GLOBE IVSS 2020

THE RELATIONSHIP BETWEEN WEATHER PARAMETERS, NORMALIZED DIFFERENCE VEGETATION INDEX (NDVI), LAND COVER AND MOSQUITO BORNE DISEASES.

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ABSTRACT

This report computes monthly trends in **precipitation, humidity** and **temperature**, **NDVI, land cover** against **MALARIA OCCURRENCE** computed data. This data was collected between January 2017 and February 2018.

This report identifies the link between the **weather parameters**, and **malaria prevalence** in the region.

The report also includes use of data collected using the **GLOBE Observer** app to show how different **GLOBE protocols (Clouds, Land cover)** can be linked with the **Mosquito protocol** to determine mosquito seasons and favorable climatic conditions for the growth of mosquitoes. This can help to develop mitigation measures before the disasters like outbreak of mosquito borne diseases strike

RESEARCH QUESTION

What is the relationship between weather parameters and Normalized Difference Vegetation Index (NDVI), land cover and mosquitoes?

HYPOTHESIS

Owing to the altitude of the site of research, there is expected overall parameter variations. Homa Bay region experiences convectional rainfall which may influence the trend of the parameters of study. Using the satellite map (figure 1.0), it shows that there is **green vegetation cover** which suggests that the **NDVI** should be above **0.4**. Additionally, the area will **record high number of mosquitoes and malaria occurrence** at different times of the period of study owing to rainfall occurrence and due to its nearness to a large water body (Lake Victoria).

LITERATURE REVIEW

Malaria transmission and infection risk in Kenya is determined largely by altitude, rainfall patterns, and temperature. Malaria is common in regions experiencing high temperatures and high amount of rainfall or near a water body.

Normalized Difference Vegetation Index (NDVI) quantifies vegetation by measuring the difference between near-infrared - which vegetation strongly reflects - and red light - which vegetation absorbs. NDVI always ranges from -1 to +1. For negative values, it's highly likely that it's water. On the other hand, NDVI value close to +1 indicates a high possibility that it is dense green leaves.

RESULTS
Tables and Graphs

Homa Bay School Automatic Weather Station Data(aggregated to Monthly)

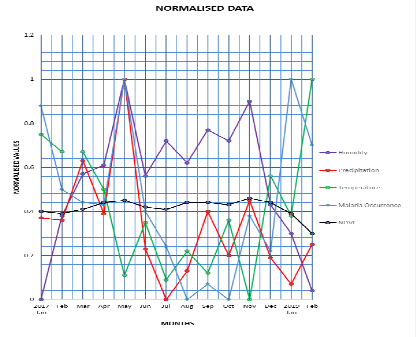
dateTimeUTC	humidity	precipitation	pressure	radiation	temperature
2017-Jan	58.0	0.6	87.9	239.8	24.8
2017-Feb	65.1	0.6	87.9	249.0	24.6
2017-Mar	68.8	1.0	87.9	252.4	24.6
2017-Apr	69.6	0.7	88.0	239.3	24.1
2017-May	77.1	1.6	88.1	221.1	22.9
2017-Jun	68.6	0.4	88.1	229.3	23.6
2017-Jul	71.6	0.0	88.2	201.0	22.8
2017-Aug	60.7	0.3	88.1	216.3	23.2
2017-Sep	72.7	0.7	88.1	219.7	22.9
2017-Oct	71.7	0.4	88.0	238.1	23.6
2017-Nov	75.2	0.8	88.0	213.1	22.5
2017-Dec	66.3	0.3	36.4	241.1	24.2
2018-Jan	63.7	0.2	46.5	207.8	23.7
2018-Feb	58.8	0.4	63.5	239.6	25.6

NDVI MODIS DATA

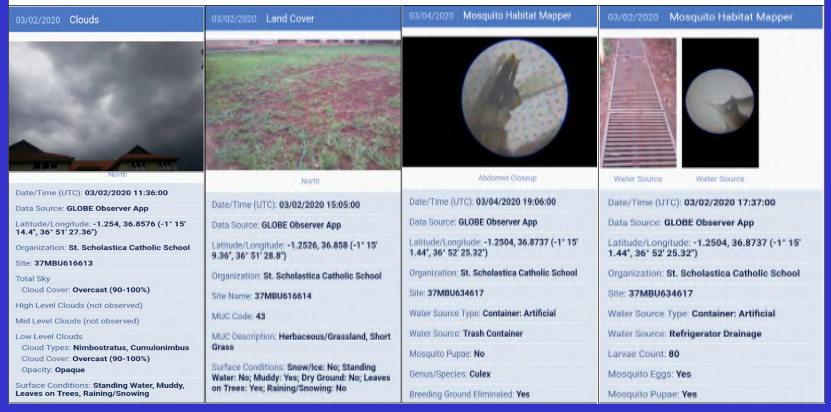
Month (2017)	NDVI pixel values (16bit raster)	Rescaled NDVI values
Jan-17	401	0.401
Feb-17	391	0.391
Mar-17	413	0.413
Apr-17	437	0.437
May-17	446	0.446
Jun-17	424	0.424
Jul-17	414	0.414
Aug-17	442	0.442
Sep-17	437	0.437
Oct-17	431	0.431
Nov-17	456	0.456
Dec-17	444	0.444
Jan-18	386	0.386
Feb-18	300	0.3

Homabay County Malaria Occurrence (Confirmed Malaria data was used)

Period	2017 Confirmed Malaria in July	2017 Malaria in pregnancy	2017 Suspected Malaria	2018 Confirmed Malaria in July	2018 Malaria in pregnancy	2018 Suspected Malaria
January	48195	625	11572	44842	458	19981
February	35020	728	12319	33645	695	18551
March	32924	590	11292	29268	394	15505
April	32599	488	10814	14790	471	9497
May	52251	590	18575	21340	485	24089
June	51620	548	9168	18485	555	22805
July	25061	300	8193	19661	395	23315
August	17997	269	6660	13376	204	16302
September	20148	460	7963	12500	308	18298
October	17773	297	6715	10661	283	17942
November	30409	197	13050	7445	304	14505
December	25341	310	13198	8048	254	13055
December	25341	310	13198	8048	254	13055



GLOBE OBSERVER DATA



DISCUSSION

Temperature.
The region has high temperatures at the beginning of 2017 in January but it gradually falls throughout the months with the lowest in May and July. June is hotter than may and July. It rises from July gradually but drastically falls to the lowest of the selected period of study in November. Unusually or unexpectedly it rises to the highest levels in February of 2018. Seemingly, this region has two weather patterns.

Humidity
At the beginning of 2017, humidity is very low but gradually rises to hit the highest record in may. It is relatively high throughout the following months though in November it falls through the following year to February. From the foregoing, it appears that the region has two low humid seasons in the year.

Precipitation
Attitudinally this area receives convectional rainfall. It has one heavy season in may. The other months are average though the lowest is July 2017 followed by January of 2018.

NDVI
The normalized difference vegetation index is average from the beginning of 2017 to the end of the same year. However, it falls in the month s of January and February in 2018. May and November have high NDVI compared to the other months. In general, all the parameters combined provide a different correlation with the vegetation cover at different times of the year.

Malaria Occurrence
Cases of malaria occurrence begin at a high record but reduce gradually in the first quota of 2017. In May, surprisingly, they rise to their highest at normalised +1. May to October records low occurrence with August and October being the lowest months of this occurrence. The last two months of 2017 record relatively below average occurrence. January and February of 2018 have higher occurrence. Generally, January, May and the next January are the peak months of occurrence. **Malaria** occurrence was directly proportional to precipitation, temperature and to some extend NDVI.

From the **GLOBE Observer** data as show in the photographs, we observe that:
Cloud show presence of heavy rainfall at the period when there was green vegetation cover. At the same time heavy rainfall was recorded. When mosquito data was collected it showed presence of mosquitoes at the same site. This shows that water provided breeding habitat for mosquitoes and the vegetation cover was the hiding places for those mosquitoes. This is an indication that, there is direct relationship between clouds, land cover and mosquito protocols from the GLOBE Observer app.

CONCLUSION

The effects of these changing parameter patterns include irregular rain patterns in different parts of the region. By extension, they change plant cover, animal migration and life cycles. **Temperature** records are to a greater percentage proportional to **malaria occurrence**. In May, there is **high humidity, high malaria occurrence, high precipitation and high NDVI.**

Arguably, this **high rainfall** leads to **expansive vegetation cover** around this area, a possible **high breeding of mosquitoes**. **Mosquitoes** need **high temperatures**. The presence of high rain means that the water stagnates in rather clean environment. This provides suitable environment for mosquito eggs habitation, their incubation and hatching into larvae.

This region receives high rainfall within the first six months of the year. This should be good time for people to be educated on **preventive measures of malaria**. They should also be provided with mosquito nets and repellants. Additionally, they should consider the two seasons and decide on the **suitable mosquito preventive measures** so as to prevent malaria outbreaks during these two periods of the year. Finally, all the above show that the is a direct relationship between **Mosquito mapper app, Clouds app** and **Land cover app** in the **GLOBE observer app**.

RECOMMENDATIONS

1. The NDVI serves as a useful supplement or even substitute to traditional scouting. Imagine being able to quickly determine problem areas in the field based on regions with low NDVI values instead of relying on time-consuming practices that are also prone to human error. This then serves as a strong insight on why today's health practitioners and the wider society should embrace technology in disease outbreak prediction and risk control especially **mosquito borne diseases**.
2. The ease and availability of data also means that scientists can then quickly deploy teams to examine specific mosquito affected areas, allowing them to diagnose issues more efficiently rather than spending time and resources looking for answers with no avail.
3. This NDVI knowledge makes time-sensitive events like the onset of certain diseases such as **malaria** much more manageable. In the end, all these will benefit the bottom line - less time and less resources are spent while getting as much or even more insight than traditional methods.
4. Having conducted this research as a founding for others to come, we feel there is need to do further study on mosquitoes and their relationship with these selected parameters in this research.
5. The government departments of health, agriculture, water and sanitation should be provided with this interpretation for better preparation and control of disease epidemics, drought, famine and floods.
6. Finally, using **the mosquito habitat mapper**, which is an element of STEM study, the mosquito prevalence can be studied for identification and decommissioning.

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- Huang, J., Wang, H., Dai, Q., & Han, D. (2014). 'Analysis of NDVI Data for Crop Identification and Yield Estimation', Selected Topics in Applied Earth Observations and Remote Sensing, IEEE Journal of, 7(11), 4374-4384.