Geospatial Assessment and Socioeconomic Implications of Shoreline Change along the Ondo State – Nigeria Coastline.

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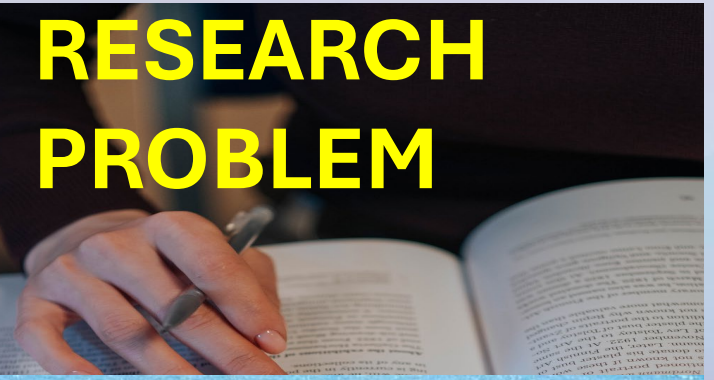
PRESENTATION OUTLINE

- Background
- Research Problem
- Aim and Objectives
- Study Area
- Methodology
- Results
- Discussions and Policy Implications
- Conclusion
- Recommendations
- Acknowledgements
- References

BACKGROUND

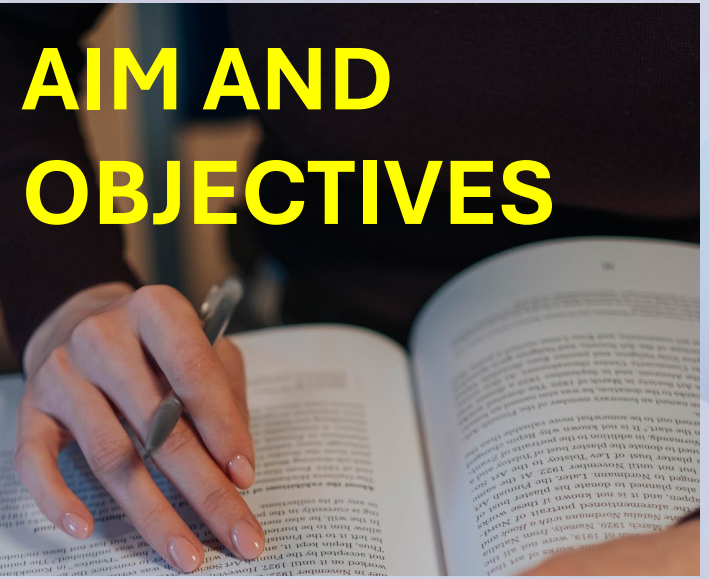
- Shoreline changes driven by climatic change, sea level rise, and anthropogenic activities remain a significant global issue in many of the world's coastal regions (Ankrah et al., 2023)
- Satellite data show nearly 70% of the world's sandy shorelines are experiencing erosion *(Luijendijk et al., 2018)*.
- Nigeria's coastline (approx. 850 km) faces severe threats *(Dada et al., 2019)*.
- Ondo State coastal communities, particularly communities such as Idi-Ogba and Ayetoro, have witnessed severe shoreline retreats and face increasing threats from erosion and sea-level rise.

RESEARCH PROBLEM



- Ondo's mud coast is rapidly retreating due to erosion, sea-level rise, and oil exploration activities.
- Resulting impacts include land loss, habitat degradation, and declining coastal livelihoods(Dada et al., 2019)
- Research gaps remain in long-term, spatial analysis of shoreline change and socioeconomic effects.
- Nigeria's coast is highly vulnerable: 41 million people live in climate-risk zones (Moran et al, 2018b).
- A 0.5 m sea-level rise could displace 27–53 million people, underscoring the need for updated shoreline assessments USAID (2012)

AIM AND OBJECTIVES



Aim: Assess shoreline change dynamics along the Ondo State, Nigeria, coast, and its impact on the socioeconomics of the people.

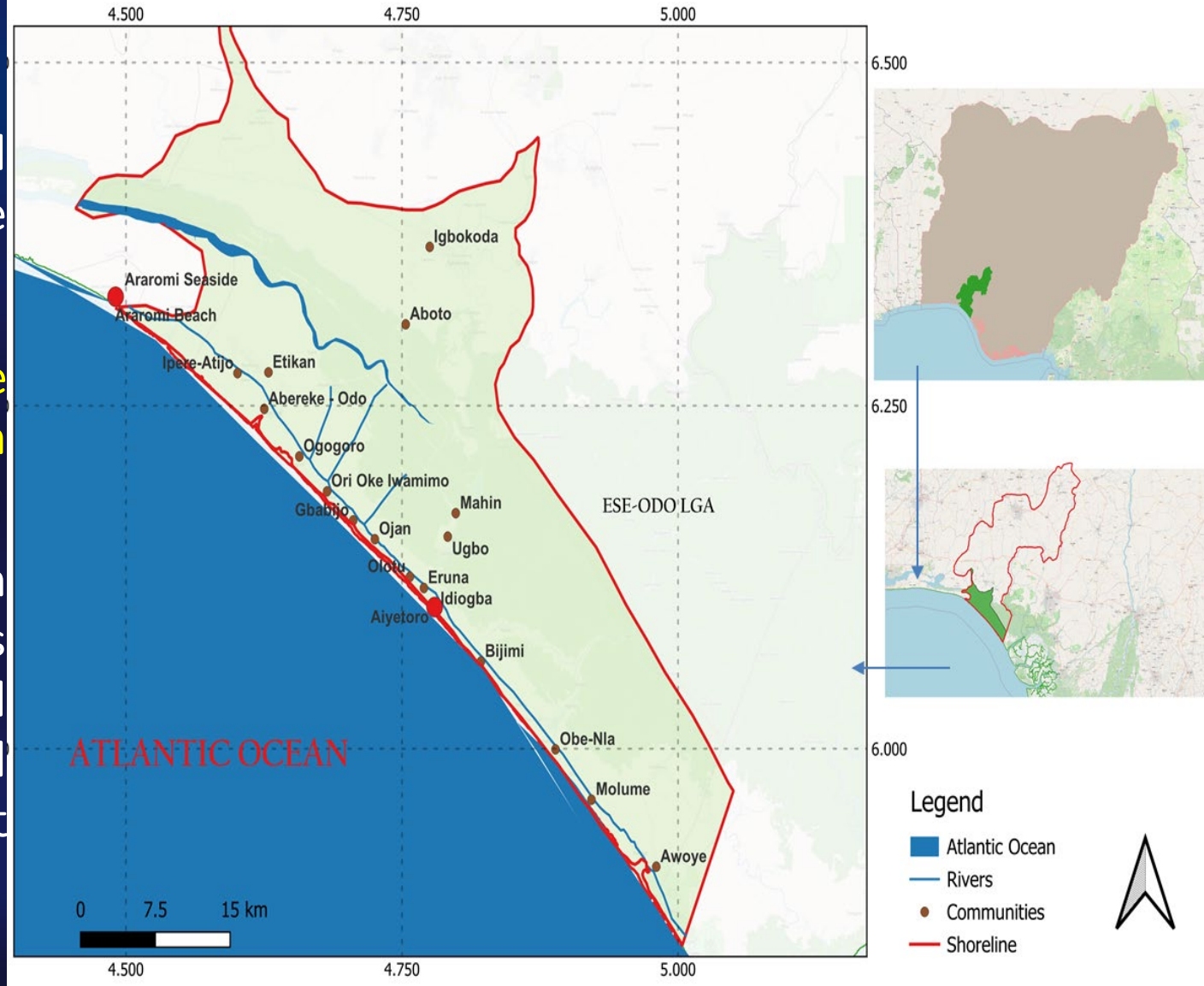
- Map historical shoreline positions (1986–2024).
- Quantify erosion/accretion rates using DSAS
- Assess livelihood impacts and adaptation strategies.

STUDY AREA

- Ondo State lies within latitude 5°54' and 6°20' North of the equator and longitude 4°27' and 5°00' East of the Greenwich.

- The coastline extends about 80km. The Coastline is described as the Mahin Transgressive Mud Coast (Popoola, 2014)

- The study area is characterized by both hot and humid meteorological conditions with the relative humidity of 68% and mean annual rainfall between 1500 and 2000 mm. The mean temperature is about 30.3 °C (Akinsemolu et al. ,2018).



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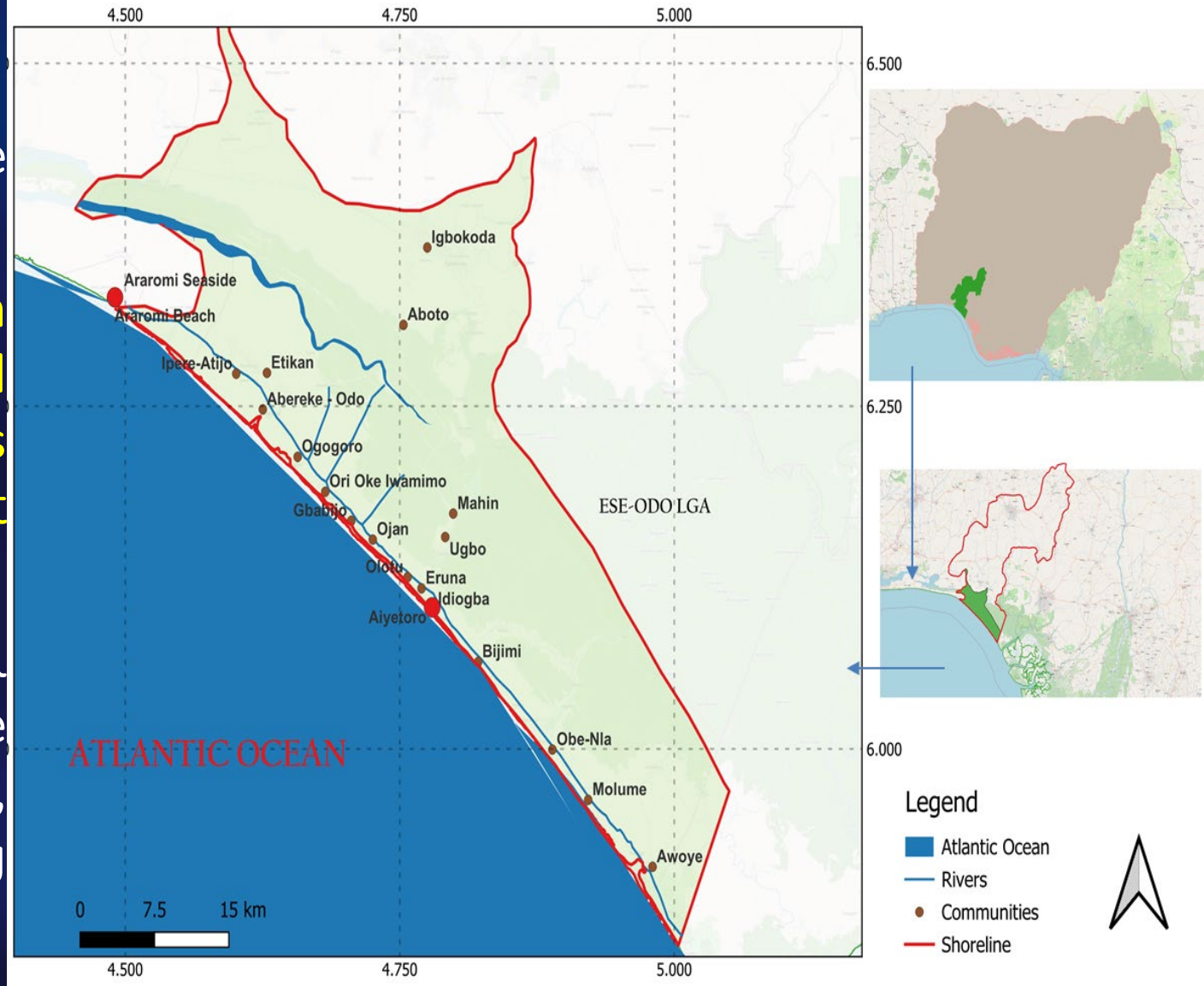
STUDY AREA contd.

- Population: 290,615 according to the 2006 NPC
- Based on the National Population growth rate of 2.87%, the projected population of Ilaje for 2024 is estimated to be 483,362 (Ogunrayi et al., 2023)
- The main occupation of the local community is fishing. Others are farming, boat construction, lumbering, mat making, net weaving, and trading (Olajide & Popoola, 2020).



METHODOLOGY

1. **Data Acquisition** → Multi-temporal Satellite Images (Landsat 5, 7, 8; Sentinel-2), Google Earth Engine (GEE).
2. **Data Pre-processing** → Radiometric & Geometric Correction → Cloud Masking → Sub setting → Baseline & Transect Generation
3. **Shoreline Extraction** →NDWI / MNDWI / SWIR2 (Sentinel-2) + K-means++ clustering (unsupervised)
4. AWEI + Otsu Thresholding (Landsat) Connected-component Filtering → Vectorization & Multi-period Shoreline Mapping → Accuracy Validation ($\kappa = 0.986$; ≈10 m horizontal)
5. **Shoreline Change Analysis** →Computation of Change Metrics (EPR, NSM, LRR, WLR) → Temporal Trend & Spatial Variation Mapping
6. **Socioeconomic Assessment** → Community-level Surveys → Livelihood & Infrastructure Impact Analysis → Perception of Shoreline Change
7. **Integrated Interpretation** → Link Geospatial Change Patterns with Socioeconomic Impacts → Identify Vulnerable Zones
8. **Outputs** →Shoreline Change Maps • Impact Graphs • Vulnerability Hotspot Maps • Policy Insights

Results: Shoreline Dynamics (1986 -2024)

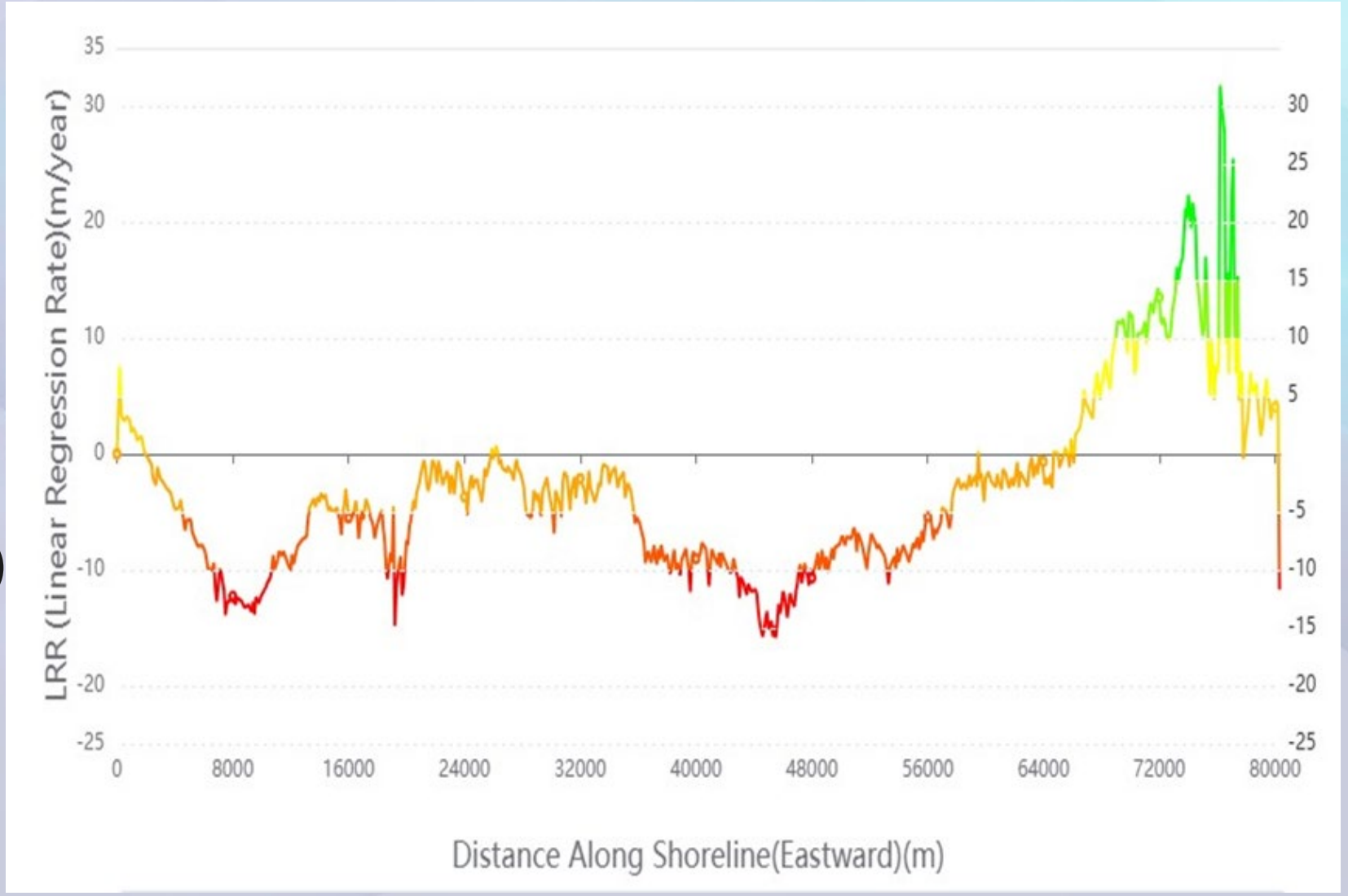
81% showing erosion,

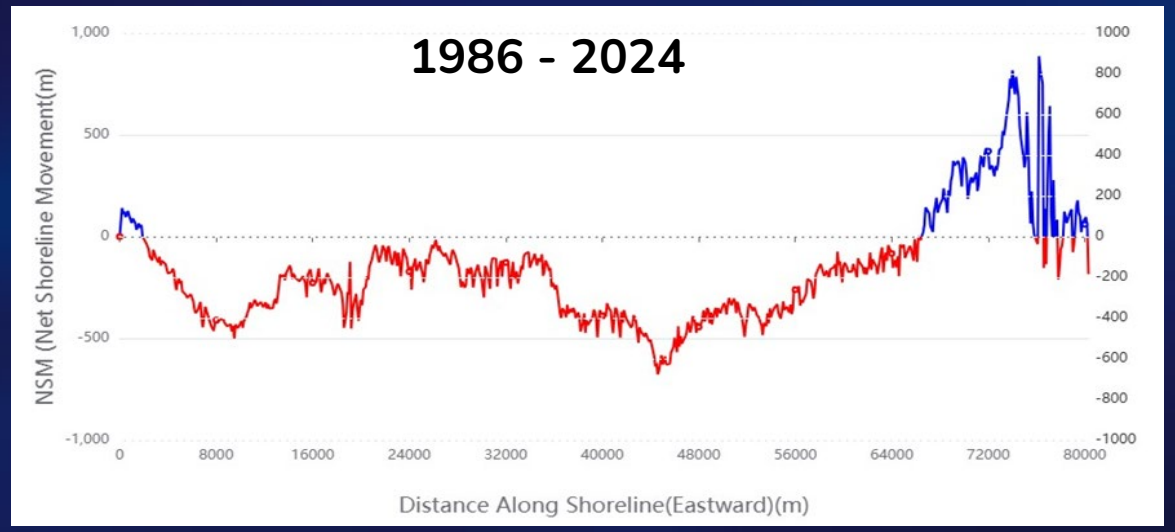
LRR of -3.11 m/yr.

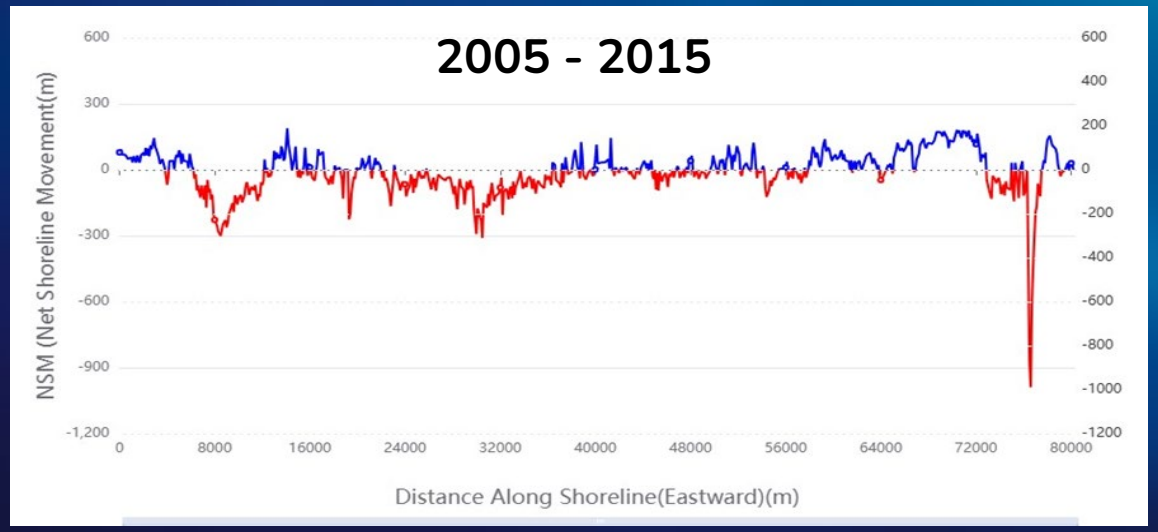
Mean shoreline retreat of -166.24

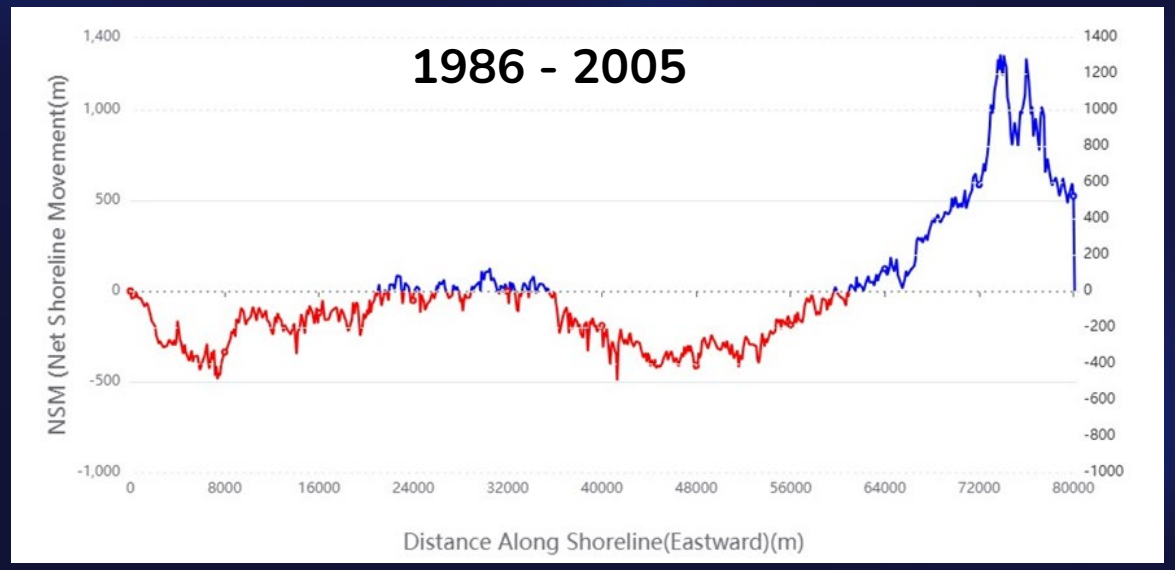
Mean Erosion Rate:-5.59m/yr. (EPR)
Mean Accretion Rate: +1.30m/yr.

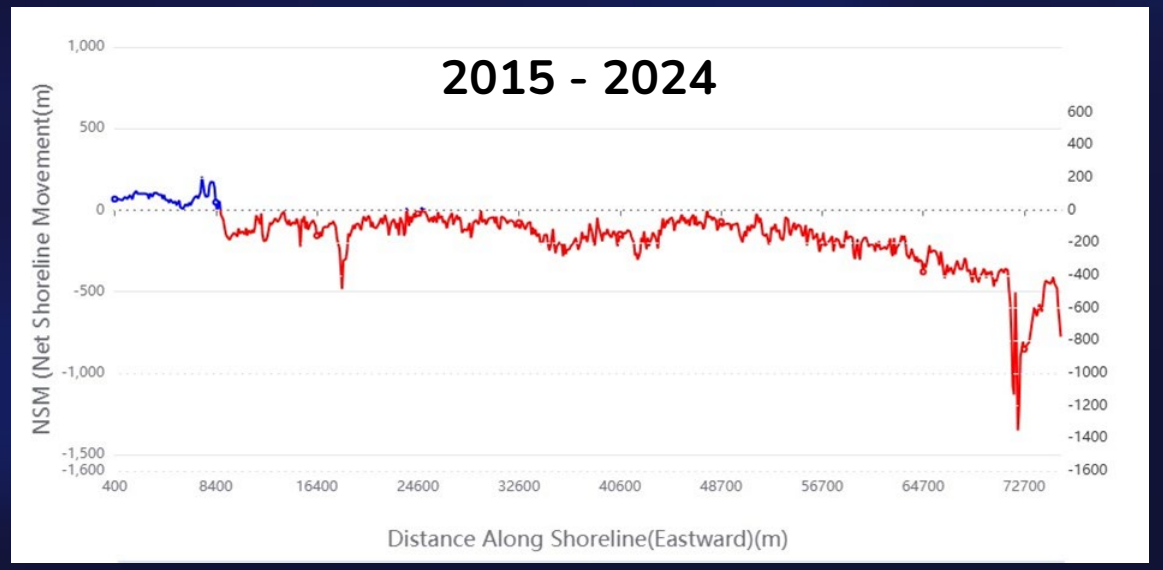
Mean EPR: -4.30m/yr.











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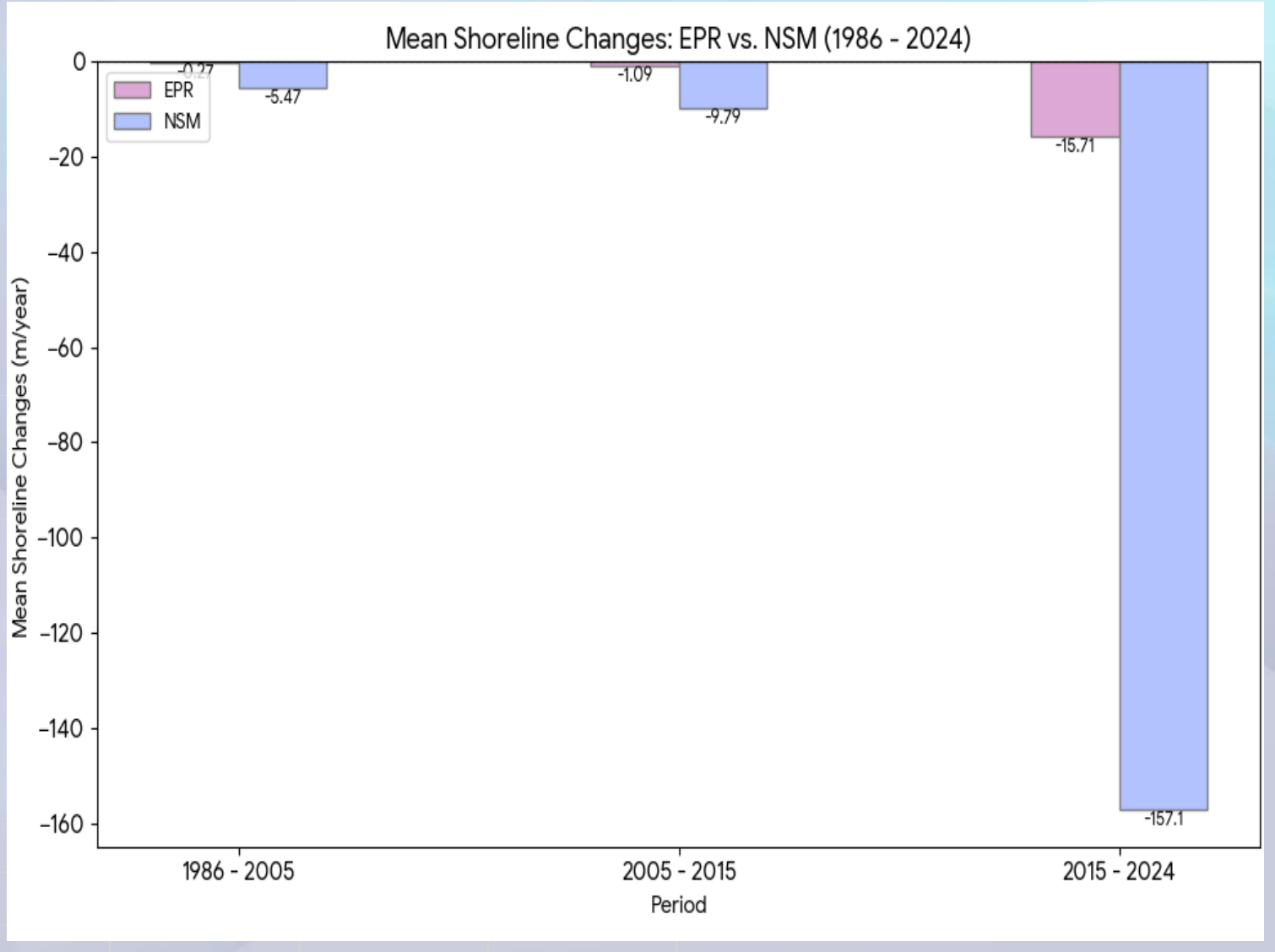
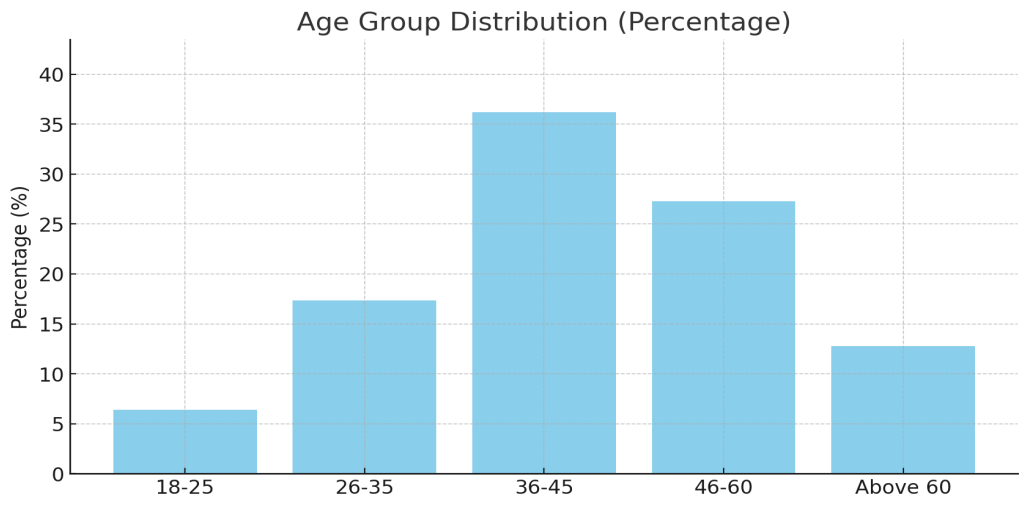
Results

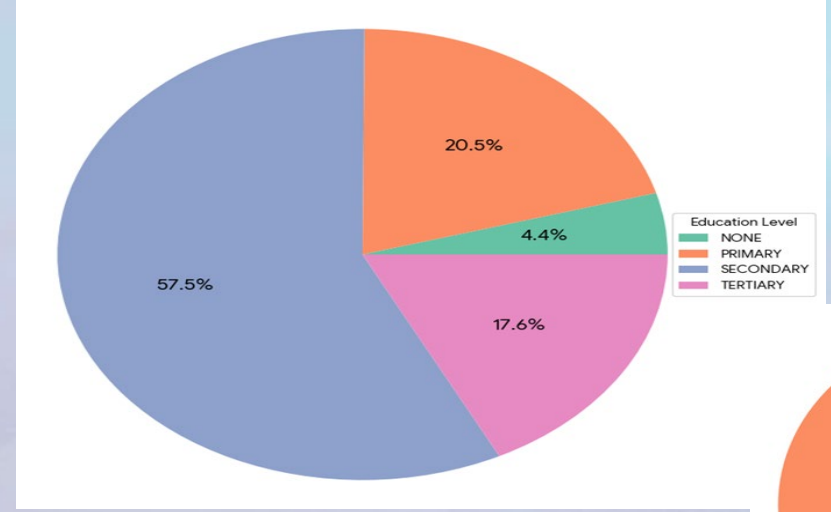
Mean Shoreline Change per period

Period	EPR (m/year)	NSM (m/year)
1986 - 2005	-0.27	-5.47
2005 - 2015	-1.09	-9.79
2015 - 2024	-15.71	-157.12

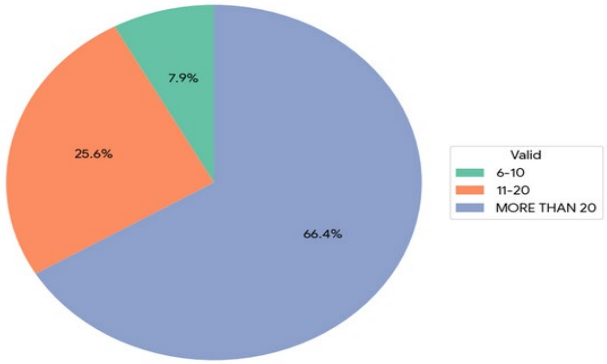


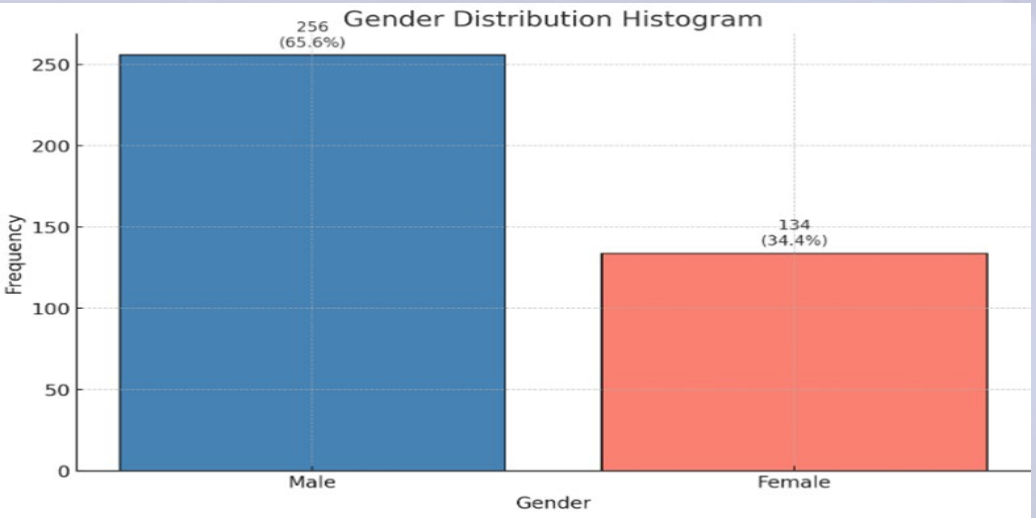
Results: Socioeconomics (Demographics).

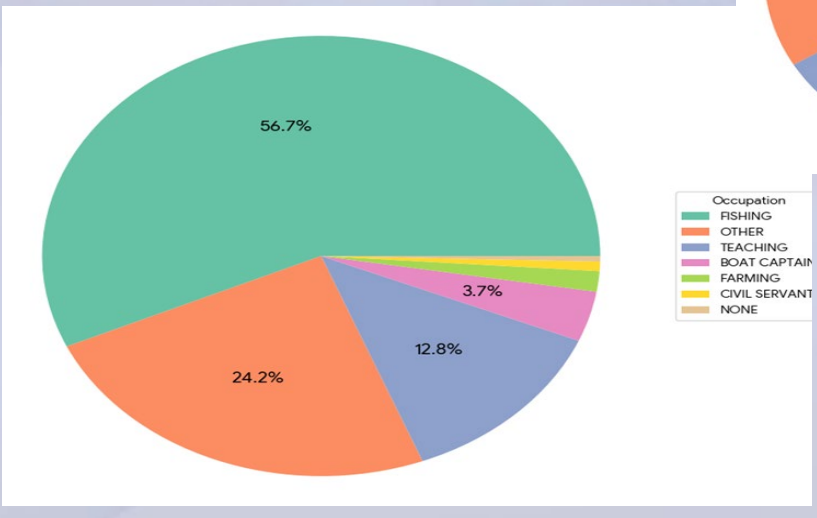




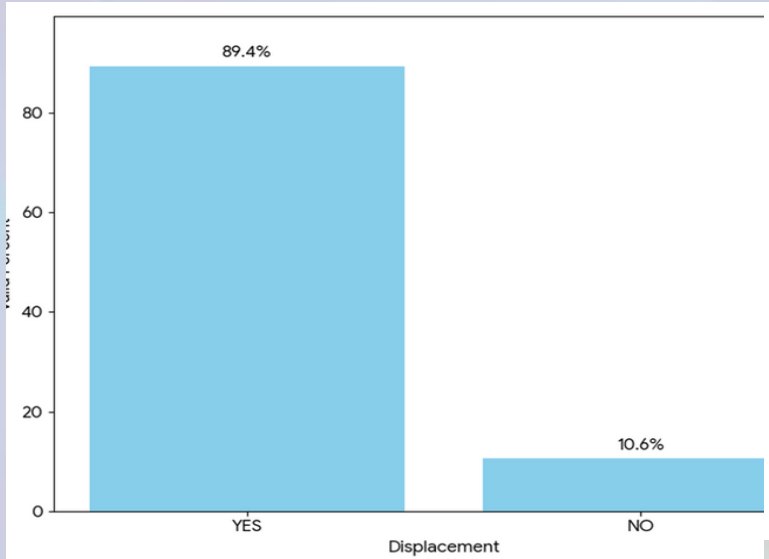
Length of stay(yr.)

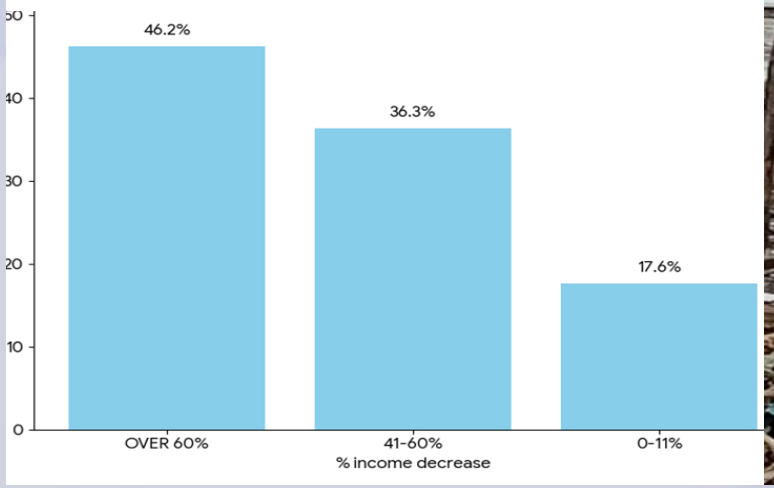


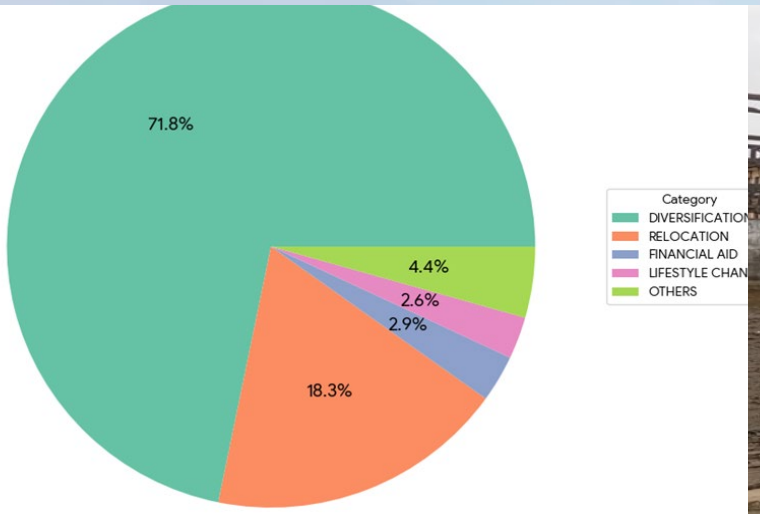




Human impacts of shoreline change in Ondo coastal communities







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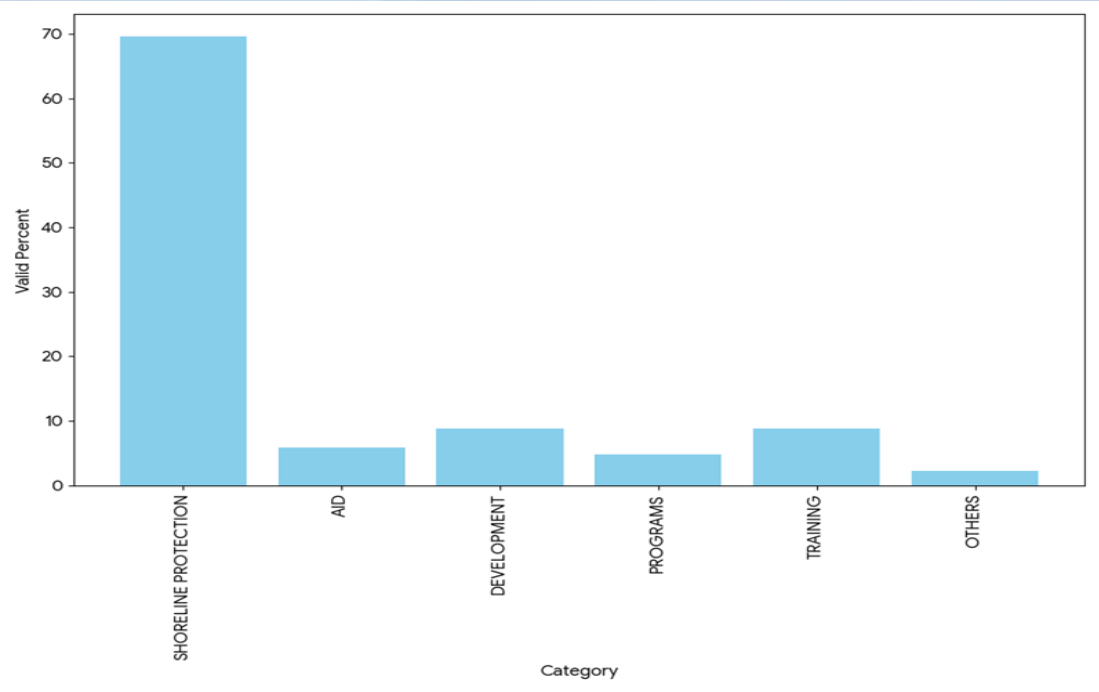
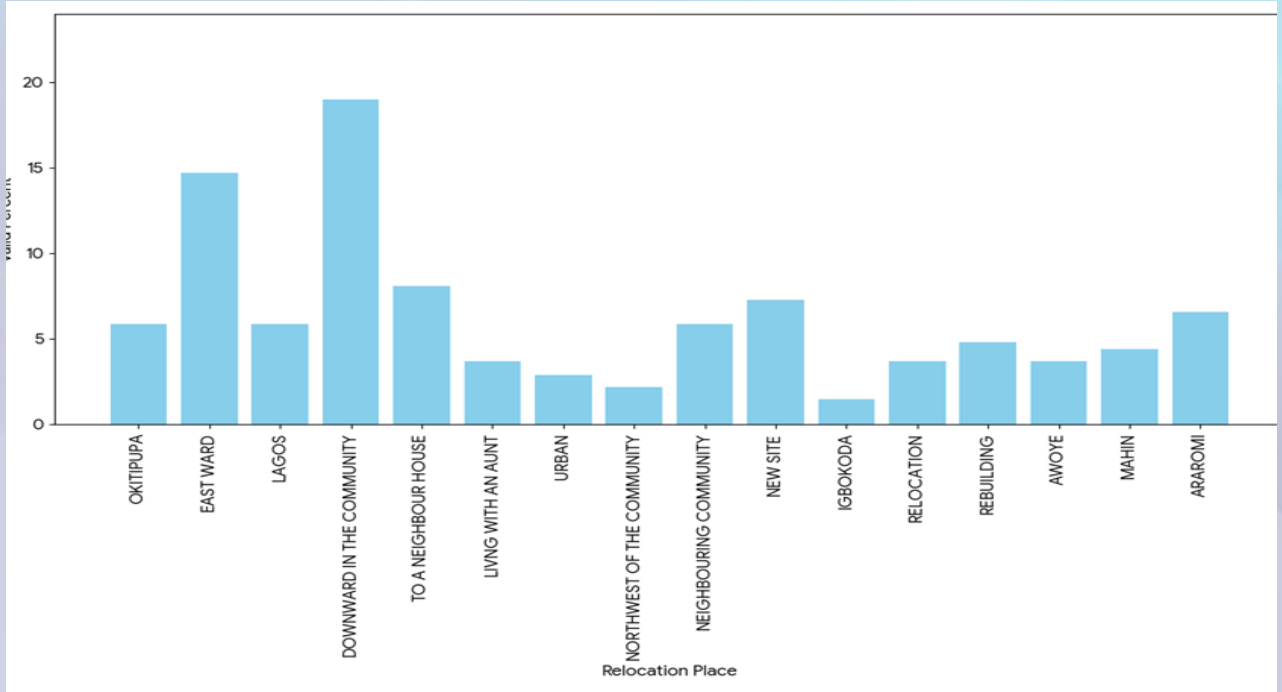
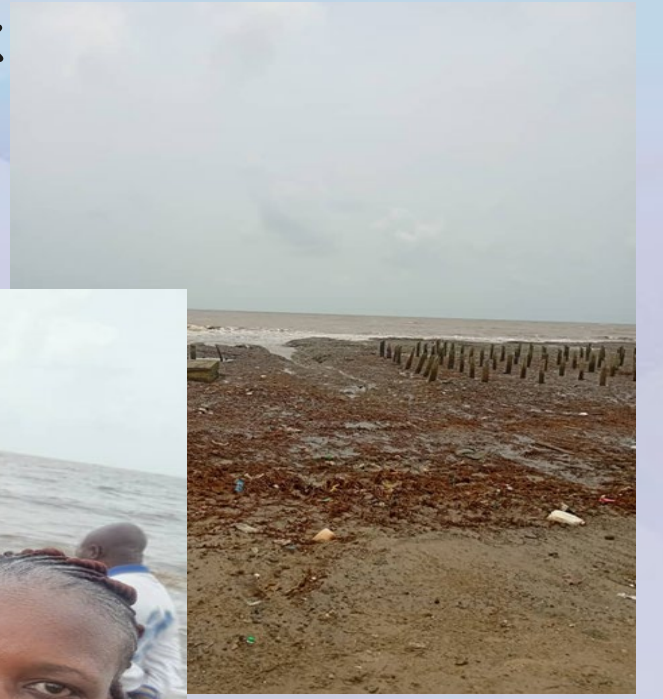
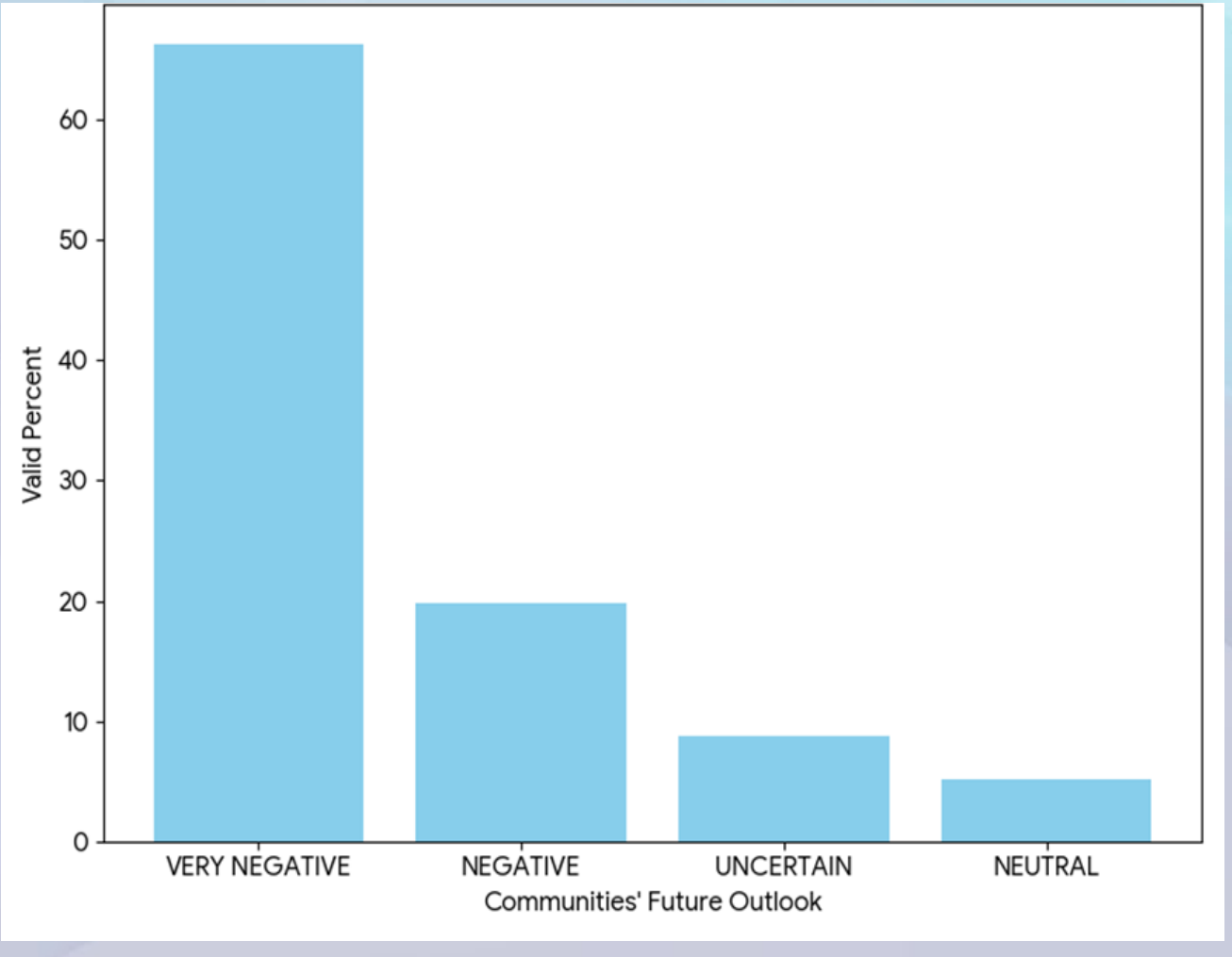
Socioeconomic Impacts: Displacements





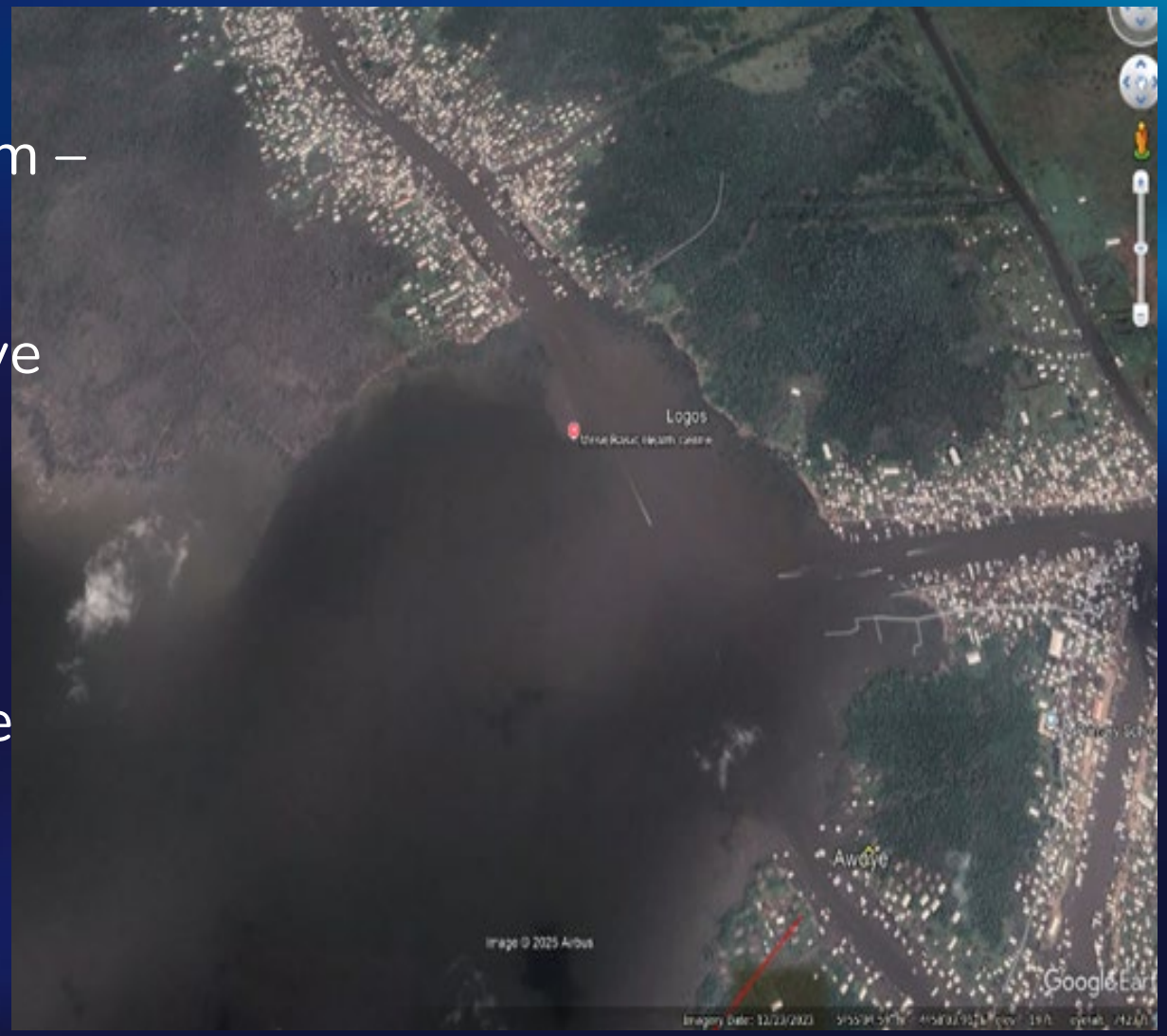
Socioeconomic Implications: : Communities' Future Outlook

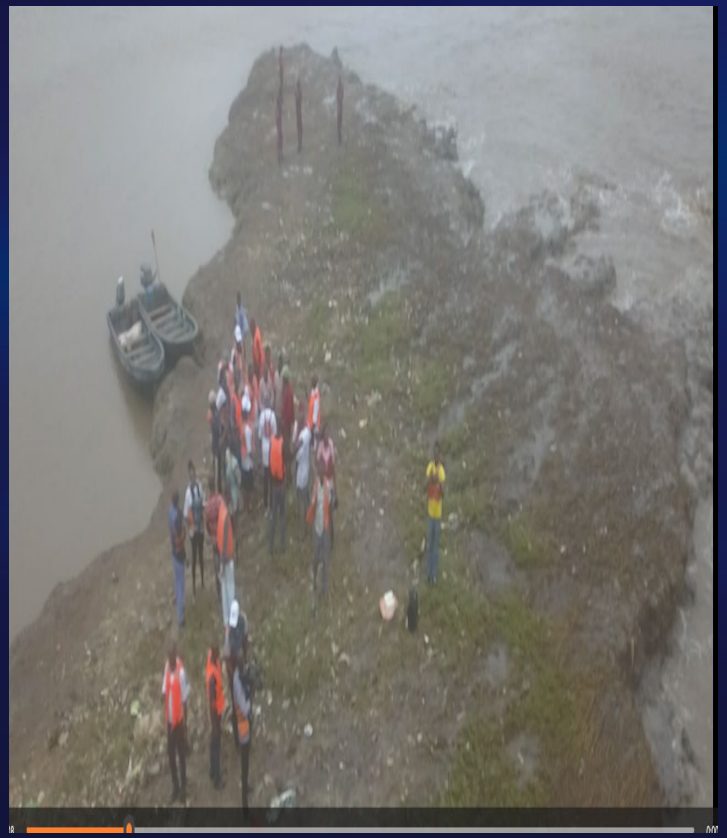




Discussion and Policy Implications

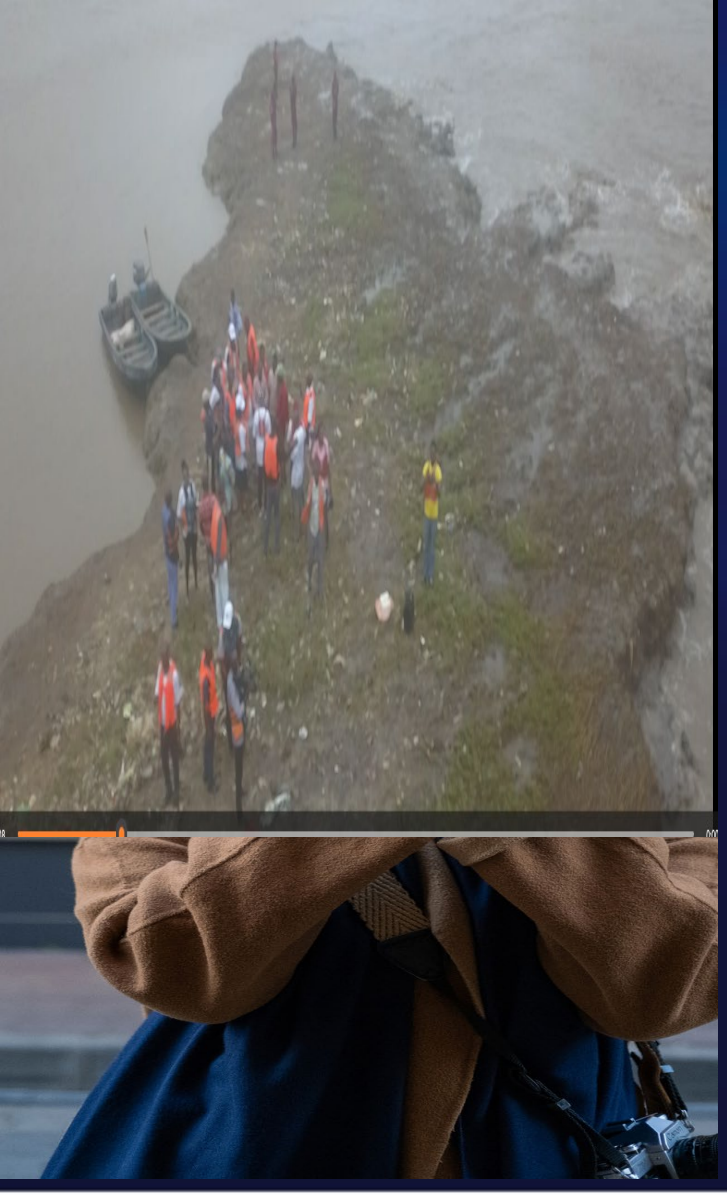
- Erosion going from episodic to chronic: from –0.27 m/yr. to –15.71 m/yr.
- Communities Future Outlook: >80% believe negative outlook.
- Relocation Place: within same community, strong ties to ancestral land.
- Expected Intervention: 70% need shoreline protection.
- Overall Insights: High Vulnerability, limited adaptive capacity, integrated coastal management.





Conclusions

- Dynamic Coastline: Western accretion vs. severe, accelerating eastern erosion—now chronic, large-scale shoreline loss
- Accelerated Retreat: EPR worsened from –0.27 → –9.23 → –15.71 m/yr. (1986–2024).
- Ecological Decline: Vegetation loss, wetland conversion, mangrove degradation, and weakened natural defences.
- Socioeconomic Fallout: Livelihood collapse, displacement, salinity intrusion, income decline—worst in the Ayetoro–Awoye corridor; urgent need for integrated coastal governance.



Recommendations: Technical, Policy & Environmental Actions

- 🌍 Integrated Coastal Management
- 🛰️ Continuous Monitoring (DSAS, Satellite Data)
- 🤝 Institutional Collaboration — NDDC, OSOPADEC, FG, Academia, Communities
- 🏗️ Sustainable Land Reclamation
- 🔁 Focus on Long-Term Resilience

Acknowledgements

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🎓 Academic Guidance

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🌊 Community Contribution

Appreciation to the Ondo State coastal communities for their cooperation, insights, and participation, which greatly enriched this study.

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