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Mediterranean Coastal Zones:
Managing the Water-Food-Energy
and Ecosystem NEXUS

1st Multi-Stakeholders Consultation Meeting

Water-Energy-Food-Ecosystems Nexus

in Lebanon

Environment protection and ecosystems health

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Protection of Nature Service- Ministry of Environment- Lebanon
24th August 2022

Current status and trends regarding ecosystems

Presentation Outline

1. Definition of Ecosystem
2. Brief Description of Current Situation of the Ecosystem Sector
3. Legal Framework: Strategies –Policies – Plans
4. Trends
5. Challenges & Threats; Needs & Opportunities to ecosystems
6. Sustainability and Project match with SDG'S
7. How to manage this complex change & how to induce a positive change
8. Challenges, opportunities, risk and threats to the project implementation

Introduction to Ecology

- The meaning of the word ecology was given by German Biologist Hackle in 1869.
- The word ecology is derived from Greek words 'Oikos' meaning *house, habitat or place of living* and 'Logos' meaning *to study.*
- *Ecology* is defined as the study of interrelationship of different organisms with each other and with their environment. It is concerned with the general principles that apply to both animals and plants.

WHAT IS AN ECOSYSTEM?

An ecosystem is a community of living organisms interacting with each other and their non-living environment.

What makes up an ecosystem?

- All living things (plants, animals, and bacteria)
- Non living things (the sun, rocks, and soil)

MAIN DIFFERENCES

ECOLOGY AND ECOSYSTEM

DEFINITION

Ecology is a branch of biology which deals with the relationships of organisms to one another and to their physical environment	Ecosystem is a community of interacting organisms and their physical environment; an ecosystem is a subpart of ecology

RELATIONSHIP

Ecology includes the study of relationship between living organisms and their environment	Ecosystem is a place like a forest, taiga, grass land, desert, stillwater, river or a stream, coral reefs etc

Visit www.pediaa.com

Ecosystem Scientific Definition

An ecosystem is the basic unit of the field of the scientific study of nature. According to this discipline, an ecosystem is a physically defined environment, made up of two inseparable components:

The biotope (abiotic): a particular physical environment with specific physical characteristics such as the climate, temperature, humidity, concentration of nutrients or pH.

The biocenosis (biotic): a set of living organisms such as animals, plants or micro-organisms, that are in constant interaction and are, therefore, in a situation of interdependence.

The concept of < ecosystem > is possible at several scales of magnitude. From multicellular organisms such as insects animals or plants to lakes, mountain ranges or forests to the planet Earth as a whole.

Current Situation

Biodiversity

- Lebanon is part of the Mediterranean Basin Biodiversity hotspot and is characterized by its biodiversity richness due to its location, climate and topography
- Lebanon hosts one of the highest densities of floral diversity in the Mediterranean basin

Source: Mediterranean Basin Biodiversity Hotspot, CEPF, 2010

Major Ecosystems

Type Ecosystem	Sub-Category/Characteristics
Terrestrial Ecosystems	Forests
Mountainous ecosystems	**Lower mountain ecosystem** associated with the thermo-Mediterranean vegetation series
	Middle mountain ecosystem features the EU-Mediterranean vegetation series
	Upper mountain ecosystem integrating the supra-Mediterranean vegetation series
	High mountain ecosystem where coniferous forests thrive
	Subalpine ecosystem the very high slopes of nearly 2,000-2,500 m a.s.l.
	Alpine system of high rate of endemism on the very high peaks of Mount Lebanon at 2,700 m and above
River valley ecosystems	Highly distinctive and are subject to their own characterizing feature
Aquatic ecosystems	Rivers, streams, springs, boggy lands and wetlands encompass high diversity
Semi-arid and arid ecosystems	Inlands of Northern Bekaa in their natural extension toward the desertic internal plains of Syria
Coastal and marine ecosystems	**Coastal Ecosystems** Include sandy shore ecosystems and rocky shore ecosystems Island and archipelago systems have particular significance as they present special combinations of terrestrial and marine habitats
	Marine ecosystem, typical of the East Mediterranean.

Source: SOER, 2020

Forest Ecosystems

- Forests in Lebanon occupy around 13% of its total area, while other wooded lands cover about 10% of the territory
- About 57% of the forests are of broadleaved species, coniferous species contribute 32% while the rest are mixed conifer/broadleaf forests
- The highest forest concentrations in Lebanon are in Mount Lebanon (37%) and North Lebanon (30%), followed by South Lebanon (9%) and Nabatieh (6%)

Distribution of Forests in Lebanon

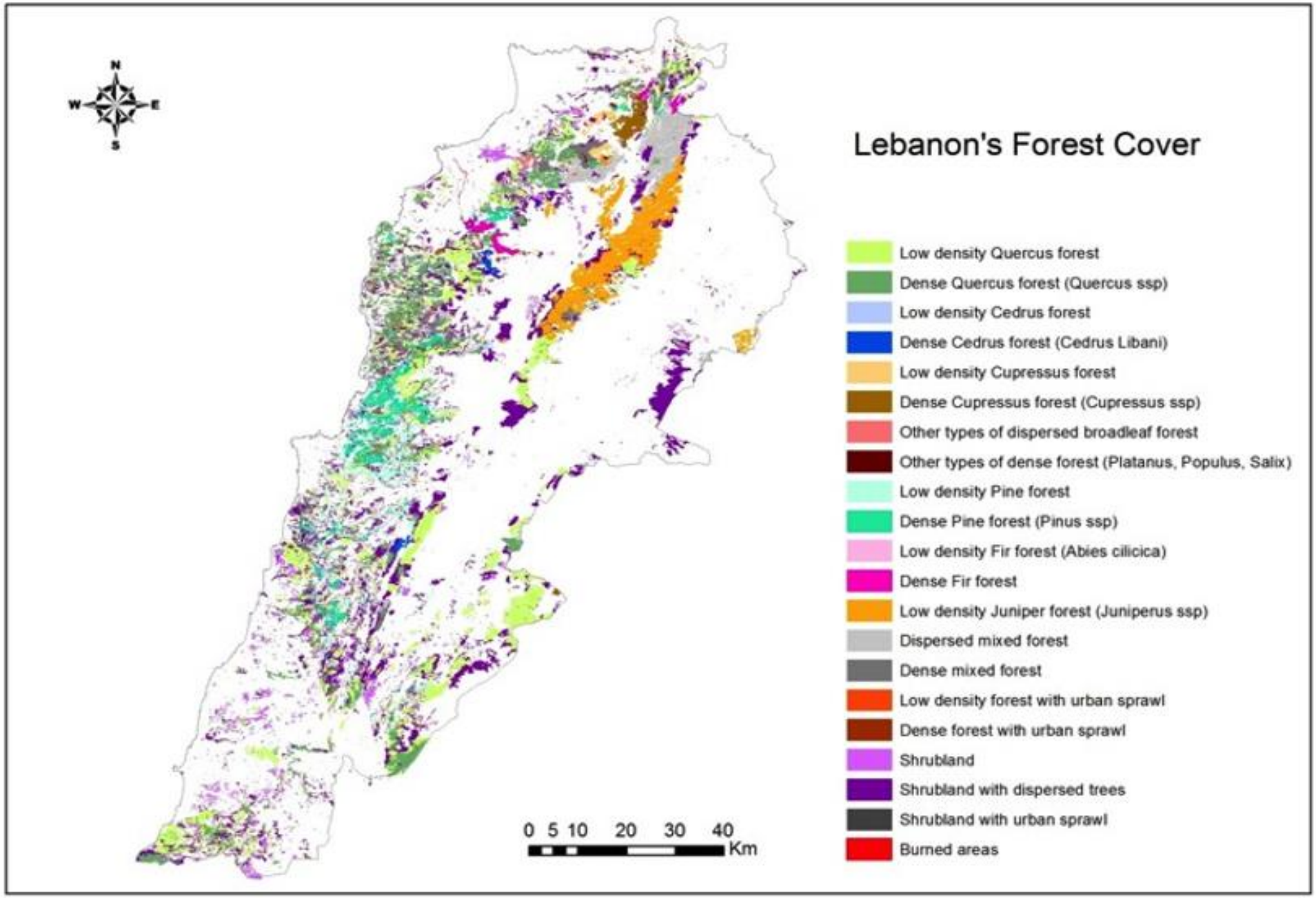

Figure 5-1 Map showing the distribution of Lebanese forests in 2005 (UNDP / CEDRO – 2016)

Rivers and Coastlines

- Lebanon has 17 perennial and 23 seasonal rivers characterized with varying topographic features and creating a diversity of conditions for riparian habitats and species
- Of the 17 rivers in Lebanon 15 flow into the coastal water supplying sediments and nutrient uploads especially during floods
- Other habitats are created by the many streams that flow over the slopes of the Lebanese mountains in narrow courses which creates optimal conditions for certain species to grow
- The Lebanese coastline extends over 220 km with various references giving different estimates the highest of which is at 370.92 km
- The coastline is characterized by 3 bays 12 headlands and several river deltas

Coastal Habitats

- Coastal areas in Lebanon include sandy beaches (20%) and rocky shores (80%) creating several coastal habitat types where species are spread between supra-littoral mid-littoral infra-littoral and circa-littoral habitats
- Vermetid platforms are one of the most characteristic habitats of the Lebanese Coastal Zones and are threatened
- These platforms are very fragile habitats and their optimum environmental conditions are in the intertidal or immediate subtidal zone which interacts with the surrounding physical and chemical changing factors

Marine Habitats

- Marine habitats in Lebanon are not well defined or mapped for fauna and flora associations
- More than 20 benthic biocenosis of hard substrata for the littoral rock, infra-littoral rock and upper circa-littoral rock have been identified
- The habitats were divided between hard and soft substrata for marine divisions for the selection of sites to be included in the national inventories of natural sites of conservation interest
- Limitations of classification include scarcity of research on marine habitats specificity and difference of certain habitats from the rest of Mediterranean and relative homogeneity of the infralittoral fauna and flora


SOER, 2021

Terrestrial Biodiversity

- As for terrestrial flora Lebanon hosts about 2,600 terrestrial plant species revealing a high rate (12%) of endemism including 8.5% broad endemics (Lebanon, Syria, and Palestine) and 3.5% narrow endemics to Lebanon
- A significant number of species are rare and threatened most of which are located in the high mountain summits thus affected by isolation
- Terrestrial mammals in Lebanon include 59 species, most of which are at a least concern level of threat based on the IUCN red list
- An estimated 842 insect species are known to exist in Lebanon, however, specialists in the field estimate that species range between 14,000 and 18,000 species

Birds, Reptiles and Amphibians

- A total of 404 species of birds were recorded in Lebanon
- 70.4% of these species are passage migrants winter visitors or both 17.0% are vagrants 18.0% are summer breeders and 16.0% are breeding residents
- 63 known species of reptiles and 7 species of amphibians have been identified in Lebanon

Freshwater Biodiversity

- Freshwater biodiversity in Lebanon contributes to 16% of fauna and 6% of flora species; it encompasses 987 species
- 656 are known freshwater invertebrates that include 61 species of worms 41 species of mollusks 60 species of crustaceans and 494 species of insects
- A survey of limnic and terrestrial mollusks collected 17 freshwater and 33 land gastropod species as well as 6 small clams 11 new records of mollusks were also reported for first occurrence in Lebanon


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SOER, 2020

SBR, 2005

SBR, 2005

Legal Framework

Legal Framework

Many legal texts regulate various issues related to ecosystems and biodiversity in Lebanon including:

- protected areas law (130/2019), and laws declaring selected areas as protected
- laws and regulations related to forest management
- ratification of international agreements and conventions addressing biodiversity conservation and protection of natural resources from pollution
- Regulating fishing, hunting and harvesting of plants (sage and oregano)
- Regulating import and export of selected species
- Etc.

Strategies, Policies and Plans

National Policies, Strategies and Plans

MoA-National Strategy for Agriculture (NAS) Sector, 2020-2025
MoE-National Action Plan for the Conservation of the Coralligenous assemblages in Lebanon, 2020
MoE - A Stranding Network for Sea Turtles and Cetaceans & A Protocol for Monitoring the Interaction between Marine Litter and Marine Turtles in Lebanon, 2020
MoE-National Monitoring Programme for Marine Biodiversity in Lebanon, 2018
MoE-Action Plan Concerning Species Introductions and Invasive Species in Lebanon, 2018
Lebanon's Nationally Determined Contribution (NDC) Updated 2020 Version (MoE, 2020)
MoE-Lebanon's National Biodiversity Strategy and Action Plan (NBSAP), 2016-2030
National Strategy For Conservation And Management Of Plant Genetic Resources For Food And Agriculture In Lebanon 2015-2030
MoA-National Strategy for Agriculture Sector, 2015-2019
Lebanon National Forest Plan (2015-2025)
National Afforestation and Reforestation Program (NARP) 2014-2028
MoA- Agricultural Sector Development Strategy, 2010 - 2014
National Strategy for Forest Fire Management in Lebanon 2009
MoA-National Action Program (NAP) to Combat Desertification, 2003
National Physical Master Plan for the Lebanese Territory, 2009 (NPMPLT)
The National Master Plan for Quarries (NMPQ), 2009

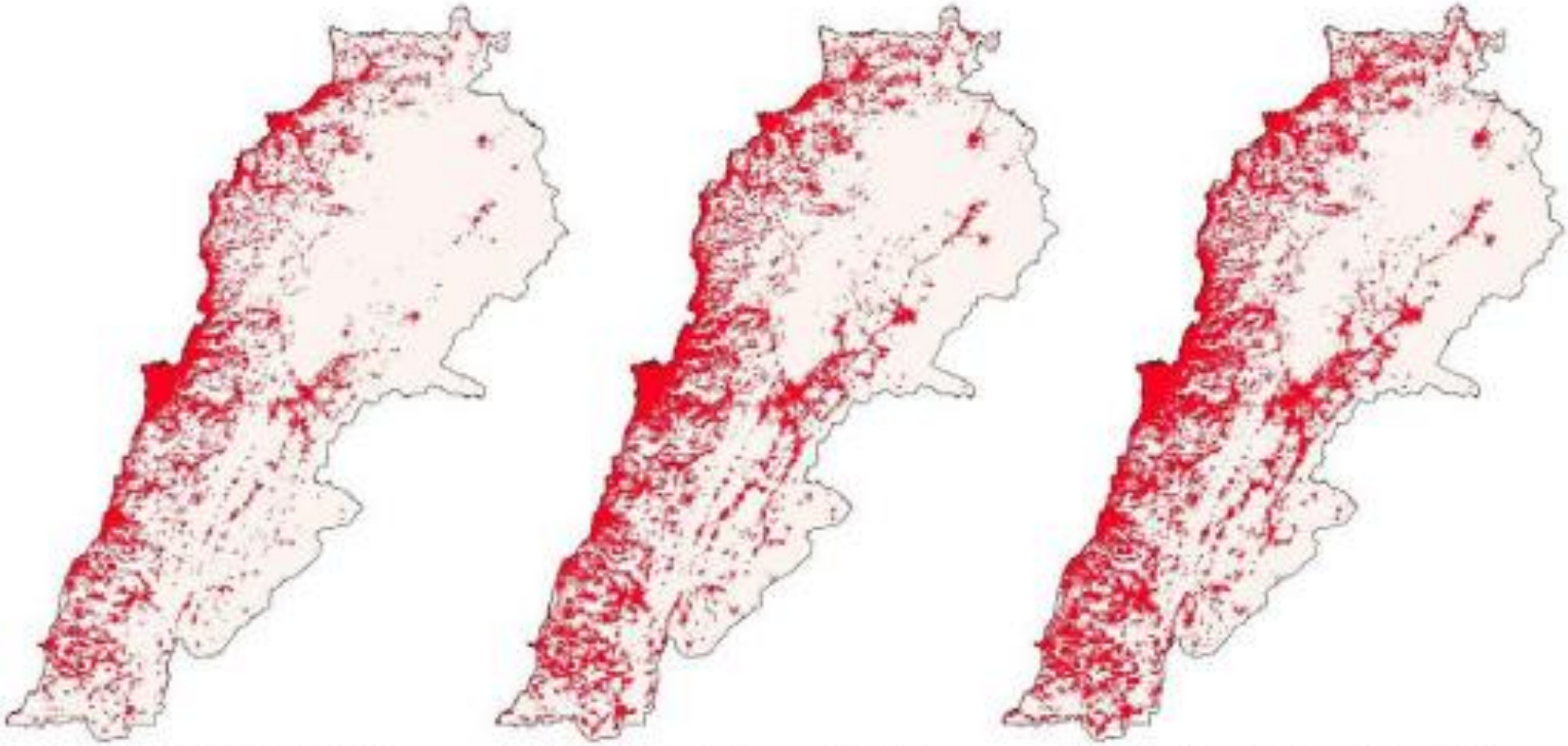
Interlinkages with other sectors

Interlinkages

- Ecosystems are highly impacted by the availability and quality of water and air.
- The pollution of water resources and the altering of the natural water courses can lead to the deterioration of habitats and the death of species, some of which are rare and threatened on the national and global scales.
- The elevated price and unavailability of fuels increases the risks on forests that are usually illegally exploited for firewood, and in some instances intentionally incinerated for the same purpose.
- Emissions and leakages from energy related activities cause adverse impacts on ecosystems and biodiversity as well,

Trends

Urban Expansion



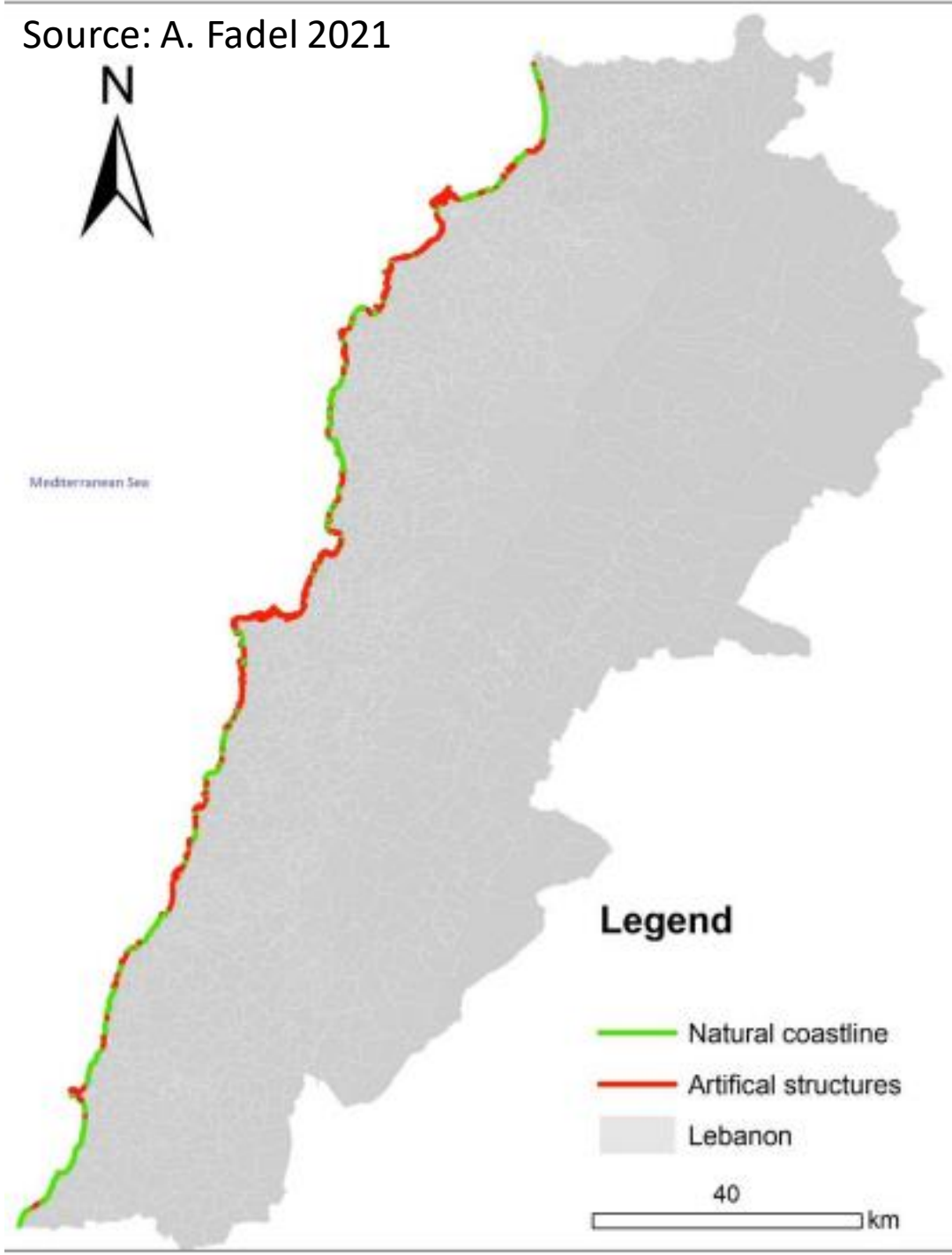
(a) Built up areas in 1975 (b) Built up areas in 2000 (c) Built up areas in 2014

Source: SOER, 20

Encroachment over Coastal Habitats

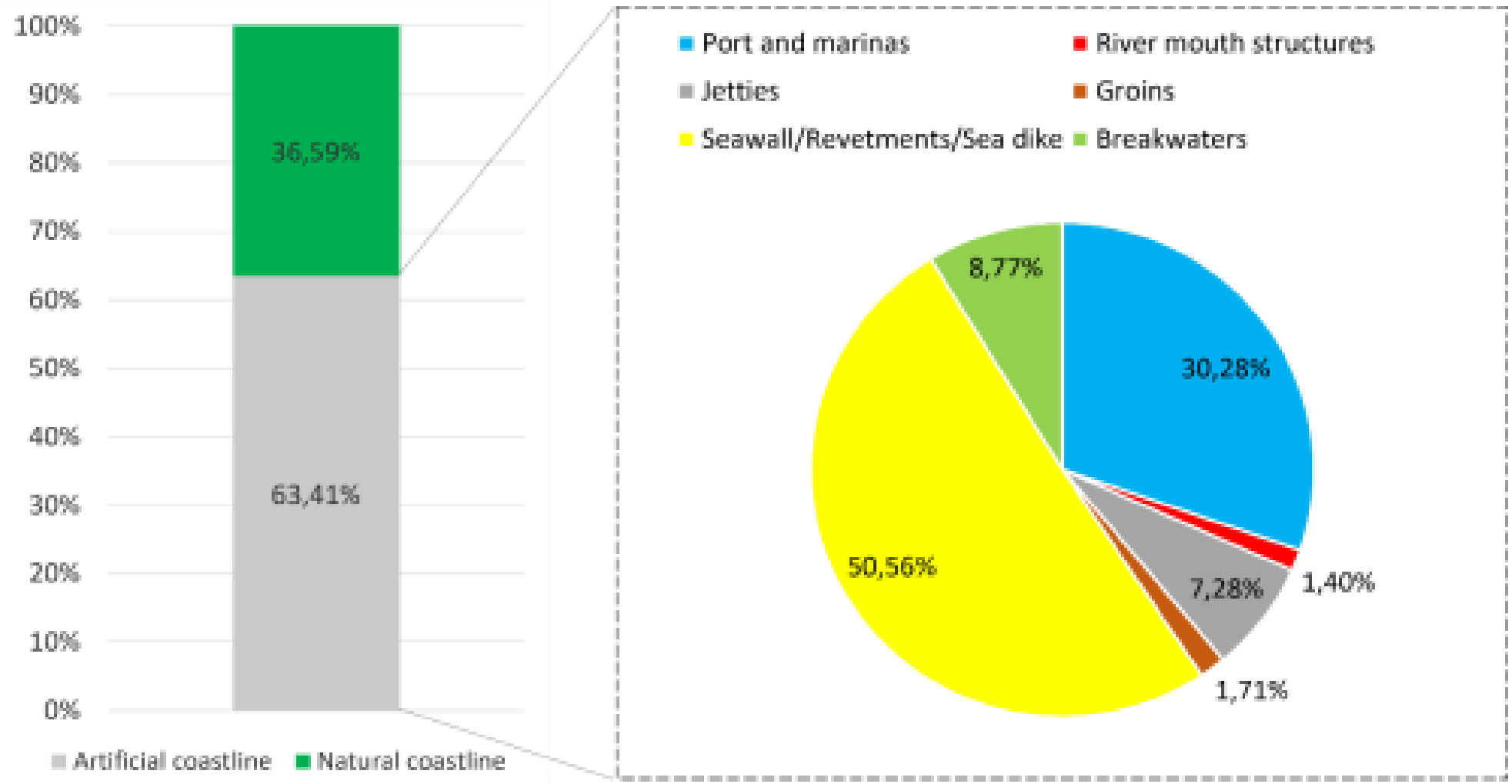
- Total length of Lebanese coastline is approximately 342 km. The natural part represents **36,59%** (125 km), and the artificial coastline **63,41%** (217 km)
- Between 1963 and 2005 the highest urban expansion occurred on the coastal cities:
  - Beirut increasing from 63 to 121 km^2
  - Jounieh from 5.3 to 38 km^2
  - Tripoli from 4.3 to 14 km^2

Source: A. Fadel 2021



Encroachment over Coastal Habitats

- Artificial Coastline



Source: A. Fadel, 2021

Figure 8 Percentage of Natural coastline and the different types of artificial coastline in Lebanon

Status of Ecosystems and Species

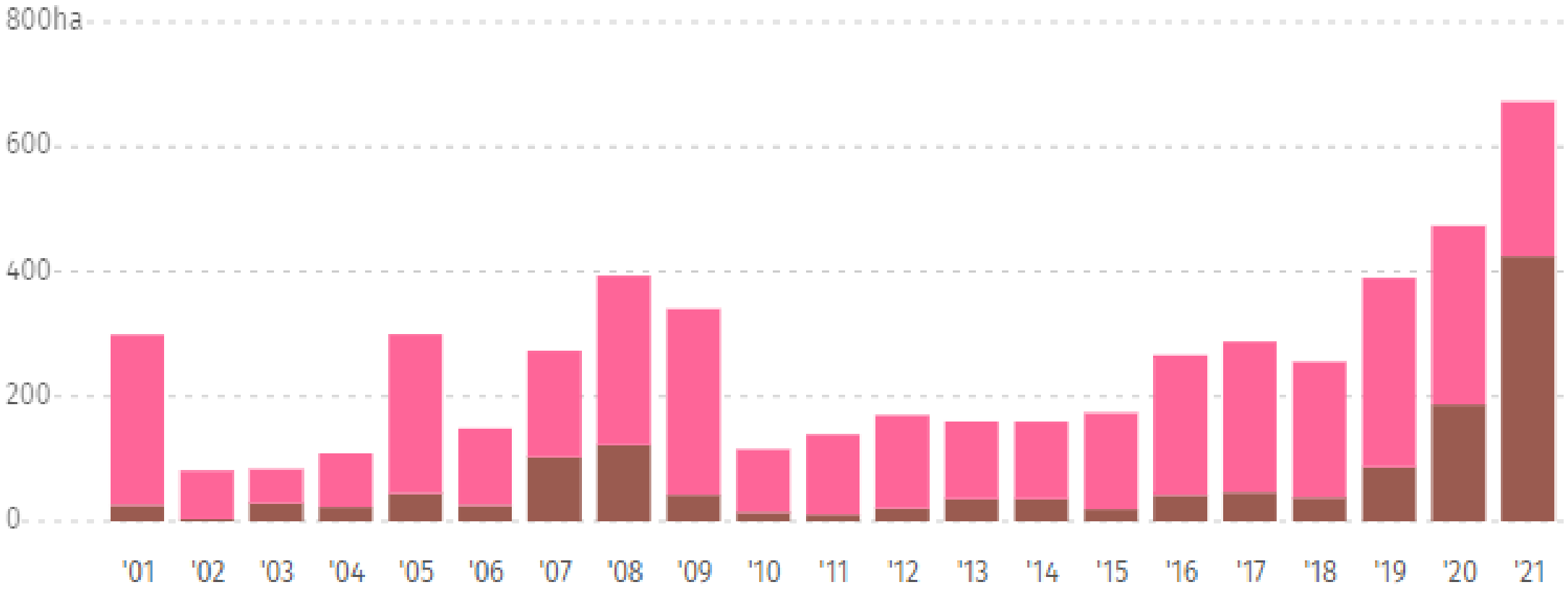
- Lebanon has lost approximately 34% of the surface of its vermetid platforms between 1962 and 2010 (mainly due to sea-filling and chaotic coastal construction activities)
- 5% percent of the country's freshwater fauna are threatened, including the Globally Near Threatened Otter *Lutra lutra*
- Out of the 25 freshwater fish species: one is vulnerable, three endangered and two critically endangered, caused mainly by overfishing

Status of Ecosystems and Species

- Two of Lebanon's amphibian species and 17 of its reptile species are considered threatened
- The IUCN Red List status of threat indicates that 1 species of the birds of Lebanon is Critically Endangered, 4 are Endangered, 13 are Vulnerable, and 24 are Near Threatened
- Due to uncontrolled hunting and other threats, successive decline in the common bird species was rated at 14% in 1999, 18% in 2003, and 19.8% in 2008
- The status of the mammals: 36.54% of the existing mammals are rare, 1.92 % near threatened, 7.7 % vulnerable, and 1.92 % close to extinction

Forest Cover

From 2001 to 2021, Lebanon lost 1.38 kha of tree cover from fires (26%) and 3.92kha from all other drivers of loss.



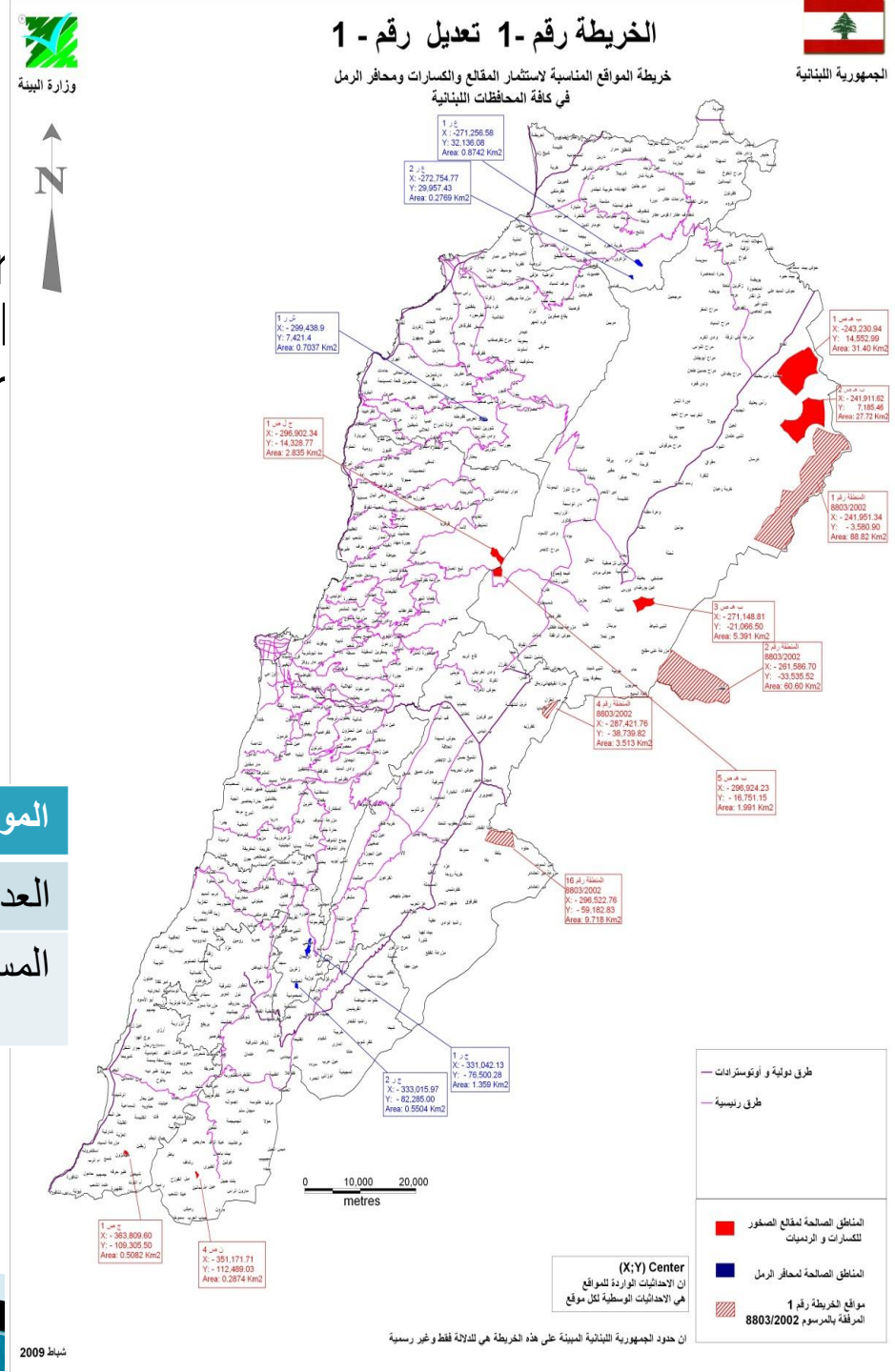
Source: Global Forest Watch

Quarries

- The map presents in r
areas designated by t
national Plan for Quar

- In yellow, quarries located outside designated areas are presented

المواقع في الخريطة	صخور	رمول
العدد	11	5
المساحة كلم مربع	232.7836	3.7642



Climate Change Impacts on Ecosystems

- Lebanon has a diverse natural environment including coastal, forest and mountainous areas, many of which have unique biodiversity and ecosystems that are sensitive to Climate Change
- Changes in rainfall patterns are affecting the frequency of intense rainfall events and altering catchments and drainage basins and leading to destructive flooding
- Increased temperature and drier conditions increase severity and intensity of forest fires
- The reduced rainfall and elevated summer temperatures with more prevalence of hot days in the past ten years caused the drying up of aquatic habitats early in the season, thus increasing pressures on amphibian species
- Climate regime shifts have altered Lake Qaroun's ecosystem

Challenges & Threats to Ecosystems

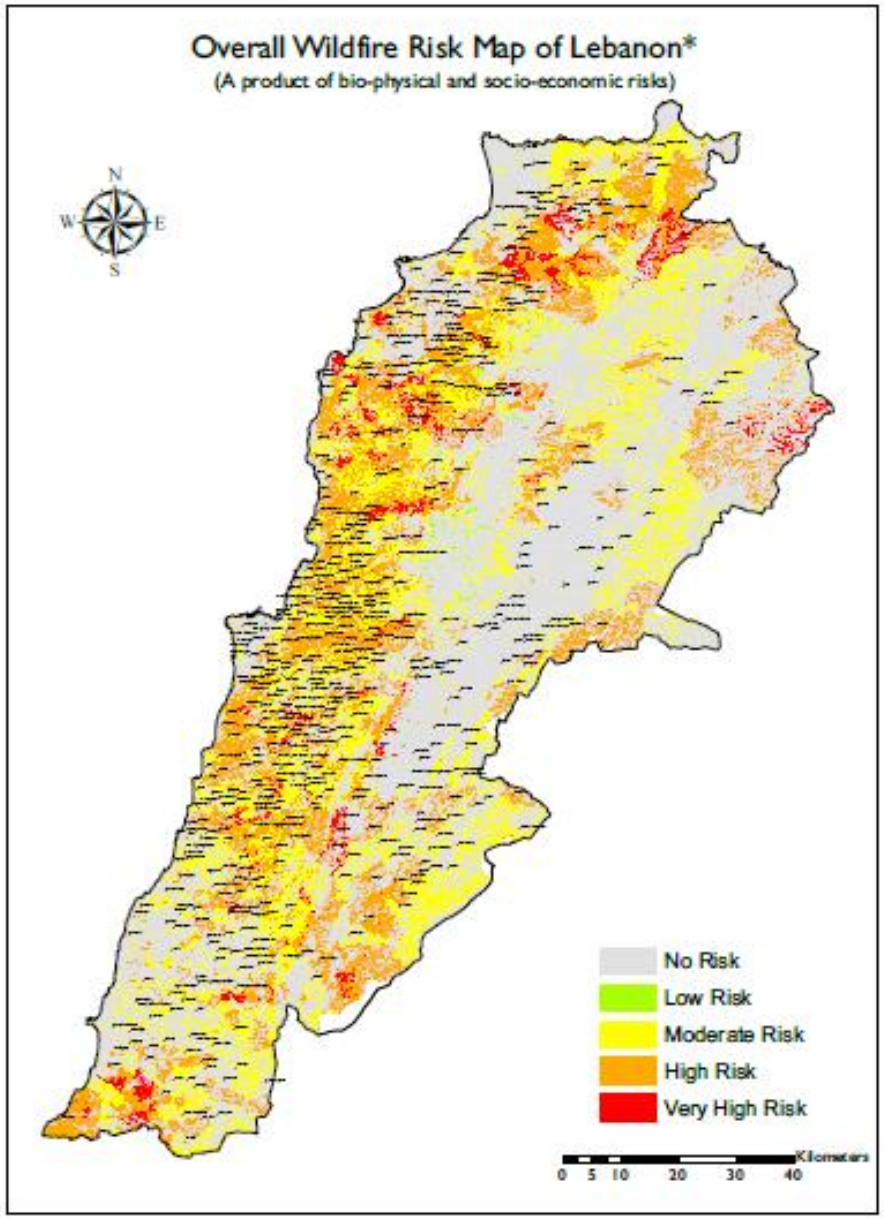
Challenges and Threats

- Urban Expansion and Haphazard Urbanization

Challenges and Threats

- Unsustainable practices in collecting forest products and
- Forest fires

https://www.thenationalnews.com/world/mena/bushfires-threaten-to-destroy-lebanon-s-ancient-mountain-forests-1.1078581



Challenges & Threats

- Pollution (soil, water and air pollution, solid waste dumping, etc.)

Challenges and Threats

- Climate change
- Diseases
- Uncontrolled hunting
- Invasive species
- Quarrying and Overgrazing
- Uncontrolled recreational activities (snow-sports, offroad activities using all-terrain vehicles, fishing, scuba-diving, jet-skis, boating)

SOER, 2020

Opportunities and Needs

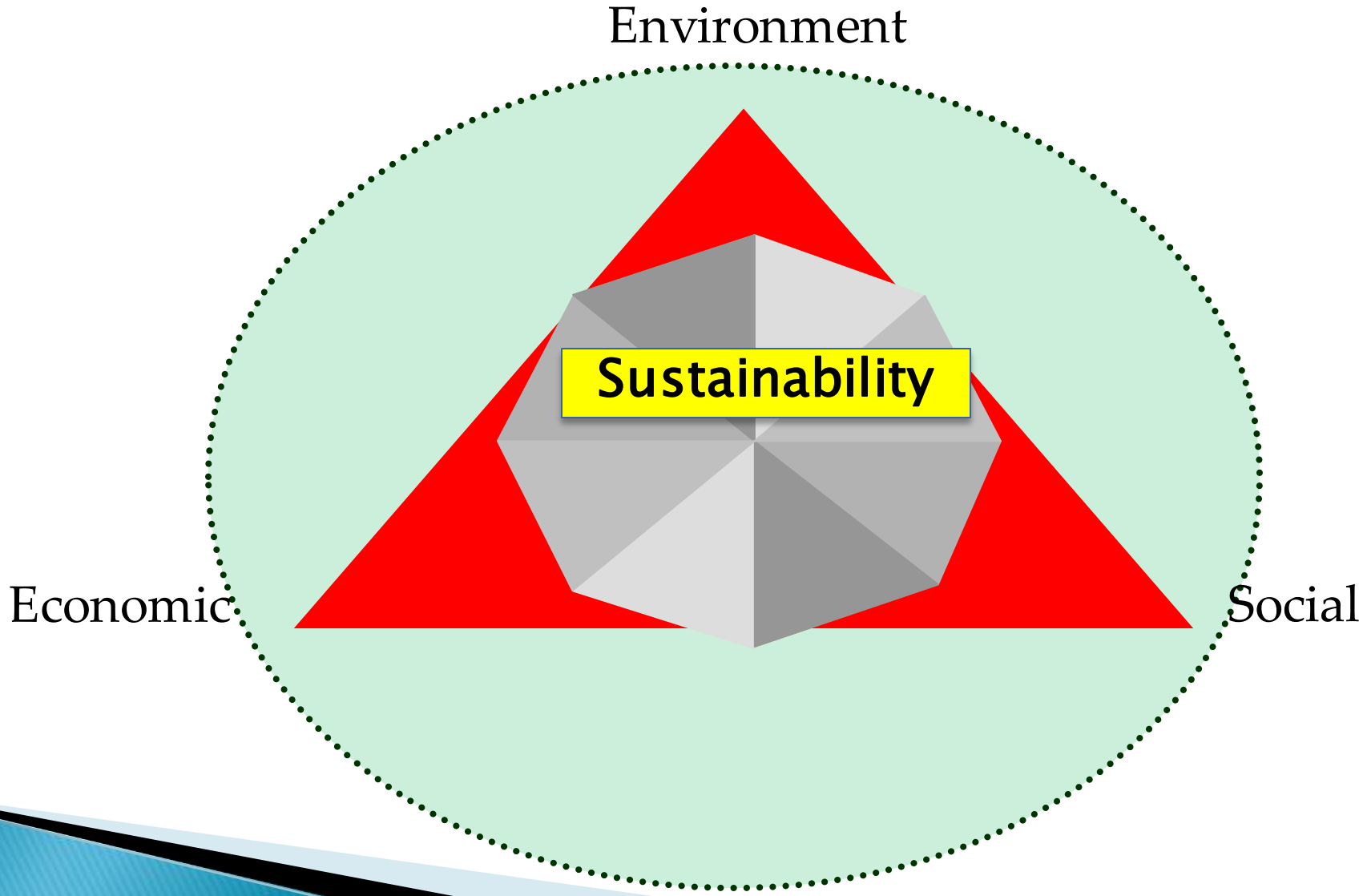
Opportunities

- Sustainable forest management to protect from fires and diseases
- Development of management plans for protected areas for sustainable management and enhancement of livelihoods
- Increasing awareness on biodiversity richness and necessity for their protection

Needs

- Enforcing legislation related to ecosystem and biodiversity protection
- Activation of forest guards and environmental police
- Developing and implementing management plans for protected areas

Three pillars of sustainability



CP 2.2 and Sustainable Development Goals

SDG 2
End hunger, achieve food security and improved nutrition and promote sustainable agriculture

SDG 5
Achieve gender equality and empower all women and girls

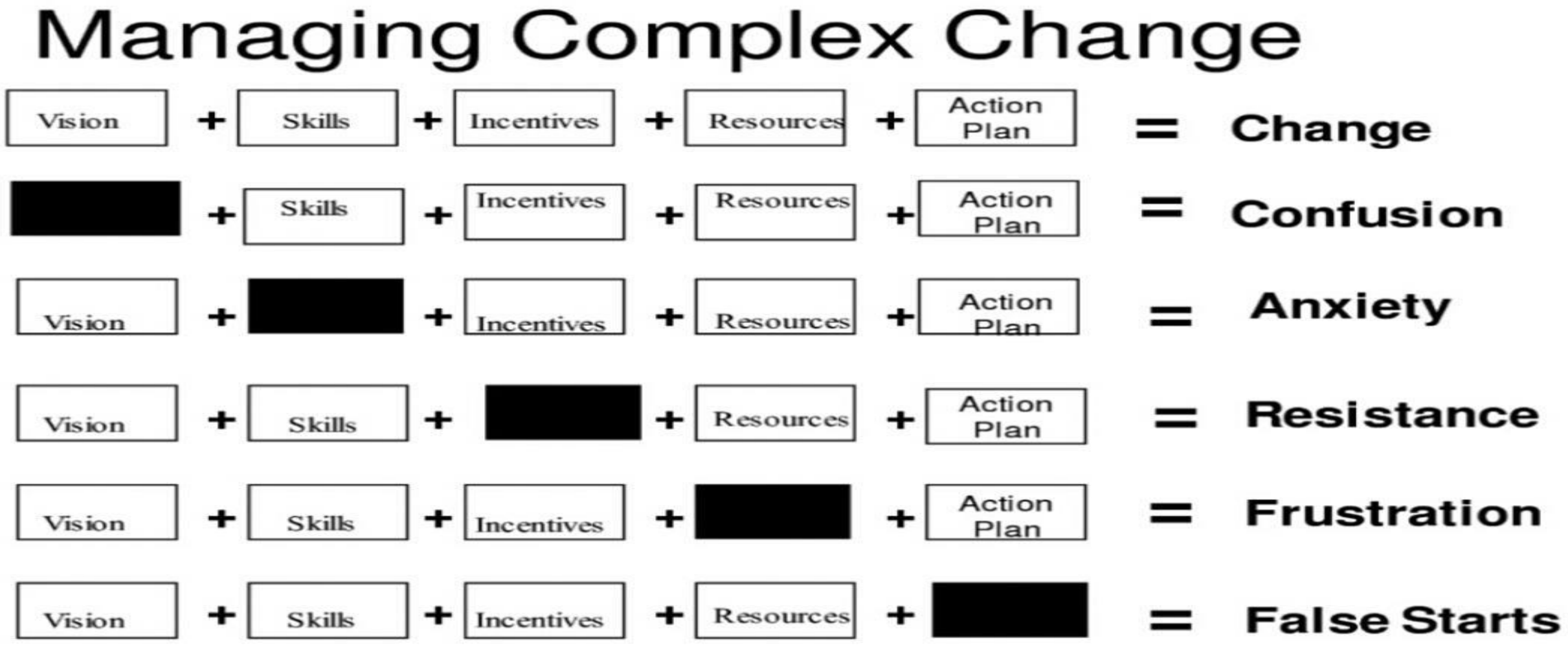
SDG 6
Ensure availability and sustainable management of water and sanitation for all

SDG 7
Ensure access to affordable, reliable, sustainable and modern energy for all

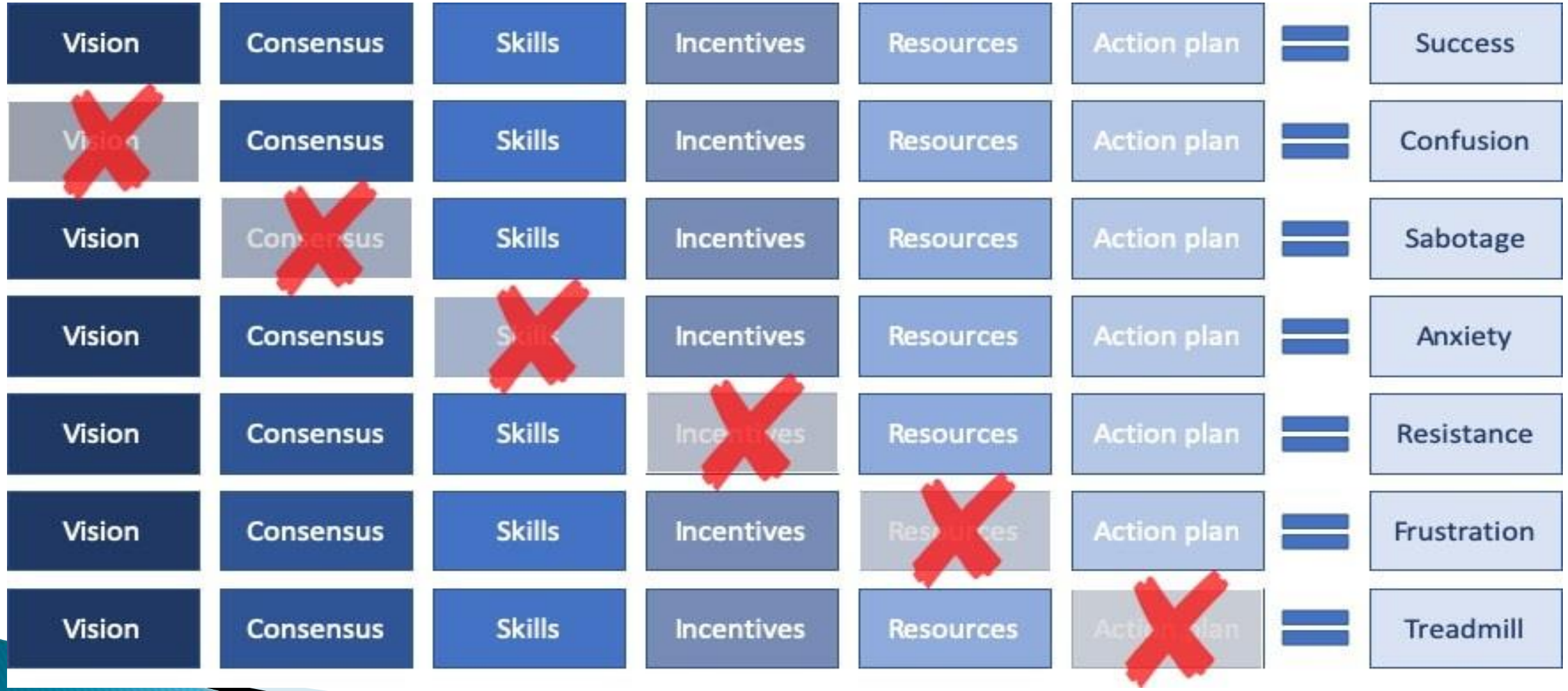
SDG 15
Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

SDG 17
Strengthen the means of implementation and revitalize the global partnership for sustainable development

The Lippitt-Knoster Model for Managing Complex Change Oct 2020



The Lippitt-Knoster Model for Managing Complex Change ammended



KOTTER'S 8 STEP CHANGE MODEL

Proper Administrative Procedure

Challenges to the project:

- Quadruple Equation for four main Economic sectors;
- Creation of a new body to run the equation;
- Harmonize the work of three public institutions;
- To make a positive change;
- Find synchronized solutions to four main sectors at the same time

Opportunities:

- Integrated approach for a new topic;
- Creation of a new body representing the concerned stakeholders;
- Funding for new developments and Job opportunities;
- Share knowledge with other involved countries partners to this project;
- New partnerships

Proper Administrative Procedure

Risks and threats:

- Lack of co-financing resources
- Bad economic situation;
- Country's unstable conditions;
- Different scale of National priorities;
- Failure in Public administrations;
- Sustainability of the project outcomes;
- No incentives for the involvment of public sector officials;
- Policy and institutional coherence;
- Meeting the targets of the SDG'S

Thank You!

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