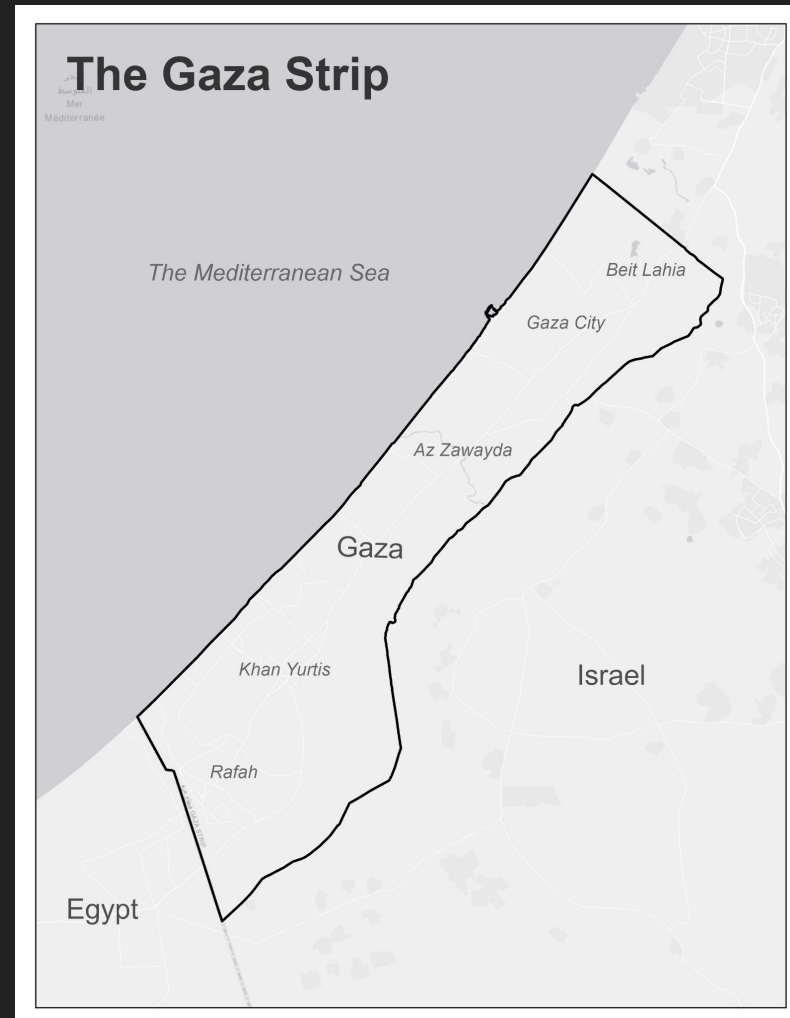


Remote Sensing the Impacts of Israeli Violence on the Strawberry Harvest in Northern Gaza

Leda Hinkle | Spring 2024 | GISC 340

Study Area Background

- Palestinian territory approximately 40 km long and 10 km wide
- Surrounded by Israel, Egypt, and the Mediterranean Sea



Study Area Characteristics

- Dense population, with an average of 5,700 people per square km prior to October conflict (BBC News)
- Agricultural economy - 3/4 of the land under cultivation
- 90% of farmers have less than half an acre of land (ANERA Reports)
- 44% of household food consumption came from domestic producers prior to declaration of war in October, 2023 (Vos and Kim, 2024)



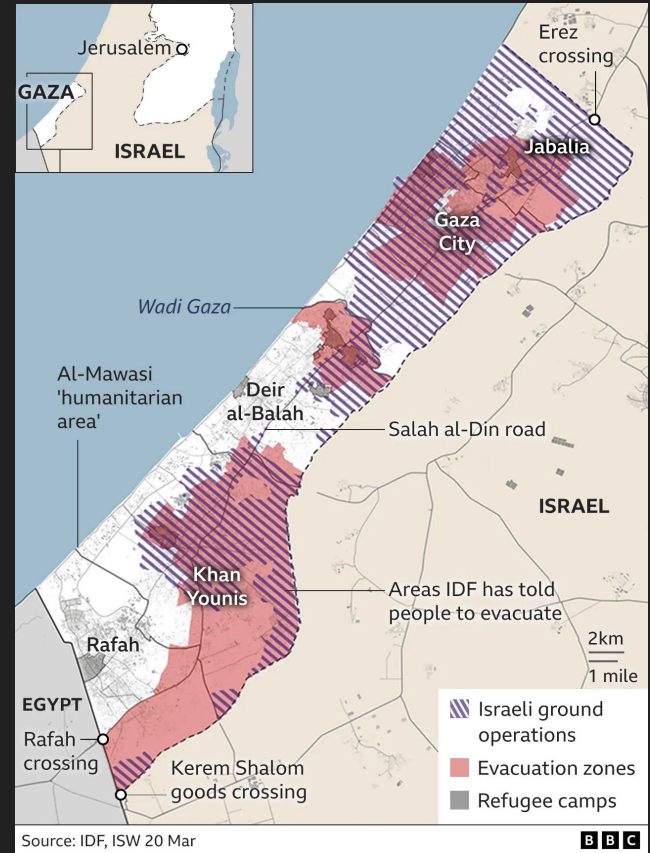
ACTED

Context

On October 8, 2023, Israel declared war on Gaza.

Responding to October 7th attacks by Hamas, Israel conducted an intense bombing campaign followed by a ground invasion.

As of March 20th, **1.7 million people have been displaced** by the violence in a territory with a total population of 2.2 million (BBC News). Displacement has further concentrated populations around/within overcrowded refugee camps and in the city Rafah.



Impact on Agriculture

Israeli clearing operations have reduced swaths of agricultural land to sand under the tracks of tanks and heavy vehicles.

Malnutrition and famine runs rampant among citizens of Gaza. In addition to the 80% of civilian infrastructure has been destroyed or severely damaged (World Health Organization), **more than 1/3 of agricultural lands have been damaged** (UNOSAT and UN Food and Agriculture Organization).



Narrowing the project scope to strawberries

In Gaza, strawberry cultivation begins in November with January becoming the peak of the harvest. Since October, this is the first crop rotation to have been totally impacted by Israel's invasion.

Strawberries are one of Palestine's most vital crops, holding particular significance in the Gaza Strip where they are referred to as “red gold” (Rahman 2023 & Serim 2024)



What extent of productive agricultural land area has been lost to Israeli violence during the strawberry harvest in Northern Gaza?

Data

Planet Labs Sentinel 2, Level 1 data:

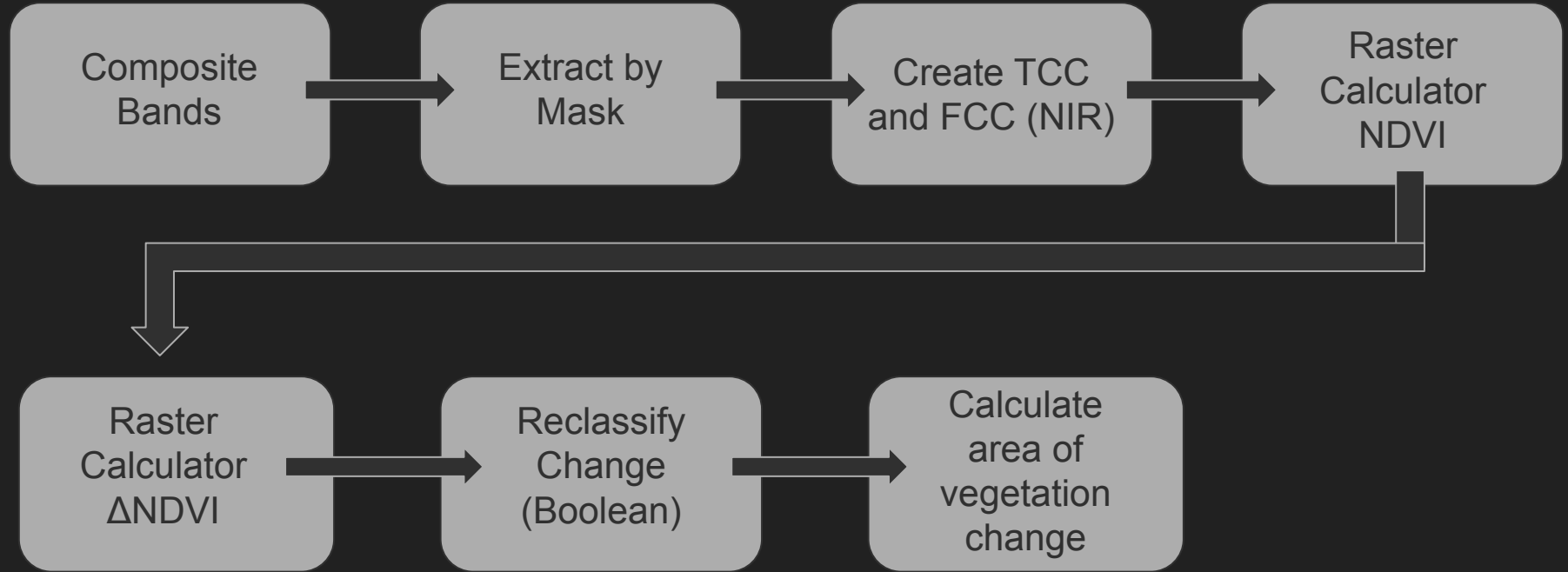
- S2B_MSIL1C_20230115T082209_N0509_R121_T36RXV_20230115T090355
- S2B_MSIL1C_20240110T082229_N0510_R121_T36RXV_20240110T090720
 - January 15, 2023 and January 10, 2024
 - spatial resolution: 10 x 10m, radiometric resolution: 16-bit
 - Tile T36RXV, spectral resolution: Visible and NIR used in project

Planet Labs PSScene (Imagery from Planet Labs' PlanetScope sensors)

- January 30, 2024 and January 10, 2023
- spatial resolution: 3 x 3m, radiometric resolution: 16-bit
- Spectral resolution: Blue, Green, Red, NIR

All Data is in GeoTIFF format

Methodology



Results: TCC



Results: NIR FCC



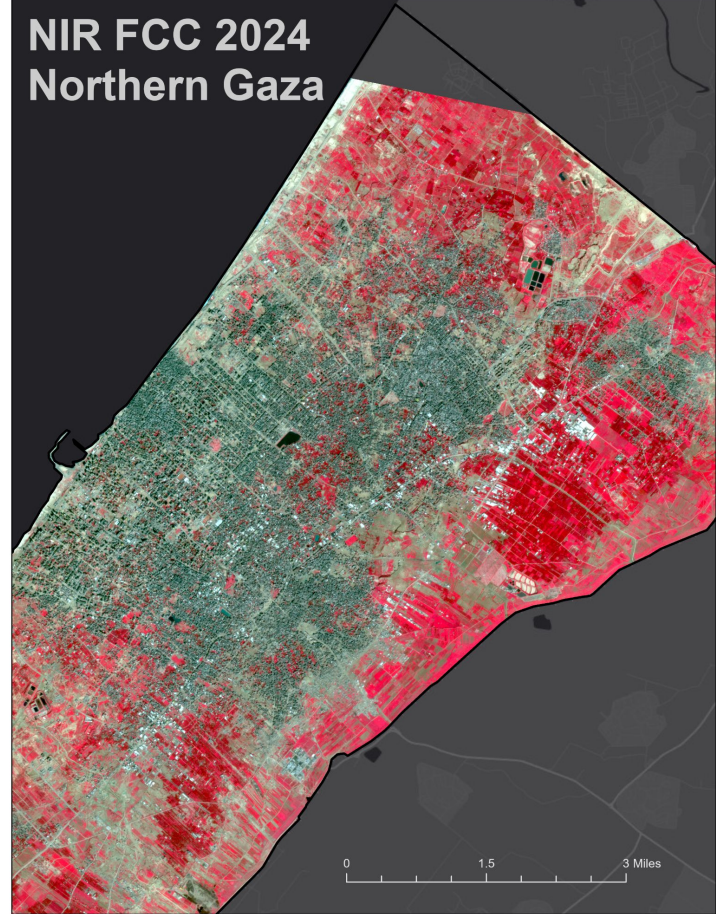
Vegetation is symbolized by the color red

Results: FCC

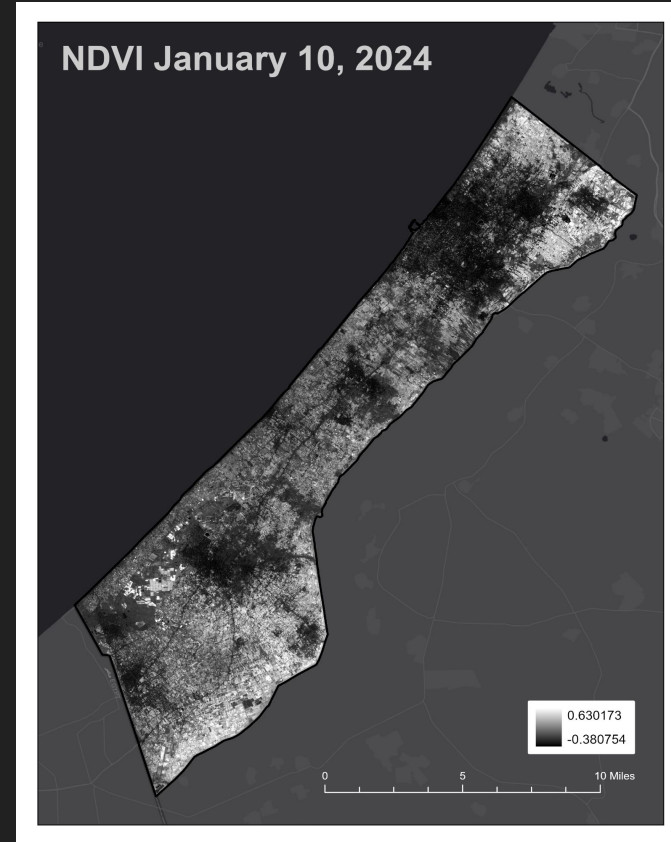
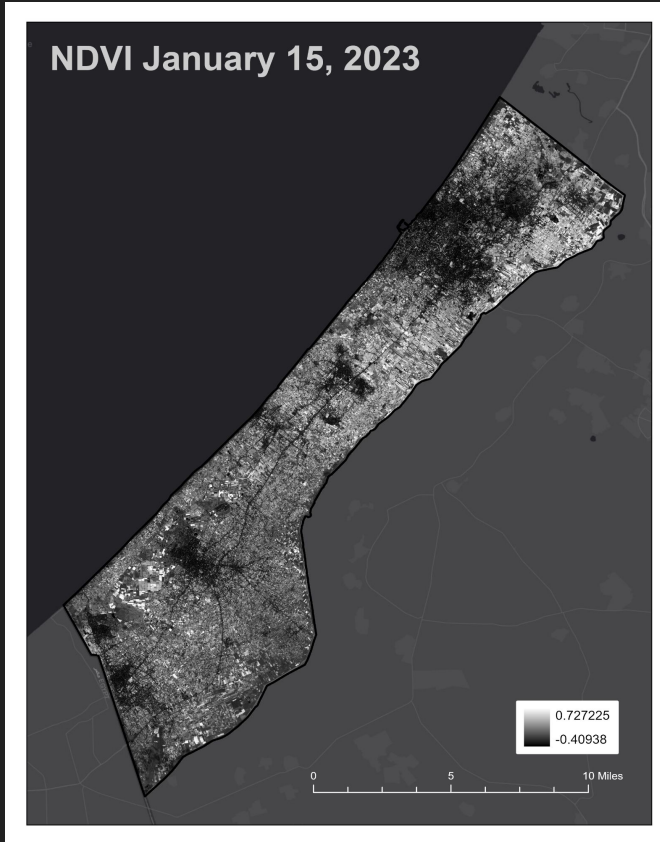
NIR FCC 2023
Northern Gaza



NIR FCC 2024
Northern Gaza

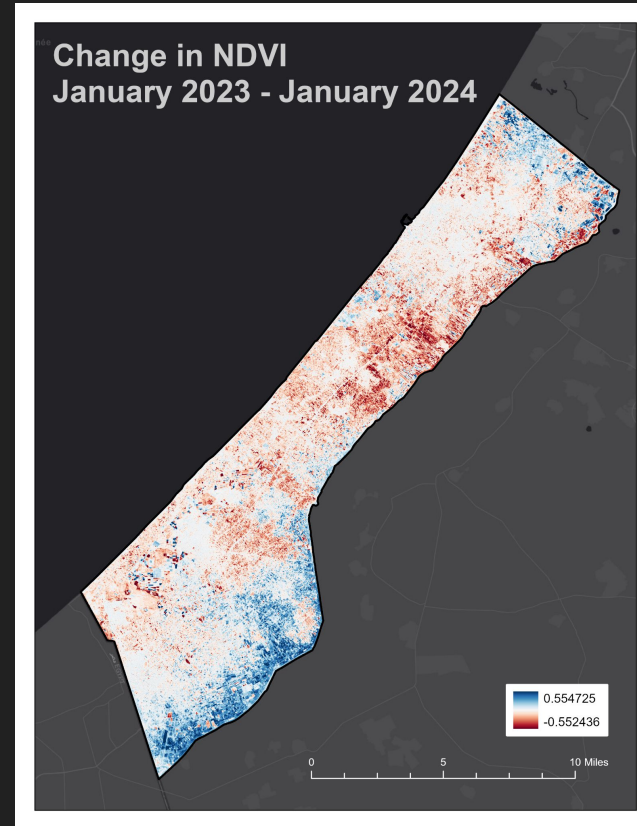
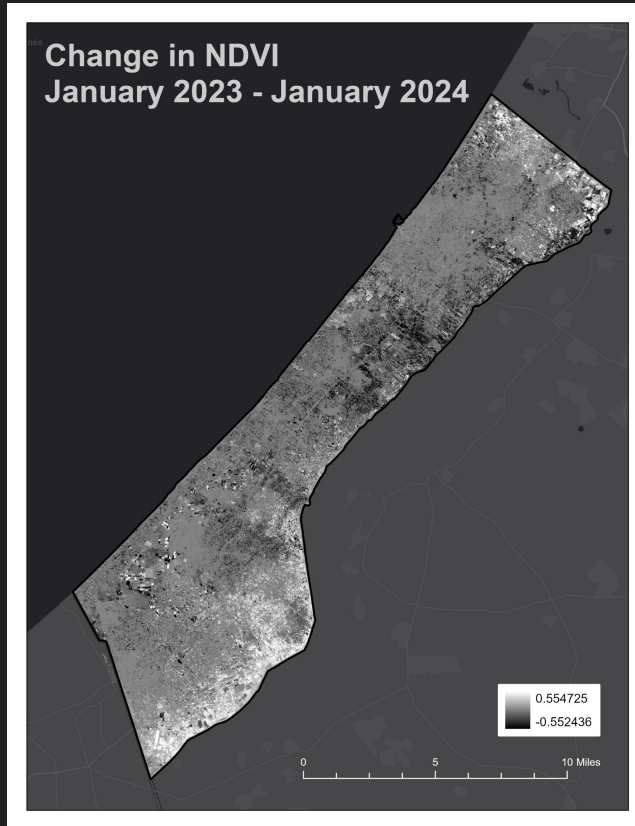


Results: NDVI



Bright areas = healthy/vegetated areas
Dark areas = unhealthy vegetation/non-vegetated areas

Results: NDVI Change Map



Positive values = vegetation gain
Values around zero = no change
Negative values = vegetation loss

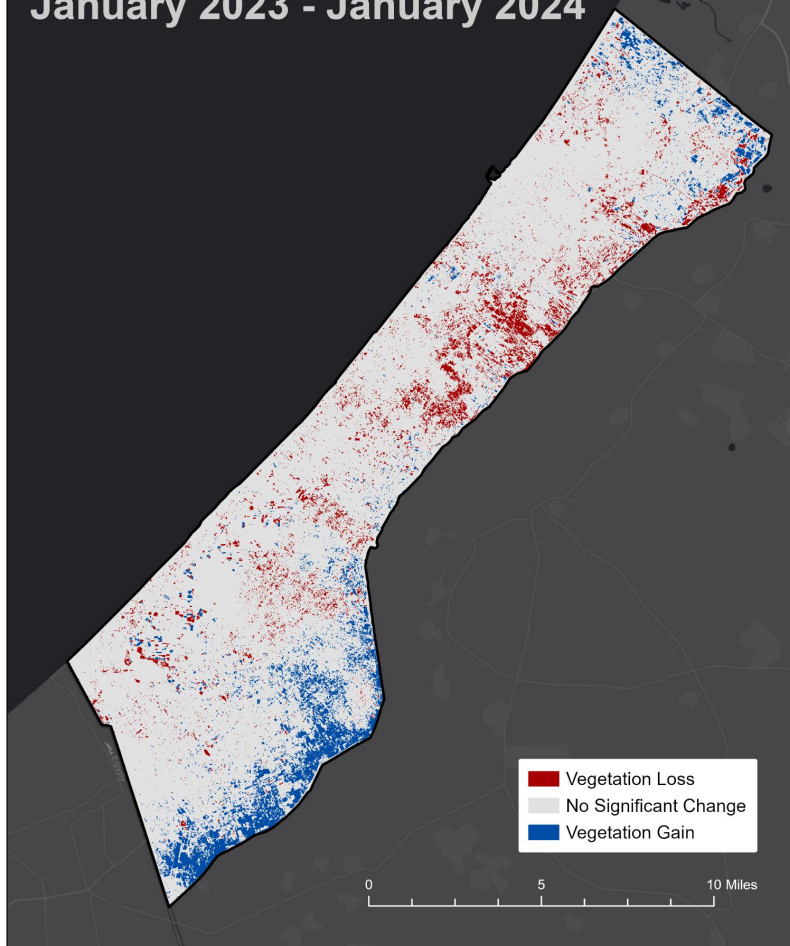
Reclassifying Sentinel Change NDVI: Establishing Thresholds of Significance



Significant Change +/- 1.5 Standard Deviation

Results and Discussion

Vegetation Change from January 2023 - January 2024

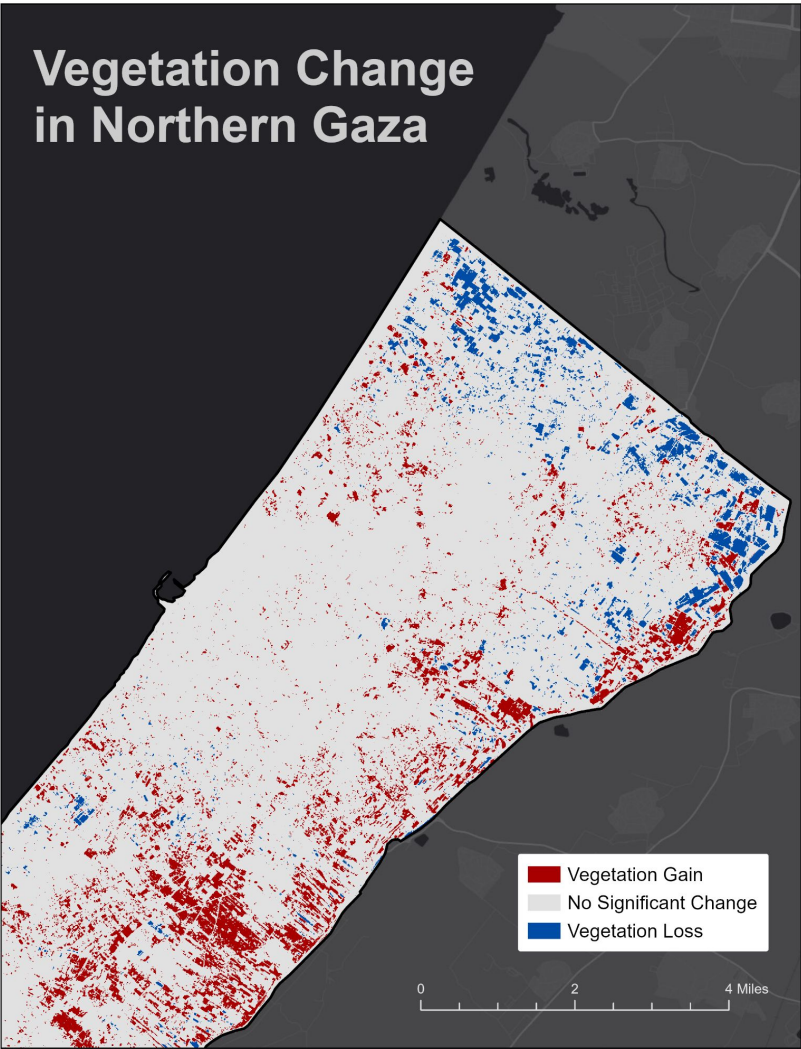


	OBJECTID *	Value	Count	Class	Area (km ²)
1	1	1	232721	Vegetation Loss	23.2721
2	2	2	3145173	No Change	314.5173
3	3	3	267437	Vegetation Gain	26.7437

While 23.3 sq km of vegetation were lost, there was also a vegetation gain of 26.7 sq km for a net gain of 3.5 sq km.

However, rates of vegetation gain/loss are clustered throughout the Gaza Strip, demonstrating that different areas within Gaza are experiencing different trends in vegetation increases/decreases.

Vegetation Change in Northern Gaza



	OBJECTID *	Value	Count	Class	Area (km²)
1	1	1	129678	Vegetation Loss	12.9678
2	2	2	1259471	No Change	125.9471
3	3	3	53234	Vegetation Gain	5.3234

Northern Gaza, facing the brunt of Israel’s invasion, has had more agricultural land lost between January, 2023 and January 2024.

The region, also where most strawberry production occurs, has had a net loss of 7.6 sq km.

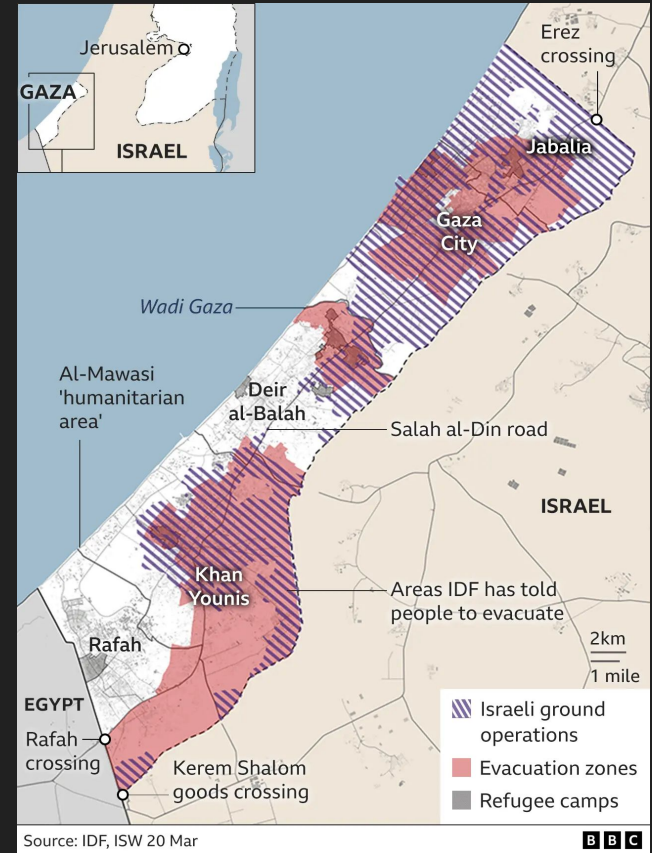
Conclusion

Throughout the whole of the Gaza Strip, there was actually a net gain in vegetation between January 2023 and January 2024. However, vegetation gains and losses were concentrated in different parts of the territory.

The whole of the Gaza Strip: + 3.5 sq km of vegetation

Northern Gaza: - 7.6 sq km of vegetation

The distribution of increases/decreases in vegetation are illustrative of the geographic extent of Israel's invasion. Changes in vegetation demonstrate the geographic characteristics of Israeli violence against Gaza - higher rates in the North and urban areas.



Sources

- Anera. "Agriculture in Gaza and the West Bank." 2017. *ANERA Reports*. <https://www.anera.org/wp-content/uploads/2017/03/AgReport.pdf>
- BBC News. "Gaza Strip in maps: how life has changed." 2024. *BBC News*. <https://www.bbc.com/news/world-middle-east-20415675>
- Hoog, N.D., Voce, A., Morresi, E., Ganguly, M. & A. Kirk. "How war destroyed Gaza's neighborhoods - a visual investigation." 2024. *The Guardian*. <https://www.theguardian.com/world/ng-interactive/2024/jan/30/how-war-destroyed-gazas-neighbourhoods-visual-investigation>
- Nasser, M. "Photo essay: strawberry season in the Gaza Strip." 2021. *Mondoweiss*. <https://mondoweiss.net/2021/12/photo-essay-strawberry-season-in-the-gaza-strip/>
- Rahman, R.A. "In pictures: Gaza's strawberry harvest." 2023. *Middle East Eye*. <https://www.middleeasteye.net/discover/pictures-gazas-farmers-gather-strawberry-harvesting-season>
- Serim, S. "For the first time in 50 years, Gaza strawberries not around to bring joy." 2024. *TRT World*. <https://www.trtworld.com/middle-east/for-first-time-in-57-years-gaza-strawberries-not-around-to-bring-joy-17409929>
- Vos, R. & S. Kim. "Long-lasting devastation to livelihoods from damage to agricultural lands in Gaza." 2024. *International Food Policy Research Institute*. <https://www.ifpri.org/blog/long-lasting-devastation-livelihoods-damage-agricultural-lands-gaza>
- Yerushalmy, J. "Gaza before and after: satellite images show destruction following Israeli airstrikes." 2023. *The Guardian*. <https://www.theguardian.com/world/2023/oct/27/gaza-before-and-after-satellite-images-show-destruction-after-israeli-airstrikes>