Belgian Development Agency
BirdLife International
Critical Ecosystem Partnership Fund (CEPF)
Earthwatch Institute
EarthWays Foundation
Endangered Species Recovery Fund (ESRF)
ENPI (European Neighborhood and Partnership Instrument) Program
Food and Agriculture Organization (FAO)
Ford Foundation
Global Diversity Foundation (GDF) regional programmes
Global Environment Fund Grants (GEF)

Global Green Grants Fund
Green Development Foundation
Hanns Seidel Foundation
Hima Fund Qatar
International Center for Agricultural Research in the Dry Areas (ICARDA)
International Union for the Conservation of Nature (IUCN)
Japan Biodiversity Fund, through CBD (Convention of Biological Diversity) Secretariat
Marine Stewardship Council
MAVA Foundation
Saudi Fund for Development
Swedish International Development Agency SIDA (Eriksson 2021)
Swiss Confederation/Swiss Federal Department of Foreign Affairs
Telemachus Foundation
The Islamic Development Bank
UNDP/PAPP
UNESCO
United Nations Development Program (UNDP)
United Nations Environment Program (UNEP – ROWA)
United Nations Environmental Program (UNEP)
US Forest Service
Federal Ministry for Economic Cooperation and Development (BMZ)
USAID
Wildlife Trust
World Food Programme (WFP)
World Wildlife Fund (WWF)

Private Sector
KFW Bank, Germany
Bank of Palestine
PALTEL
Padico Holdings

Others
Local community
Private personal donations
Religious bodies (e.g. Church of Sweden)

3 The construction process of the NBSAP

3.1 System development for NBSAP

General issues

The CBD recommends working to targets in 2030 and 2050. There is a UN General Assembly Resolution that sets 2020-2030 as the decade for ecosystem restoration (see https://www.decadeonrestoration.org/). According to the consolidated guidance set by COP, under mainly Decisions IX/8 and X/2 (https://www.cbd.int/nbsap/guidance.shtml), the NBSAP should consider the following issues to meet the objectives of CBD:

a) Ensure that NBSAP is action-driven, practical and prioritized, and provide an effective and up-to-date national framework for the implementation of the three objectives of the Convention, its relevant provisions and relevant guidance developed under the Convention;

b) Ensure that NBSAP takes into account the principles of the Rio Declaration on Environment and Development adopted at the United Nations Conference on Environment and Development;

c) Emphasize the integration of the objectives of the Convention into relevant sectoral and cross-sectoral plans, programs and policies.

d) Promote the mainstreaming of gender considerations;

e) Promote synergies between activities to implement the Convention and poverty eradication;

f) Identify priority actions at national level, including strategic actions to achieve the objectives of the Convention;

g) Develop a plan to mobilize national, regional and international financial resources in support of priority activities.

An NBSAP Forum was launched by CBD together with UNDP, UNEP, UNEP-WCMC, etc.

While there are strategies and action plans for use of some natural resources, there is very uneven development of good indicators going forward (e.g. https://www.bipindicators.net/about). This is largely due to Israeli occupation but there are also local issues that impede development and protection of resources. There are many challenges to doing so. An example is that the enforcement of laws relating to environmental protection is limited due to the lack of Palestinian sovereignty

The new global targets should be adopted as the minimum for national targets. Parties will implement the post-2020 GBF and report their progress to the COP. The COP will undertake reviews on specific parties' implementation of the post-2020 GBF, based on monitoring indicators and systems. Non-governmental stakeholders will galvanize the development andf review of the post-2020 GBF, and participate in its implementation. Supporting and mainstreaming measures will be created, including strategies and policies, financial resources, science–policy interface, awareness-raising activities and training courses. (Xu et al., 2021). The tools are available to countries and many do correct assessment and planning including for their NBSAPs. IPBES (https://ipbes.net) and CBD (https://www.cbd.int/nbsap/) provide resources to carry out the needed steps (e.g. Figure 3.2). See also Ash et al. (2010) and UNEP-WCMC (2011) and CBD (2020), the Strategic Plan for Biodiversity 2011-2020, including Aichi Biodiversity Targets. https://www.cbd.int/sp and https://www.cbd.int/nbsap/guidance.shtml

Indicators globally and nationally will be followed as per the guidelines in the Biodiversity Indicators Partnership (BIP www.bipindicators.net), a global initiative to promote the development and delivery of biodiversity indicators. TEEB (2009) suggests that the status of biodiversity could be measured according to an expanded CBD indicator set and summarized into the following five SMART (specific, measurable, achievable, realistic and time-specific) targets/indicators for biodiversity:

• Taxonomic difference between species – phylogenetic trends

• Population trends (e.g. based on a modified version of the Living Planet Index: see Collen et al., 2009; Loh et al. 2005)

• Species extinction risk trends (based on the Red List index: see Baillie et al., 2008)

• Ecosystem extent (following CBD practice, with agreement on classes and definitions)

• The condition of ecosystems according to key attributes.

The two noted problematic areas in SP in terms of conservation are the lack of appropriate knowledge (proper ecosystem assessment) and the gap between the knowledge that exists and implementation. Limited

knowledge is indeed a disadvantage but it should not prohibit some work, provided accuracy of information is included (see Section 2). Sometimes the indefinite nature of knowledge in biodiversity can be useful in science education because it allows students to understand the value of gaining new knowledge. The second obstacle is even more ominous: how to ensure effective implementation with measurable results. It is not sufficient to say, for example, that there is rich biodiversity in a 'protected area' and conclude therefore that the protection has had an effect. The real test is to study the counterfactual form: "what would have happened if the intervention did not occur" (Ferraro and Pattanayak, 2006). Such studies can be done scientifically, for example by measuring and comparing outcomes in areas with intervention/conservation efforts and areas without such intervention (these should preferably be randomly assigned). This is classic scientifically-controlled studies. However, this has not been done in many situations around the world as in the case of SP. (See recommendation in Section 10).

The old concepts of species management in environmental protection have now given way to ecosystem-based management or ecosystem approaches. Ecosystem approaches are now "applied in ecology, human ecology, environmental planning, anthropology, psychology, and other disciplines, [and] may provide a more trans disciplinary route to successful integration of environment and development." (Slocombe, 1993). It is incumbent to look at the whole ecosystem and how to manage our resources, in an integrated approach to bring the various components into consideration (both the components of the ecosystem that the species live in and the components of the human stakeholders and groups that will ensure long-term sustainability).

Taking some ideas from the literature (e.g. Mistry et al., 2021, and the desktop study where over 3000 documents reviewed) and via the participatory thematic workshops and focus groups, ideas were developed for working with Palestinians of all backgrounds to build an inclusive national strategy and action plan. Specific points to consider:

1) Develop training modules for local people to disseminate widely via social media that are culturally sensitive and that draw on the rich traditional knowledge and practices of our people (in the Fertile Crescent). These can include Powerpoint presentations (here is an example), written briefings in lay-person language, videos, applications on mobile phones (e.g. https://apple.co/3F33a1k), etc.
2) Traditional knowledge action plans that are developed collectively in a participatory way are very practical. Knowledge from the past can be very valuable in conserving biodiversity as they have tested solutions from the past (Boivin and Crowther, 2021).
3) Stakeholder and community analysis is critical.
4) Think of rights, responsibilities, and returns (benefits).
5) Think of both spatial and temporal issues when building action plans (where, when).

Facilitators for all workshops should follow classical guidelines of effective facilitation, leading to results achievement, including:

a) consider all aspects of the session and its relation to NBSAP preparation(desktop information digestion)
b) prepare beforehand by researching the signed-up participants so as to know more about them
c) clearly explain at the beginning to participants about the NBSAP, its process and what is expected of the session, and especially highlight the benefits to them, to society, and to nature (utilitarian, aesthetic, ecosystem, intrinsic)
d) do a round of introductions (to get to know the participants: learn their names and backgrounds)
e) develop an action-oriented main agenda: with a list of subjects, breakouts (if needed), report back, etc.
f) encourage participation and avoid lecturing, merely facilitate: be neutral, an active listener, observant, positive, and aware of group dynamics
g) Encourage feedback and questions.

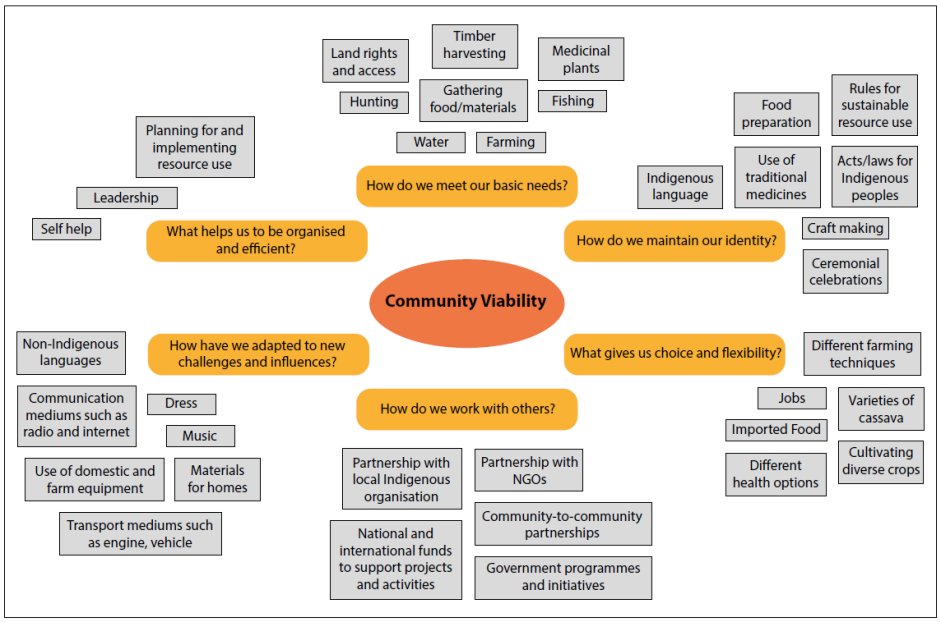


Figure 3.1 Issues to consider in gathering the data (after Mistry et al., 2021)

The NBSAP process included a series of preliminary activities that supported the drafting and that brought together existing cartographic and cognitive data, such as the collection and cataloguing of all available technical documentation. In parallel, capacity-building was done, including via weekly workshops (over 30 held and are continuing) and training in GIS and remote sensing. All data collected are archived in databases and are to be uploaded onto a central CHM.

Local work done

The guidelines of CBD COP Decision 9/8 was followed that calls for engaging indigenous and local communities, and all relevant sectors and stakeholders including representatives of society and the economy that have a significant impact on, benefit from or use biodiversity and its related ecosystem services. CBD NBSAP webpages (www.cbd.int/nbsap) were useful including the training modules on NBSAP (https://www.cbd.int/nbsap/training/). The criteria used in determining solutions to save biodiversity was that the community: needs it, does it, controls it, and benefits from it, and that the solution is fair, good for the environment, and sustainable without long-term external support (Mistry et al., 2021).

The local activities to build the NBSAP included:

I. Preparing, updating and implementing national biodiversity strategies and action plans with the participation of a broad set of representatives from all major groups to build ownership and commitment;

II. Identifying relevant stakeholders from all major groups for each of the actions of the national biodiversity strategies and action plans;

III. Consulting those responsible for policies in other areas so as to promote policy integration and multidisciplinary, cross-sectoral and horizontal co-operation to ensure coherence;

IV. Establishing appropriate mechanisms to improve the participation and involvement of indigenous and local communities and civil society representatives;

V. Striving for improved action and cooperation to encourage the involvement of the private sector, namely through the development of partnerships at the national level;

VI. Strengthening the contribution of the scientific community in order to improve the science/policy interface to support research-based advice on biodiversity.

The Manual for the Development of Sectoral Strategies for 2017-2022 was prepared by the Ministry of Finance and Planning and it identified a set of expectations that are deemed as the objectives of the sectoral planning process. These are as follows:

1. Determine the role of responsibility centers, Non-Governmental Organizations (NGOs) and the private sector in the delivery of services and the sector's development.

2. Determine the Government's efforts to achieve the strategic objectives over the next six years through goals, objectives and standards of program policies.

3. Determine the required arrangements to ensure coordination between governmental and NGO plans.

4. Describe actions needed to influence the decisions and actions of civil society organizations and the private sector (including legislation and laws).

5. Describe the expected role of the private sector over the next six years including adherence to laws and legislations, fund transfer and governmental support.

6. Describe interventions agreed upon by all development partners, including funding plans for development projects (internal and external).

International flora was joined, including the COP26 International Group cop26-international-group@googlegroups.com https://nbsapforum.net/forum and the technical ad hoc group on post-2020 indicators.

Both the civil society and the scientific community were engaged to bridge the policy-practice gap (Koh et al. 2022).

The overall process was undertaken through the following eight activities:

Activity 1: Perform and deliver an inception report, including a comprehensive involvement of key actors and information sources:

1.1 Stakeholders

A stakeholders' participatory framework for reviewing/updating the NBSAP was developed, where first the stakeholder groups were identified, including their roles and responsibilities and the ways/means of ensuring their participation in the NBSAP revision and updating process. The list of stakeholders was created and updated over the various workshops, meetings and interviews in relation to their profession and required feedback. The groups and lists of stakeholders compiled for the preparation of the 6th National Report was used as a platform from which the list was improved and expanded as relevant to the NBSAP. They included Government ministries and authorities, representatives of local community organizations, research and academic bodies, the private sector, bodies representing the agricultural, forestry, fishery, tourism, energy, transport, manufacturing and other sectors, environmental management bodies, non-governmental organizations, women's organizations, and agencies addressing sustainable development and poverty eradication. Systematic gender mainstreaming was considered during the preparation of the NBSAP, and in associated implementation and reporting mechanisms; in line with the 2015–2020 Gender Plan of Action under the Convention on Biological Diversity.

An Inaugural National Conference was held on 8 November 2021 in Ramallah (Red Crescent Society). Having concluded and shared the 6th CBD NR, the purpose of the workshop was to introduce the participants to the NBSAP process, to invite comment and to help clarify the methodology of formulating the NBSAP (inception report). A total of 55 people attended including government officials, NGO members, academics, community representatives, independent scientists and activists. The main elements of the process were presented to the plenary. The workshop also generated ideas for weekly thematic meetings to involve reading material and generation of action points towards the strategy. (Recordings can be found here, in two parts: part 1, part 2.

1.2 Specifying the data/information sources from which the information needed for updating the NBSAP are accessible and secured.

All appropriate sources of information were considered when reviewing/updating the NBSAP in order to ensure that they comprehensively reflect national circumstances. This not only includes strategies/reports prepared by the EQA but also strategies/reports prepared by other ministries and authorities of relevance. Key sources of information include country biodiversity studies and/or assessments, as well as the 6th National Report (an outcome of this consultancy), national biodiversity frameworks and national reviews of implementation of the Convention and the 1999 National Biodiversity Strategies and Action Plans for Palestine (1999 NBSAPP). It also includes the collection of assessments done regarding the values of biodiversity and of the ecosystem services and functions they underpin, threats to and underlying causes of biodiversity loss, and other sources as relevant and needed for the preparation of the NBSAP. Furthermore, advantage of reports, publications, and databases submitted to other biodiversity-related Conventions, such as the Rio Convention (1992) was taken, and relevant multilateral environmental agreements, as well as regional biodiversity reports and assessments, and relevant information managed or maintained by international organizations. Over 1000 published documents were reviewed (800 of which are in the Section 9 References) as were hundreds of web-based information sources (see also Section 10 Web Resources).

Outputs of Activity 1:

1. Database of selected stakeholders, involved in the preparation of the 6th NR and of many others who were/would be key to NBSAP work, providing interactive information with their contact details, potential roles and responsibility while reviewing/updating the NBSAPP, workshops/meetings participated in, means of communication, and other, as appropriate was compiled. (Stakeholders' inventory link). Stakeholders were also asked to fill surveys of data (example here).
2. A collective shared drive of archived data/ information which the consultancy team and EQA can access when needed and as appropriate. The generation of a document database (available here link).
3. An inception report, completed on 3 September 2022 (link), was developed to clearly describe the plan of work and ensure it meets all needed requirements for arriving at an exemplary NBSAP document. It outlines the process of updating the NBSAP, including stakeholder consultations, the detailed logframe, timeframe, and milestones, role of the consultancy team, key actors and data sources, the media plan, the financial work plan, the archive of relevant publications that will be considered during the updating of the NBSAPP (Outputs 1 and 2). Taking into account the objectives, activities and log-frame, the consultancy team came up with a detailed action plan with specific tasks assigned to each partner (see Section 1.6). Each team member knows exactly his/her tasks and obligations including deliverables. A media plan is to be elaborated to announce the initiation of the NBSAP revision and updating.

Activity 2: Stocktaking and assessment of outcomes and recommendations from past and current related literature

Consultation with relevant stakeholders gathered information through communicating and conducting meetings with them, in a manner that enabled analyzing, interpreting, verifying and setting synergies where appropriate. The GIS consultancy expert provided GIS training. In addition, to the development of a public awareness package to inform the media and civil society.

The stocktaking took these issues into consideration:

1. Assessed and compiled the biodiversity values, including, as appropriate, ecosystem services, poverty eradication, climate change adaptation and mitigation, national development and human well-being, as well as the economic, social, cultural, and other values of biodiversity as emphasized in the Convention on Biological Diversity, making use, as appropriate, of the methodologies and conceptual framework of the Millennium Ecosystem Assessment: UNEP/CBD/COP/DEC/IX/8.

2. Assessed and compiled information and data related to the causes and consequences of biodiversity loss; the main threats to biodiversity (and ecosystems), including direct and indirect drivers of biodiversity change, and included actions for addressing the identified threats. Data types included drivers of biodiversity (flora and fauna) loss in protected areas, forest, agriculture, marine biodiversity, wetlands and dry land environments. Described the impacts of declining biodiversity and ecosystems on human well-being, livelihoods, poverty reduction, etc. Linked the threats (direct drivers) with the underlying causes (indirect drivers) and related these to the relevant economic sectors. Among the potential threats assessed were poaching, boundaries encroachment, alien invasive species, uncontrolled fires, tree cutting and vegetation clearing, human-wildlife conflict, and others.

3. Reviewed and compiled national constitutional, legal and institutional framework through conducting an overview of the biodiversity policy and planning framework and relevant broader policy and planning processes (national development plans; poverty reduction strategies; climate change adaptation plans, etc.). Included an outline of relevant constitutional, legal and institutional national frameworks. The institutional framework included government institutions, higher learning and research institutions, nongovernment organizations, community-based organizations, local communities and the private sector.

4. Compiled results of the stocktaking of outcomes and recommendations from current and past reports, plans, and strategies including revision of related literature and sources of information such as spatial data (done in Action 1.4). This includes SP's national data, mainly the accomplishments of the 1999 NBSAPP, but also similar data from other nearby countries like Jordan and Lebanon.

5. Incorporated lessons learned from the earlier 1999 NBSAPP, including summary results of any evaluation of its effectiveness. It identified the challenges and gaps that need to be addressed and main priority areas for the revised NBSAPP. It also included brief reflections on the process of developing the previous 1999 NBSAPP and how this may have influenced its effectiveness. The evaluation of the effectiveness of the 1999 NBSAPP includes the improved conservation of protected areas and wetlands, rational use of biotechnology, policy, legal, institutional and human resources strengthening, equitable sharing of benefits derived from the use of biological resources, challenges and gaps to be addressed, and success stories.

Outputs of Activity 2: As also noted in Sections 1 and 2 of this report, they included:

a) Gathering of data and information, including all relevant publications, plans, policies, and reports also integrating the findings of desktop studies and 6th National Report in a manner that responds to the requirements for NBSAP development,

b) Assessment emanating from a review of biodiversity values, including ecosystem services, as well as the economic, social, cultural, and other values of biodiversity as emphasized in the Convention on Biological Diversity,

c) Assessment emanating from a review of causes, drivers and consequences of biodiversity loss including the impact of declining biodiversity on human well-being,

d) Brief review of national laws, plans, strategies, policies, projects and programs relevant to Biological Conservation (work done by two external consultancies, although there is still much to be done in this area and SP plans to create new laws and regulations),

e) Summary of the results of the evaluation of the effectiveness of the 1999 NBSAPP and lessons learnt (see Section 1.8).

Activity 3: Develop the national biodiversity strategy: Principles, Priorities and Targets of the Strategy

The next step was proceeded to determine the national goals, objectives, and targets in line with the post-2020 guidelines. This was consistent with the flexible framework established in Decisions VII/30 and VIII/15, taking into account all outputs of previous actions, mainly the rapid stocktaking and review, the assessment of biodiversity values, the rapid assessment of threats and drivers to loss of biodiversity, and the stakeholders engagement, as appropriate.

The national targets, principles and priorities are:

a. A long-term vision for the state of biodiversity in SP. It will be an inspirational statement that reflects the importance of biodiversity for people and is broadly shared across the country. This shall be aligned with the Strategic Plan for Biodiversity 2011-2020 and with other long-term relevant national development plans.

b. Principles governing the strategy including core values and beliefs underlying the NBSAP.

c. Main goals or priority areas including the most pressing issues that are addressed by the NBSAP. Among these should be goals to ensure the mainstreaming of biodiversity (i.e. integration of biodiversity into broader national policies, strategies and plans).

d. National Targets (SMART) in line with the post 2020 targets. These should be strategic, specific, measurable, and ambitious but realistic targets that are time-bound. They may be grouped under the main goals or priority areas and correspond with the Strategic Plan for Biodiversity 2011-2020 and the global Aichi Targets.

30 consultation workshops were conducted online, three workshops in person (launching plus two more), and over 20 focus group meetings to gather ideas for action plans that fall under the post-2020 framework modified to meet local needs. All stakeholders participated in developing action plans for building the national biodiversity strategy and action plan. Another 10 workshops were also held to take up the action points and to use them to publicize the work. See the list of the workshops (dates, titles, facilitators, recordings) and the list of attendees Action Points from the workshops can be found in this link

The mid-term National Workshop of the NBSAP was held in February 2022, with the following objectives:

a) To review the progress of preparation of strategy and action plans at various levels under NBSAP project. This includes briefing on outputs of the weekly workshops and desktop and focus group/individual meetings;

b) To facilitate the exchange of ideas and experiences amongst the coordinators of agencies involved in the process;

c) To outline the future course of action to meet the objectives of NBSAP;

d) To seek the participation of agencies and sectors not so far involved in the process, including generating interest for subsequent implementation of the action plans. Four breakout sessions were held (conservation, ecosystem service/benefit sharing, databases/research, and resource mobilization) and they generated action points which were incorporated into the system.

TheEQA with the aid of a consulting team and (especially the Natural Resources Directorate, Planning and Policy Directirate), Ministry of Agriculture, Ministry of Finance and Planning, Ministry of National Economy, Ministry of Labor, Water Authority, Palestinian Central Bureau of Statistics, Risk Prevention and Agricultural Insurance Fund, Palestinian Agricultural Credit Institution, the Ministry of Local Government, Ministry of Health, Ministry of Education, etc.

The consultative workshop considered the following aspects:

- The proposed country specific targets, principles, and priorities of biodiversity conservation, including the long-term vision, principles governing the strategy, the goals and strategic objectives, and national targets.
- The adopted Strategic Plan for Biodiversity (2011-2020) and post 2020 Framework and its associated goals, the Aichi Targets and indicators to be prioritized and nationally relevant; all in a Palestinian context.
- The 1999 NBSAP and national frameworks and their associated goals and targets to be included in the updated NBSAP.

The NBSAP strategy focused on the following issues:

- involving indigenous and local communities as per the prevailing legal provisions, especially those marginalized, living in geo-political Area C, east Jerusalem, and Gaza Strip, and whose ecosystems are particularly threatened, for example by colonial activities.
- considering ways and means of promoting gender equality.
- setting synergies, and mainstreaming of biodiversity with sectoral developments,
- setting synergies with poverty reduction strategies and policies (SDGS),
- setting synergies with climate change adaptation strategies.
- setting synergies with economic development strategies and trade policies
- setting synergies with other sectors such as agriculture, tourism, and education.

Mainstreaming relies on assessing a number of linkages between biodiversity and the targeted sector including: (a) how each sector uses and benefits from biodiversity and ecosystem services, (b) how the sector impacts on biodiversity and ecosystem services, (c) how the policy area targeted for mainstreaming functions, (d) how the policy-making process unfolds, including incentives for reducing adverse impacts on biodiversity, (e) who are the main actors and stakeholders in the policy area targeted for mainstreaming, and (f) alternative policy options relevant to the targeted sector or policy area.

Outputs of Activity 3:

1. Country specific vision, mission, goals, objectives and targets (see Section 5.1).

2. Action plans (see Section 5.2).

3. Outlining how the NBSAP could be integrated and mainstreamed into sectoral development, gender equality, poverty reduction, climate change mitigation and adaptation plans, and others such as agriculture, tourism and education (section (See Section 6).

Activity 4: Develop EQA in-house capacity in GIS and remote sensing

Development of EQA in-house capacity to implement and manage geographic database (GIS) and remote sensing on natural resources and biological diversity has been carried out. At least 8 people (EQA staff and others from local institutions) have been trained. The training included how to:

a. Prepare and structure GIS data

b. Describe all fields layer in the geo-database, and characterize metadata for each layer

c. Digitize/create new thematic layers, using scanned maps, satellite images and GIS data, in accordance with the structure and coding system defined by the GIS unit of the EQA

d. Produce thematic maps on natural resources and biological diversity using the GIS and Remote Sencing software, including habitat and land cover photo-interpretation from aerial and satellite images

e. Perform spatial analysis to assess land cover, habitats, biodiversity, change and developments occurring in protected areas (with a special focus on land use and forest types, including mapping of forest restoration

sites) and for producing geographic statistics including how to calculate the area of annual change in protected areas and to develop a map of annual human-induced change within the targeted area.

Training at this level was restricted to provide an overview of the basic functionality of the GIS system: web applications and data entry, using client specific data,basic functionality of ArcGIS Desktop, data entry/manipulation (geodatabase), query building, report generation, data migration, automation, integration, dissemination, preparation of map products, web applications, and mobile applications,

It did not entail any complex GIS analysis, data entry or manipulation.

GIS was then used extensively in preparation of a new Protected Area Network (under the leadership of EQA, IUCN, and PIBS).

Outputs of Activity 4

1. Development of EQA institutional capacity-building to implement and manage a Geographic Information System database (GIS) on natural resources and biological diversity.

2. Implementation of a capacity-building training program on GIS & RS for both natural resources and biodiversity EQA staff (including viewers, field surveyors and data collector users, professional users, and power administrator users), where all participants were well-trained in terms of GIS and RS, and GIS applications used on CBD web-pages.

3. Production of data to support the preparation of the NBSAP interpretations and discussion especially in the field of land cover, biodiversity and developments in protected areas.

4. Set of high precision maps and thematic layers for the natural resources and biological diversity were produced, also to support the production of the NBSAP.

5. A training manual and evaluation report for the capacity-building training workshops was produced.

6. Minutes of meeting and attendance sheets for the training sessions were kept, to act as raw data for strategies that the communities can take to produce tangible biodiversity changes.

Activity 5: Development of the National Strategy Action Plan

Actions were planned to achieve the national strategic goals, objectives, and targets. These consist largely of strategic actions, such as institutional, legislative, economic or other policy and institutional actions that will provide the enabling conditions and incentives necessary to achieve the goals and/or priority areas and targets of the updated NBSAP. More specific actions would be indicative, acknowledging that approaches will need to be adapted in the light of implementation experience.

The plan determines who does what, where, when and how using a specific approach and tools that will be decided upon in consultation with EQA. It was built in synergy with the developed strategies, set out under Activities 2 and 3 above, and in line with existing national development goals and sectoral plans and the CBD, and in synergy with relevant MEAs, specifically the Rio Convention (UNFCCC & UNCCD Conventions), 2020 Biodiversity Framework, World Heritage Convention, CITIES, CMS, and Global Assessment of Biodiversity carried out by IPBES.

The Action Plan was set in a manner that responds to the national circumstances, mainly in relation to the political conflict, including the lack of access to and control over natural resources and the challenges that face the environment as a result.Two scenarios were considered while building the action plan, based on the political situation and Israeli control over natural resources. The scenarios are: a. the status quo (existing situation), and b. a free State of Palestine with the borders of 1967.

The large number of strategies and actions in the NBSAP necessitated prioritizing them through national workshops. For example, from over 380 potential action plans, 97 were selected that achieve agreed upon objectives and goals. The facilitating committee can discuss the prioritization table in detail, attempting to

be as 'objective' as possible. However, the introductory note acknowledges that some biases are inevitable. The strategies were prioritized on three parameters:

1. Urgency: the immediacy of the strategy, including those that need immediate initiation even if their execution may take long (with 1 denoting very immediate/urgent, and 3 denoting least immediate/urgent).
2. Overall impact: the level to which the strategy will have a significant, national-level impact, including localized impacts of national significance, such as the conservation of a highly endemic species (with 1 denoting highest overall impact, and 3 denoting lowest overall impact),
3. Current neglect: the adequacy or inadequacy with which the strategy is currently being addressed (with 1 denoting highest level of neglect, and 3 denoting least level of neglect).

The aim was to integrate biodiversity into broader national policies, strategies and plans and to develop sectoral and cross–sectoral action plans and mainstreaming, including:

a. Developing a communication, education, public awareness and outreach plan for NBSAP.

b. Developing an access and benefit-sharing plan in relation to genetic resources and their utilization to ratify the Nagoya Protocol.

c. Developing an accountability framework for the NBSAP.

d. Developing or amending policies, legislation, and institutional arrangements.

e. Putting into place or amending regulations and procedures.

Outputs of Activity 5:

A finalized Action Plan on all the above results, and in consultation with relevant stakeholders including: relevant governmental organizations such as the MoA (Ministry of Agriculture), MoTA (Ministry of Tourism and Antiquities), MoP (Ministry of Planning), MoNE (Ministry of National Economy), PWA (Palestine Water Authority), MoWA (Ministry of Women's Affairs), ; international organizations: UNEP, FAO, IUCN commissions, CBD secretariat; academic institutions; and local NGOs and civil society organizations, through conducting consultation workshops and individual meetings with senior decision-makers to receive recommendations, suggestions and comments.

An outline of the strategic Action Plan that reflects the strategic areas, targets and objectives; all interlinked to the associated duration, priority, implementing bodies, outputs, means of verification and costs, is found in Section 5.

Activity 6: Development of an implementation plan for the NBSAP (including mainstreaming and resource mobilization An implementation plan was built that reflects on the actions set out under Activity 5. This includes identifying the human, technical and financial resources necessary to carry out the actions.Additionally, specification of the national coordination structures was done for ensuring implementation and follow-up to the NBSAP. Other issues that will help implementation are:

Strengthening the national clearing house mechanism for biodiversity so as to promote the sharing of knowledge and expertise needed for implementation of the NBSAP.

Establishing a monitoring approach, including the identification of indicators by which progress towards national targets will be measured and reported.

Holding a consultative workshop and individual meetings with senior decision-makers to receive recommendations, suggestions and comments. During implementation, the NBSAP is likely to draw the attention of those governmental, private sector and civil society bodies that operate in economic or policy sectors that depend, and have an impact, on biodiversity. This will be encouraged and every effort should be made to bring these and other relevant stakeholders into the NBSAP process, to elicit their views and to

understand their relationship with biodiversity, such that they may become involved in the implementation of the NBSAP, and/or fully engaged and incorporated into the next revision cycle.

Preparing, negotiating and adopting legislative and administrative measures will be carried out by civil servants and politicians. There are plans for research to be undertaken that fulfil the needs/gaps of key biodiversity areas, upon consultation with related key actors such as universities and research institutes.

Outputs of Activity 6:

The implementation plan with all its setup, procedures and frameworks including the following: Capacity development plan for the NBSAP implementation, Communication and outreach strategy, Resource mobilization plan for NBSAP implementation (**see Section 6**).

Activity 7: Monitoring and Evaluation (Building the institutional, legal, monitoring, reporting and exchange national system)

Monitoring and evaluation mechanisms were built and procedures into the plan of action, and all were set in place for the start of the implementation phase; frameworks for each set of activities have been developed for keeping track of outcomes in relation to objectives and activities, and thus for gleaning lessons from the planning and implementation process to be fed into the next NBSAP planning cycle.Furthermore, dynamic and interactive indicator sheets and a monitoring approach for the implementation of the CBD, including provisions for reporting and the identification of indicators to track progress towards national targets was built.

National coordination structure was strengthened such as biodiversity units, national committees, and national (and, where relevant, regional) institutional networks for biodiversity that will guide, coordinate and clarify the roles and responsibilities of various institutional actors and ensure the proper implementation of the NBSAP, while considering gender equality and participation. Roles and mandate for conservation of biodiversity in SP were specified, such as the control and management of protected areas (PAs).

All relevant setups and decisions were set in a legal form. As well as recommendations for in depth revision of national legislation in the field of biodiversity and natural resources, for identifying gaps and recommending amendments to those legislations.

Outputs of Activity 7 (see also Section 6):

1. Monitoring and evaluation procedures and a set of frameworks / indicators for the implementation of the NBSAP.

2. Recommendations for strengthening the national coordination structure such as biodiversity units, national committees, national institutional network including a list of members (individuals or institutions).

3. Recommendations for gender equality and participation.

4. Building local capacities in terms of biodiversity conservation, strategic planning, managerial aspects, GIS & RS, relevant international frameworks, and much else.

5. The national Clearing-House Mechanism (CHM) was set-up.

6. A list of proposed amendments to national legislation of relevance to biodiversity.

Activity 8: Finalize the revised/updated NBSAP drafts, distribute them and edit according to inputs

The revised and updated NBSAP final drafts were further edited and distributed to participating stakeholders. Then a day workshop was held to get final inputs; (input was also sought by email from those who could not attend the meeting as well as those who wished to send input by email). Final editing and final approval followed, and three key documents of the revised/updated NBSAP (in English, with executive in Arabic) were produced.

Evaluation of the process and a report on the process engaged were produced, including feedback from stakeholders on the process and success, was carried out. This was accomplished in a collective manner through evaluation surveys done at the end of each consultation workshop and meeting; specific evaluation sheets regarding the process of NBSAP production and consultation were filled in, analyzed and reported on.

Outputs of Activity 8:

1. The revised and updated NBSAP document and interactive supportive documents, maps, etc.

2. The evaluation report for the process of the consultation, engagement of stakeholders and production of the NBSAP.

3. A final technical report, including all documents of the consultancy.

> "A public hearing is essentially a structured forum where diverse agencies, interest groups and individuals can articulate their views or grievances on a specific matter as inputs for decision-making. By providing space for expression of divergent views and interests, a public hearing can also function as a dispute resolution mechanism. The participants in a public hearing are heard by a 'hearing panel' (or a jury or 'commissioners'). This panel is responsible for recording the testimony of the participants for submission to the decision-making or planning agency. The objective is to improve the quality and democratic nature of public decision-making. Public hearings may be organized by government (for example for Environmental Impact Assessment of proposed development projects) or by citizens' groups or NGOs (e.g. People's Commission on Environment and Development). They may vary greatly in levels of formality and scale. For example, a public hearing may aim to provide a forum at a village, *Gram Panchayat* (or cluster of these), block, district or state level. In the NBSAP context, a public hearing could also be centered on a particular theme or sub-theme (agriculture, fisheries, wildlife, food security, gender, livelihoods, nomads), local area, eco-region or whatever is particularly relevant in the specific area. *The value of a public hearing depends on the quality of the process that is followed*. The larger the geographical area a public hearing aims to cover, or the more complex and vast the thematic areas to be covered, the more preparatory ground work will be required to make the exercise meaningful." (*Adapted from Guidelines for NBSAP Executing Agencies, for Conducting Public Hearings, 2001)*

Key issues for Weekly Workshops, held November 2021-August 2022

1. Regional, national, and thematic workshops provide an opportunity for networking at various levels and thereby learning from each other's experiences. The outputs so far (after the 6th meeting) were exemplary in coming up with action points, etc.
2. Regular meetings and workshops allow for the orientation of new people and refreshing of the objectives for those who have already been involved.
3. More time and effort need to be invested in planning, to allow for innovation of formats/schedules of a meeting.
4. More effort should be expended by participants to read ahead of the workshop (good material here is critical).
5. There needs to be regular discussion and orientation regarding cross-cutting issues (gender, equity etc.), intersectoral issues, and inter-state linkages, and the need to build them into the NBSAP. This needs to happen especially at the initial stages of the process and be reinforced later on.
6. Future regional workshops need to focus on regional specific issues, which could then be reflected in the national plan. Responsibility for organizing regional workshops by executing agencies allows for their greater involvement in the process.
7. More than one round of regional or thematic workshops might enable refinement of action plans, greater interaction and new ideas.
8. Budgetary and programatic plans need to be incorporated.

Questions asked of Ministries (examples)

Here are 15 specific questions to ask the **Ministry of Agriculture** (based on our earlier work we can also think of other questions for them and also model other Ministries in the same way). We can also print these.

1) After reading the briefing and from what you know, please tell us in what area the Ministry of Agriculture can/would contribute (as much as possible).

2) How can we involve the different offices of your Ministry (including local districts) in Biodiversity Conservation?

3) How can we involve farmers in better ways to understand value of conserving biodiversity (e.g. keeping green natural areas around olive groves; not using pesticides, etc.)?

4) How can we promote eco-friendly agriculture (permaculture, organic farming, etc.)?

5) How can we involve youth and women in eco-friendly agriculture?

6) The updated MOA (2020) Strategic Goals for the Agriculture Sector speaks about responsible production and consumption; let us talk more about that especially in relation to biodiversity.

7) Are there plans to update this and how can we include more on biodiversity and agricultural diversity (genetic resources, wild and domesticated plants and animals) as action plans in MOA work (in collaboration with EQA)? How can we promote in situ and ex situ conservation of these resources?

8) Are there any existing programs for soil conservation?

9) Let us talk about increased planting using native trees.

10) We need to discuss programs for reducing chemical pesticides.

11) How can MOA and EQA promote traditional/indigenous people's knowledge?

12) We need to discuss this project with Disney Conservation Fund and how it could strengthen work of rangers.

13) Do you think there is a chance for further domestication of plants and animals in Palestine (part of the Fertile Crescent where initial domestication happened)? If so whose responsibility is this (e.g. NARC research)?

14) Does the MoA have a role to play in promoting community gardens, roof-top and wall gardening, etc.?

15) Besides CBD, SP has signed a number of International Conventions that relate to biodiversity and that become essentially local laws (obligations are being fulfilled). Please relay to us role of your Ministry in each of those (or who would know): Convention Concerning the Protection of the World Cultural and Natural Heritage; Cartagena Protocol on Biosafety to the Convention on Biological Diversity; Paris Agreement under the UN Framework Convention on Climate Change; United Nations Framework Convention on Climate Change; United Nations Convention on the Law of the Sea; United Nations Convention to Combat Desertification.

Ministry of Local Government

1) After reading the briefing and from what you know, please tell us in what area the Ministry of Local Government can/would contribute (as much as possible).

2) How can we involve the different offices of your Ministry (including local municipalities) in Biodiversity Conservation?

3) How well does the spatial plan help planning local urban and village work and how can we improve it?

4) How can we promote eco-friendly cities and villages?

5) How can we involve youth and women in eco-friendly practices?

6) Can you tell us about programs you have for control of feral dogs and cats in ways that also do not harm local biodiversity (e.g. not using poisoning, castration, etc.)?

7) Would the MoLG be willing to put programs in place to encourage green buildings, leaving green spaces around buildings, etc.?

8) Do you have or are willing to allow EQA or others to provide capacity-building for engineers and others working in local government?

9) Let us talk about increased planting using native trees in streets and community green areas (and increase those) instead of introduced foreign trees.

10) Need to discuss programs of reducing use of chemicals in local municipalities and village councils.

11) To what extent do you think the local municipalities and village councils should be involved in environmental work and to what extent they should coordinate with EQA?

12) Does the MoLG have a role to play in promoting community gardens, roof-top and wall gardening, etc.?

13) What role do you think local authorities have to play in issues of raising public environmental awareness and education?

14) What are the key documents of your Ministry (MoLG) that are related to biodiversity and environmental conservation?

15) Besides CBD, SP has signed a number of International Conventions that relate to biodiversity and that become essentially local laws (obligations are being fulfilled). Please relay to us the role of your Ministry in each of those (or who would know): Convention Concerning the Protection of the World Cultural and Natural Heritage; Cartagena Protocol on Biosafety to the Convention on Biological Diversity; Paris Agreement under the UN Framework Convention on Climate Change; United Nations Framework Convention on Climate Change; United Nations Convention on the Law of the Sea; United Nations Convention to Combat Desertification.

16) What are existing projects and what additional resources would you need to **protect the environment (including biodiversity) better** a) at national level, b) at local level? Can you provide us with data?

In going about change, we should ask ourselves these five questions:

1) What do you understand to be the cause(s) of the problem you are concerned about?

2) What action(s) do you propose to address the problem?

3) What is the mechanism of change that you believe will be instigated by your proposed action, i.e. what do you predict will happen as a result of the action you will take and how will that contribute to change?

4) What criteria or process will you use to evaluate whether your theory of change is indeed correct?

5) Who do you intend to help and how will you be accountable to those people (via participation in your planning, implementation, evaluation, reporting, or whatever)?

In laying out the NBSAP, adherance to the policy and recommendations of CBD was done but taken into account local situations and available local guidelines and resources, in particular:

1) Results of consultations conducted especially for this purpose, including those in the weekly workshops held 25 November 2021 and then in weekly ongoing workshops and focus groups, governorate-level workshops, institutional workshops, or other consultations and meetings carried out over the consultation phase.

2) Outcomes of activities carried out and reports delivered by the four technical teams, which presented an in-depth diagnosis and analysis of the status of subsectors (see sections

3) Results of the analysis of all feedback and data gathered.

4) MoPAD-issued Technical Annex of the Guidance on Developing Sector and Cross-Cutting Strategies.

5) Guidelines on general political issues taken from the PLO Permanent Status Guidelines of the PLO Negotiations Affairs Department.

6) The Manual for the Development of Sectoral Strategies (2017-2022), which was prepared by the Ministry of Finance and Planning, has identified a set of expectations that are deemed to be the objectives of the sectoral planning process. These were as follows:

a) Determine the role of responsibility centers, non-governmental organizations (NGOs) and the private sector in the delivery of services and the sector's development. This is an ongoing process but some roles are listed in the first tab of this link.

b) Determine the Government's efforts to achieve the strategic objectives over the next six years through goals, objectives and standards of program policies. (This is still to be done through the work on the NBSAP).

c) Determine the required arrangements to ensure coordination between governmental and NGO plans. (This is still to be done through the work on the NBSAP).

d) Describe actions needed to influence the decisions and actions of civil society organizations and the private sector (including legislation and laws). This is 80% done via the action plans but is an ongoing process.

e) Describe the expected role of the private sector over the next six years including adherence to laws and legislations, fund transfer and governmental support. This is still to be done through the work on the NBSAP.

f) Describe interventions agreed upon by all development partners, including funding plans for development projects (internal and external).

h) Two focus group meetings were done in order to brainstorm on the most important topics related to the strategy, and which must be raised with and familiarized among the local community.

i) Review of the Key Points from the 6th National Report and NBSAP was done to gather information about the topics chosen in the focus group meetings and the text translated to be used in public education and awareness (see Link for the final document containing these summaries in Arabic and English).

j) We also consulted manuals of styles for reporting. For example, IUCN Style Manual.

In working, consideration was taken, for many people, biodiversity is valued for its utilitarian usage (ecosystem services in the narrow sense), while it should be valued as a long-term natural heritage protected for its own value.

3.2 Prioritization and Allignment with Post-2020 Global Targets

In Decision 14/34, COP CBD set out the process for developing a post-2020 global biodiversity framework, established the Open-ended Working Group on the Post-2020 Global Biodiversity Framework to support this process and designated its Co-Chairs. Subsequently, the Working Group at its first meeting requested the Co-Chairs and the Executive Secretary, with the oversight of the Bureau of the Conference of the Parties, to continue the preparatory process in accordance with decisions 14/34, CP-9/7 and NP-3/15, and to prepare documentation, including a zero draft text of the post-2020 global biodiversity framework1 for consideration by the Working Group at its second meeting. Pursuant to these requests, a zero draft of the post-2020 global biodiversity framework was issued for consideration by the Working Group at its second meeting (CBD/WG2020/2/3 https://www.cbd.int/article/zero-draft-update-august-2020). The first draft of a post-2020 framework was done in July 2021 (https://www.cbd.int/doc/c/abb5/591f/2e46096d3f0330b08ce87a45/wg2020-03-03-en.pdf). See also https://www.cbd.int/article/draft-1-global-biodiversity-framework

The United Nations Biodiversity Conference held in Kunming, China, on 12- 13 October 2021 (COP16) declared that, "putting biodiversity on a path to recovery is a defining challenge of this decade, in the context of the UN Decade of Action for Sustainable Development, the UN Decade on Ecosystem Restoration and the UN Decade for Ocean Science for Sustainable Development, requiring strong political momentum to develop, adopt and implement an ambitious and transformative post-2020 global biodiversity framework that promotes the three objectives of the Convention in a balanced manner". The issued declaration, with many relevant points that summarized the above, will be submitted to the General Assembly of United Nations, the 2022 High-Level Political Forum on Sustainable Development, and the second part of the 5th United Nations Environment Assembly.

The timeline of the development of the post-2020 targets included a first meeting in September 2021 (summarized in the meeting in Kunming, China, in October 2021), and a second one in Geneva in March 2022, and a third one in June 2022 (see https://www.cbd.int/conferences/post2020). However, the conference in March 2022 did not come up with final language and a meeting will be held in Montreal in December 2022. The vision of the new framework is a world living in harmony with nature where: **"By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people."**

Below is the Theory of Change:

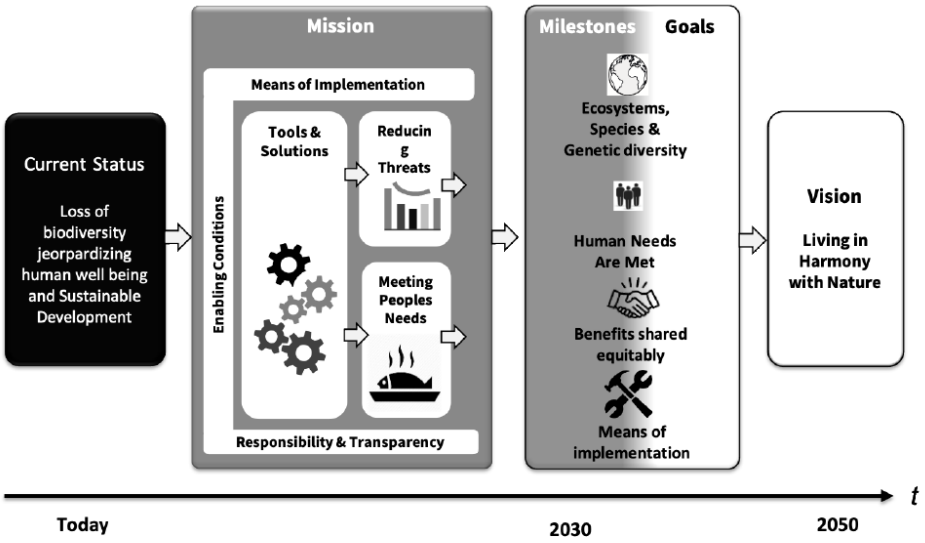


Figure 3.2 Theory of Change for 2050 Vision (CBD)

In SP, these were used as a framework and the goals and objectives adjusted (see Section 5) but modified according to local needs. Determination of local needs, which was then translated to action points, (Annex 1) was done through:
A) The desktop study, and the inception report
B) The first meeting held 8 November 2021 with stakeholders
C) More than 30 weekly thematic workshops and more than 15 other specialized workshops.
E) Focus groups held with almost all Ministries and stakeholders.

The Post-2020 Global Biodiversity Framework also speaks of responsibility and transparency: "*The successful implementation of the framework requires responsibility and transparency, which will be supported by effective mechanisms for planning, monitoring, reporting and review. Countries, Parties to the Convention, have a responsibility to implement mechanisms for planning, monitoring, reporting and review... These mechanisms allow for transparent communication of progress to all, timely course correction and input in the preparation of the next global biodiversity framework, while minimizing the burden at the national and international levels, by:*

a) Establishing national targets as part of national strategies and action plans and as contributions towards the achievement of the global targets;

b) Reporting national targets to enable the collation of national targets in relation to the global action targets, as needed, and their adjustment to match the global action targets;

c) Enabling the evaluation of national and collective actions against targets."

Scientific review of the Post -020 Global Biodiversity Framework produced the following critical key messages to consider (CBD 2022).

Key messages

Key Message 1: High levels of ambition for halting and reversing biodiversity loss (Goal A) cannot be met without transformative change which is a "fundamental, system-wide reorganization across technological, economic and social factors, including paradigms, goals and values, needed for the conservation and sustainable use of biodiversity, long-term human wellbeing and sustainable development".

A portfolio of actions is needed to address interacting drivers.

Key Message 2: Achieving ambitious objectives for ecosystems, species and genetic diversity (Goal A) depends on a comprehensive portfolio of actions to reduce all of the direct drivers of biodiversity loss from land and sea use change, direct exploitation of organisms, climate change, pollution, invasive alien species, and their interactions.

Action must be coordinated and progress assessed frequently.

Key Message 3: Global targets of the GBF provide an important template for action, but it is how these targets are implemented and how actions are coordinated across local, national and international levels that will determine success in achieving objectives for biodiversity. Regular assessments of the implementation of targets and their contributions to progress towards clearly defined goals and milestones for biodiversity are therefore vital elements of the GBF.

Addressing threats in both natural and managed ecosystems is essential.

Key Message 4: Reversing biodiversity loss will require addressing threats to biodiversity in both natural and managed ecosystems, as well as the interconnections between them. "Natural" and "managed" ecosystems differ in their species and genetic composition, ecosystem functions and supply of benefits to people, hence the targets for action, reference states, monitoring requirements, and relevant indicators differ between them.

All dimensions of biodiversity are interconnected and this should guide action.

Key Message 5: All dimensions of biodiversity — genetic, population, species, community and ecosystem — show interlinked responses to human drivers. Efforts to mitigate the effects on drivers on one dimension (e.g. population abundances) will depend on action on other dimensions (e.g. genetic diversity). Knowledge of the interlinked relationships between dimensions can be used to guide prioritization for conservation.

Act now, and sustain it to ensure recovery.

Key Message 6: Ambitious action is needed as soon as possible and must be sustained over time if biodiversity is yo be put on a trend towards recovery by mid-century. There is good evidence that while some dimensions of biodiversity recover rapidly following conservation action, many show long-lasting, or time-delayed, changes in response to actions to mitigate the effects of drivers.

Coordinate actions across locations,

Key Message 7: The degree of biodiversity change, and relative importance of drivers, vary greatly across scales and from place to place, and drivers in one place can affect biodiversity far away in other places.

Invest in monitoring to guide effective action.

Key Message 8: Successful implementation of the GBF requires substantial investment in monitoring capacity to detect change and attribute drivers. Ensure the supply of, and access to, data that underpin the effective use of indicators to track progress and guide action needed to implement the GBF at local, national and international levels. The set of indicators for monitoring progress to Goal A of the GBF should be expanded to comprehensively cover outcomes, drivers, and actions and the interdependencies between them.

3.3 Methods for mainstreaming and participation

According to the CBD Post-2020 Framework: "*Outreach, awareness and uptake of the post-2020 global biodiversity framework by all stakeholders is essential to effective implementation, including by:*

1. *Increasing understanding, awareness and appreciation of the values of biodiversity, including the associated knowledge, values and approaches used by indigenous people and local communities;*
2. *Raising awareness of all actors of the existence of the goals and targets of the post-2020 global biodiversity framework and progress made towards their achievement;*
3. *Promoting or developing platforms and partnerships, including with media and civil society, to share information on successes, lessons learned and experiences in acting for biodiversity.*"

Policy-makers need to consider four key factors to maximize social acceptance and meet policy objectives efficiently and fairly:

• Address the right actors and balance diverse interests between and within different groups, sectors and areas, supported by robust coordination mechanisms;

• Pay attention to the specific cultural and institutional context when designing policy to ensure that proposed solutions are appropriate, time bound, harness local knowledge and can deliver policy goals efficiently;

• Take property rights, fairness and equity into account and consider distributional impacts of costs and benefits, including on future generations, throughout the policy development process;

• Base all policies on good governance: economic information leads to increasing transparency and supports good governance practices, while good governance opens the field for economic information.

Afted developing the local action points (over 400 initial action points gathered and then narrowd to 76 priority action points under 17 targets (sectiuon 5.2 and Annex 1). Game et al. (2013) noted the common mistakes in conservation priority setting: not acknowledging conservation plans are prioritizations; trying to solve an ill-defined problem; not prioritizing actions; arbitrariness; hidden value judgments; and not acknowledging the risk of failure. Prioritizing actions is key to them being achievable in the periods set (to 2030 and 2050).

Figure 3.3: Perrino et al. (2022) noted six areas of development in recent years that will help bridge the gap between the ambitious planned post-2020 goals and targets and actual implementation, including mainstreaming, accountability, and ownership.

TEEB (2009) shows that economic values are sustained if biodiversity loss and ecosystem degradation is reduced. Neglecting biodiversity in decision-making is economically inefficient and socially inequitable. When economic values inform policy, the quality and durability of the choices made across all sectors and levels is improved.

A first conference for Environmental Journalism was held (see https://www.maan-ctr.org/magazine/article/2449/) and it revealed that there is much to improve in this area despite previous accomplishments. Under the patronage of the Prime Minister Dr. Mohammad Shtayyeh, the first environmental exhibition for biodiversity, funded by Hanns Seidel Foundation through the "Mahmiyat.ps" Project, took place in the Nativity Church Square in Bethlehem on 30 September 2020. It included 200 pictures (posters on stands) plus tables for NGOs and academic centers engaged in nature protection. This exhibition was the result of joint efforts in which members of the local community and the EQA participated, the main partners in the exhibition. Around 400 people visited the exhibition. A video was developed for those who couldn't reach Bethlehem due to the pandemic and was distributed online. Another NGO led activities on ecotourism paths that thousands of people participated in, locals and internationals across the landscape of SP, including protected areas: Palestine Trail (phtrail.org).

As part of this NBSAP project, focus group meetings were held tocollect data about the stakeholders and to review their information. Key stakeholders list was generated, reviewed and disseminated so as to have key stakeholders and influencers working in the field of biodiversity, environment, and conservation in SP. The list (can be found in this link - note it has several tabs) is to be uploaded later on the CHM website and to be available for everyone. More than 400 stakeholders have had their emails subscribed to a list called NBSAP@palestinenature.org and are regularly invited to attend all events, including weekly workshops, as well as receive reading matter and other material related to the NBSAP project. This has become a very productive tool for capacity-building and consultation to build a more participatory NBSAP.

In gathering input, participation varied by topic. For example, in the weekly thematic workshops, some individuals attended only specific areas of interest to them (see https://docs.google.com/spreadsheets/d/1OJ3O2Py1FnbwZanG2_Pw9l5ND9y6QK8DEiABhrY7lLw/edit?usp=sharing)

The PIBS is part of the ICCA Consortium (a non-governmental influence group) that has been actively involved in the UN CBD process and the negotiations of the Post-2020 Global Biodiversity Framework (see web updates here: https://www.iccaconsortium.org/index.php/category/convention-on-biodiversity/).

4 Outputs from the NBSAP

4.1 National vision and mission

SP works on a national strategy in line with global guidelines adopted at successive COP meetings. The workgroup for the CBD vision for 2050 https://www.cbd.int/doc/recommendations/sbstta-21/sbstta-21-rec-01-en.pdf emphasized the need for tailored vision and forward strategies, regionally and nationally, in ways that lead to set targets and objectives for biodiversity conservation. The most recent principles that we use are articulated well in the 2021 Kunming Declaration (https://www.cbd.int/doc/c/99c8/9426/1537e277fa5f846e9245a706/kunmingdeclaration-en.pdf). The Declaration will be submitted to the General Assembly of United Nations, the 2022 High-Level Political Forum on Sustainable Development, and the second part of the 5th United Nations Environment Assembly.

Here are its points:

1. Ensure the development, adoption and implementation of an effective post-2020 global biodiversity framework, that includes provision of the necessary means of implementation, in line with the Convention, and appropriate mechanisms for monitoring, reporting and review, to reverse the current loss of biodiversity and ensure that biodiversity is put on a path to recovery by 2030 at the latest, towards the full realization of the 2050 Vision of "Living in Harmony with Nature";

2. Support, as appropriate, the development, adoption and implementation of an effective post-2020 Implementation Plan, and Capacity Building Action Plan, for the Cartagena Protocol on Biosafety;

3. Work across respective governments to continue to promote the integration, or "mainstreaming", of the conservation and sustainable use of biodiversity into decision-making including through the integration of the multiple values of biodiversity into policies, regulations, planning processes, poverty reduction strategies and economic accounting, and strengthen cross- sectoral coordinating mechanisms on biodiversity;

4. Accelerate and strengthen the development and update of the National Biodiversity Strategies and Action Plans, to ensure the effective implementation of the post 2020 global biodiversity framework at national level;

5. Improve the effectiveness, and increase the coverage, globally, of area-based conservation and management through enhancing and establishing effective systems of protected areas and adopting other effective area-based conservation measures, as well as spatial planning tools, to protect species and genetic diversity and reduce or eliminate threats to biodiversity, recognizing the rights of indigenous peoples and local communities and ensuring their full and effective participation;

6. Strengthen sustainable use of biodiversity for meeting the needs of people;

7. Actively enhance the global environmental legal framework and strengthen environmental law at national level, and its enforcement, to protect biodiversity and to combat its illegal use, and to respect, protect and promote human rights obligations when taking actions to protect biodiversity;

8. Step up efforts to ensure, through the Convention, the Nagoya Protocol and other agreements as appropriate, the fair and equitable benefit-sharing arising out of the utilization of genetic resources, including traditional knowledge associated with genetic resources, taking into account the context of digital sequence information on genetic resources;

9. Strengthen measures, and their implementation, for the development, assessment, regulation, management, and transfer, as appropriate, of relevant biotechnologies, with a view to promote the benefits and to reduce the risks, including those associated with the use and release of living modified organisms which are likely to have adverse environmental impacts;

10. Increase the application of ecosystem-based approaches to address biodiversity loss, restore degraded ecosystems, boost resilience, mitigate and adapt to climate change, support sustainable food production, promote health, and contribute to addressing other challenges, enhancing One Health and other holistic approaches and ensuring benefits across economic, social, and environmental dimensions of sustainable development, through robust safeguards for environmental and social protection, highlighting that such ecosystem-based approaches do not replace the priority actions needed to urgently reduce greenhouse gas emissions in a way that is consistent with the goals of the Paris Agreement.

11. Step up actions to reduce the negative effects of human activities on the ocean to protect marine and coastal biodiversity and strengthen the resilience of marine and coastal ecosystems to climate change;

12. Ensure that post-pandemic recovery policies, programmes and plans contribute to the conservation and sustainable use of biodiversity, promoting sustainable and inclusive development;

13.Work with ministries of finance and economy, and other relevant ministries, to reform incentive structures, eliminating, phasing out or reforming subsidies and other incentives that are harmful to biodiversity, while protecting people in vulnerable situations, to mobilize additional financial resources from all sources, and align all financial flows in support of the conservation and sustainable use of biodiversity;

14. Increase the provision of financial, technological and capacity building support to developing countries necessary to implement the post 2020 global biodiversity framework and in line with the provisions of the Convention;

15. Enable the full and effective participation of indigenous peoples and local communities, women, youth, civil society, local governments and authorities, academia, the business and financial sectors, and other relevant stakeholders, and encourage them to make voluntary commitments in the context of the Sharm el Sheikh to Kunming Action Agenda for Nature and People, and to continue to build the momentum for the implementation of the post 2020 global biodiversity framework;

16. Further develop communication, education and public awareness tools on biodiversity to support changes in behavior towards the conservation and sustainable use of biodiversity;

17. Further enhance collaboration and coordinate actions with ongoing multilateral environmental agreements, such as the United Nations Framework Convention on Climate Change, the United Nations

Convention to Combat Desertification, and the biodiversity-related conventions, as well as the 2030 Agenda for Sustainable Development and other related international and multilateral processes, to promote the protection, conservation, sustainable management and restoration of terrestrial, freshwater and marine biodiversity, while contributing to other sustainable development goals, aligned to the 2030 Agenda for Sustainable Development. Our strategy is based on representation, effectiveness, adequacy (to achieve vision and mission stated below), coherence, and complementarity. It follows the guidelines and regulations and systems described in the methodology.

The post-2020 GBF recognized that:

a) Ecosystems and their biodiversity underpin the global economy and human well-being and need to be valued and protected,

b) Damage to global ecosystem services and biodiversity is acute and accelerating (five major threats globally Climate Change, overexploitation, pollution, habitat destruction, and invasive alien species and locally added in SP is the Israeli occupation/colonization),

c) Ecosystem damage carries costs for business and society,

d) Growing demand from an expanding wealthier population is a key cause of biodiversity loss,

e) Investing in ecological infrastructure can offer greater returns than man-made alternatives and thus makes economic sense.

At the conclusion of NBSAP preparation process, developed and publicized new NBSAP visions, mission, strategic goals objectives, and milestones were presented at a workshop on 9 June 2022.

Vision

By 2050 human and natural communities will be coexisting in harmony where biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy State of Palestine and delivering benefits essential for all people.

Mission

NBSAP of SP sets parameters, conditions, and programs revisited every five years to achieve the vision stated via participatory strategic planning and implementation, capacity-building, mainstreaming, and bridging science-policy-practice gaps.

4.2 Strategic Goals, Objectives, Milestones, Targets, and Action Plans

Goal A. Increase protection and conservation measures to halt the decline and minimize loss of habitats and species.

Objective A1: The integrity and connectivity of ecosystems are enhanced, with an increase of at least 15 per cent in the area, supporting healthy and resilient populations of all species, the rate of extinctions are reduced at least tenfold, the risk of species extinctions across all taxonomic and functional groups, is halved, and genetic diversity of wild and domesticated species is safeguarded, with at least 90 per cent of genetic diversity within all species maintained.

Milestone A1: Net gain in the area, connectivity and integrity of natural systems of at least 5 per cent by 2030.

Milestone A2: The increase in the extinction rate is halted or reversed in SP via habitat and ecosystem effective conservation

Milestone A3: Genetic diversity of wild and domesticated species is safeguarded, with an increase in the proportion of species that have at least 90 per cent of their genetic diversity maintained
Milestone A4: By 2035 protect minimum six large vertebrates showing increase in population.

Target 1. *By 2030, have an updated protected area and KBA network that is logical, science based and manageable*

Action 1.1: Establishment of effective and well managed protected areas network in SP
Action 1.2 Develop the laws and regulations for conservation
Action 1.3 Protect the very limited forests remaining in SP and expand it with adaptive natural cover
Action 1.4 Develop Micro-Reserve (MR) when it is impossible to protect large areas
Action 1.5 Develop biosphere reserves
Action 1.6 Develop and implement plans for cross-border (trans-boundaries) cooperation especially in areas of KBAs and regions of special interest including exchange of expertise and knowledge and even joint management (e.g. Jordan River area with Jordan)
Action 1.7 Develop and implement plans to protect the most vulnerable species of large vertebrates

Target 2. *Reclaim/protect 50% of freshwater degraded areas (springs like Al-Auja) by 2050 under scenario of sovereignty/independence. For scenario of lack of independence, protect 50% of those in areas A and B by 2030. For marine areas, develop management plan associated with good data collection by 2030 and have significant improvement in protection based on that study by 2050.*

Action 2.1 Develop and implement a program for preservation of key wetlands and freshwater sources like Marj Sanour, Marj Deir Ballot springs, Bassat Wadi el Mallaha.
Action 2.2 Rehabilitation of the water springs and wells in areas of rich biodiversity
Action 2.3 Protect 8-10% of the marine ecosystem off the coast of the Gaza strip

Target 3. *Ensure active management actions to enable the recovery and conservation of species and genetic diversity of wild and domesticated species, including via ex situ conservation.*

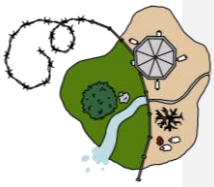
Action 3.1 Create "greening belts" in order to combat desertification in particular near Mediterranean and Irano-Turanian areas including KBAs
Action 3.2 Create a central animal rehabilitation unit in SP
Action 3.3 Develop a comprehensive biodiversity survey including red listing plants and animals and updating vegetation maps
Action 3.4 Develop and implement plans to protect and enhance soil biodiversity
Action 3.5 Implement environmental interventions within urban areas to provide habitats for the sustainability of biodiversity
Action 3.6 Conserve plant stocks from which domesticated plants originated through seed and gene banking and establish a national botanical garden and develop existing ones including gene banks and seed banks.

Action 3.7 Develop national red lists according to IUCN criteria

Objective A2: Reducing the six major threats in SP affecting biodiversity (Climate Change, Habitat Destruction, Pollution, Overexploitation, Invasive Alien Species, Israeli Colonization)

Milestone A5: By 2030 have structured strategies and SMART action plans to deal with the six major threats

Milestone A6: By 2030 have strong and enforced incentives and disincentives to result in 50% decrease in harmful practices.



Target 4. *Develop strategies with different scenarios and action plans to deal with threats of occupation and colonization to biodiversity*.

Action 4.1 Develop a negotiation paper to be adopted by the PLO regarding nature areas and conservation in final status negotiations

Action 4.2 Enhance studies and legal actions relating to occupation and colonization impact on the environment

Target 5. *Effectively manage human-wildlife interactions to avoid or reduce human-wildlife conflict.*

Action 5.1 Reduce and eventually eliminate habitat degradation related to ecosystems (especially in KBA's & PAN).

Action 5.2 Set a management plan responsible for controlling fires to reduce habitat damage.

Action 5.3 Control domesticated and feral animals in terms of impact on the environment and human health.

Action 5.4 Develop a program for assessment of wildlife impact on human health (zoonotics), wildlife harm to human health like snakebites, and otherwise minimize human-wildlife conflict.

Target 6. *Ensure that the harvesting, trade, and use of any wild species is managed to protect biodiversity. Laws and policies are instituted to ensure sustainable and safe use for any allowed harvesting/trade/use and ensure enforcement of laws and regulations for protection.*

Action 6.1 Develop and implement program for control of trade in wildlife species and in excessive harvesting of wild plants

Target 7. *Control pathways for the introduction of invasive alien species, preventing, or reducing their rate of introduction and establishment and control or eradicate IAS to eliminate or reduce their impacts, focusing on priority species and priority sites.*

Action 7.1 Adopting the national strategy on mitigating and combating invasive alien species and its action plans

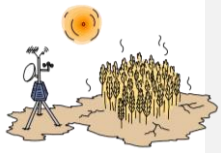
Target 8. *Reduce solid and liquid waste pollution by 30% by 2030 and by 60% by 2050.*

Action 8.1 Develop and implement a plan to reduce solid waste

Action 8.2 Develop and implement a plan to reduce use of single use metals and plastics and increase recycled components

Action 8.3 Develop and implement a plan to reduce use of pesticides

Target 9. *Minimize the impact of climate change on biodiversity, contribute to mitigation and adaptation through ecosystem-based approaches, contributing at least 10 GtCO2e per year to global mitigation efforts, and ensure that all mitigation and adaptation efforts avoid negative impacts on biodiversity.*

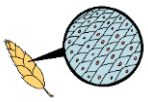


Action 9.1 Develop a concerted plan of water management systems and policies that conserves biodiversity and ecosystem services

Action 9.2 Develop and implement a plan to monitor air pollution and controlling emissions based on new policies and procedures enforced by EQA in cooperation with other ministries

Action 9.3 Implement action plans described in the national strategy for climate change (EQA)

Target 10. *Establish, strengthen capacity for, and implement measures to prevent, manage or control potential adverse impacts of biotechnology on biodiversity and human health, reducing the risk of these impacts.*



Action 10.1 Adopt and implement the national biosafety framework

Target 11. *Enhance responsible living including in production and consumption that strengthens both biodiversity and people's well-being*

Action 11.1 Create a national system of incentives and disincentives relating to biodiversity conservation

Action 11.2 Enhance the EIA procedures to include detailed actual field surveys for biodiversity

Action 11.3 Publicize and implement the updated environmental law regarding the 6 threats that impact the Palestinian environment

Action 11.4 Develop green buildings criteria to encourage the vertical urban expansion to increase the biodiversity inside the cities

Action 11.5 Incorporate green design in public infrastructure (roads, public transportation, etc)

Action 11.6 Reforming/regulating quarrying to ensure it does not affect PAs and biodiversity

Goal B. Enhance ecosystem services (nature's contribution to people) and equitable benefit sharing.

Objective B: Nature's contributions to people is valued, maintained or enhanced through conservation and sustainable use supporting the global development agenda with a substantial increase in both monetary and non-monetary benefits shared equitably.

Milestone B.1: Nature and its contributions to people are fully accounted for and inform all relevant public and private decisions.

Milestone B.2 The long-term sustainability of all categories of nature's contributions to people is ensured, with those currently in decline restored, contributing to each of the relevant Sustainable Development Goals

Milestone B.3 The share of monetary benefits received by providers, including holders of traditional knowledge, has increased equitably by 2030.

Milestone B.4 Non-monetary benefits, such as the participation of providers, including holders of traditional knowledge, in research and development, has increased and improved in a fair and equitable way.

Milestone B.5 Increase women participation in leadership positions by 2030. Increase children's awareness activities to reach 30% of all students (elementary, middle, and high school) by 2030

Target 12. *Develop policies, procedures, and systems to enhance equitable benefits from nature (e.g. eco-tourism, medicinal plants, and recreational activities) while protecting biodiversity.*

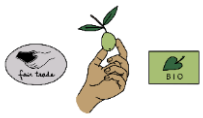
Action 12.1 Develop ecotourism (including agrotourism) plan with an oversight board, to develop and mainstream ecotour paths while minimizing impact on environment

Action 12.2 Develop and implement plans for restoring and reusing traditional knowledge in enhancing agrobiodiversity, food security, and biodiversity conservation

Action 12.3 Increase participation of women's groups in ecosystem services, such as embroidery of fauna and flora, ecotourism, poverty alleviation, etc.

Action 12.4 Develop and implement a program to educate all sectors of society on healthy living practices (these protect biodiversity).

Target 13. *Develop sustainable agricultural production that ensures food sovereignty while enhancing biodiversity and providing fair and equitable benefit to all.*



Action 13.1 Develop a system that enhances agrobiodiversity for biodiversity protection and food production including for protection of local plant varieties and encouraging their cultivation.

Action 13.2 Development and implementation of programs to enhance eco-friendly agriculture especially around olive trees.

Action 13.3 Encourage local production and consumption to ensure food sovereignty and to minimize impact on environment.

Action 13.4 Implement more fair trade and organic agriculture including of diverse high value products.

Action 13.5 Expand community and home gardens as well as other similar community initiatives in a biodiversity friendly way

Action 13.6 Domesticate more wild varieties

Goal C. Researching, mainstreaming and valorizing biodiversity conservation at all levels of society in an inclusive and participatory manner.

Objective C: Develop programs for capacity building, knowledge generation, and knowledge dissemination (awareness).

Milestone C1: New university level programs relating to biodiversity planned and introduced.

Milestone C2: Increased children education and awareness via both curricular and extracurricular programs.

Milestone C3: Increase research productivity in areas of biodiversity by 300% by 2030

Target 14. *Expand and modernize research of habitats, ecosystems, species and traditional practices and ensure that is used and shared equitably in society.*

Action 14.1 Encourage and expand biodiversity research programs.

Action 14.2 Develop biodiversity capacity building (research and practice) and mainstreaming programs that ensure gender equality.

Action 14.3 Develop a functional clearing house mechanism that serves all needs for biodiversity areas (education, conservation, knowledge acquisition and dissemination, resource mobilization).

Action 14.4 Expand existing institutes of biodiversity and establish other similar centers

Action 14.5 Create a database of medicinal and herbal plants including methods of conservation.

Action 14.6 Develop programs to ensure women hold minimum 40% of conservation jobs (at government and non-government levels) and participate equitably and share benefit (monetary and non-monetary) from biodiversity resources and knowledge generation.

Action 14.7 Install weather stations across all habitats and make use of the remote sensing and GIS data.

Target 15. *Mainstreaming biodiversity to all sectors of the Palestinian society ensuring action plans that result in tangible and measurable protection of biodiversity.*

Action 15.1 Use of locals in the data collection process as a method of mainstreaming and upload to CHM and/or available data acquisition portals.

Action 15.2 Develop new programs (curricular and extracurricular) in Palestinian universities in areas of biodiversity and sustainability.

Action 15.3 Develop and implement a mass communication strategy and action plans for mainstreaming biodiversity through the media.

Action 15.4 Develop programs with ministry of education to change Palestinian school curricula and enhance extra-curricular activities including environmental clubs.

Action 15.5 Make yearly and monthly national themes for biodiversity as well as calendar of key days for biodiversity.

Action 15.6 Develop programs to integrate biodiversity values into university systems at all levels (staff, faculty, students) including developing green academic institutions.

Action 15.7 Develop youth programs including by use of museums of natural and cultural heritage as well as botanic gardens.

Action 15.8 Designate other national fauna and flora similar to the Sunbird (national bird) and Faquaa Iris (national plant).

Goal D. Improved governance, partnerships, and resource mobilization.

Objective D1: Bridging science-policy-practice gaps.

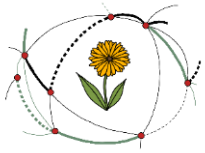
Milestone D1: By 2030, new systems are developed and implemented (e.g. via documentary evidence) that improve performance of governmental, academics, and NGOs.

Milestone D2: Create a biodiversity board composed of key stakeholders that oversees the implementation of the NBSAP.

Milestone D3: Develop & implement effective strategies and action plans that are science based to influence policy.

Milestone D4: Develop & implement effective strategies and action plans that ensure policies (including laws and regulations) are implemented.

Target 16. *Restructuring entities that are engaged in biodiversity research, education, and conservation and connections between them to be more effective as a conservation network by (among other things) creating channels of communication, joint capacity building, mergers of entities, creation of new entities and NGOs in deserving areas, and management restructuring in the EQA and areas of other ministries related to biodiversity.*



Action 16.1 Create a national biodiversity oversight committee of effective partners and stakeholders to manage and implement NBSAP.

Action 16.2 Increase capacity building for government officials related to biodiversity

Action 16.3 Develop programs for training school teachers and professors to teach courses and modules related to biodiversity.

Action 16.4 Revisit signed agreements and puts biodiversity issues on agenda of negotiations over our natural resources.

Action 16.5 Join four international treaties after ensuring proper mechanisms for compliance and benefits: Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on Wetlands (RAMSAR) 1971, CMS (Convention on Migratory Species) - Bonn, and Agreement on the Conservation of African-Eurasian Migratory Waterbirds.

Action 16.6 Reforming governance and administrative organization of relevant sections of EQA, MOA, and NGOs to ensure efficiency and efficacy of operations related to biodiversity conservation.

Action 16.7 Develop programs to encourage further work through regional and global networking with relevant entities (planetary responsibility).

Action 16.8 Develop NGOs and introduce branches of existing environmental entities in poorly served areas.

Action 16.9 Developing plans for regular contact between researchers and policy makers to ensure that the gap between science and policy is bridged.

Objective D2: Mobilize resources (financial and otherwise) to achieve mission

Milestone D5: Adequate financial resources to implement the framework are available and deployed, progressively closing the financing gap.

Milestone D6: Adequate other means, including capacity-building and development, technical and scientific cooperation and technology transfer to implement the framework for 2030, are available and deployed.

Target 17. *Increase financial and non-financial resources for biodiversity in SP (doubled by 2030 and quadrupled by 2050).*

Action 17.1 Develop an Environmental Trust Fund to support local campaigns and environmental projects.

Action 17.2 Marshal global and local resources available for local biodiversity and makes Palestinian biodiversity globally visible.

Action 17.3 Develop capacity for project fundraising and management in biodiversity stakeholders especially for women.
Action 17.4 All budgets for projects and institutions dealing with biodiversity should be transparent and publicized including their outputs and outcomes (including on CHM).

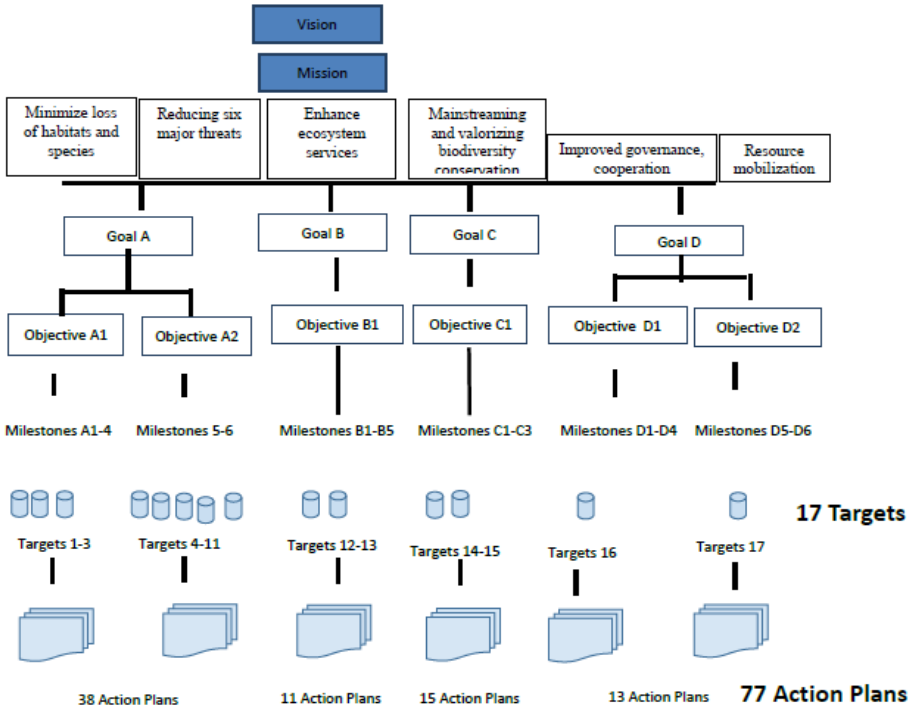


Figure 4.1 Diagram of the NBSAPs goals, objectives, targets, and action plans.

5 Implementation

5.1 Communication and Outreach Strategy

Public participation will be critical for this process to achieve these objectives. Mainstreaming is critical, especially taking in human well-being and bridging knowledge/science with policy and implementation (Håkansson et al.. 2019; Hooykaas et al., 2019; Saito, 2013). The overall communication strategy of the project focuses on spreading awareness and promoting the process of building the NBSAP but also acts as a tool for behavioral change that results in better cooperation and partnerships with all concerned to achieve the proposed strategic changes and action plans for biodiversity.

Target groups

1. Stakeholders whose contacts were assembled during the 6th NR process
2. Other stakeholders and influencers (NGOs, CSOs, GOs, private sector, academia), gathered via focus groups and individual meetings
3. Local, regional and international experts.

In formulating a communications plan for the NBSAP, ensuring that the aim is to encourage a strong understanding of the importance of actions to conserve biodiversity (in all dimensions as articulated in the NBSAP)is needed, and give a full coverage of the issues involved. How effective will an exercise of this nature be, in actually achieving conservation and sustainable use, and in protecting indigenous knowledge and local community rights.

Most Palestinians over the age of 10 (71%) use the internet (https://www.pcbs.gov.ps/post.aspx?lang=en&ItemID=3738) and most use social media and have mobile phones and applications (https://datareportal.com/reports/digital-2021-palestine). As such, it is incumbent on a communications strategy for the NBSAP to use social media. Media principles for Palestine include:

1) Outreach to all segments of society but tailor it to fit the audience: government officials, private sector, NGOs, CSOs, academia, nature enthusiasts, farmers, etc.

2) Be culturally sensitive and draw on the rich traditional knowledge and practices of the people (in the Fertile Crescent).

3) Use common language and avoid scientific terminologies, and present educational material in attractive formats such as audio, video, games, mobile applications, etc.

4) Ensure outreach is done in a fair and equitable way, especially to reach marginalized segments of society.

Some other notes/activities:

1. A small brochure to be produced describing the NBSAP and its importance
2. A short five minute video to be produced that explains the process of building the NBSAP and the importance of strategic biodiversity conservation
3. Webpages of partners will highlight this project and include news and other developments
4. Workshops and focus group meetings will be widely publicized, both on social media and mainstream media (via press releases and media advisories)
5. All team members will be encouraged to engage in public lectures and informal communications in promotion of the communications plan.
6. Social media: Significant use of social media (including Facebook). The chosen strategy here is to begin slowly and accelerate postings as time goes by in line with project objectives. Posts will start with brief “infomercials” highlighting the project and its objectives, then highlight activities including educational and research activities, and then highlight outputs (like publications, educational modules, etc.). Hashtags #NBSAP-Palestine #استراتيجية-التنوع-الحيوي-فلسطين will be used.
7. Direct email communications e

Indicators for the activities

- Video produced and the number of viewers recorded
- Webpages created and browsed
- Mainstream stories produced
- Number of social media posts and likes/views

- Emails sent and interactions received

Action plan included in the new NBSAP related to mainstreaming (this is based on CBD/SBI/3/13/Add.1). Below, actions discussed in other relevant action plans under the five objectives have been excluded discussed, such as behavior-changing environmental education and awareness, or bridging science-policy-practice gaps. This section focuses mainly on communication/media/publicity aspects that will help achieve the desired targets and objectives outlined in Section 6.1.

Action area 5: People everywhere have relevant information, awareness and capacities for sustainable development and lifestyles that are in harmony with nature, reflecting the values10 of biodiversity11 and their central role in people's lives and livelihoods, and take gender-specific measurable steps towards sustainable consumption and lifestyles, taking into account individual and national socioeconomic conditions. Action 5.1: Educational institutions and other relevant bodies reflect the gendered social, cultural, intrinsic, and traditional values of nature and biodiversity in formal and informal education systems, including technical and university training, to promote understanding and provide gender-specific guidance on sustainable consumption and lifestyles and the role of biodiversity in achieving them.

See CBD/SBI/3/4/Add.1

In communicating the NBSAP, emphasize should be made on:

1) The most important aspect is grassroots involvement: involving local people in all levels in planning, managing natural resources, and ensuring that all have fair/equal access to benefit sharing from the rich biodiversity in SP, and will continue to be involve as a work-in-progress, even after the end of the construction of the revised NBSAP.

2) SP was the first country to comply with post-2020 guidelines and align its NBSAP to global priorities while tailoring them regionally and locally. The policy and recommendations of CBD, IPBES, TEEB and other relevant global frameworks were adhered to however, took into account local situations and available local guidelines and resources in particular.

3) Communication empowerment and capacity building is needed: this should help all people but especially the youth (as the future) to become better, innovative citizen activists who protect the environment.

4) In line with national development goals, the new NBSAP preserves both cultural and natural heritage. It is based on caring, empathy, and collaboration both across borders and within borders. It moves beyond measures of GDP to measures of human and nature well-being as real indicators of sustainability with a balanced ecosystem. Respect (for ourselves, for others, for nature) leads to sustainability and coexistence (with each other and with nature).

5) Usage of indigenous knowledge, practices, and value systems: Cultural heritage and knowledge can be very valuable to conserve biodiversity, with tested solutions from the past (Boivin and Crowther, 2021). Indigenous knowledge includes traditional ways of production and consumption and includes things like (collaboration, support), and (self-sustenance, resilience). Using new work together (e.g. for food sovereignty) while protecting the environment.

6) Environmental justice has to be achieved. People should be entitled to clean air, clean water, and a healthy environment all around.

Mainstreaming are also included in the Action Plan (Annex 1).

5.2 Capacity Building

The biggest challenge faced in SP (but it is also an opportunity) is to develop human capacity to implement the actions described in this NBSAP. To do this, the action plans for capacity-building must also be prioritized in order to achieve the targets set forth for 2030 and 2050. But it is considered important to highlight this issue here. As discussed in stocktaking Section 2.2.7, this is a critical issue in SP. People are our strength. With qualified, trained and motivated people, other issues like coordination, fundraising, and bridging science-policy-practice gaps can be accomplished. While the stakeholders prioritized some activities/actions related to that, many more can be introduced that are more sectoral and relevant to particular issues/target groups. For example, school and university education can and should be improved.

5.3 Monitoring and Evaluation

The United Nations has adopted a Global Indicator Framework (GIF), with a set of 234 indicators developed by the Inter-Agency and Expert Group on Sustainable Development Goals Indicators (IAEG-SDGs). The GIF covers all 17 SDGs and 169 targets for the 2030 Agenda.

Implementation requires significant resources and the production of timely and reliable data, disaggregated by a number of specific characteristics, including by geographic location. Geospatial data and other enabling technologies play an instrumental role since many of the indicators and their associated targets have a geographic context. See also The SGD's Partnership Platform and Global indicator framework for the SDGs and targets of the 2030 Agenda for Sustainable Development). SP should use this in monitoring its SDGs.

More specifically on biodiversity, Monitoring and Evaluation (M&E) follows the guidelines of the CBD: https://www.cbd.int/sbi/review.shtml

https://www.cbd.int/doc/c/3572/0ba5/0c4173a13cf0e7b040f7e6e2/sbi-03-11-en.pdf

https://www.cbd.int/doc/c/f191/8db7/17c0a45b42a5a4fcd0bbbb8c/sbstta-24-l-10-en.pdf

https://www.cbd.int/doc/c/f99a/e9c0/8e074f4d4fedd295ab9cb0e4/sbstta-24-cgpaper-item-03-v3-en.pdf

M&E mechanisms were established at the beginning of the project, and mutually agreed upon benchmarks to monitor progress were put in place to achieve the collective writing of the NBSAP. For each action point in Annex 1, roles were listed and responsibilities and potential funding sources. The Introduction and particularly in Sections 1.4 to 1.6, discussesnational constitutional, legal, and institutional frameworks, international binding agreements, and stakeholders. In Section 1.7 the synergies which would also be needed for M&E is discussed.

Going forward, and in addition to the M&E points placed in the respective actions, the following should be added:

1) M&E should be led by the national Biodiversity Committee, chaired by the EQA, which should meet at least bimonthly to monitor implementation of the NBSAP.
2) A full review of NBSAP progress should be carried out by the Biodiversity Committee in 2026, and a further full review and revision in 2030, and then every five years thereafter to 2050. Each review should include progress, gaps, obstacles, and responsibilities, and alert the responsible party (via the EQA) to any changes needed to achieve targets and milestones.
3) Financial monitoring related to NBSAP is recommended (as with any project implementation).Indicator-based and data-driven measuring and monitoring of targets and action plans, based on experiences globally and locally were developed (shown in Annex 1 Action Plans).
4) Palestine need not reinvent the developing M&E indicators (to which SP already contributed: https://www.cbd.int/recommendation/sbstta/?id=6987) relevant to the implementation of the NBSAP but did tailor this for local needs including issue of dealing with political instability.

5) Establish a coordinating mechanism for NBSAP implementation with local authorities (governorates, municipalities, village councils). The EQA will lead on this via their regional offices. To do this, training in M&E for the local teams of the EQA should be carried out.
6) Include M&E in actions and steps to integrate biodiversity into broader national policies, strategies and plans (such as national development plans, poverty reduction strategies, climate change adaptation plans, etc.) and into sectoral policies, strategies and plans, across government, the private sector and civil society. M&E related to the NBSAP must be tailored to 22 sectoral strategies: (Empowerment, Education, Agriculture, Health, International Relations, Justice, Culture and Heritage, Employment, Energy, Local Governance, Housing, Water and Wastewater, Social Protection, Communications and Information Technology, Security, Public Finance Management, National Economy, Tourism and Antiquities, Transport, Higher Education, Civil Services, and Land Public Services), and three cross-sectoral strategies (Social Cohesion, Youth, Environment).

5.4 Mobilizing Financial and Human Resources

In terms of the environment, SP is in agreement with the European Joint Programming (2019) summary and reiteration of the need for more funding for National Priorities:

1. Climate change: European Development Partners (EDPs) support the EQA via the NGO Development Center (NDC), but the Palestinian Authority (PA) and EDPs need to do more and better.
2. Water scarcity: By 2030, the World Bank estimates that SP will face large water supply and wastewater treatment gaps. There is a need to address these water management issues, which are already acute in Gaza.
3. Water, energy and food security nexus: One such example is the desalination of water, using energy from solar panels, and how this would benefit the agricultural sector.
4. Environmental governance: This needs to be strengthened in SP as well as coordination between the local governments and EQA.
5. Waste: It is necessary to improve the handling of waste, as a regional and global common interest,
6. Green economy: Encourage investment in green technology production to enhance competitive positioning in the global supply chain.
7. "Green" adjustment required by climate change has been more of a priority for agriculture. Agriculture will have to be responsive to innovation in energy efficiency, water saving and reduction of chemicals,

Plus it is suggested to add an **eighth priority to 2030: capacity building related to these issues and to biodiversity and data gathering (research) and ensuring data sharing and transparenct.** The small challenge of finding additional resources is much less significant than the big challenge of designing strategies and tactics that produce results on the ground with efficiency and with transparency (Grindle, 2004). Funding from global agencies must a) be driven by local strategy (see other recommendations and national strategy sections), based on adopted national strategies and not on donor desires, b) encourage collaboration and integration of academic, civil society and government actors, c) involve better scientific design ahead of the proposal writing to ensure that the proposed ideas are scientifically-based and testable in terms of outcomes, and d) tested for outputs and outcomes (measurable, specific etc. i.e. the SMART criteria).

Restructure human capacity-building efforts on a national level by a) identifying needs which are based on preliminary analysis including areas like trained experts in alpha-level taxonomy and professionals in fields like conservation and biodiversity, b) use existing programs and/or build new ones to build human assets as needed (this should be flexible and change with time), c) universities and other stakeholders can use experts coming to Palestine and send people abroad to gain expertise.

1. **Gathering additional data:** investment in more studies of threats and threat response/mitigation strategies performed by qualified academicians at academic institutions. These have to be studies based on solid on-the-ground data collection. The most logical candidates for such studies (including EIA) are qualified academics. The need to align knowledge developed with practice via developing cooperative work between different stakeholders is evdent.
2. **Threat Response:** SP must consider environmental threats as highest-level threats to our population at least on par with occupation/colonization. The PNA can go to international tribunals and adopt other legal non-violent strategies to end the Israeli occupation and gain sovereignty but itshould then exercise this sovereignty as per international obligations, for example under the CBD (EQA, 2015).
3. **Climate Change:** To address climate change in the context of a developing state like the State of Palestine, there must be mainstreaming of awareness and institutionalizing actions and policies at the local level of municipalities. add schools and all sectors of Palestinian society. To do this would require first studying climate changes effects and designing modules to teach about this (by academics and researchers) and then running well-designed programs (by credible NGOs in cooperation with the educational sector).
4. **Invasive Alien species:** To address Invasive Alien Species which pose a significant threat to biodiversity, stakeholders (especially the EQA, MOA and NGOs) need to follow recommendations as per international standards to deal with this global threat (Kettunen et al., 2009).
5. **Dealing with liquid and solid waste**: Programs need to be mainstreamed (by the EQA, MOH, NGOs, and others) to reduce both liquid and solid waste. In parallel, development of programs that deal with existing waste are needed. it is possible to expand existing sewage treatment facilities and build new ones to deal with sewage that is now dumped in ecologically sensitive areas like Wadi Nar (to Mar Saba and beyond). It is also possible to expand and mainstream solid waste recycling and upcycling (upcycling is, for example, using discarded plastic bottles to build green walls). This should be done via municipal programs in partnerships with NGOs and the private sector and the communities affected. Since 70% of solid waste in SP is organic, developing composting centers would be highly recommended (these can be done in academic centers like universities, by NGOs, and by government agencies like the MOA and EQA). The PMNH has a model center and is now working with schools on this. There are other initiatives but all this needs to be scaled up.
6. **Energy**: The Ministry of Energy in partnership with the private sector needs to develop alternative renewable energy sources like solar and wind (Yaseen, 2009) which will have positive impact on biodiversity conservation.

Overall and Most Important Recommendations for Development in the next five years:

1. **Research:** Strengthen locally-led research in all areas of biodiversity, conservation, management, and education. We cannot conserve things or design proactive sustainable programs without appropriate base-line information that is verifiable and objective. Academia must lead this effort and maximize the use of resources by sharing among universities and research centers. We believe, based on preliminary work, that the five most important areas for research in the next five years are: a) mammals and birds (distribution, ecology, taxonomy), b) freshwater habitats (including animals around them like frogs and dragon flies, etc., since these are threatened due to the water issues), c) methodologies of environmental education and awareness, d) biodiversity and management issues in selected protected areas, e) methodologies of improving environmental facilities such as botanical gardens and museums (the science of museology, exhibition design for behavioral changes, etc.).
2. **Sovereignty**: Enhance and strengthen the Palestinian National Development Goal which is based on the essentiality of sovereignty to manage our own natural resources. We need to develop a database of environmental justice issues (Al-Haq http://www.alhaq.org/ and PMNH are very interested in this issue) and engage in efforts to achieve freedom and justice in parallel with other

environmental work. We can add material to this site: https://ejatlas.org/ but that site is not very scientific and is global. We need to create a local database (e.g. through a partnership with Al-Haq and an academic center like PMNH) that has these goals: a) compiling reliable quantitative and qualitative data on environmental status in Palestine with a focus on human impact (e.g. biodiversity, liquid and solid waste dumping, and habitat destruction); b) compiling data on any links between environmental decline and policies/activities of Israeli public and private actors. c) compiling legal research on environmental justice issues in Palestine in ways that can contribute towards environmental justice and sustainability. The database must also be used to hold the occupying power accountable.

3. **Conservation issues and dealing with threats**: It is incumbent on us in Palestine to build a comprehensive conservation strategy that is based on international and objective criteria and takes into account all stakeholders (governmental, academia, NGOs, funders) and all relevant activities (research, setting priorities, laws, action, and implementation) and that these follow timeliness. This is analogous to the SMART business model (specific, measurable, achievable, relevant and time bound). Whether immediate threats like overhunting and overgrazing, or intermediate term threats like global climate change, we believe the Palestinian Authority and stakeholders need to develop strategies and act on them (see above for the threat recommendations).
4. **Management of Protected Areas**: Issues between the various government agencies needs to be resolved to ensure that one agency is responsible for all aspects of protected areas. This can be done either by a) the MOA transfers authority over all designated Protected Areas to the EQA (after the latter has been restructured in a way to handle this), or b) the MOA and EQA transfer the responsibility to a third party (similar to what happened in Jordan with the RSCN) but certainly this should not be a party that is not specialized in this area (e.g. the impending transfer of Wadi Al-Quff to the jurisdiction of the Hebron Municipality would be a bad idea).
5. **Education**: Restructure environmental education at all levels (from early childhood to universities to communities). This restructuring must be based on modern educational theory and avoid duplications of efforts (e.g. consolidate guidelines for school environmental activities that have been published by several NGOs and distribute an updated version with buy-in from all relevant stakeholders under the auspices of the MOE). One idea is to do like the Royal Society for the Conservation of Nature (Jordan) did, which is to establish an Academy for Nature Conservation http://www.rscn.org.jo/%D9%8C%D9%8Croyal-academy-nature-conservation Ecotourism education for future tour guides needs to be updated and restructured (by the MOTA in collaboration with academia) and a national strategy for ecotourism developed that ensures safety, proper guidance, and minimal or positive impact on the local environment.
6. **Update and enforce laws:** Update the 1999 Environmental Law and enforce these laws. One possible way is to create a special unit within the Palestinian security services similar to the Rangers in Jordanian police forces (see http://www.rangers.psd.gov.jo/?q=en/about/about-rangers/growing). Also implement national special and development plans, as approved.
7. **Ensure that the action plans developed are inclusive of all sectors of society including governmental institutions, academia, NGOs, CSOs, and private sectors.** These can be noted in the Action Plans in Annex I.

Five statistical policy markers exist to monitor external development finance for environmental purposes within the OECD/DAC; these are the "Environment" marker (introduced in 1992) and the Four Rio markers covering: Biodiversity (introduced in 1998), Climate Change Adaptation (introduced in 2010), Climate Change Mitigation (introduced in 1998), and Desertification (introduced in 1998). Globally, funds worth billions of US dollars have already been mobilized for biodiversity (see Figure 6.1).

Financing: We need to a) diversify sources of funding, b) invest more public financing in biodiversity (currently miniscule), c) improve spending effectiveness, d) invest in infrastructure and human resources, e) leverage global finance.

Relevant projects could include a botanical garden, a natural history museum, an environmental center or a mixture of these. They must: a) be found in areas near people (e.g. distributed across Governorates) and b) be led by people whose philosophy is to go to the people (especially remote villages) and not expect the people to come to them.

Funding for all work related to the environment should be streamlined and have certain guidelines such as a) ensure outcome driven projects and insist on evaluation of outcomes, b) give priority to funding joint projects, not funding to a specific NGO or government agency, c) give priority to projects that address national priorities agreed to by stakeholders together, and d) be transparent with as few overheads as possible.

Sources of funding are many (see https://futurefornature.org/other-funding-and-award-options/)

Palestinian institutions have been successful at getting funding for Biodiversity from global and regional institutions

Recommendations

1) Financing for biodiversity in Palestine should be more outcome-driven. For example, holding workshops for 200 people does not necessarily translate into behavioral changes, which is the point after all, not merely being informed.
2) Funded activities like education should lead to behavioral change.
3) Funded research studies should be based on impact on conservation efforts (Figure 6.2). We recommend that aid projects to the Palestinian territories get impact assessment studies, whether by independent auditors or via participatory impact assessments of the type described by Catley et al., (2007). Such evaluation is critical if investments in biodiversity conservation are to be justified (Ferraro and Pattanayak, 2006).
4) GEF funding for large grants must be made available to Palestine.
5) There is a significant amount of resources now available that is focused on climate change (e.g. Green Climate Fund (https://www.greenclimate.fund/) but we need to connect the nexus to biodiversity, ecosystem services and endogenous people needs. Even crowdfunding can be used successfully (Gallo-Cajiao et al., 2018).
6) Sovereignity and ending the occupation are critical for the successful implementation of projects.
7) A mechanism needs to be established to avoid redundancy of projects and better project coordination so as to achieve the NBSAP. We propose this should also be added to the function of the Palestine National Biodiversity Committee (PNBC).
8) Resources that are not financial can be better leveraged, including networking, attending conferences, emailing colleagues to seek their support, and much more. There are even groups whose function is to support Palestine scientifically (e.g. Science for the People https://scienceforthepeople.org/).
9) In many cases, the list of species requiring conservation action will exceed the available financial and human resources. Consequently, a decision has to be made on: which species and how many populations of each should be conserved, and in which areas where the species occurs should conservation or recovery actions take place (Heywood et al., 2015). To do this, some countries have created ranking systems. For example, in New Zealand: A = Highest priority for conservation action, B = Second priority for conservation action; C = Third priority for conservation action; D = Plants about which little information exists but which are considered threatened; M = Plants that are rare or localized and of cultural importance to the Maori; O = Plants which are threatened in New Zealand but are thought to be secure in other parts of their range outside New Zealand; X = Plants which have not been sighted for a number of years, but which may still exist. We need to adopt a similar system in Palestine.
10) Focus on the nexus of Water-Food-Energy-Climate for biodiversity support.

11) The European Commission recently confirmed that it promotes an extreme form of biodiversity offsetting, called 'like for like or better' or 'Nature-Based Solutions'. In this system, the destruction of one habitat can be offset by the restoration of the habitat for another species. These 'Nature-Based Solutions' are in turn in the taxonomy of sustainable finance (link).

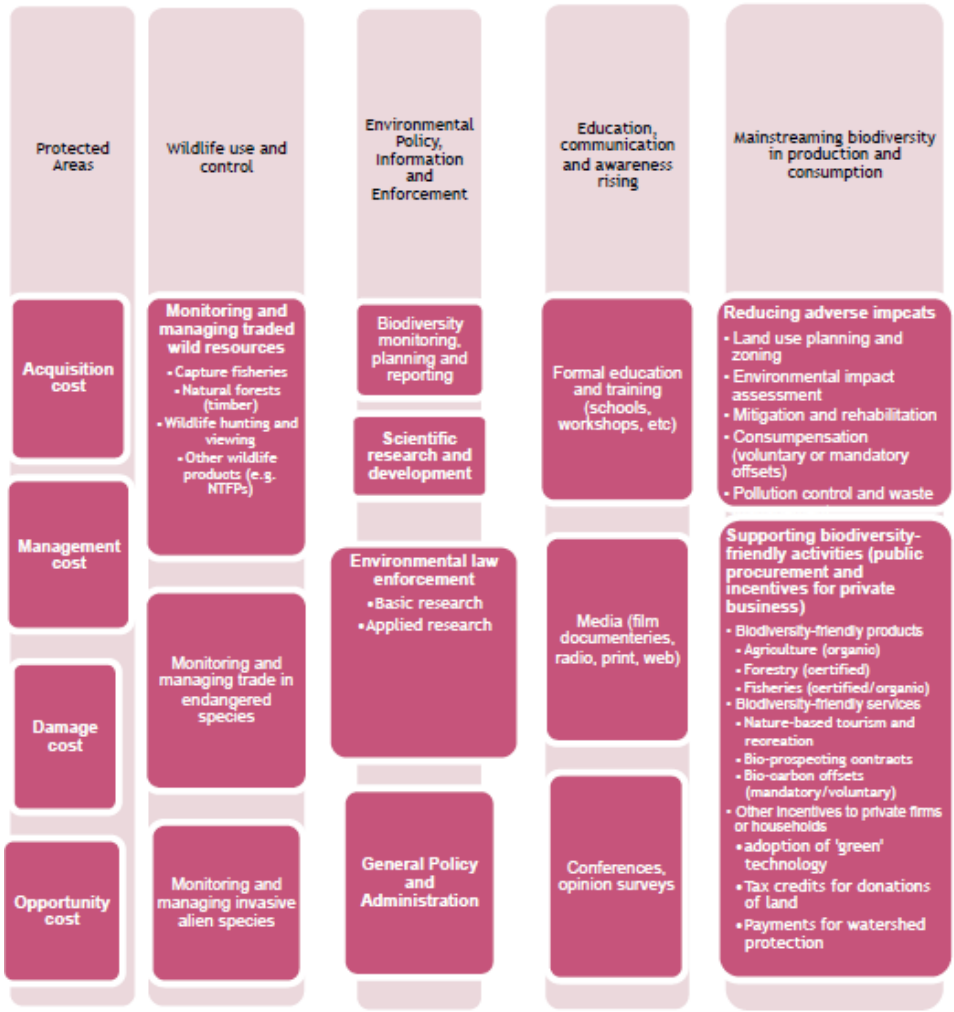


Figure 5.1 Taking into consideration conservation programs and their impact before applying for funding (IUCN, 2012).

6 Reframing the Issues and Conclusion

Most people have started to understand something that biologists have been warning about for decades: that a human-induced environmental catastrophe, including climate change, may soon become irreversible. 40% of coral reefs have disappeared, species loss is accelerating, and agricultural production is impacted. But the common people have grown much more aware over the past few years as icecaps have melted, global temperatures soared, variations in climate caused flooding in many places and there have been massive forest fires elsewhere.

World leaders meeting at a UN Summit in September 2020 committed to reversing biodiversity loss by 2030, and the post-2020 framework to 2050 sets some ambitious targets. The developed nations pledged massive amounts of money towards this and many understood the crucial limitation of time to act. As usual, politicians were dragged into doing somethings right only after much public pressure. Politicians and business people will try to only do marginal things or even "dump money at the issue", in many ways to merely deal with it as a public relations issue. The money is also not calculated to be used to effect the STRUCTURAL changes needed, precisely because structural changes that benefit people and nature reduce profits for the greedy tiny minority that manages most world resources and capital. We need much more than that. What is needed is to leverage public interest, public pressure, and even some of the available money to bring about the necessary structural change. This will not be easy for many people but it is crucial for our survival as a human civilization.

Palestine is a country reeling from the five major global threats (climate change, habitat destruction, overexploitation, pollution and invasive species), compounded by a sixth threat of colonial occupation. The NBSAP articulated in these pages must help us act in ways that would improve harmony between the Palestinian people and the Palestinian environment. In the various sections of this document and in the amended SMART action plans, we have articulated tools and expanded on the resources needed for doing this. But the will and the leadership are key to implementing this plan. This requires participation of everyone, from the farmers to the students to academics, NGOs, government and indeed all sectors of our society. A healthy environment and biodiversity conservation are critical for everyone, and so are the responsibility of everyone.

There have been unanticipated positive aspects:

1. Creation of widespread awareness about biodiversity issues;
2. Generation of fresh data on various aspects of biodiversity;
3. Capacity enhancement and empowerment of people, especially village communities;
4. Widespread networking amongst the various individuals and organizations involved in the process;
5. Implementation of ideas came not just after the process was complete but even during the process of building the NBSAP, for example, on the issues of Protected Area management, science-policy interphase, and CHM/database. Based on the work, new proposals were also submitted.

But also unanticipated negative aspects:

Amongst some academics, local communities and NGOs there was some friction, driven by high expectations and sometimes a lack of clarity on roles and responsibilities (and some potential perceived conflict between narrow group/individual interests and public interest). We took into consideration, when developing the details of action plans, the potential conflicts and varied

interests of the stakeholders. In the context of Palestine, a rights-based approach is critical in implementing the action plans for using natural resources such as water (see Laban et al., 2009) and also "nature's contribution to people" (discussed earlier in Section 2.7), especially in light of the gap in power structure (Qumsiyeh and Albaradeiya, 2022).

There is a professionalization of biodiversity services in Palestine. We can cite a few examples from the collective work led by the EQA, for example on the Biosafety Framework (EQA 2021), on invasive species (EQA 2022), and on the Protected Area Network (upcoming IUCN/EQA). For the latter, we note that four Protected Areas were studied in significant detail while much larger areas are yet to be studied (redrawn borders shown in Figure 7.2).

Figure 6.1 A new protected area network for Palestine (redline). Old PAN is shown in black outlines.

The new map gives us plenty of opportunies for biodiversoity conservation. For example Fig. 7.3 shows 4 areas well studied but they are all in the Mediterranean phytogeograpohical zone where as four much larger areas are not studied yet and cover three additional phytogeographical zones.

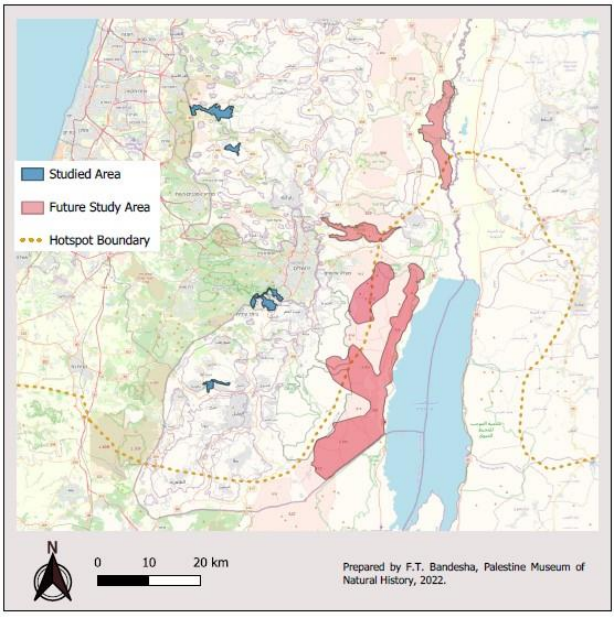


Figure 6.3 A new protected area network for Palestine (redline). Old PAN is shown in black outlines.

7 Glossary

Some of these are from Heywood et al. (2018).

Access and benefit sharing: According to Article 1 of the CBD, the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding, including (Art. 8j) the equitable sharing of the benefits arising from the utilization of knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for conservation and sustainable use of biological diversity (Source: Art. 1, Art 8j, CBD).

Afforestation: Converting grasslands or shrub-lands into tree plantations. Afforestation is sometimes suggested as a tool to sequester carbon, but it can have negative impacts on biodiversity and ecosystem function.

Agrobiodiversity: Agricultural biodiversity is the biological diversity that sustains key functions, structures and processes of agricultural ecosystems. It includes the variety and variability of animals, plants and micro-organisms, at the genetic, species and ecosystem levels.

Agroecology: The science and practice of applying ecological concepts, principles and knowledge (i.e. the interactions of, and explanations for, the diversity, abundance and activities of organisms) to the study, design and management of sustainable agroecosystems. It includes the roles of human beings as a central organism in agroecology by way of social and economic processes in farming systems. Agroecology examines the roles and interactions among all relevant biophysical, technical and socioeconomic components of farming systems and their surrounding landscapes.

Agroecosystem: An ecosystem dominated by agriculture, containing assets and functions such as biodiversity, ecological succession and food webs. An agroecosystem is not restricted to the immediate site of agricultural activity (e.g. the farm), but rather includes the region that is impacted by this activity, usually by changes to the complexity of species assemblages and energy flows, as well as to the net nutrient balance.

Aquaculture: The farming of aquatic organisms, including fish, mollusks, crustaceans and aquatic plants, involving interventions such as regular stocking, feeding, protection from predators, to enhance production. (In contrast, aquatic organisms which are exploitable by the public as a common property resource, are classed as fisheries, not aquaculture.)

Augmentation (population augmentation): The process of adding individuals to a declining/threatened wild population with the aim of enhancing its numbers and genetic diversity so as to improve its viability and help its recovery. Also known as population reinforcement, supplementation or enhancement. The term genetic augmentation is applied when the augmentation is specifically designed to alter the genetic diversity of the threatened population.

Baseline: A minimum or starting point from which to compare other information (e.g. for comparisons between the past and present, or before and after an intervention).

Biocultural diversity: The diversity exhibited by interacting natural systems and human cultures. The concept rests on three propositions: firstly, that the diversity of life includes human cultures and languages; secondly, that links exist between biodiversity and human cultural diversity; and

finally, that these links have developed over time through mutual adaptation and possibly co-evolution between humans, plants and animals.

Biodiversity loss: Biodiversity loss refers to species' extinctions due to habitat destruction, land conversion for agriculture and development, climate change, pollution, the spread of invasive species and other reasons.

Biodiversity: 1) Genetic diversity: the variation between individuals and between populations within a species; species diversity: the different types of plants, animals and other life forms within a region; community or ecosystem diversity: the variety of habitats found within an area (grassland, marsh, and woodland, for instance). 2) An umbrella term to describe collectively the variety and variability of nature. It encompasses three basic levels of organization in living systems: the genetic, species, and ecosystem levels. Plant and animal species are the most commonly recognized units of biological diversity, thus public concern has been mainly devoted to conserving species diversity (Source: GEMET/ WRES / GILP96).

Biome: Biomes are global-scale zones, generally defined by the type of plant life that they support in response to average rainfall and temperature patterns, for example, tundra, coral reefs or savannas.

Biosphere reserve: Protected areas that are strictly set aside to protect biodiversity and also possibly geological/geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring

Biota: All living organisms of an area; the flora and fauna considered as a unit.

Climate change mitigation: In the context of climate change, a human intervention to reduce the sources or enhance the sinks of greenhouse gases. Examples include using fossil fuels more efficiently for industrial processes or electricity generation, switching to solar energy or wind power, improving the insulation of buildings, and expanding forests and other 'sinks' to remove greater amounts of carbon dioxide from the atmosphere (Source: UNFCCC).

Cross-sectoral: Relating to interactions between sectors (that is, the distinct parts of society, or of a nation's economy), such as how one sector affects another sector, or how a factor affects two or more sectors.

Endemic species: Plants and animals that exist only in one geographic region.

Endemism: The ecological state of a species being unique to a defined geographic location, such as an island, nation, country or other defined zone, or habitat type; organisms that are indigenous to a place are not endemic to it if they are also found elsewhere.

Ex situ conservation: The maintenance of germplasm in facilities such as seed banks, pollen banks, field gene-banks, botanic gardens (living collections), and tissue/cell culture laboratories for short, medium or long-term storage. This is the conservation of components of biological diversity outside their natural habitats (Source: EEA/ CBD).

Habitat: 1) The locality in which a plant or animal naturally grows or lives. It can be either the geographical area over which it extends, or the particular location in which a specimen is found. 2) A physical portion of the environment that is inhabited by an organism or population of organisms. A habitat is characterized by a relative uniformity of the physical environment and

fairly close interaction of all the biological species involved. In terms of region, a habitat may comprise a desert, a tropical forest, a prairie field, the Arctic Tundra or the Arctic Ocean (Source:

Habitat loss: A decline in species-specific habitat quality that leads to reduced survival and/or reproductive success in a population e.g. related to changes in food availability cover or climate. (Source: IUCN) Loss of suitable habitat for a given species as such that the particular species no longer occurs in that area (Source: D.B. Lindenmayer, J. Fischer: Habitat Fragmentation and Landscape Change, Island Press 2013). This concept also includes habitat fragmentation, caused by geological processes or human activities.

Harmonization: The process of bringing together, and comparing, models or scenarios to make them compatible or consistent with one another.

Hazardous waste: Any waste or combination of wastes with the potential to damage human health, living organisms or the environment. Hazardous wastes usually require special handling and disposal procedures which are regulated by national and international laws (Source: GEMET/HMD / DEE / HMH).

Heavy metal: A metal whose specific gravity is approximately 5.0 or higher (Source: GEMET/MGH).

Herbicide: A chemical that controls or destroys undesirable plants (Source: GEMET/LANDY).

In situ conservation: (1) At the habitat level, creating protected areas of various types for the conservation of ecosystem diversity and biological diversity or important or significant species diversity; and (2) at the species/population level, conserving individual target species or small groups of target species (threatened or not) through in situ management and monitoring.

Indicators: A quantitative or qualitative factor or variable that provides a simple, measurable and quantifiable characteristic or attribute responding in a known and communicable way to a changing environmental condition, to a changing ecological process or function, or to a changing element of biodiversity.

Indicator species: An indicator species is a species or group of species chosen as an indicator of, or proxy for, the state of an ecosystem or of a certain process within that ecosystem. Examples include crayfish as indicators of freshwater quality; corals as indicators of marine processes such as siltation, seawater rise and sea temperature fluctuation; peregrine falcons as an indicator of pesticide loads; or native plants as indicators for the presence and impact of alien species (Source: GEMET).

Indigenous knowledge: Local knowledge that is unique to a given culture or society, which is the basis for local-level decision-making in agriculture, health care, education and other matters of concern in rural communities (Source: GEMET/ WIK).

Insecticide: Any chemical agent used to destroy invertebrate pests (Source: GEMET/LBC).

In-situ conservation: The conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

Invasive alien species: Invasive alien species are animals, plants or other organisms introduced by humans into places out of their natural range of distribution, where they have become

established and disperse, generating a negative impact on the local ecosystem and species (Source: IUCN).

Key Biodiversity Areas: Sites contributing significantly to the global persistence of biodiversity. They represent the most important sites for biodiversity worldwide, and are identified nationally using globally standardized criteria and thresholds.

Nationally determined contribution: National contributions of efforts undertaken to achieve the long-term temperature goal as set out in the Paris Agreement (Source: Paris Agreement, Art. 2 and 3).

Native species: Indigenous species of animals or plants that naturally occur in a given region or ecosystem.

Nature reserve: Protected land and coastal areas that are approved under the Man and Biosphere Program (MAB) in conjunction with the Convention on International Trade in Endangered Species (CITES). Each reserve has to have an ecosystem that is recognized for its diversity and usefulness as a conservation unit. The reserves have at least one core area where there can be no interference with the natural ecosystem. A transition zone surrounds this and within it scientific research is allowed. Beyond this is a buffer zone which protects the whole reserve from agricultural, industrial and urban development. Biosphere reserves and buffer zones were regarded as examples of a new generation of conservation techniques

Overexploitation: Overexploitation means harvesting species from the wild at rates faster than natural populations can recover. It includes overfishing, and overgrazing.

Protected area: A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values (Source: IUCN). Portions of land protected by special restrictions and laws for the conservation of the natural environment. They include large tracts of land set aside for the protection of wildlife and its habitat; areas of great natural beauty or unique interest; areas containing rare forms of plant and animal life; areas representing unusual geologic formation; places of historic and prehistoric interest; areas containing ecosystems of special importance for scientific investigation and study; and areas which safeguard the needs of the biosphere (Source: GEMET- DODERO / WPR).

Protected landscape or seascape: Where the interaction of people and nature over time has produced a distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.

Resilience: The level of disturbance that an ecosystem or society can undergo without crossing a threshold to a situation with different structure or outputs. Resilience depends on factors such as ecological dynamics as well as the organizational and institutional capacity to understand, manage, and respond to these dynamics.

Restoration: The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. In conservation, restoration is a general term that is used in many ways, including: ecological restoration, habitat restoration, species restoration, population restoration, etc. Its use without qualification is best avoided. It is any intentional activities that initiate or accelerate the recovery of an ecosystem from a degraded state. The use of the term restoration

without qualification, such as ecological restoration, habitat restoration, species restoration, population restoration, etc., is best avoided.

Soil conservation: Management of soil to prevent or reduce soil erosion and depletion by wind and water; preservation of soil against deterioration and loss by using it within its capabilities; the application of conservation practices needed for its protection and improvement (Source: GEMET/MGH / LANDY).

Species richness: The number of species within a given sample, community, or area.

Species: A taxonomic category ranking immediately below a genus and including closely related, morphologically similar individuals which actually or potentially can interbreed,

Stakeholders: Any individuals, groups or organizations who affect, or could be affected (whether positively or negatively) by a particular issue and its associated policies, decisions and action.

Strict nature reserve: An area which is strictly protected for biodiversity and also possibly geological/ geomorphological features, where human visitation, use and impacts are controlled and limited to ensure protection of the conservation values**.**

Sustainable Development Goals (SDGs): A set of goals adopted by the United Nations in 2015 to end poverty, protect the planet, and ensure prosperity for all, as part of the 2030 Agenda for Sustainable Development.

Wetlands: Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters. Wetlands may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands (Source: RAMSAR Convention, Art 1.1 and 2,1). Areas that are inundated by surface or ground water with frequency sufficient to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth or reproduction (Source: GEMET/LANDY).

Wilderness area: Protected areas that are usually large unmodified or slightly modified, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition

Wildlife: Animals and plants that grow independently of people, usually in natural conditions

Zoonotic diseases: Diseases which are directly transmitted from animals to humans via various routes of transmission (e.g. air - influenza; bites and saliva - rabies).

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9 Web resources

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Annex I – Action Plans

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