Phase 1: Project Setup and Research Foundation (August 2025)

Week 1-2 (August 1-15, 2025)

Literature Review:

- Conduct a comprehensive review of academic papers, reports, and news articles on sand exploitation in Indonesia, focusing on environmental impacts and measurement methods.
- Key sources: ResearchGate articles on sand market analysis, Mongabay reports on sea sand exports, and UNEP reports on sand sustainability.
- **Output**: A literature review document summarizing findings, gaps, and methodologies.

Data Source Identification:

- Identify datasets such as Sentinel-2 satellite imagery, Landsat data, and government environmental reports.
- Explore tools like QGIS, Google Earth Engine, and machine learning models for remote sensing analysis.
- Output: A list of data sources and tools with availability details.

Collaborator Contact:

- Reach out to experts at institutions like University of Indonesia, Prof. Dodi Sudiana.
- Contact BMKG, BRIN, BPS in Indonesia.
- Output: A list of potential collaborators and initial correspondence.

Research Proposal:

- Draft a proposal outlining objectives, methodology (remote sensing, field surveys, data analysis), and expected outcomes.
- Output: A draft research proposal.

Phase 2: Data Collection and Analysis (August 16 - September 30, 2025)

Week 3-4 (August 16-29, 2025)

Data Acquisition and Preprocessing:

- Acquire satellite imagery (e.g., Sentinel-2, Landsat-8) for known sand exploitation sites in regions like Riau, Sulawesi, and Batam.
- Collect historical records and environmental reports from government agencies or NGOs.
- Preprocess data (e.g., normalize spectral bands, remove cloud cover) using tools like Google Earth Engine.
- **Output**: A preprocessed dataset ready for analysis.

Week 5-6 (September 1-15, 2025)

Field Surveys and Remote Sensing Analysis:

- Conduct field surveys at accessible sites (e.g., Riau or Sulawesi) to validate satellite data, measuring area, depth, and vegetation loss.
- Use remote sensing to map affected areas, employing techniques like NDVI (Normalized Difference Vegetation Index) for tree loss and InSAR for land subsidence.
- **Output**: Maps of affected areas and preliminary damage estimates.

Week 7-8 (September 16-30, 2025)

Data Analysis: Quantify environmental damage

- Estimate tree loss.
- Measure land height decrement analysis.
- Predict climate impacts (e.g., flooding risk) using environmental models.
- Use machine learning (e.g., random forest, CNNs) to enhance analysis accuracy.
- **Output**: Preliminary results, including damage estimates and climate predictions.

Phase 3: Methodology Development and Validation (October 2025)

Week 9-10 (October 1-15, 2025)

Methodology Development:

- Develop a standardized methodology for monitoring sand exploitation impacts, including protocols for data collection (satellite imagery, field surveys), analysis (remote sensing, ML), and reporting.
- Incorporate best practices from UNEP and USGS reports on sustainable sand management.
- **Output**: A detailed methodology document.

Week 11-12 (October 16-31, 2025)

Methodology Validation:

- Conduct pilot studies or simulations to test the methodology on a subset of data.
- Validate results with expert feedback from collaborators or peer review.
- **Output**: A validated methodology ready for broader application.

Phase 4: Reporting and Publication (October Onwards 2025)

Week 13-14 (November 1-15, 2025)

Report Compilation:

- Compile findings into a comprehensive report, including maps, damage estimates, methodology, and policy recommendations.
- Ensure the report meets academic standards for clarity and rigor.
- **Output**: A draft research paper.

Week 15 (November 16-30, 2025)

Paper Finalization and Submission:

- Finalize the research paper, ensuring accurate citations and adherence to journal/conference guidelines.
- Submit to suitable venues, such as:

  Journals: Environmental Science and Pollution Research, Journal of Coastal Research.

  Conferences: International Conference on Environmental Science and Technology, Asia-Pacific Conference on Sustainable Development.
- **Output**: A submitted research paper.