



HOBYO
RESILIENCE PLAN




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FOR A BETTER URBAN FUTURE

Hobyo Resilience Plan
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UNITED NATIONS HUMAN SETTLEMENTS PROGRAMME
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Contents

1 INTRODUCTION

The Hobyo Resilience Plan provides an overview of the main features related to resilience in the town and its surrounding landscape. It briefly analyses the current development challenges with a special focus on climate-related and environmental-related risks affecting vulnerable population.

It is a complementary technical document to several other planning studies and reports to shape the future of Hobyo in a more sustainable way, providing basic urban services to all communities and leaving no one behind.

This Resilience Plan provides an identification of the main existing processes currently taking place in Hobyo from a vulnerability perspective. The vision and example interventions are focused in reverting, at least partially, those processes.

Given the lack of available information from all spheres – social, environmental, economic, etc– it wasn't possible to develop a full scope document.

However, this document does propose a clear methodology that can be later applied and customized. Firstly, a regional and urban scale analysis identifies hazards, vulnerable areas and current resilience elements. With this information, an interdependence assessment is conducted through the problem tree analysis. This analysis identifies the process(es) that are in the root of the main hazards perceived across different scales. Once the processes have been identified, a complete vision can be proposed, focused on modifying the main damaging process(es) and not spending energy on solving side sympthoms. This method aims to reduce the hazards and vulnerabilities of the communities in Hobyo on the long run.

Responding to the environmental challenges is an endeavor that requires, in general, large-scale, long-term environmental strategic plans, which include continuous monitoring and evaluation from the local authorities. This document proposes examples of specific interventions that local and regional administrations and individuals can undertake to increase urban and regional resilience. These actions are chosen according to their simplicity and based on their effectiveness (drawn from scientific literature descriptions). It would be advisable to present alongside the interventions a monitoring and evaluation plan, so as to ensure their being effective.

UN-Habitat's mandate on the implementation for the sustainability agenda is making cities and urban settlements resilient, inclusive and sustainable under Sustainable Development Goal (SDG) 11. UN-Habitat has developed more comprehensive, local tools for resilience planning, such as the City Resilience Action Planning Tool (CityRAP Tool), that would be advisable to develop on the field involving local participatory processes. It would also be advisable to conduct a Vulnerability and Risk Analysis (VRA) on the field for a more complete vision of the current processes.

It is hoped that this working paper contributes to the necessary public discussion on Hobyo's future development and facilitates decision-making by local, regional, state and federal authorities.

Reference is being made to other studies and data updates undertaken by UN agencies and other international stakeholders, such as: SWALIM (Somalia Water and Land Information Management), IOM-supported interventions in Hobyo, such as the Community Action Planning process, and CCCM Cluster.

This Resilience Plan was drafted with support from the Hobyo Core Facilitation Team (CFT) of Midnimo II (Unity) project: "Support for the Attainment of Durable Solutions in Areas Impacted by Displacement and Returns in Galmudug and Hirshabelle States."

Midnimo II is jointly implemented by The United Nations Development Programme (UNDP), International Organization for Migration (IOM) and the United Nation Human Settlements Programme (UN-Habitat) and funded by United Nations Peacebuilding Fund.

HAZARDS

The first part of this resilience plan identifies hazards, based mainly on those related to environmental issues, such as coastal erosion, water scarcity, etc. This identification is twofold, taking place on both regional and urban scale.

VULNERABILITY

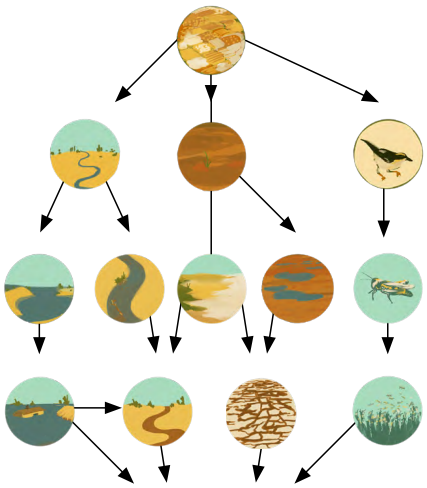
The second part of this resilience plan identifies vulnerable areas, such as IDP camps and public facilities, that would be endangered by their current exposure to extreme weather events, such as floods or sand storms.

RESILIENCE ELEMENTS

The third part of this resilience plan identifies the current elements that provide resilience, both on regional and urban scale.

SIMPLIFIED INTERDEPENDENCE ASSESSMENT

Using the problem tree analysis, hazards are presented (on a simplified format) with causal relations, providing a vision of the processes taking place currently in the town and its surrounding region. This method helps identify the root processes in the origin of the different hazards.



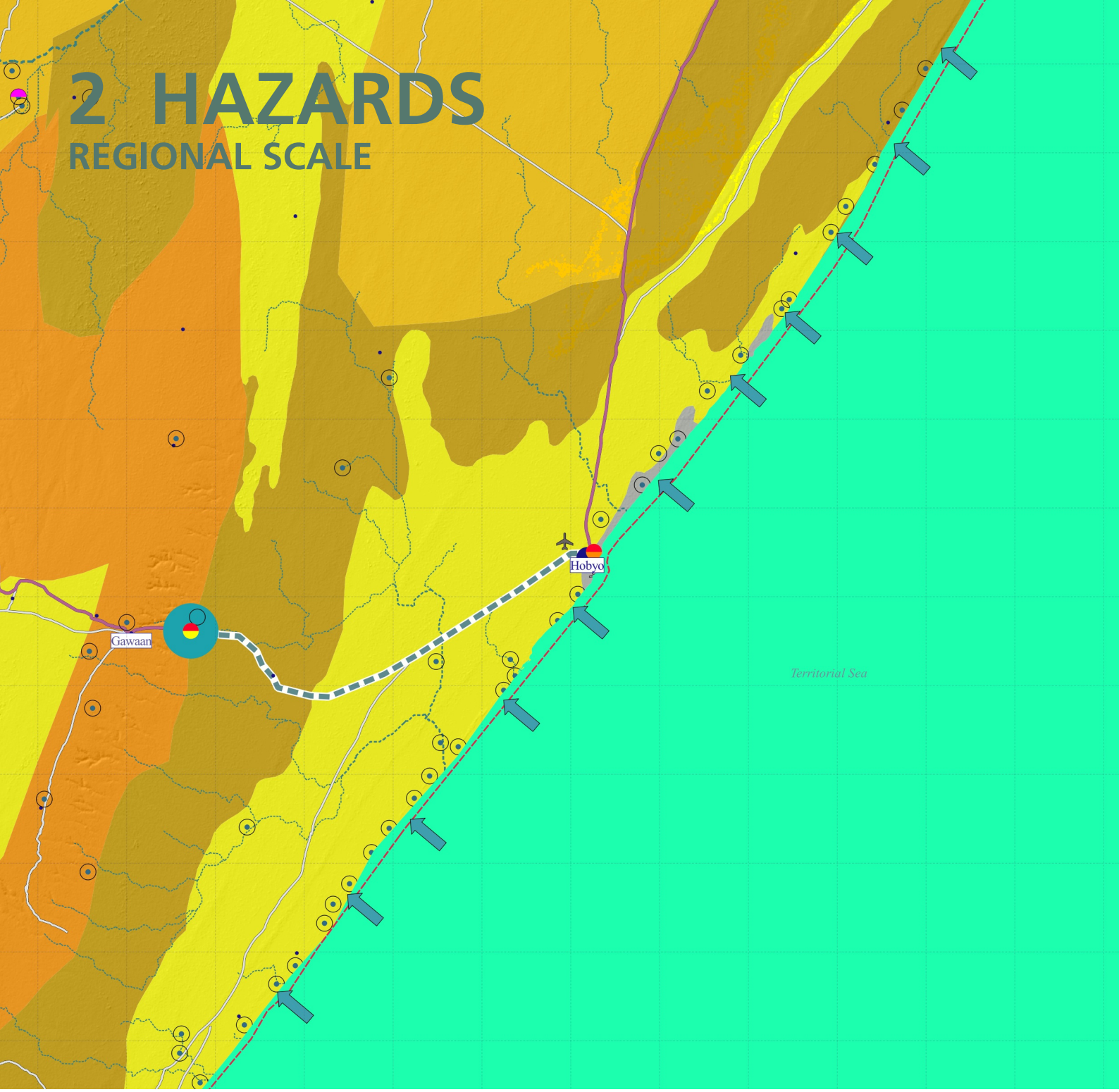
VISION

By reversing key elements previously identified on the problem tree, the causal relations between them are also reverted. This results on a vision for an improved future resilience that tackles the root elements of the damaging processes.

EXAMPLE INTERVENTIONS

Lastly, this resilience plan proposes tactical solutions and examples of specific interventions that local administrations and individuals can undertake to increase urban and regional resilience. These actions are chosen according to their simplicity and based on their effectiveness (drawn from scientific literature descriptions). It would be advisable to present alongside the interventions a monitoring and evaluation plan, so as to ensure their being effective.

2 HAZARDS
REGIONAL SCALE



Hazards | Regional scale

Toxic waste pollution

Hobyo ocean seems to be affected by toxic waste dumping

Water scarcity

Water sources
-Source: OSM 2020 and FAO SWALIM 2020)-

No data available

Total dissolved solids (TDS)

600 mg/L < TDS < 1000 mg/L

1000 mg/L < TDS

Electrical conductivity (EC)

2000 µS/cm < EC < 3000 µS/cm

3000 µS/cm < EC < 4000 µS/cm

4000 µS/cm < EC

Distance to this source from Hobyo (26 km)

Closest water source of considered good quality

Coastal erosion

Possible future encroachment upon the land by the sea, related with sea level rise and dune vegetation degradation

Possible soil degradation by coastal vegetation grazing

Main land uses in relation with land forms
Source: FAO SWALIM 2020 (Landuse and Landform maps)

Coastal dune | Pastoralism (high density)

Coastal plain | Pastoralism (high density)

Coastal plain | Pastoralism (medium density)

Coastal plain | Agropastoral (medium density) in stabilized sand dune

N

1:300.000

0 5.000 10.000 m

There is evidence[1] that since 1991 the Somali shore has been used as a dump site for the disposal of **toxic waste** by international firms. Some were companies related to the 'Ndrangheta, a criminal mafia from Calabria.[2,3] The Indian Ocean tsunami of December 2004 created waves that are believed to have stirred up hazardous waste deposits on the beaches around North Hobyo.[4,5,6] According to the United Nations Environment Programme (UNEP), the hazardous waste dumped along Somalia's coast comprised uranium radioactive waste, lead, cadmium, mercury, industrial, hospital, chemical, leather treatment and other toxic waste. Most of the waste was simply dumped on the beaches in containers and disposable leaking barrels which ranged from small to big tanks without regard to the health of the local population and any environmentally devastating impacts.[7]

Contamination from the waste deposits has thus caused health and environmental problems to the surrounding local fishing communities including contamination of groundwater.[7] Many people in Hobyo and Benadir have complained of unusual health problems as a result of the tsunami winds blowing towards inland villages. The health problems include acute respiratory infections, dry heavy coughing and mouth bleeding, abdominal haemorrhages, unusual skin chemical reactions, and sudden death after inhaling toxic materials.[7]

It is important to underscore that since 1998, the Indian Ocean has experienced frequent cyclones and heavy tidal waves in the coastal regions of Somalia. Natural disasters are short-term catastrophes, but the contamination of the environment by radioactive waste can cause severe effects on human health as well as serious long-term impacts on groundwater, soil, agriculture and fisheries. Therefore, the current situation along the Somali coastline poses a very serious environmental hazard, not only in Somalia but also in the eastern Africa sub-region.[7] Contamination from toxic and nuclear waste is, from an environmental point of view, the major problem of the region. It would require a coordinated approach and extensive field research to assess the situation, involving top level stakeholders such as the UN Council on Human Rights. Polluted sites in the ocean, on the coast and inland must be identified, isolated and reclaimed. This region is also affected by other processes.

Water quality[8]. According to local residents, water from the Hobyo well has bad quality. Even though the reference documents defined by WHO[9] don't determine limits for water potability within the available parameters (dissolved solids -TDS- and electrical conductivity -EC-), both mark up very high. A value above 1000 mg/l seems to point at undrinkable water quality, and it can cause damage to the water pipes according to WHO[9]. The registered EC value is above 4000 µS cm at a temperature of 26°C, considered as barely drinkable for humans. It is possible that this parameter is related to the proximity from the well to the sea. According to locals, part of the population collects water from the Gawan aquifer, about 30 km away. Additionally, there is one private company selling filtered water in town. Both sources are unavailable for some citizens who can not afford the cost, being forced to drink water from the local well and reporting related health problems. Further research must be conducted to know more about the nature of the detected dissolved solids in the water, assessing whether they are of calcic, salt or other nature.

Approaching Gawan there is an area that seems to be affected by **headward erosion**. The section of the road connecting Gawan to Hobyo and the settlement of Gawan itself can be endangered on the mid-term by their proximity to a potential sinking area. The rest of the plain may also be affected by different soil degradation processes that may be related to overgrazing.[10]

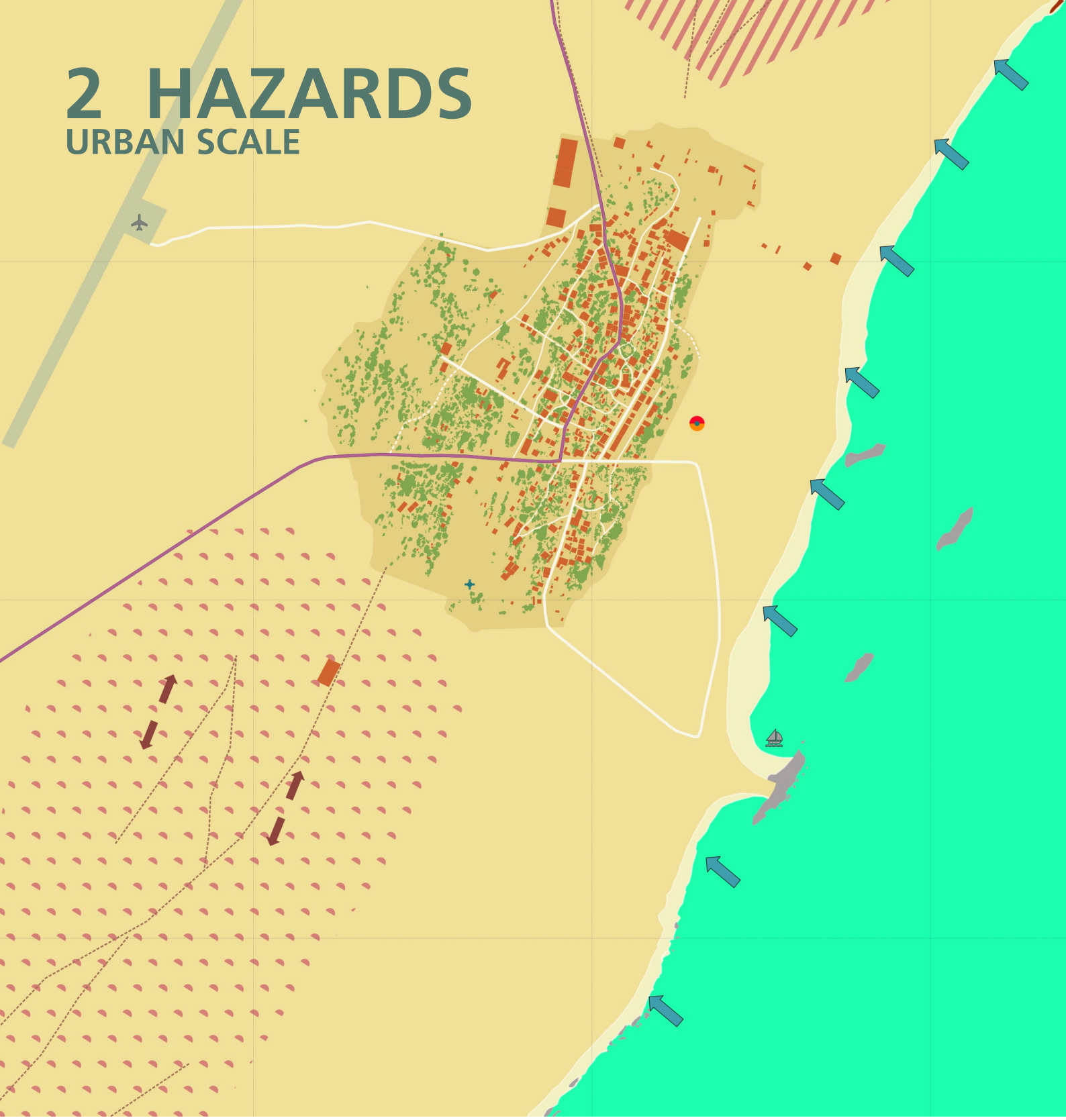
toxic waste

poor water quality

soil degradation

1. Bashir Mohamed Hussein, PhD. (2010) The evidence of toxic and radioactive wastes dumping in Somalia and its impact on the enjoyment of human rights: A case study. Paper presented at the United Nations Human Rights Council (Geneva) 14th Session Panel discussion on Toxic Wastes. SomaCent Development Research Foundation
2. "Establishment hit by fresh accusations in toxic waste scandal"(2009) Willan, P. The Herald
3. Toxic Somalia: L'autre piraterie (2020) Documentary movie.
4. "Somalia's secret dumps of toxic waste washed ashore by tsunami"(2005) Clayton, J. The Times.
5. Antonopoulos, Georgios A. (2016). Illegal Entrepreneurship, Organized Crime and Social Control: Essays in Honor of Professor Dick Hobbs. Springer. pp. 86–95. ISBN 978-3-319-31608-6
6. "Shipwreck may hold radioactive waste sunk by mafia off Italian coast"(2009) Hooper, J. The Guardian
7. After the Tsunami.Rapid Environmental Assessment,UN Environment Programme, 2005
8. FAO-SWALIM, 2020. http://www.faoswalim.org
9. WHO, 2017, Guidelines for drinking-water quality, 4th edition, incorporating the 1st addendum
10. SWALIM Land Degradation Assessment and a Monitoring Framework in Somalia, Project Report No L-14. 2009

2 HAZARDS
URBAN SCALE



Hazards | Urban scale

Toxic waste pollution

Toxic waste pollution

Water scarcity

H_WaterSources copiar

Total dissolved solids (TDS)

1000 mg/L < TDS

Electrical conductivity (EC)

4000 µS/cm < EC

Coastal erosion

Possible future encroachment upon the land by the sea, related with sea level rise and dune vegetation degradation

Sand storms

Main wind direction

Observed dunes

Barkhan (crescent-shaped) dunes

Longitudinal dunes

Footpaths that may contribute to vegetation loss

1:15.000

0 125 250 375 500 m

Projections under a low-mitigation **climate change** scenario for Somalia suggest temperatures may increase 3° to 4°C by 2080.[11] The sea level along the coast is rising at approximately 1.3 mm/year.[12] Global climate models for the region predict overall precipitation to increase in future decades.[13] Eight of the last ten years have seen chronic droughts in East Africa, including Somalia, and persistent droughts are likely to continue.[14] This will further threaten livelihoods and food security. Climate change could lead to loss of biodiversity and soil fertility, and increase the prevalence of pests and disease, threatening agriculture and human health and increasing rates of urban migration, thus exacerbating conflict in Somalia.[15] Climate change is a worsening factor in all hazards described below.

Climate is only becoming more extreme, with an increasing number of dust storms and droughts, stronger winds, and notably hotter temperatures over the past four decades.[16] **Storms** represent a great risk for settlements and infrastructures along the coast. According to pictures of Hobyo after storms, the high water mark line may be crossing the town already. Another natural hazard to the town are **tsunamis**, like the one that took place in 2004.

Coastal erosion is the encroachment upon the land by the sea and is measured by averaging over a period, which is long enough to eliminate the impacts of weather, storm events and local sediment dynamics[19]. The Hobyo coast line does not appear to have receded significantly in the last decades, after comparing aerial views between 1983 and the current year. Nevertheless, local residents who have lived there for generations[18] declare it to be a major problem of the area. Severe storms may have generated the perception that coastal erosion is a major hazard. If current climate change projections are correct, sea level rise and changing erosion and storm patterns are likely to shift landward the position of the high water mark line by several meters[17]. This constitutes a major mid-term hazard in Hobyo.

Another declared hazard for the town of Hobyo are sandstorms. Part of the town is frequently buried by sand after **strong wind events**. This may be related to the fact that Hobyo is located in a place that was originally a sand dune system. The predominant wind varies between the directions SW-NE according to the season.[20]

In that sense, **dune degradation** by dune vegetation loss may suppose a major threat in Hobyo. Dunes play a significant role in buffering from storms and other natural events.[21] Vegetation plays an important role in dune protection: They work as sediment traps, avoid wind erosion and allow the coastal dunes to recover their size after extreme weather events. Their conservation may also promote other ecosystems services such as water regulation and biodiversity.

Dune ecosystems are extremely fragile and even light interventions may damage them. A first approach indicates possible causes of vegetation loss and consequent dune degradation, such as construction of settlements, dune mining, dune grazing and the presence of pathways on dune ecosystems.

climate change

storms and tsunamis

coastal erosion

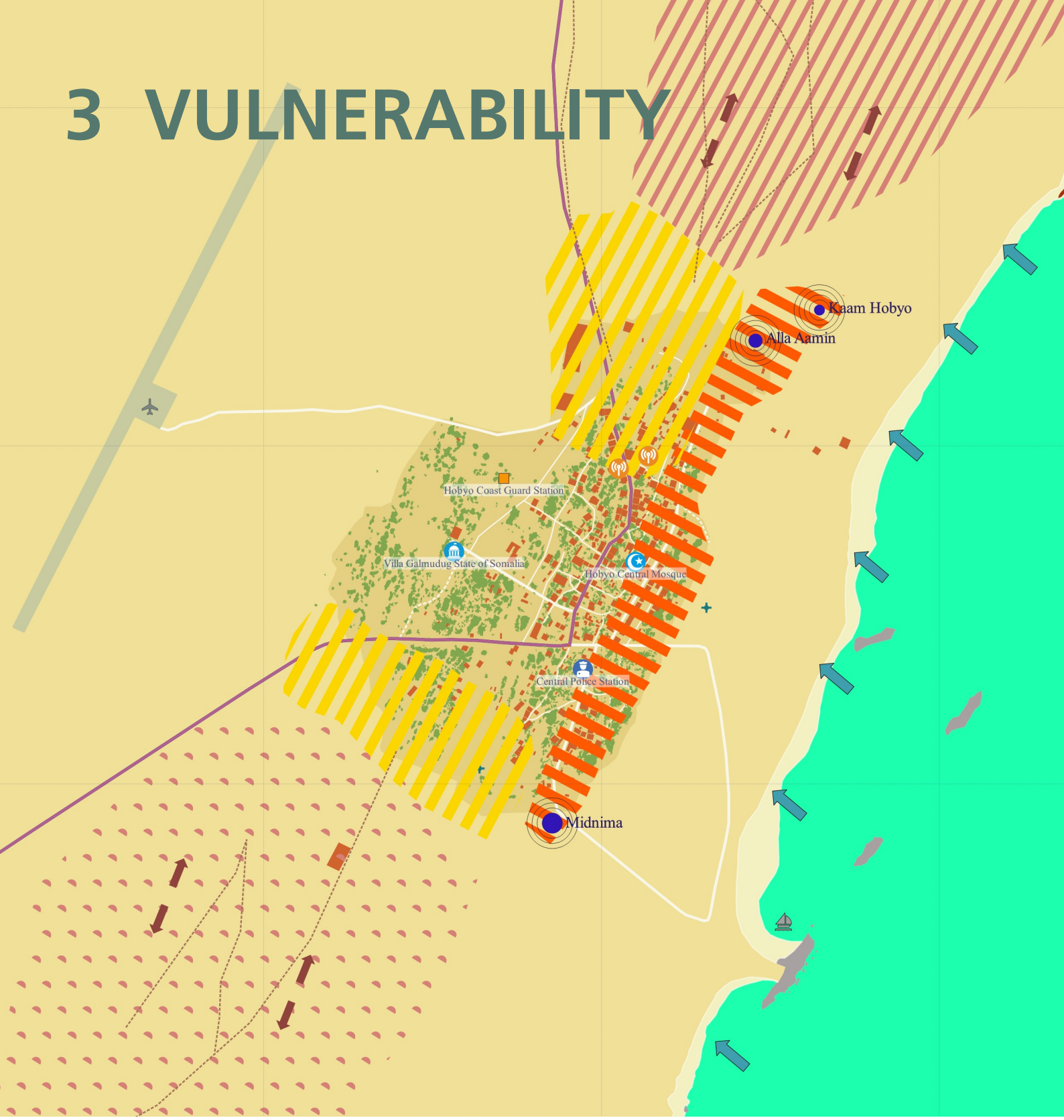
strong winds

dune ecosystem degradation

Mining from dune sand in Hobyo. Photo Xasan Cabdi, 2017. via Google Earth

11. World Bank-FAO Future Climate Predictions, 2019 http://sdwebx.worldbank.org/climateportal/index.cfm?page=country_future_climate&ThisRegion=Africa&ThisCcode=SOM
12. National Adaptation Plan (NAP) Stocktaking Report, 2017
13. IPCC 2013; World Bank-FAO Future Climate Predictions, 2019
14. Carty, Oxfam: A Climate in Crisis: How climate change is making drought and humanitarian disaster worse in East Africa, 2017
15. Federal Republic of Somalia: Ministry of Natural Resources, Somalia National Adaptation Programme of Action to Climate Change, 2013. http://unfccc.int/resource/docs/napa/som01.pdf
16. Ministry of National Resources, 2013.
17. Sanò M., Jiménez J.A., Medina R., Stanica A., Sanchez-Arcilla A., Trumbic I. , The role of coastal setbacks in the context of coastal erosion and climate change, Ocean & Coastal Management, 54 (2011) 943-950
18. UN Field Questionnaire, 2021
19. Eurosion. Living with Coastal Erosion in Europe. Sediment and space for sustainability. Results for the Eurosion study. European Communities, 2004
20. Atlas of Somali Water and Land Resources: Climate, 2009
21. Everard M., Jones L., Watts B., Have we neglected the societal importance of sand dunes? An ecosystem services perspective.

3 VULNERABILITY



Vulnerability | Urban scale

Sensitivity

IDP Camps
Source: CCCM Cluster 2020

Sensitive facilities

- Police Station
- Religious
- Communication Tower
- Administrative
- Coast Guard Station

Flood exposure

Level of exposure has been evaluated through:
-distance to the sea
-distance to dune areas

- City area that may be affected during storms
- City area that may be affected by sand storms
- IDP camps probably affected by storms

1:15.000
0 125 250 375 500 m N

Vulnerability is identified according to two factors: Sensitivity (structural risk) and Exposure (proximity to hazard). It is important to highlight that, given the size of the town and the threats that affect it, it could be possible to consider the whole town as a vulnerable unit exposed to the hazards described above. Additionally, IDP camps are emphasized as specially vulnerable elements.

As far as sensitivity, IDP camps are identified as one of the most vulnerable structures, given their lack of physical sturdiness. In Hobyo, there are three IDP Camps[22]: Midnima, Alla aamin and Kaam Hobyo. The three camps comprise approximately 330 people combined.

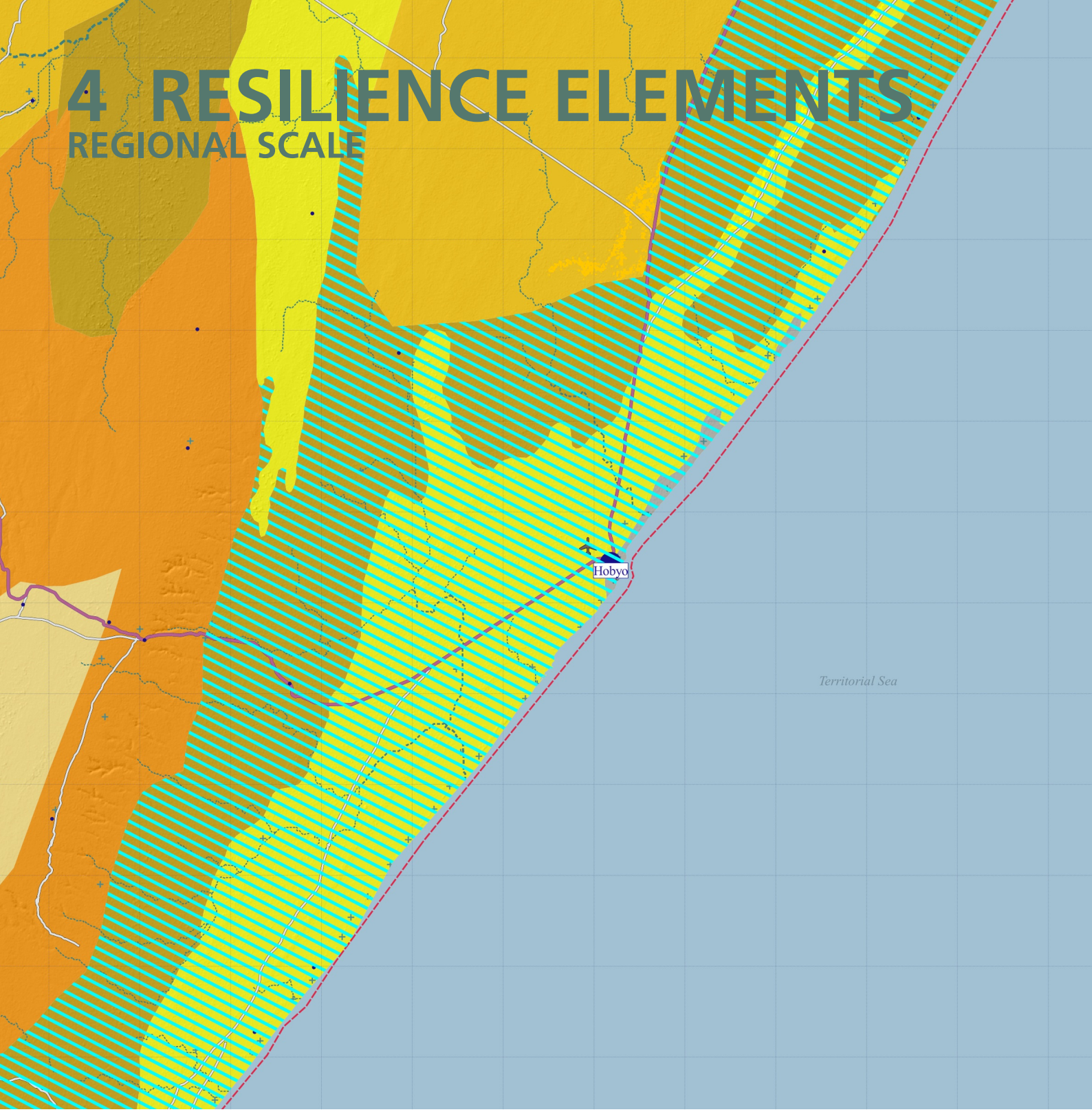
IDP Camps seem to be in the most exposed areas of the city: Closest to the sea and most exposed to the coastal winds.

This map does not cover the whole region. A more exhaustive mapping of IDP camps on regional scale is advisable in order to fully tackle the IDP vulnerability issue.

Photo Geir H. Ommundsen, 2018. via Google Earth

22. Detailed Site Assesment (DSA); Hobyo district, Mudug Region, Somalia; February 2020

4 RESILIENCE ELEMENTS
REGIONAL SCALE



Resilience elements | Regional scale

- Coastal area
- Coastal dune
- Coastal plain

0 5.000 10.000 m

N 1:300.000

The main resilience element currently present in the Hobyo region is the **natural coastal ecosystem**.

The eastern coast of Somalia has not been very altered by human intervention. **Extensive dune systems** can be found along the coastline, spreading more than 700 km without large size cities interferring in the coastal dynamics. This is a defense ecosystem highly resilient against coastal erosion[23].

As opposed to artificial defense structures –that are extremely costly and have a strong environmental impact–, natural dune systems are a much more cost-efficient, low-impact method to resist extreme events. Several studies suggest that extreme weather episodes always overcome artificial defenses, regardless of how high was the investment in the construction and maintenance of such defense structures.[24]

Currently the livelihoods in Hobyo are supported mainly through fishing. Maintaining the marine systems is of upmost importance to the region. Some natural elements, such as the presence of basaltic rocks in the coast, are currently functioning as natural reefs that multiply marine productivity. The upwelling system (a motion that brings dense, cooler, and usually nutrient-rich water from deep water towards the ocean surface, replacing the warmer, usually nutrient-depleted surface water) that is present along the coast caused by the Somali current is also promoting a highly productive oceanic ecosystem, as the associated nutrients of the upwelling stimulate the growth and reproduction of primary producers such as phytoplankton.[25]

The productivity of the **marine ecosystem** in the region, due to the systems described above, has been tangible as it has been subject to illegal exploitation by foreign companies since 1991, with the collapse of the Somali government and the disbandment of the Somali Navy. The phenomenon of piracy sprung from local fishermen defending the Somali territorial waters and grew into a lucrative business, involving large ransom payments and hijacking commercial vessels.[26] The Somali government has been active in policing the area and piracy has winded down since the late 2010s.[27]

According to marine biologists, indicators are that the local fishery is recovering because of the lack of commercial-scale fishing.[28] As such, piracy off the coast of Somalia appears to have had a positive impact on the problem of overfishing in Somali waters by foreign vessels. A comparison has been made with the situation in Tanzania further south, which has also been affected by predatory fishing by foreign ships and generally lacks the means to effectively protect and regulate its territorial waters. There, catches have dropped to dramatically low levels, whereas in Somalia they have risen back to more acceptable levels since the beginning of the piracy.[29]

Taking into account the potential productivity of the marine system and how it interacts with the current coastal dynamics, it comes as a conclusion that preserving these two systems would provide protection against coastal erosion and promote a sustainable economy based on the high marine productivity in the region.

It would be advisable to conduct more detailed analysis of the ecosystemic services provided by the coastal dune systems, basaltic rocks and the upwelling system in the area, in order to further understand their role in landscape resilience.

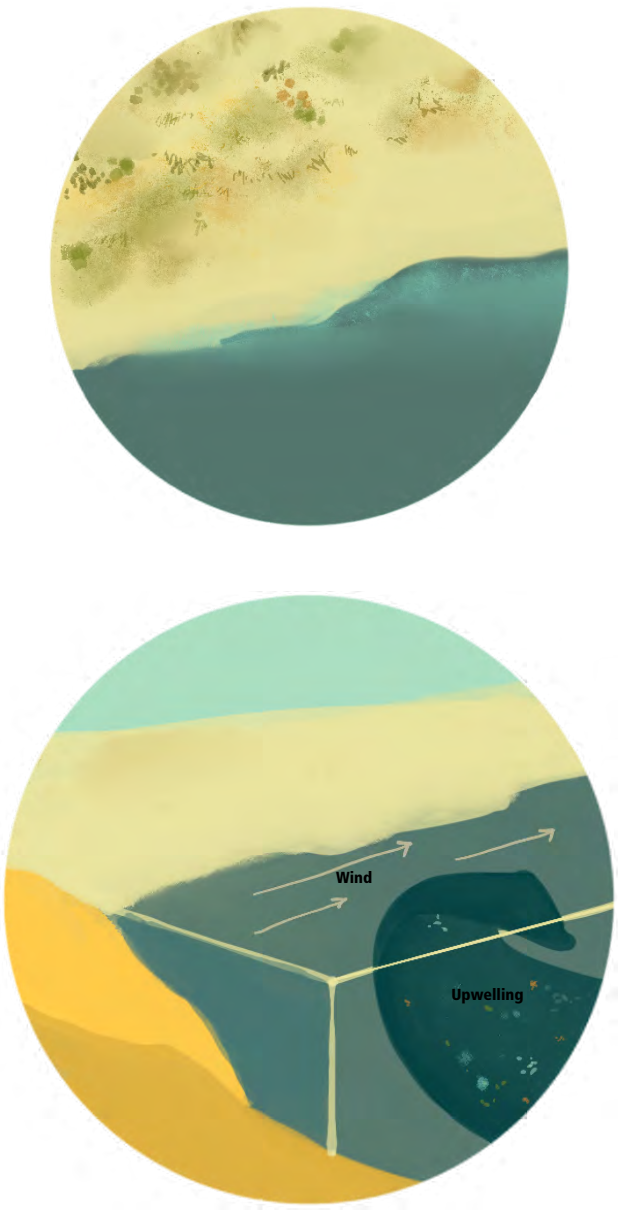


Diagram showing the upwelling system that brings nutrients from deep waters towards the coast, increasing productivity close to land.

Basaltic rocks on the Hobyo coast. Photo Geir H. Ommundsen,2018 via Google Earth

23. Everard M., Jones L., Watts B., Have we neglected the societal importance of sand dunes? An ecosystem services perspective.
24. Eurosion. Living with Coastal Erosion in Europe. Sediment and space for sustainability. Results for the Eurosion study. European Communities, 2004
25. Mann, K.H., Lazier, J.R.N. (2006) "Dynamics of marine ecosystems: biological-physical interactions in the oceans." Oxford: Blackwell Publishing Ltd. ISBN 1-4051-1118-6
26. Somali Pirates Seize Two Ships, Sky News, 15 August 2008. https://web.archive.org/web/20081216082741/http://news.sky.com/skynews/Home/World-News/Somali-Pirates-Seized-Ships-Hijackings-In-The-Countrys-Waters/Article/200808315079721 Retrieved 15/02/2021
27. Commander, Combined Maritime Forces Public Affairs (29 September 2008). "Combined Task Force 150 Thwarts Criminal Activities". US Africa Command. Archived from the original on 6 December 2008. Retrieved 25/02/2021
28. "Kenyan Fishermen Celebrate Somali Pirates" Broadcast on Channel Four News, CNN International. Aired November 20, 2009 https://vimeo.com/8616994
29. Georges Pernoud (21 May 2010). Dans les îles Eparses (in French). Thalassa (television). Event occurs at 51'48", 1:00:17. Retrieved 23 May 2010.

4 RESILIENCE ELEMENTS
URBAN SCALE

Resilience | Urban scale

Ecosystems
that may be functioning as coastal erosion mitigators

Coastal morphology
with low anthrogenic modifications

- Shore, Coast and Coastal hinterland
- Volcanic rock
- Barkhan (crescent-shaped) dunes
- Longitudinal dunes

Urban elements
that may be functioning as wind
and eolic erosion effects mitigators

- Planted vegetation

1:15.000
0 125 250 375 500 m
N

On an urban scale, the resilience elements are the same as on the regional. This town does not depend directly on the presence of coastal infrastructures and its surroundings are relatively well preserved.

The systematic **incorporation of halophyte vegetation** –native species adapted to salt environments–, is a form of protecting the urban environment against wind and extreme temperatures that is already being promoted in Hobyo. This urban strategy improves the resilience of the town against certain extreme weather events and protects it from the wind. Giving it continuity by planting native vegetation in dispersed open areas of the town contributes to creating shadow areas that avoid extreme urban temperatures, trapping wind and sand and providing leisure zones.

Hobyo urban vegetation. Photo Mo Haji, 2015 via Google Earth

5 INTERDEPENDENCE ASSESSMENT

INTERDEPENDENCE ASSESSMENT |
REGIONAL VULNERABILITY

The interdependence assessment provides information about the causality relation between key elements that create environmental vulnerability in a regional scale. Different hazards are inter-related and derive from different causes that may not be considered as threats themselves, but that have a considerable effect on landscape resilience.

This methodology, the problem tree, is chosen in this case as an available approach to process the information at hand. It would be advisable to conduct a more complete field analysis with local participation and updated data, such as the aforementioned Vulnerability and Risk Analysis (VRA) or CityRAP tool.

At a regional and urban scale concerning Hobyo, it is considered that toxic wate pollution is a mayor hazard. This topic needs to be adressed seriously prior to any other intervention related to sustainable development in the area, taking into account that nuclear and toxic waste may be present in every food chain and water supply.

One other important issue that may limit the city's growth is the lack of good quality water. This supposes a real challenge and, to some extent, restricts its growth to water availability or investment in substantial water infrastructures. Paradoxically, the name "Hobyo" means "here, water".

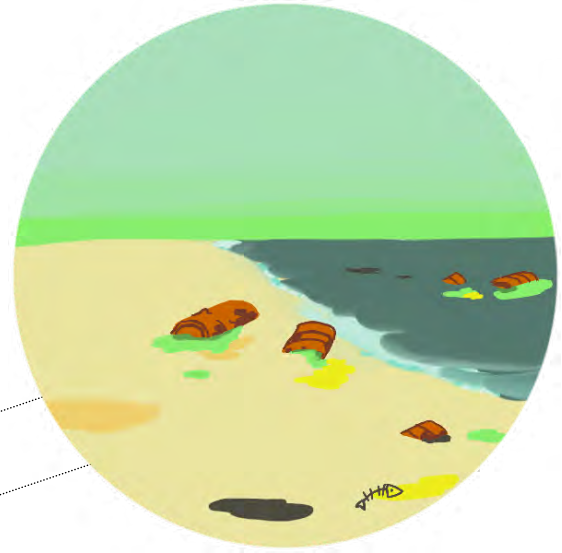
Finally, the current land management seems to be in conflict with the conservation of the coastal ecosystem, which plays an essential role in coastal flood and storm protection. These extreme weather events are amplified by climate change. It is possible that current actions –dune mining, pathways, livestock grazing– may be degrading the dunes around the town without realizing the role they play in urban protection. Hobyo's adaptation to climate change would need to include a coastal dune conservation program.

These processes seem to be favoring a highly vulnerable region, exposed to the previously identified hazards.

lack of good quality water availability

health problems

toxic waste pollution



strong damage to human health

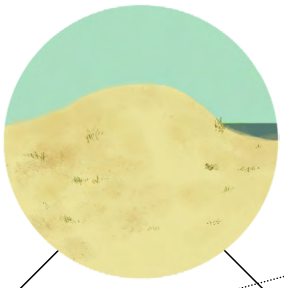
strong damage to economic activities

dune mining for building materials

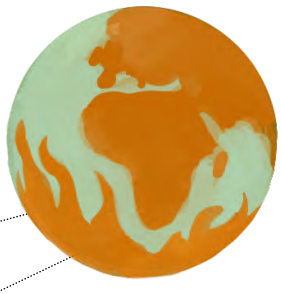
unregulated pathways through dunefield

coastal grazing

coastal vegetation loss
dune ecosystem degradation:
loss of protective functions
against extreme weather events



climate change:
extreme weather events
sea level rise



sand storms

coastal erosion

strong damage to buildings and
population during extreme events

6 VISION
REGIONAL + URBAN SCALE

In the vision for resilience in Hobyo, vulnerability mitigation is achieved through independent strategies. In this case it is not possible to invert the problem tree in a systematic way, given that there is not a sole main problem at the core of the dynamics. The proposed vision suggests putting an environmental approach at the forefront of interventions. While hard infrastructures may be effective against certain threats, hazard management policies are increasingly more focused on ecosystem functions[30], considering sustainable management as a form of invisible infrastructure.

On a regional scale, it would be necessary to develop a **prioritary plan to locate toxic waste locations and evaluate their impact.**

Additionally, it would be necessary to set in place systems for **water accesibility** that do not compromise the population's health. In order to do this, research must be conducted to know more about the nature of the detected dissolved solids in the water, assessing whether they are of calcic, salt or other nature and acting in consequence.

Finally, it would be necessary to work in the **conservation of coastal systems** to ensure the city's adaptation to climate change. Restoring the dune ecosystem is essential for the future resilience of Hobyo. Native vegetation not only anchors sand in place, reducing erosion by wind, but it also traps wind-blown sand, thereby "growing" larger dunes able to recover after extreme events. Dune ecosystems are extremely susceptible to human activity and are not compatible with some of the current economic activities. Protecting these spaces guarantees a natural defense system of the coastline on the short, mid and long term.

Complementary to the above, it would be necessary to implement alternative economic systems that compensate the discontinuation of some of the current exploitation in certain areas. The proposed systems are based on three lines of work:

Firstly, it would be advisable to develop a **sustainable fishing program**[31] that creates new chains of value through preserving methods, as well as training in fishing techniques for small and medium-scale fishing industry. Secondly, it would be advisable to design **sustainable construction systems** that do not compromise the coastal system, finding alternatives to using dune sand as building material (which, incidentally, composes unstable concrete). Thirdly, it would be necessary to establish a **livestock management plan** so as not to compromise the natural resources –mainly, dune vegetation– that carry out ecosystemic functions in the region and in the city.

The complexity of management in both scales, with dynamic ecosystems and long-term socio-economic pressures, requires holistic approaches in which scientific evidence and expert knowledge are operationalised for policy needs[30]. This document only provides an overview on such needs.

In the following section, this document proposes tactical solutions and examples of specific interventions that local administrations and individuals can undertake to increase urban and regional resilience. Complete implementation plans are not suggested here.

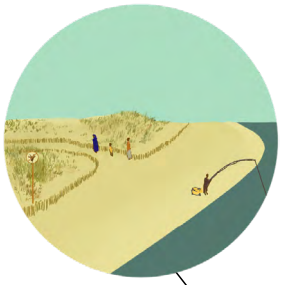
30. European Environment Agency, Flood risks and environmental vulnerability, 2016 ISSN: 1977-8449
31. Implementing Hobyo priorities, UN field questionnaire, 2021

toxic waste management

mitigated salinization of
drinking water

sustainable building materials

regulated pathways
through dunefield



grazing management

sustainable fishing

coastal vegetation
protection

dune ecosystem conservation

protective functions
against extreme weather events

7 CURRENT DEVELOPMENT PLANS

This document provides a first assessment towards resilience in Hobyo, and therefore must mention the current development plans for the construction of an industrial-sized port in town.

The National Development Plan (NDP) 2020-2024 has prioritized the Hobyo port as a National and State intervention.[32] The construction of such a port has environmental impacts, and assessment would be required to determine the scope of adequate mitigation methods. There is currently little information on the details of the development project.

The construction of a large, commercial-scale port structure is concerning as it would have a strong impact on the coastline and coastal ecosystems. A port requires the construction of coastal structures and dredging to maintain the required depth for ship docking and manoeuvring. Current natural dune ecosystems that are functioning as climate change effects mitigators may be irreversibly damaged and coastal dynamics would be deeply disturbed. Modifying the existing coastal processes has a large impact on the whole coastline, particularly in longshore litoral drifts[33], such as the Somali eastern coast.

The construction of a port in Hobyo will change the economic activities in the region, which is currently largely dependent on fishery resources. As the National Development Plan (NDP) states, fisheries are a key development priority for Galmudug.[34] Processing and marketing fishing produce would be necessary to develop this industry one step further.

In view of the port development, the following environmental concerns should be addressed in the necessary preliminary studies, to avoid irreversible disturbances of the coastal ecosystem: Increased coastal erosion on certain areas, aquifer deterioration and sea water pollution. The impact of the port construction on the communities living in the Hobyo district is also a matter to be studied.[34]

Building resilience of households, communities and government and better managing Somalia's environment and natural resources are cross-cutting imperatives outlined as National Priorities in NDP. The assessments would be guided through environmental strategies, policies and legislation.

HOBYO | Star City / Port of Hobyo model | U/C, 04/02/2018 http://ceelhuur.com/sawirro-shirkad-soo-bandhigtay-naqshada-hobyo-cusub/

3D Image: Somaliland Sun: Anglo-Turkish consortium signs deal to build and operate Somalia's Hobyo port 07/11/2020 https://www.somalilandsun.com/somalia-anglo-turkish-consortium-to-build-and-operate-hobyo-port-in-galmudug-state/

32. Somalia National Development Plan 2020-2024, page 216 "ports". https://mop.gov.so/wp-content/uploads/2019/12/NDP-9-2020-2024.pdf
33. Kudale, M., Impact of port development on the coastline and the need for protection. Indian Journal of Geo-marine Sciences, December 2010.
34. NDP, page 359.

ENVIRONMENTAL IMPACT ANALYSIS FROM PORT CONSTRUCTION:

The following table is derived from a tool of the United Nations -Economic and Social Commission for Asia and Pacific- (UN ESCAP) structuring the different types of impacts in a systematic way. This UN Tool is adapted to the Hobyo case. Document is available at this link: https://www.unescap.org/sites/default/files/pub_1234_ch2.pdf

Environmental impact	Location of port	Construction and dredging	Port operation Ship traffic and discharges	Port operation Cargo operations and waterfront industry
Water qualilty	Breakwaters may change current patterns and cause stagnation of water behind structures.	Pile driving, deposition of rubble, dredging, dans compacting and construction works increase turbidity and organic matter concentration, reducing sunlight penetration. Work vessels are possible cause of oil spills, garbage discharge, and leakage of other substances.	Possible discharges from ships could be sources of water pollution. Bilge water, ballast water, oily wastes, sewages, garbage and other waste from ships.	Runoff from raw material storage, spills from bulk cargo handling, and wind-blown dust are possible sources of contamination of port water. Toxic or harmful substances may be included in runoff from sulfur, bauxite, phosphates, nitrogenous manure, coal, metal ores and other raw materials.
Coastal hydrology	Port location may change current patterns due to alteration of wave refraction, diffraction and reflection, leading to erosion or accretion in shore zones and endangering small ships near structures	The same as location. Dredging may cause changes in litoral drifts.	-	-
Bottom contamination	Port location may accelerate sediment deposition in stagnant water, that covers bottom biota and physical habitat.	Construction and dredging disturb bottom sediments and resuspension	-	Bottom contamination may result from runoff from quay and storage area, spills from bulkcargo operations, and wind blown dust.
Marine/coastal ecology	It affects aquatic fauna and flora through changes in water quality, coastal hydrology and bottom contamination. It destroys bottom habitat and displaces fisherie resources.	Disturbance from construction activities may cause displacement of fishery resources and other mobile bottom biota; it can promote invasive species. In Hobyo, reefs may be inevitably destroyed.	Leakage of oils, oily wastes and mixtures may directly cause damage to fishery resources, aquatic biota, and coastal habitats. Fishery resources, including shellfish, may be spoiled by oil and toxic substances generated by biodegradation.	Water pollution and bottom contamination resulting from these effluents lead to deterioration of aquatic biota and fishery resources.
Air quality	-	Emissions from construction equipment, work vessels, trucks and other vehicles coud be a source of air poillution	Ships are a possible source of airborne emissions such as gasses, smoke, soot andfumes. N02 and S02 are typical pollutants generated by ships while both manoeuvering and berthing and may affect air pollution in the hinterland.	Emissions of dust from bulk cargo handling and gasses from cargo handling equipment can be sources of air pollution. Liquid cargo handling may result in the release of vapour during the cleaning of storage tanks and by the breather system for ambient temperature changes.
Noise and vibration	-	Construction activities may create a problem of noise and vibration.	-	Cargo handling equipment and road traffic are two major sources of noise and vibration,which may cause unacceptable levels of stress among local people.
Waste management	-	Spoils grenerated by dredging may cause land degradation, erosion, leakage of salt.	Ships generate: (a) oily wastes such as bilge water, ballast water, washing water,lubricant oil and other residues in machinery space; (b) sewage and garbage; and (c) cargo residues such as wood bark. Discharges and spills of these wastes cause problems of oil pollution, floating garbage, unsanitary conditions, odour and other degradation of water quality.	Cargo operations produce wastes such as the remains of bulk cargo storage, rubbish from unpacking, wood bark from log handling, floating garbage and other wastes from daily activities. Waterfront industries generate various kinds of wastes and some of them are disposed in the port area or at sea. Landfills in a port area could be deposition sites of such industrial wastes.
Visual quality	The visual quality of Hobyo will be disturbed.	-	-	Lighting for night operations may cause nuisances to the nearby community. Wastes from port-activities, smoke from ships, bulk cargo piles, and materials stacked in a port may give an unpleasant impression.
Socio-cultural impact	Port location may implicate relocation of local community, causing conflicts between different actors.	-	Port activities may disturb or completely eliminate small fishery boat operations, by generating traffic accidents and by degradation of natural resoures.	-

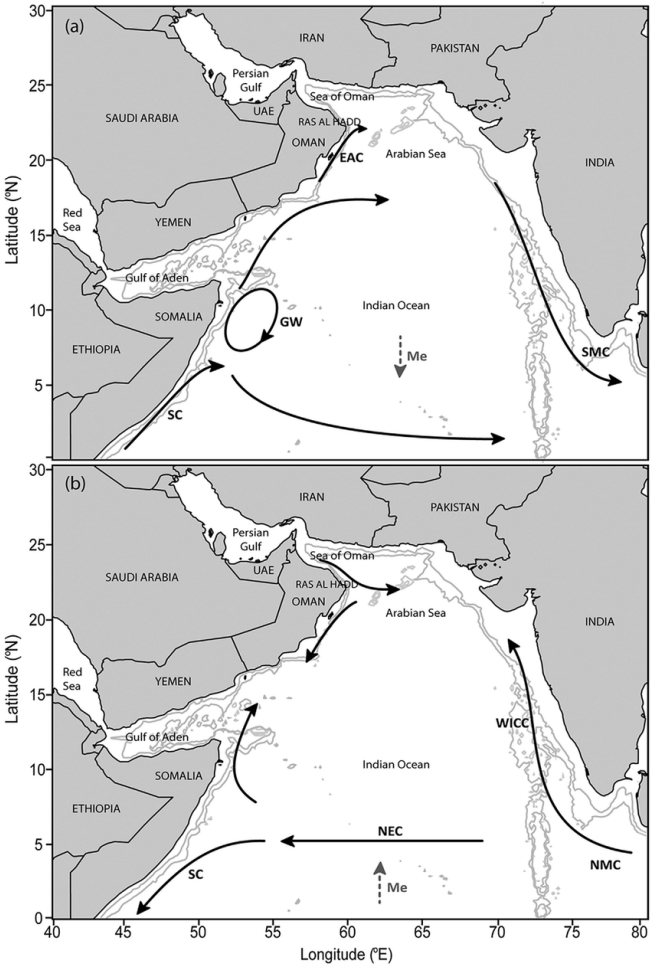
8 PRIORITY INTERVENTION

TOXIC WASTE MANAGEMENT

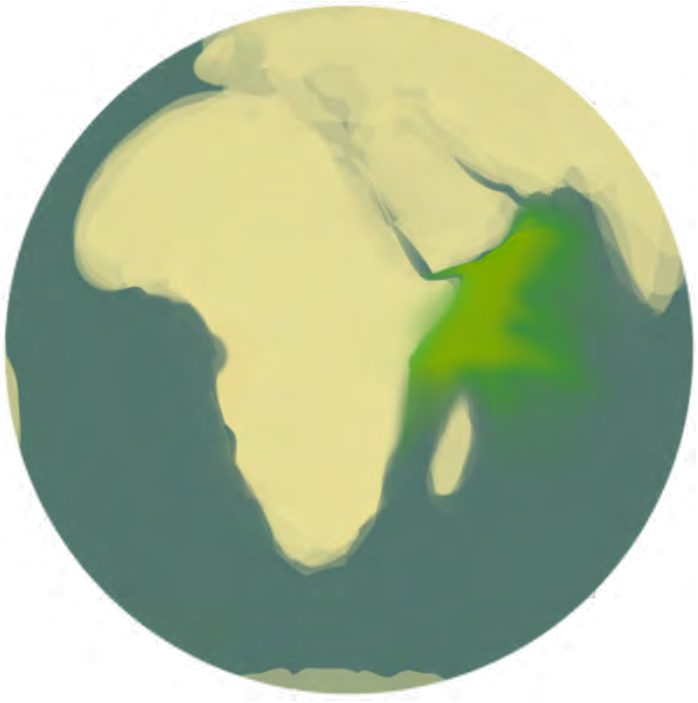
Maritime threats – piracy, human trafficking, illegal and unregulated fishing, dumping of toxic waste, and the smuggling of weapons and drugs – are considered key threats to national security as outlined in the NDP [35]. Toxic waste management, especially when dealing with nuclear and toxic waste, is an issue of abysmal scale that requires international coordination and support for Somalia.

Currently, there is limited information about the scope, impact and threats of waste dumping along Somalia's coastline. A coordinated approach to assess the situation is needed, involving top level stakeholders such as the UN Council on Human Rights and UNEP, conducting an international in-depth and extensive field research. Polluted sites in the ocean, on the coast and inland must be identified, isolated and reclaimed.[36]

Bashir Mohamed Hussein, PhD. (2010) The evidence of toxic and radioactive wastes dumping in Somalia and its impact on the enjoyment of human rights: A case study. Paper presented at the United Nations Human Rights Council (Geneva) 14th Session Panel discussion on Toxic Wastes. SomaCent Development Research Foundation. quoting Famiglia Cristiana 1998 (above) and Dayeel Bulsho Guud, 2006. Published by Somalitalk (below).



NW Indian Ocean Schematic: Known surface currents in the NW Indian Ocean during the (a) SW monsoon and (b) NE monsoon. Vitale, Sarah & Dimarco, Steven & Seidel, Howard & Wang, Zhankun. (2017). Circulation Analysis in the northwest Indian Ocean using ARGO floats and surface drifter observations, and SODA reanalysis output. Dynamics of Atmospheres and Oceans. 78. 10.1016/j.dynatmoce.2017.02.002 Modified from Schott et al. (2009) and Tomczak and Godfrey (2013).



35. Somalia National Development Plan 2020-2024, pages 149,157. https://mop.gov.so/wp-content/uploads/2019/12/NDP-9-2020-2024.pdf
36. https://ejatlas.org/conflict/somalia-toxic-waste-dumping-somalia

9 EXAMPLE INTERVENTIONS

DUNE SYSTEM CONSERVATION AND RESTORATION

Where:
On the dune ecosystem, with special attention to areas close to pathways and human presence.

What[37]: Highlighting the importance of preserving the dune ecosystem and allowing its natural dynamics to take place undisturbed. Avoiding activities that cause environmental damage. Regulating and delimitating pathways and protected areas.

Main ecosystem services provided[38]:

-Coastal erosion mitigation
-Dynamic protection against extreme weather events (storms)
-Wind protection
-Raw materials provision (Marram grass)
-Water quality
-Sand capture
-Habitat for fauna and flora
-Biodiversity conservation and connectivity

**It would be advisable to include this intervention within a complete strategic plan, including monitoring and evaluation.*

37. Manual de restauración de Dunas Costeras, Ministerio de Medio Ambiente. Dirección General de Costas, España, 2007
38. Everard M., Jones L., Watts B., Have we neglected the societal importance of sand dunes? An ecosystem services perspective.

SUSTAINABLE FISHING

Where:
Hobyo coast + Rehabilitated youth center in Hobyo (training)

What:
Training for fishing skills, handling of equipment, preservation methods, marketing, sewing skills. Targeting especially youth and women in the district to improve livelihoods, encourage growth of the local market and small-scale businesses.

How to:
Promoting sustainable fishing on small scale, by training youth in fishing skills and preservation techniques.

**It would be advisable to include this intervention within a complete strategic plan for fishing in Hobyo.*

SUSTAINABLE BUILDING MATERIALS/ TECHNIQUES

Where:
Alternative materials can be found around Hobyo, avoiding the use of dune sand in concrete. These materials can offer better durability and higher construction quality than the current sands. Distance of sample materials from Hobyo:
-sandstones | 10-20 km
-clays | 60 km
-*Phragmythes* or similar species | water ponds close to dunes | 10km
-lime | 10-20 km

What:
Promotion of new building materials that do not create direct impacts on the ecosystem and that can ensure a sustainable development.

**It would be advisable to include this intervention within a complete strategic plan, including monitoring and evaluation.*

OUTLOOK FOR HOBYO'S FUTURE DEVELOPMENT

The discussion of Hobyo´s future development is guided by national and state development planning priorities. This paper has focused on analysing environmental aspects and mitigation measures to strengthen resilience of communities and government institutions.

A coastal setback[39] is a buffer space where permanent constructions are not allowed, defined by a specific distance from the shoreline's highest water mark. The design and implementation of a setback policy to manage chronic coastal erosion and floods associated with extreme events is a complex issue, which should take into consideration coastal dynamics, including climate change, and the protection of natural and cultural landscapes, while providing public access and use of the shore.

Following this concept, the growth of Hobyo should be planned towards the interior in a compact way and not towards the coastline.

Continuing with the plantation of urban vegetation to create shadow areas that avoid extreme urban temperatures, trap wind and sand and create zones for recreation and social interaction, without compromising the livelihood of local fishermen (see Sustainable Fishing on page 24).

39. Sanò M., Jiménez J.A., Medina R., Stanica A., Sanchez-Arcilla A., Trumbic I. , The role of coastal setbacks in the context of coastal erosion and climate change, Ocean & Coastal Management, 54 (2011) 943-950

NOTES

Your comments to consolidate this paper are highly appreciated. Please send us your feedback.

Talada aad ku xoojinayso buug-yarahan aad baan u soo dhawaynaynaa. Fadlan fikirkaaga nala wadaag.

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