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Short Communication

Sources of Sand and Dust Storms in Kuwait

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Abstract

In Kuwait, the main threat on highways, oil fields, air bases, military camps, new settlements and agricultural farms is the sand encroachment phenomenon. During June – September 2018, Kuwait experienced severe sand and dust storms. The wind speed reached 70 km /hour. The north-west wind was prevailing. The sand and dust storms forced the closure of three ports and disruption of air traffic. The visibility was below 300 m. Several incidents were reported along Wafra Roads. Multiple sources of sands and dust storms (SDS) are observed in wide areas in the terrestrial and coastal environments of Kuwait .These sources vary in nature, land use, history, activity, impact and composition .The objective of the current study is to identify and characterize the sources of SDS in Kuwait .To realize this objectives, field surveys were conducted during 2017- 2018 . Landsat images of 2010 and 2017 were analyzed for land use comparison.

Introduction

Huge amounts of shifting sands attack highways (Plate 1). Before June 2018, the average amount of removed sands from desert highways was 30,000 m3 /month. During June – August 2018, this average amount increased to 200,000 m3/month (Ministry of Public Works ,2018).

Plate 1: Severe sand encroachment along Wafra Roads (August 2018).

Kuwait is cut by a NW-SE Corridor of shifting sand (Figure 1). The corridor extends in a northwest southeast direction for a distance of 167 km between Huwaimiliyah Area (at the north) to Wafra Farms (at the south). Its width ranges between 50 km (upwind side) to 25 km (downwind side). Several strategic facilities are located in the corridor of shifting sands.These include:

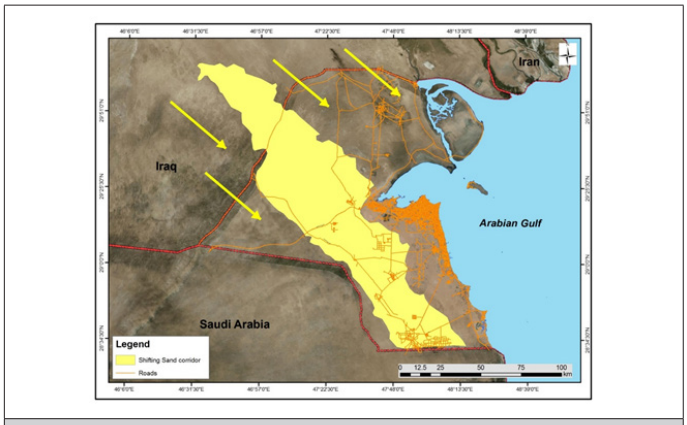

Figure 1: An image showing the corridor of shifting sands. Note the network of highways cutting the corridor.

a. Two air bases (Ali Al Salem and Ahmad Al Jaber).

b. Three oil fields (Burgan, Managish and Wafra)

c. Segments of five highways (Wafra- Mena Abdullah, Wafra-Al Zoor, Wafra –Kabd, Salmi and Ras Sabiyah)

During the period between 2010 and 2017, positive changes in the land use /land cover were noticed (Figure 2). The changes include fencing and protection of two areas of about 119 km2. These areas which cross the main natural corridor of shifting sands, resulted in its dissection into two portions (Figure 3). Consequently, the recently protected areas act as first defensive line against shifting sands advancing from the north [1].

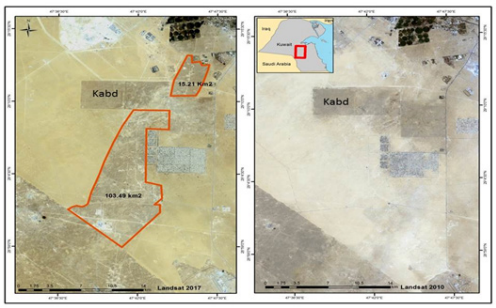

Figure 2: Changes in land use (2010 – 2017).

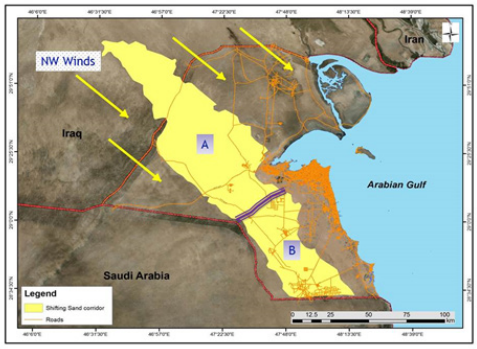

Figure 3: Dissection of the corridor of shifting sands into two portions (A& B).

Sources of sand and dust storms

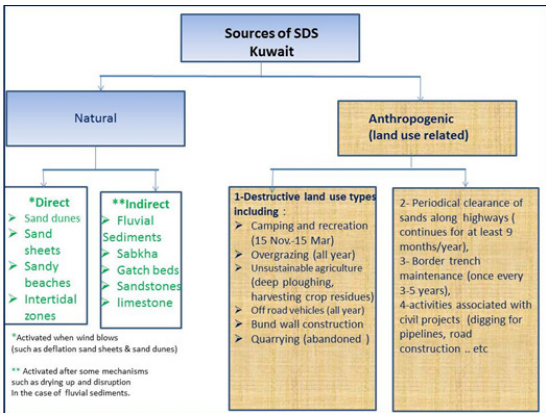

Figure 4: Sources of shifting sands.

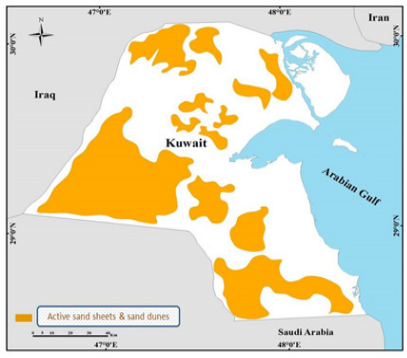

Figure 5: Direct sources of SDS (Sands and Dust Storms) in the terrestrial environment of Kuwait.

Sources of sand and dust storms are classified into two main categories: Anthropogenic (land use related) and natural (Figure 4). The first category is connected to several destructive land use types including overgrazing, off-road vehicles and camping and recreation. The second category of sources is differentiated into two subcategories: direct and indirect. Direct sources are types of sediments/landforms that start drifting when exposed to winds of about 8 m/second. These sources are widely distributing in Kuwait covering at least 40% of the country (Figure 5 & Plate 2).

Plate 2: Direct sources of shifting sands (sand dunes and sand sheets).

Indirect sources of SDS are types of sediments that convert to active sources of sand and dust under specific conditions/ mechanisms. Examples of these conditions/ mechanisms are drying up followed by cracking (case of fluvial sediments) and drop of the shallow water table followed by drying up top surface (case of bare sabkha). Some of these conditions are explained in (Table 1) and (Figure 6).

Table 1: Mechanisms of transformation of several types of indirect sources of sand and dust.

Type of indirect source	Mechanisms of transformation	Cases	Remarks
Fluvial sediments	- Drying up and cracking.	Ritqa -Abdaly	Observed after the floods of Dec. 2010 and November 2013
	- Mechanical breaking and disruption (off road vehicles and trampling).		
	- Sand blasts &deflation process		
Bare Sabkha	- Drop of shallow groundwater table.	Wafra – Al Zour sector	remarkable emission of dust, (June 2016)
	- Dryness and cracking of the topsoil (few centimeters)		
	- Sand blasts &deflation process.		
Concealed fine textured soil	Removal /disruption of armor layer (protective desert pavement)	Abraq-Salmi	
Vegetated sand sheets	Loss of vegetation cover	Umm Nega –Sabiyah sector	observed 2009 & 2017

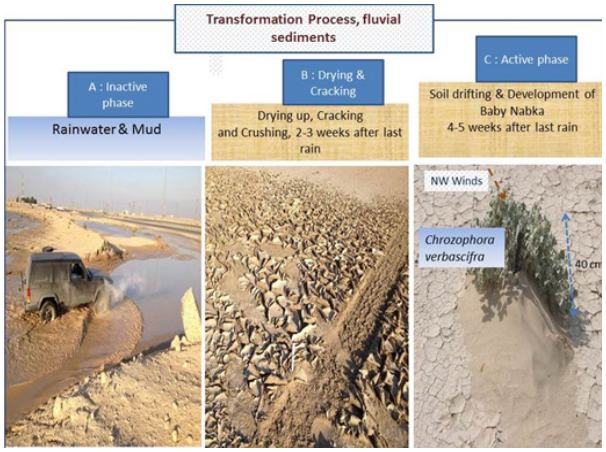

Figure 6: Process of transformation from inactive to active sources of sand and dust.

Summary and Conclusion

In Kuwait (17, 800 km2) a number of sectors are threatened by shifting sands. These include oil, agriculture, defence, ground transportation, Energy and water, Environment and Public Health. Multiple sources of sands and dust storms (SDS) are observed in Kuwait. They cover at last 40 % of the country. These sources are classified into two main categories: Anthropogenic (land use related) and natural.The first category is connected to destructive land use types .e.g, overgrazing . The second category of sources is differentiated into two subcategories: direct and indirect. Direct sources include sand dunes and sand sheets. While the indirect sources are represented by fluvial sediments and sabkhas.

References

1. Ali Al Hemoud, Ali Al Dousari, Raafat Misak, Mane Al Sudairawi, Adil Naseeb, et al. (2019) Economic Impact and Risk Assessment of Sand and Dust Storms (SDS) on the Oil and Gas Industry in Kuwait. Sustainability 11(200): 1-19.