

Christine Zhang  
Dr. Jane Dmochowski, ENVS 301, Fall 2021

## Abstract

In 2001, Dubai attempted to diversify their economy towards tourism and real-estate. Additional land mass was required to support the increase in economic activity. The Palm Jumeirah artificial island development project was one example. However, with this came environmental implications, including biodiversity loss, shoreline erosion, and water circulation change. This case study evaluates the environmental issues and stakeholder conflicts related to the Palm Jumeirah. Nations and developers need to understand the cumulative effects of artificial island development on the land, climate, communities, and economy before beginning land reclamation projects.

## Background

- The Palm Jumeirah is a palm tree shaped series of artificial archipelagos off the coast of Dubai in the United Arab Emirates (UAE)
- They were constructed by dredging sediment and redepositing it in shallow water to form land
- The project was initiated by the UAE government for urban and tourism purposes
- Researchers have found that the Palm Jumeirah has contributed to marine destruction, shoreline erosion, higher temperatures, and exacerbated socio-economic disparities.

## Stakeholders

	Stakeholder	Reason
FOR	Nakheel Properties	Business growth
	UAE Government	Diversify economy and boost tourism
	Overseas Investors	Resort development, to attract visitors
AGAINST	Inland Residents	Tourism and business gains
	Inland Residents	Visual pollution, erosion, fishing industry economic losses
	Environmental Activist	Coral reef deterioration, erosion, temperature changes

## Details and Data

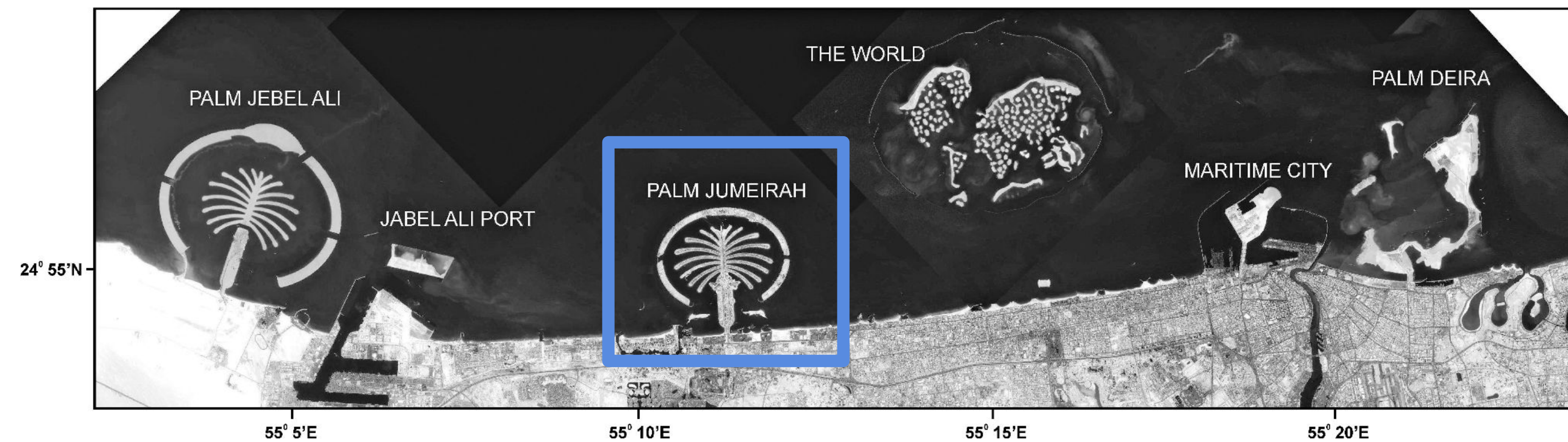


Figure 1: Map of Dubai's artificial island development projects, including the Palm Jumeirah. The development of artificial islands supports the nation's strategy to diversify the economy towards tourism and urbanization. Modified from (Cavalcante et al., 2011)



Figure 2: Redeposition of sediment and sand in progress to construct Palm Jumeirah artificial islands. The project, completed in 2006, totalled \$12 billion USD in costs.

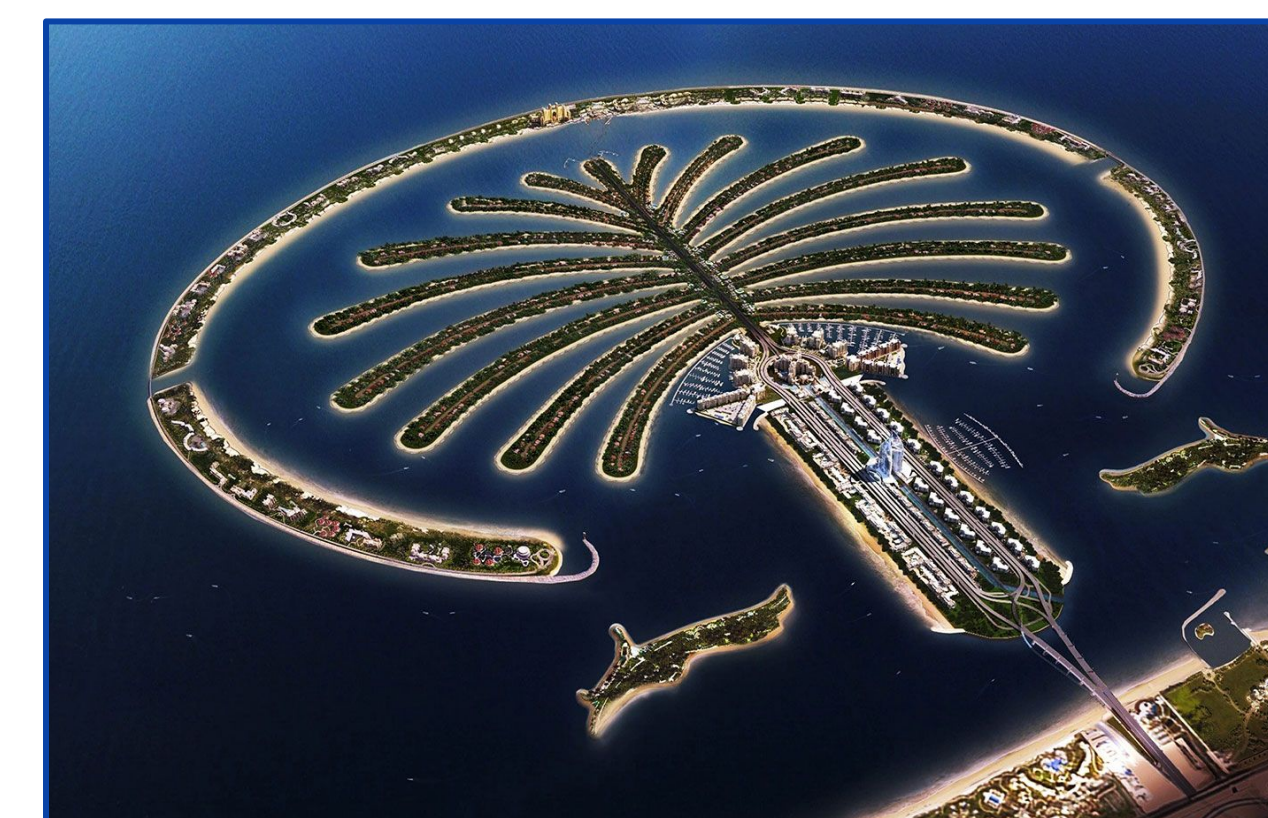


Figure 3: Aerial image of the completed Palm Jumeirah, with 17 branches and an 11km crescent shaped breakwater (Choomchaiyo, 2009). Today, there are 5,000 waterfront apartments, 4,000 residential villas, and recreational sites.

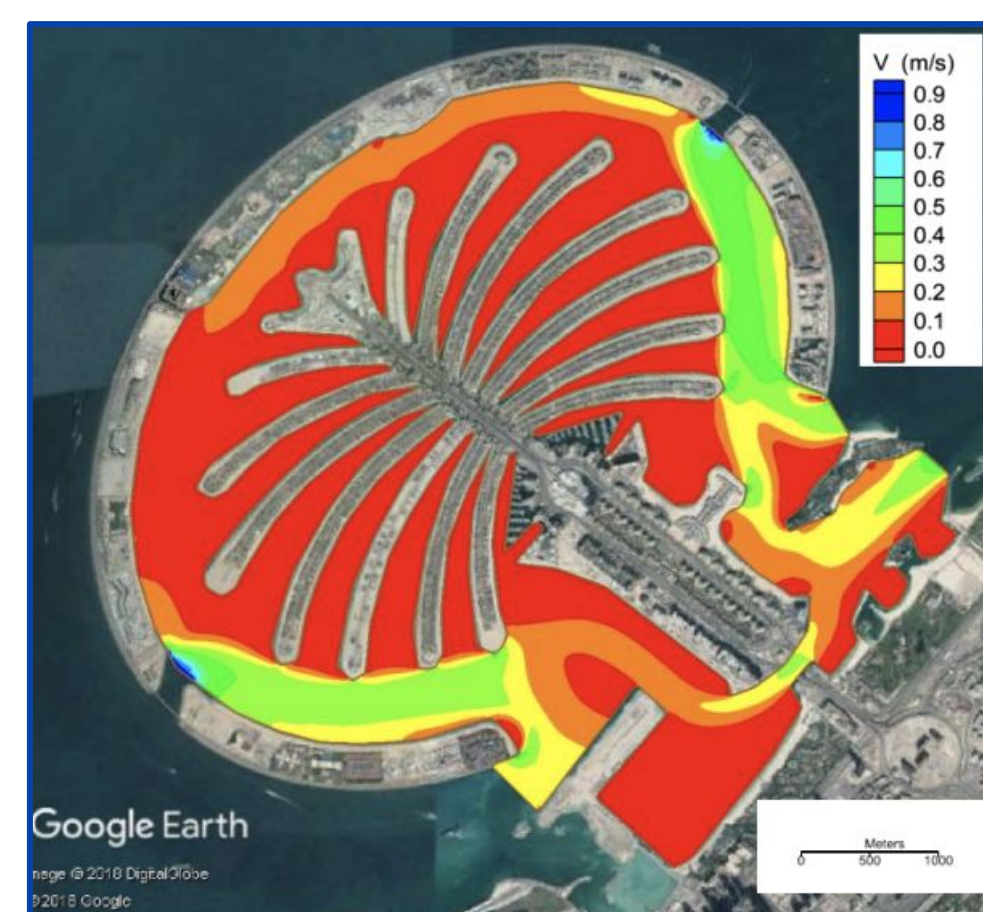


Figure 4: Water velocity within the Palm Jumeirah is stagnant, ranging between 0.03-0.05 m/s. This exacerbates shoreline erosion along neighboring coasts as longshore drift of sediment is limited. Copied from (Amrousi et al., 2019).

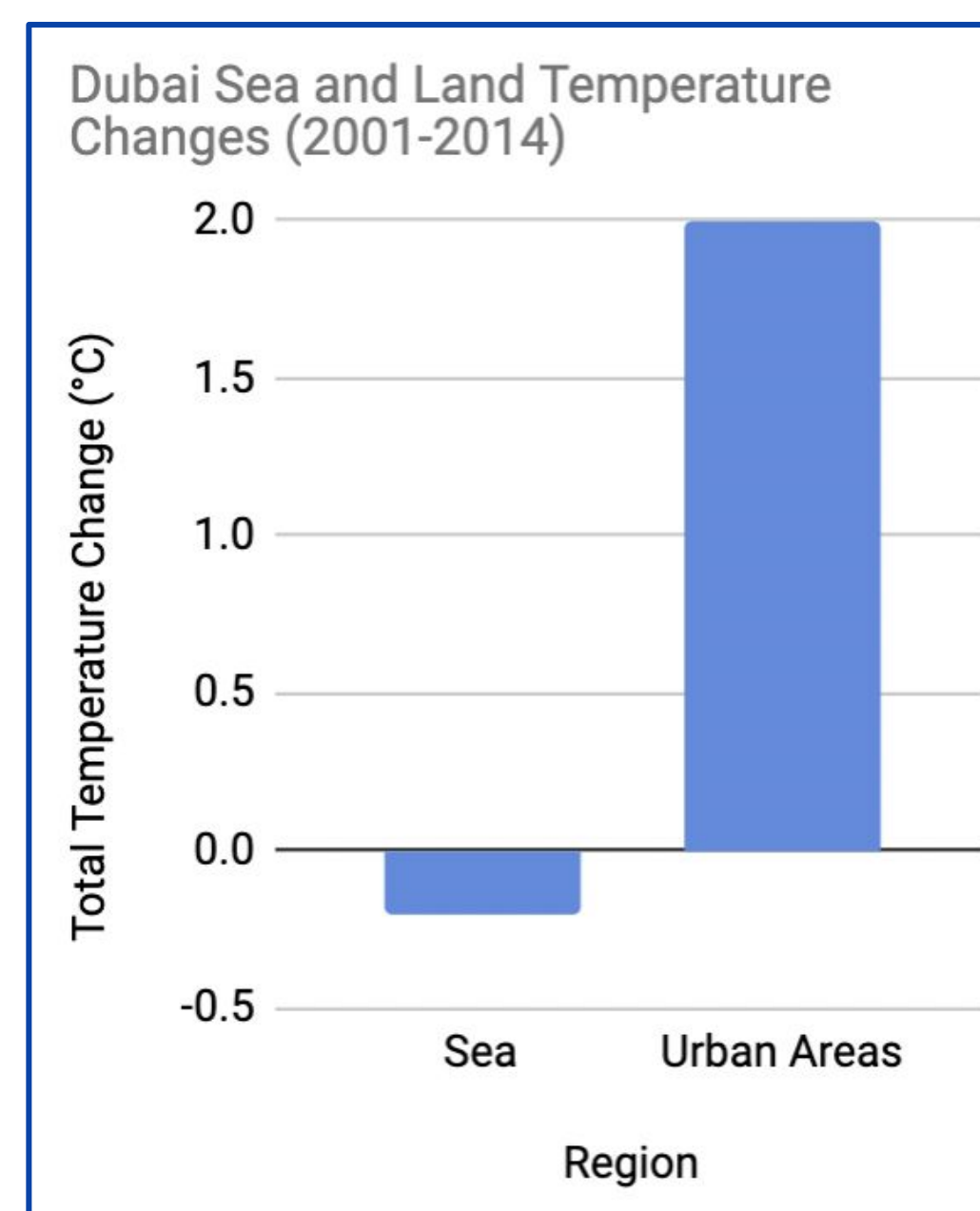


Figure 5: A 13-year longitudinal study between 2001-2014 found that urbanized region temperatures increased by 2°C, whereas sea temperatures decreased by 0.2°C. Data from (Elhacham & Alpert, 2016).

## References

1. Amrousi, M. E., Elhakeem, M., & Paleologos, E. (2019). Building on Water: The Use of Satellite Images to Track Urban Changes and Hydrodynamic Models to Simulate Flow Patterns Around Artificial Islands. *Advances in Intelligent Systems and Computing*, 363-369. [https://doi.org/10.1007/978-3-030-11051-2\\_56](https://doi.org/10.1007/978-3-030-11051-2_56)
2. Cavalcante, G. H., Kjerfve, B., Feary, D. A., Bauman, A. G., & Usseglio, P. (2011). Water Currents and Water Budget in a Coastal Megastructure, Palm Jumeirah Lagoon, Dubai, UAE. *Journal of Coastal Research*, 272, 384-393. <https://doi.org/10.2112/jcoastres-d-09-00177.1>
3. Choomchaiyo, T. (2009). *Construction of the Islands - The Impact of the Palm Islands, United Arab Emirates*. The Impact of the Palm Islands. <https://sites.google.com/site/palmislandsimpact/general-information/construction-of-the-islands>
4. Elhacham, E., & Alpert, P. (2016). Impact of coastline-intensive anthropogenic activities on the atmosphere from moderate resolution imaging spectroradiometer (MODIS) data in Dubai (2001-2014). *Earth's Future*, 4(3), 54-61. <https://doi.org/10.1002/2015ef000325>
5. Flynn, A. (2019, November 17). *Why is Palm Island important?* Greedhead. <https://greedhead.net/why-is-palm-island-important/>

## Discussion

- Engineers began dredging before breakwater calculations were completed, threatening nature and communities
- Temperature and erosion effects were felt outside of the Palm Jumeirah region, near local communities, which exacerbates socio-economic disparities.
- Dubai is pursuing "Dubai Tourism Strategy", with the aim of becoming the world's most visited city with 25 million visitors by 2025. It will be imperative to understand the cumulative effects of artificial islands before proceeding with land reclamation projects.

## Conclusion

The Palm Island artificial islands offer a solution for Dubai to expand land cover and pursue political goals. However, the environmental implications and socio-economic disparities need to be addressed. Analysis has shown that Dubai valued short term economic gain over long term ecological and climate complications. Once all risks are accounted for, then nations can confidently utilize artificial islands as a solution to address climate change.

## Teaching the Case

### Learning Objectives

Understand the stakeholder conflicts, environmental impacts, and innovative solutions relating to artificial islands

### Pre-Class Activities

Read the case, select stakeholder group, answer guiding questions

### In-Class Activities

Form task force to convince UN to support Dubai's future artificial island construction projects