PRELIMINARY GIS BASELINE ANALYSIS FOR THE PREPARATION OF AN UPDATED REGIONAL ACTION PLAN FOR THE NIGER DELTA

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I. Background:

The Niger Delta located in southern Nigeria is comprised of nine multi-cultural States with a population of approximately 30 million (Ondo States, Edo, Delta, Bayelsa, Rivers, Abia, Imo, Akwa-Ibom, Cross Rivers). The major economic activities in the region include oil & gas exploration and exploitation, as well as fishing, shipping, agriculture, timber logging, sand-mining and tourism[1]. Oil and gas have been the backbone of the Nigerian Economy for many years, contributing significantly to its foreign exchange earnings and budgetary revenues[2]. Fishing is also a major activity especially in coastal areas, as inland rivers, creeks, estuaries and coastal aquatic resources are exploited by artisanal and industrial techniques, and in combination with farming is the mainstay of the local population and contributes to the food and protein demand of Nigeria and neighboring countries.

The Niger Delta region over the years has experienced geographical economic disparity as a result of the disproportionality between the level of socio-economic development and the vast wealth derived from oil and gas exploration and exploitation in the region. This inequality in addition to pollution and environmental degradation caused by anthropogenic factors such as unsustainable oil extraction practices has inhibited the livelihood of indigenes (farming and fishing), aggrieved indigenes and triggered unrest in the region. As a consequence, the Federal government initiated several responses to address the development challenges of the region; including (i) the Niger Delta Basin Development Board (1965), (ii) the Oil Minerals Producing Areas Development Commission (1992), (iii) the Niger Delta Development Commission (2000), and (iv) Ministry of Niger Delta Affairs (2008). Also, the Presidential Amnesty Program (PAP) was institutionalized in (2009), to contribute to security stabilization in the Niger Delta through the disarmament, demobilization, rehabilitation and sustainable reintegration of ex-militants as a precondition for medium and long-term development in the region[3]. The overarching mandate of these agencies are (i) facilitate the rapid, even and sustainable development of the Niger Delta region, to attain economic prosperity, social stability, ecological regeneration and political peace; and (ii) formulate and execute plans, programs and other initiatives aimed at fast-tracking the development of the Niger Delta Region. Other stakeholders such as civil society organizations have also ventured to prepare plans to inform development in the region[4].

The Intervention of these agencies have been largely guided by strategic plans and policies such as the Niger Delta Action Plan (2012), Niger Delta collaborative development framework – a conceptual working paper (2010), Niger Delta Technical Committee Report (2008), and the Niger Delta regional development masterplan (2004), focused on the enhancing of the region's economy, physical infrastructure, human resources, and preservation/reclamation of the natural environment. Nonetheless, the development of these plans was mostly based on qualitative and quantitative analysis, stakeholder consultations and assessment on the economic, social, civic, infrastructural and environmental conditions of the region to deliver recommendations, with limited information on the distribution of persons in relation to social services and infrastructures. Furthermore, although the Niger Delta Regional Development Masterplan (NDRDMP) stated that its implementation will be supported by geographic information systems (GIS), the masterplan presented no clear strategy on how it will be achieved.

In 2016, the New Vision for the Niger Delta (NEVIND) was launched by President Muhammadu Buhari, to drive his Peace, Security and Development Agenda for the Niger Delta region of Nigeria. The New Vision for the Niger Delta

[1] Olayiwola A. G., 2010. Sustainable Transport Planning in the UK-Adaptation to Nigeria's Transport Planning policies. Journal of Applied Sciences Research. http://www.aensiweb.com/old/jasr/jasr/2010/543-558.pdf.

[2] Mmom, P.C. and Chukwu-Okeah, G.O., 2011. Factors and Processes of Coastal Zone Development in Nigeria: A Review, Department of Geography and Environmental Management, University of Port Harcourt, Nigeria.

[3] Francis et al., 2011. Securing Development and peace in the Niger Delta: A Social and Conflict Analysis for Change. Woodrow Wilson International Center for Scholars, the United States of America.

[4] Niger Delta Development Framework, 2017. The future in our hands, A state-led framework for planning and development in the Nigeria Delta: https://pindfoundation.org/niger-delta-development-forum-nddf-2017-a-state-led-framework-for-planning-development-in-the-niger-delta/.

was launched following engagements with leaders and representatives of the region, under the aegis of the Pan Niger Delta Development Forum (PANDEF). Initiative driven by the NEVIND include i) Increased Budgetary Allocation (to NDDC and MNDA), ii) Infrastructure (Investment in Ibaka Deep Sea Port, Investment in Bonny-Bodo Road Project, and Export Processing Zone (EPZ) in Delta State); iii) Ogoni Cleanup, iv) Modular Refineries, v) and vi) Presidential Amnesty Programme (PAP).[5]

The Niger Delta Action Plan is due for an update, and the Ministry of Niger Delta Affairs seeks a preliminary baseline analysis based on the best publicly available global geospatial datasets and open source tools. The expected output is a package of geospatial solutions, maps, data visualizations and projections that will form an integral part of the updated Niger Delta Action Plan - the blueprint for the future and long-term development of the region.

Incorporating GIS into the planned update of the Niger Delta action plan will provide the MNDA and other stakeholders with the positional elements required to understand spatial inequality, disproportionality in access to social services and critical infrastructure such as education, health care, water supply, sanitation, and hygiene (WASH), transportation, electricity, etc., as well as provide a framework for continuous monitoring and evaluation (M&E) of investments and interventions against baselines and expected results across various sectors and localities. This spatial approach will provide the additional benefit of enabling effective M&E, as well as reducing spatial inequality of social services and critical infrastructure in the region through objective data-driven decision making. For instance, this approach would go beyond blank statements embedded in previous plans, such as "establish schools and hospitals" to identify where schools exist and where expansion is needed due to the growing young population; "environmental protection and conversation" to undertake multi-hazard analysis to identify areas most susceptible to environmental and climatic shocks and stresses; "extension of energy to rural communities" to assessing the energy needs of rural areas based on the growing population, industry/business and transmission network and evaluate options based on the energy potential from solar, wind, etc.; and "improvement of security of lives and property" to delineating crime and violence hotspots and undertaking trend analysis to guide interventions.

II. The objective:

The objective of this assignment is to source and apply the best publicly available global geospatial and quantitative open-access datasets to establish preliminary demographic, socio-economic, political, infrastructural, environmental, climatic and other relevant sector-specific baselines for the Niger Delta region, as well as available projection upon which the updated regional action plan can be based. The output of this assignment shall provide the foundation to develop a technical, economically feasible, socially/environmentally sustainable and resilient action plan for the development and prosperity of the Niger Delta region.

III. Methodology

The data for this study comes from secondary sources. Before data collection began, an extensive literature review and search for existing freely and readily available geospatial and quantitative data was undertaken and documented. Raw data, as well as data developed from previous research and analytical work are used. Data was sourced at global, national and regional scales, then down-scaled to regional levels using GIS procedures (e.g. clipping, zonal statistics, or re-classification) for spatial datasets and descriptive statistics for quantitative data (i.e. mean or sum) derived using pivot tables and plots. Where direct indicative data are not available proxies are used. Data gaps are also identified and noted. The most recent data for10 sectors/areas of interest as considered in this study, including 1. Administrative, 2. Population and demographics, 3. Economic development, competitiveness and growth, 4. build form, 5. Environment and climate, 6. security - conflict and restiveness, 7. Social services, 8. social vulnerability and physical exposure to geophysical risk, 9. Development indication, and 10. Interventions.

[5] New Vision for the Niger Delta: https://statehouse.gov.ng/policy/economy/new-vision-for-the-niger-delta/

IV. Baseline data for various sectors in the Niger Delta Region

1. Overview of the Niger Delta Region

1.1. ***Administrative***: The Niger Delta region is located in the southern part of Nigeria, bordered by the Atlantic Ocean to the south and Cameron to the East. The region occupies a land area of 112,110 square kilometers (see Table 1A for land breakdown by State), approximately 12% of the total land area of Nigeria.

The region is comprised of nine states including Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo and Rivers (See Figure 1A), and 11,476 settlements (94% of these have populations less than 5,000).

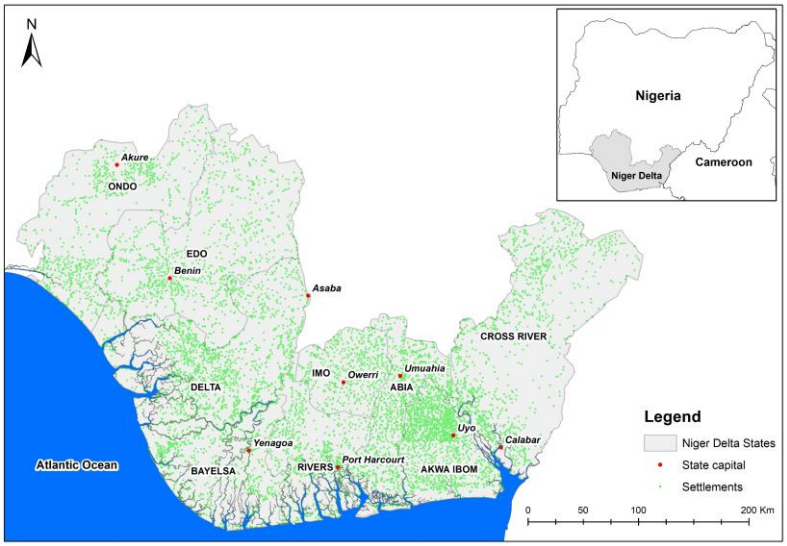

Figure 1A: Administrative map of the Niger Delta States and capitals

State/Region	State Capital	Settlement	Land Area (sq.km)
Niger Delta		11,476	112,092
Rivers	Port Harcourt	1,538	10,378
Delta	Asaba	2,149	17,163
Imo	Owerri	568	5,165
Akwa Ibom	Uyo	1,570	6,806
Ondo	Akure	968	15,068
Edo	Benin	1,276	19,698
Cross Rivers	Calabar	1,436	21,930
Abia	Umuahia	801	4,877
Bayelsa	Yenagoa	1,167	11,007

Table 1A: State, Capital, Settlement[6] and Land area of Niger Delta[7]

[6] GRID3+ (Geo-Referenced Infrastructure and Demographic Data for Development): https://grid3.gov.ng/
[7] Niger Delta Regional Masterplan (Chapter 1): https://www.nddc.gov.ng/files/13/NDRMP%20Chapter%201

2. Population and Demographics

2.1. ***Population growth (projection):*** The estimated population of the Niger Delta region for 2020 projected from the 2006 population data based-on an annual percentage growth rate of 3.04 is 48.3 million. The population of the region is projected to reach 65 million by 2030 (See Table 2). Rivers and Bayelsa States are the most and least populated states respectively, with populations of 8.4, 2.5 million (2020); and 11.7, 2.9 million (2030) respectively.

Population density from GRID3+ database varies from 1 person per 100 metres in rural areas to 1030 persons per 100 metres in urban areas[8].

State/Region	2006	Annual % growth rate	2020	2025	2030
Niger Delta	31,277,901	3.04	48,271,216	56,380,477	65,862,883
Rivers	5,198,716	3.40	8,367,973	9,918,599	11,756,563
Delta	4,112,445	3.20	6,436,711	7,553,551	8,864,174
Imo	3,927,563	3.20	6,147,338	7,213,968	8,465,670
Akwa Ibom	3,902,051	3.40	6,280,831	7,444,700	8,824,239
Ondo	3,460,877	3.00	5,267,322	6,119,755	7,110,141
Edo	3,233,366	2.70	4,718,655	5,400,674	6,181,270
Cross Rivers	2,892,988	2.90	4,341,804	5,019,297	5,802,506
Abia	2,845,380	2.70	4,152,442	4,752,623	5,439,552
Bayelsa	1,704,515	2.90	2,558,140	2,957,312	3,418,769

Table 2A: Population Statistics, Niger Delta States[9]

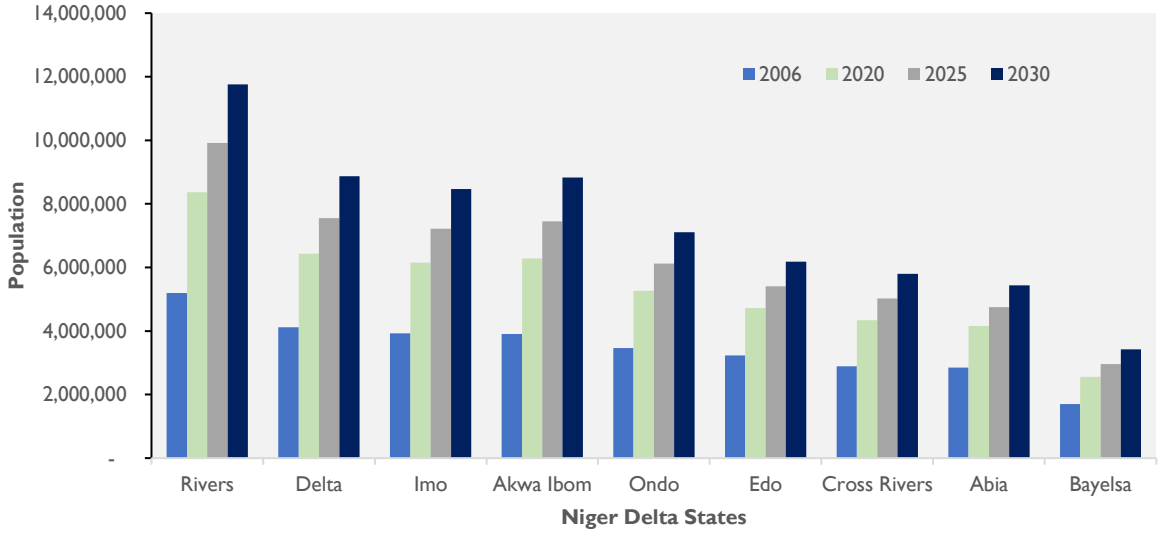

Figure 2A: Population and projection chart, Niger Delta States

[8] GRID3+ Population estimate: https://grid3.gov.ng/dataset/national-population-estimates/resources

[9] Nation Population Commission, 2006 population and projection by National Bureau of Statistics (NBS): /https://nigerianstat.gov.ng/download/474

2.2. ***Poverty and inequality***: The percentage of persons in the Niger Delta living on less than $2 varies from 0 to 90% from urban to rural area respectively (see Figure 2Ba).

Disaggregated local government area (LGA) level data shows mean % of persons living on $2 ranges from 50 to 80%, with Ekeremor (Bayelsa) and Aba North (Abia) identified as the most and least poor LGAs respectively (See Figure 2Bb).

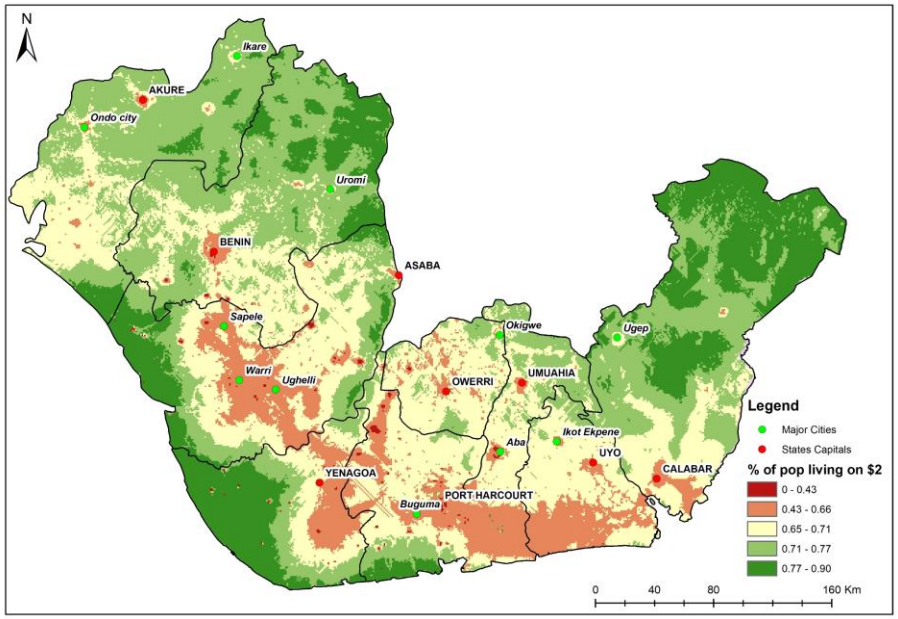

Figure 2Ba: Proportion of population living on $2[10]

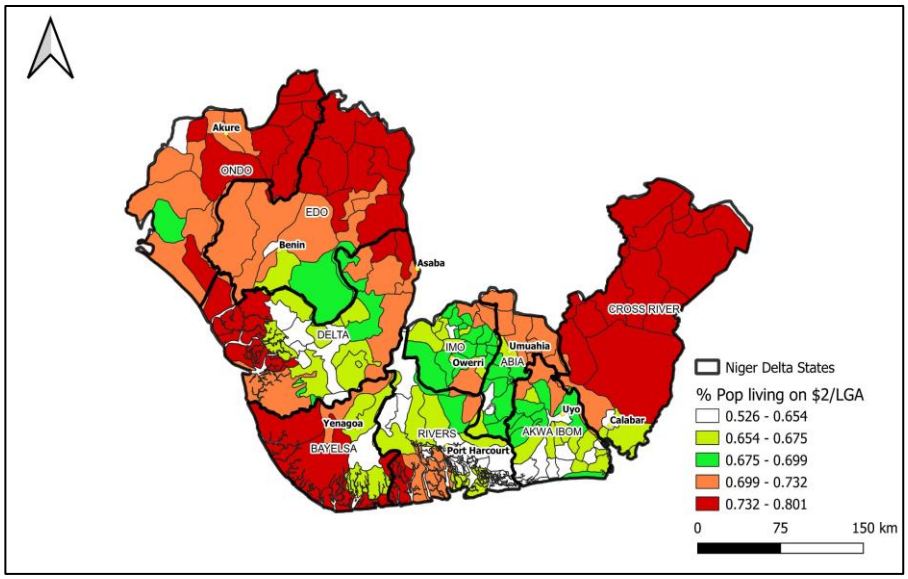

Figure 2Bb: Proportion of population living on $2 by local government area[8]

[10] Tatem AJ, Gething PW, Bhatt S, Weiss D and Pezzulo C (2013) Pilot high resolution poverty maps, University of Southampton/Oxford. DOI: 10.5258/SOTON/WP00200

Poverty and income inequality indicators for the Niger Delta region are lower than national estimates, especially for urban areas (Table 2B and Figure 2C).

Poverty Head Count (the percentage of the population living below the national poverty lines) ranges from 6.02 for Delta State to 36.29 for Cross Rivers State;

Poverty gap (the ratio by which the mean income of the poor falls below the poverty line) ranges from 0.94 for Delta State to 9.66 for Cross Rivers State;

Squared Poverty Gap index (Severity of poverty in each region) range from 0.2 for Delta State to 3.60 Cross Rivers State; and

Gini Coefficient (a measure of economic inequality in a population) ranges from 24.28 for Abia State to 31.78 Akwa Ibom State.

Federal and State	Poverty Headcount Rate	Poverty Gap Index	Squared Poverty Gap Index (Severity)	Gini Coefficient
Nigeria	40.09	12.85	5.63	35.13
✓ Urban	18.04	4.47	1.68	31.94
✓ Rural	52.10	17.42	7.78	32.77
Niger Delta	22.19	5.31	1.86	28.69
Abia	30.67	7.15	2.59	24.48
Akwa Ibom	26.82	7.25	2.74	31.78
Bayelsa	22.61	5.25	1.89	29.69
Cross River	36.29	9.66	3.60	30.68
Delta	6.02	0.94	0.21	29.84
Edo	11.99	2.90	1.01	29.52
Imo	28.86	6.89	2.35	27.24
Ondo	12.52	2.28	0.58	25.54
Rivers	23.91	5.46	1.73	29.47

Table 2B: Poverty and inequality Statistics, Niger Delta[11]

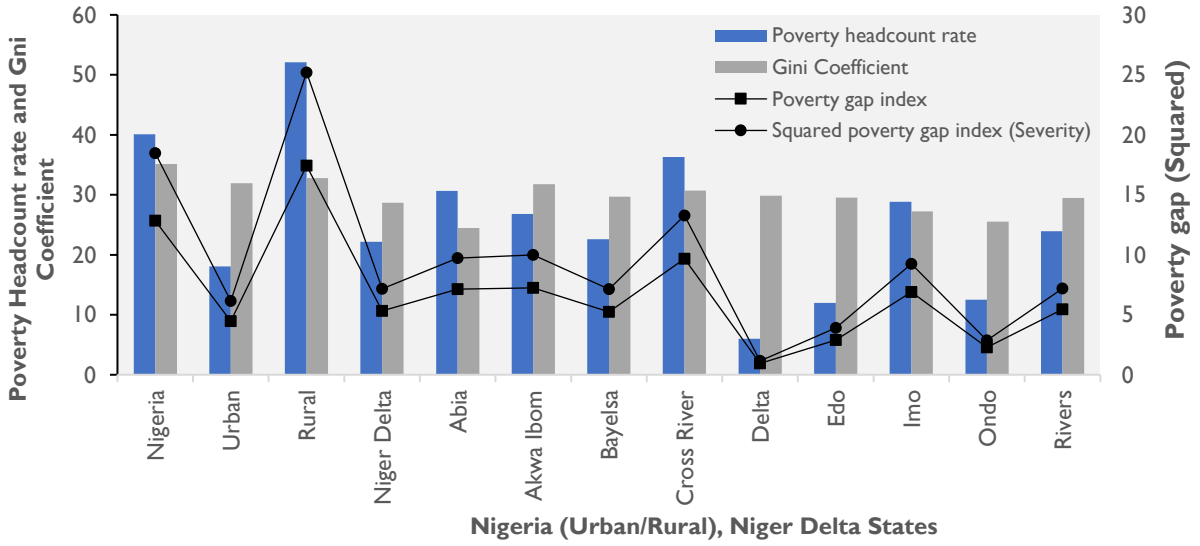

Figure 2C: Poverty and inequality plot for the Niger Delta States and Nigeria (urban and rural)

[11] Nigerian bureau of Statistics, 2020. Poverty and Inequality in Nigeria: Executive Summary: https://nigerianstat.gov.ng/download/1092

3. Economic development, competitiveness and growth

3.1. ***Gross Domestic Product (GDP)***: NBS state-level GDP analysis revealed that 7 Niger Delta states accounted for 22% of national GDP out of the 22 states considered from 2012 to 2017. During that period Niger Delta states experienced progressive GDP growth from ₦19 trillion in 2013 to ₦25 trillion in 2017, a 31% increase.

The industry is consistently been the highest contributing sector to the Niger Delta GDP in 2017 (51%), followed by Services (29%), and Agriculture (20%).

GDP data for Abia and Imo state GDPs are not considered in the summaries above and are reported to be estimated at ₦2.4 trillion and ₦ 2.3 trillion respectively[12].

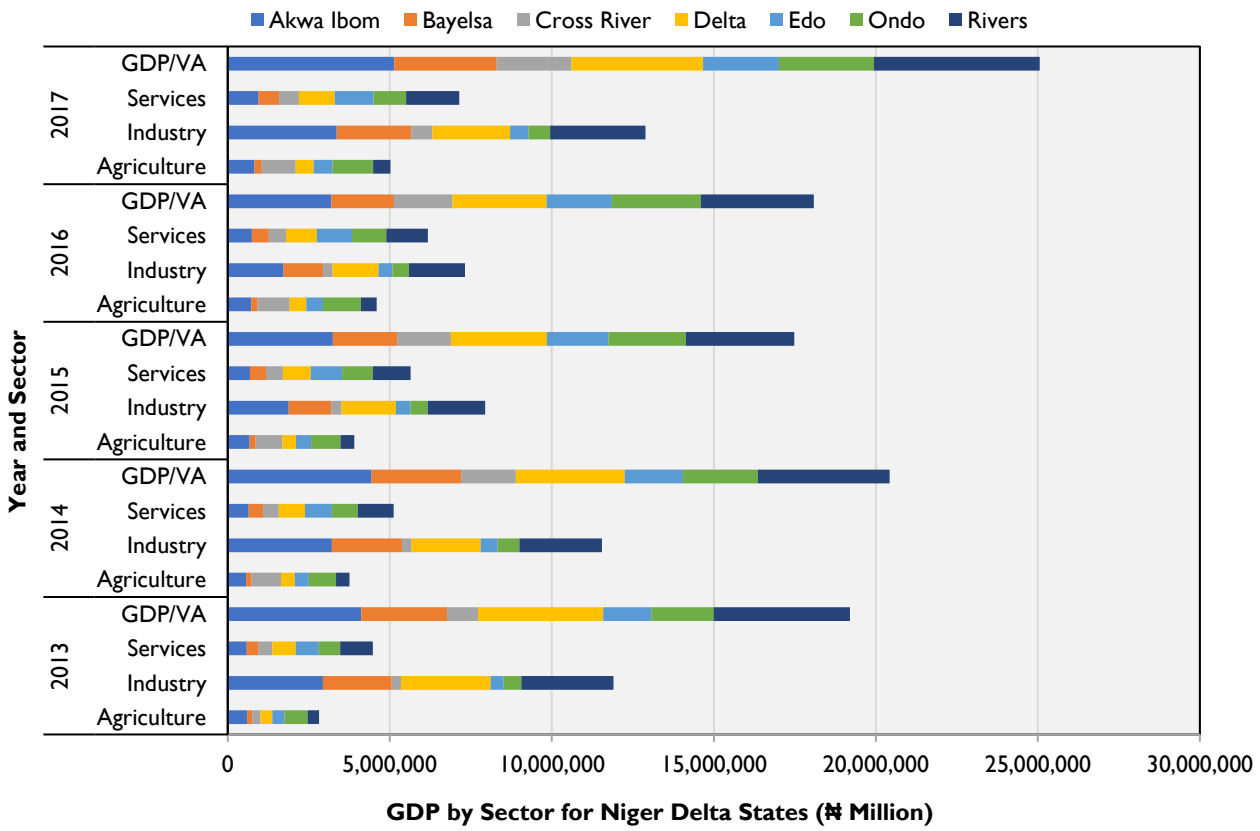

Figure 3A: GDP of 7 Niger Delta States and the contribution of various sectors[13]

[12]Other GDP references: https://en.wikipedia.org/wiki/List_of_Nigerian_states_by_GDP#cite_note-5

[13] Nigerian Bureau of Statistics, States Nominal Gross Domestic Product (2013-2017): https://nigerianstat.gov.ng/download/947

3.2. ***Economic Activity hotspots (Nighttime light imagery trend***): Much research has suggested that nighttime light (NL) can be used as a proxy for several variables, including urbanization, density, and economic growth, especially at sub-national regions of developing countries where disaggregated data from statistical offices are not available.

In 2015, visible Nighttime light (NL) hotspots are identified in 51 LGAs in the Niger Delta region, consisting of Abia (4), Akwa Ibom (5), Bayelsa (5), Cross River (3), Delta (9), Edo (6), Imo (4), Ondo (3), and Rivers (12). In 2017, 6 additional LGAs are identified, including Cross River (1), Bayelsa (1) and Delta (4); and in 2019, 2 LGAs are identified as economic hotspots Rivers (1) and Edo (1). In total 29 LGAs are identified using NL as economic hotspot locations in the Niger Delta region.

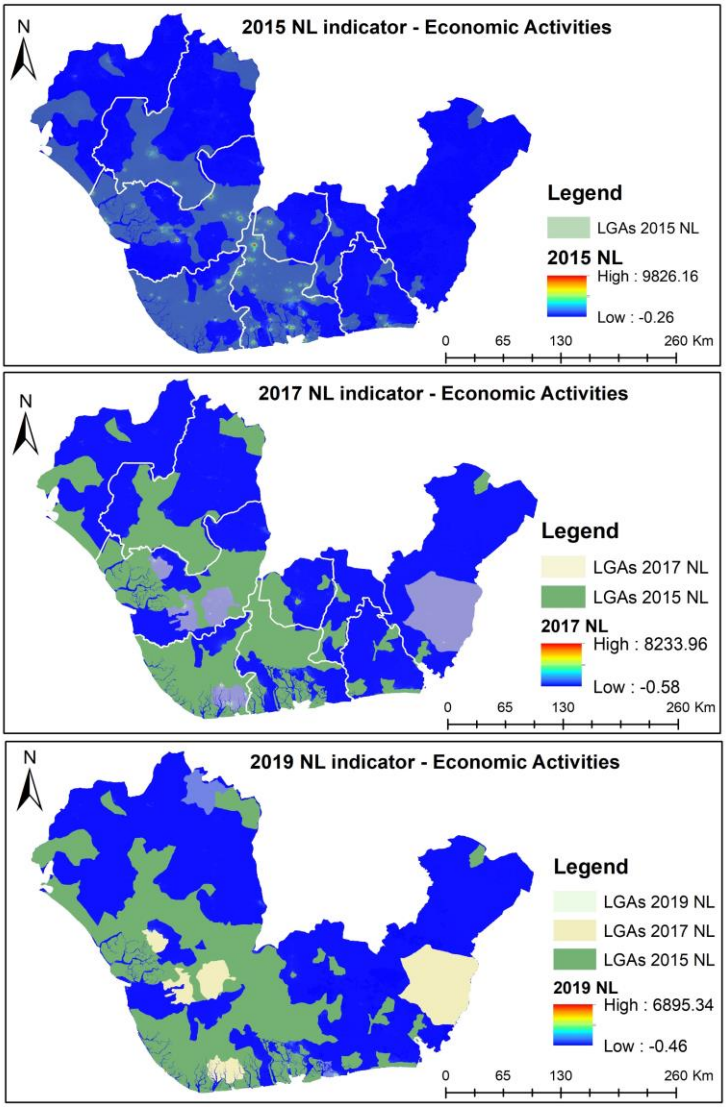

Figure 3B: Spatial Trend of Nighttime Light (NL) as an indicator for Economic Activities[14]

[14] Night Light (2015 - 2019): https://www.ngdc.noaa.gov/eog/viirs/download_dnb_composites.html#NTL_2015

3.3. ***Ease of doing business:*** Nigeria ranks 131 under the Global Ease of Doing Business index[15] that takes into account several indices such as the cost of starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts and resolving insolvency.

Figure 3C shows the ease of doing business indicators for states in the Niger Delta region. Rivers is the easiest state the start a business and Ondo the most difficult; Cross Rivers is the easiest state to get a construction permit and Rivers the most difficult; Delta is the easiest state to register a property and Cross Rivers the most difficult, and Edo is the easiest state to enforce a contract and Imo the most difficult. The average distance to frontier score (how far a location is from the best performance achieved by any economy on each Doing Business indicator) in the Niger Delta region based on the four indicators range from 51 (Rivers and Imo) to 58 (Bayelsa). The DTF score range from 0 to 100, with 100 representing the frontier of best practices (the higher the score, the better).

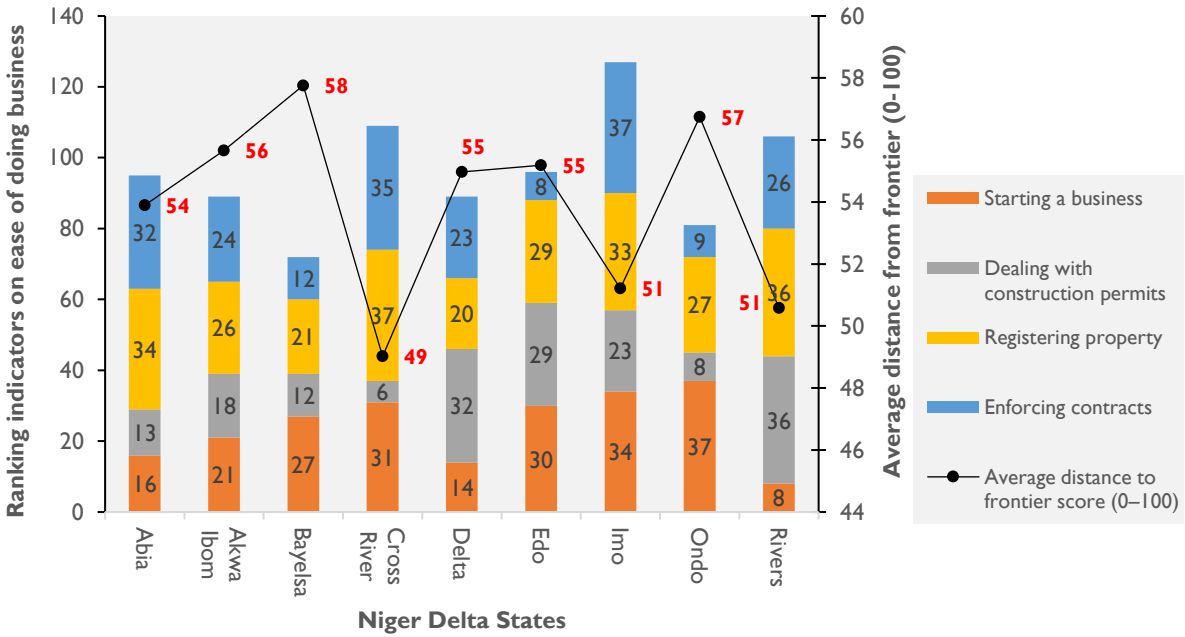

Figure 3C: Analysis and plot of ease of doing business indicators and ranking in the Niger Delta[16]

[15] Doing Business, 2019. Comparing Business Regulation in 190 Economies: https://www.doingbusiness.org/en/reports/global-reports/doing-business-2020
[16] Doing Business in Nigeria 2018: https://www.doingbusiness.org/content/dam/doingBusiness/media/Subnational-Reports/DB_in_Nigeria_2018_w-bookmarks.pdf

3.4. ***Connectivity and transport infrastructure (Seaport, Rail, Airport, road Network)***:

Air transport (Airports and Airstrips): The 7 major airports in the Niger Delta region include Akwa Ibom International Airport (Akwa Ibom), Akure Airport (Ondo), Port Harcourt International Airport (Rivers), Asaba International Airport and Osubi Airport (Delta), Margaret Ekpo International Airport (Cross River) and (Imo). The Bayelsa Cargo Airport (Bayelsa) was established in 2018. 10 Airstrips are also identified in the Niger Delta include Bebi Airstrip Obudu (Cross River), Escravos, Forcados and Oguni Airstrips (Delta), Exxon Mobil Airstrip (Akwa Ibom), IEPL Helipad and NLNG - Finima Airstrip and Helipad, Bonny, Nigeria Air Force Base (Rivers), Mazi Alex Otti Heliport (Abia), and Oselu Helipad (Edo).

Sea Port and terminals: The 4 main seaports in the region include Warri (Delta), Portharcourt and Onne (Rivers), and Calabar (Cross River). 22 other small ports and terminals are spread over the Niger Delta Region, including onshore terminals such as Sapele, Koko, Burutu, Forcados (Delta), Bonny and Okirika (Rivers). Railway networks heading north-east and north-west originate from Rivers and Delta Ports, respectively.

Rail lines and stations: Two rial lines origination from Delta and Rivers ports travel north-east and north-west respectively, with stations in Aba, Umuahia, Port Harcourt, Ivioghe, Uzanu and Agbor.

Road transport: Primary (9,126 Km), Secondary (5,133 Km), and other roads (36,440 Km) cross-cross the Niger Delta region. 40% of roads in the Nigeria Delta is reported to be in poor condition[5].

River network: major rivers provide a network to support river transport in the Niger Delta region. These including Nun (Bayelsa), Forcados (Delta), Silko (Ondo) Osse and Ossimino (Benin), Imo (Imo), Qua Ibeo (Akwa Ibom), and Cross (Cross River).

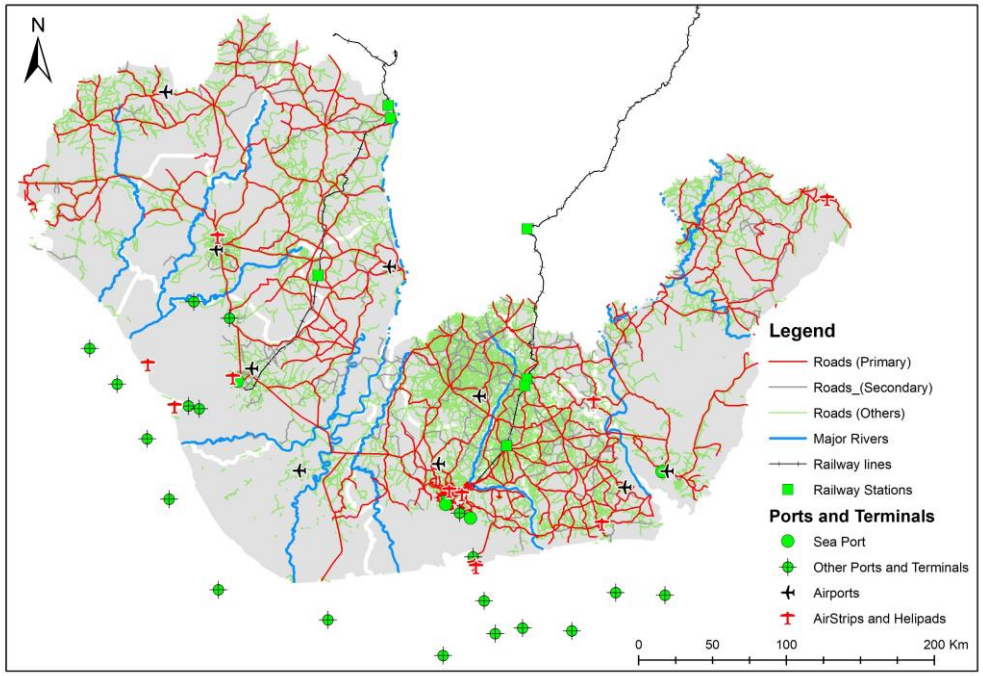

Figure 3D: Transportation and connectivity[17]

[17] OpenStreetMap, 2020: https://download.geofabrik.de/africa.html and World Bank GRIP (Global Roads Inventory Project) – 2018.

3.5. ***Industries and economic zones***: Industrial activities in the Niger Delta region is dominated by Palm oil (39%), Food/Agriculture (21), construction (19%) and Drinks/Water (5%) industries. Other activities including Oil and Gas, Steel, Timber, Rubber/ Plastic, Asphalt, Chemicals (Pint, Soap, foam), Aluminum and other accounted for 16% of all industrial activities (Figure 3Eb). Figure 3Ea shows the spread of industries in the region, with clusters in Imo, Abia and Cross River, as well as special economic and economic exclusive zones. The Niger Delta region is bordered by Nigeria's Economic Exclusive Zone to the south and holds 2 Special Economic Zones (Calabar Free Trade Zone, Cross River and Onne Oil & Gas Export Free Zone, Rivers).

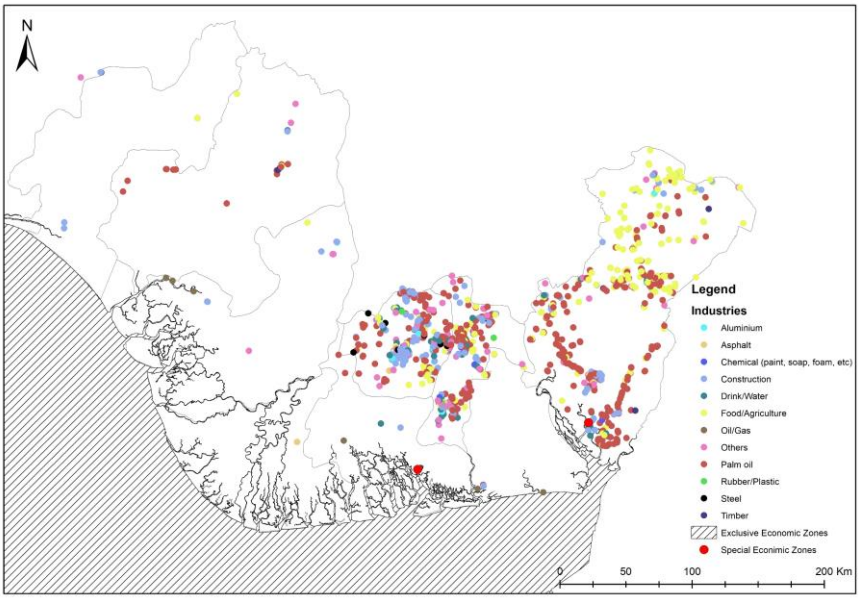

Figure 3Ea: Spatial distribution of industries[18]

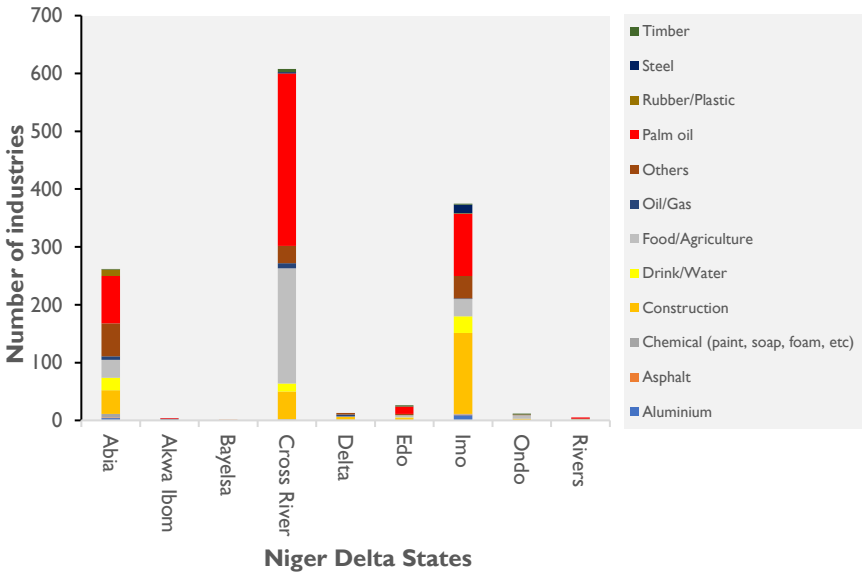

Figure 3Eb: Analysis and plot of number industry by classes and State

[18] GRID3+ (Geo-Referenced Infrastructure and Demographic Data for Development): https://grid3.gov.ng/

3.6. ***Oil and gas infrastructure, reserves and production***: Oil and gas is a key contributing sector to the Nigerian economy as it provides 95% of foreign exchange earnings and about 75% of budgetary revenues[19]. Figure 3Fa presents the distribution of oil and gas infrastructures:

- Oil, gas and condensate fields (397);
- Pipelines (oil, gas and condensate);
- CPF (central processing facility) (68);
- FPSO (floating production, storage and off-loading) (14);
- LNG (liquefied natural gas) (2) – Bonny, Rivers and Brass, Bayelsa,
- Refinery (3) – Eleme Petrochemical and Port Harcourt Refinery (Rivers), and Warri Refinery (Delta).

From 2006 to 2020 (Figure 3Fb), approximately 134 billion barrels of crude oil was produced in Nigeria (daily production multiplied by 365days), and at an average cost of $45/barrel during that period, $6 trillion could have been accrued.

Gas reserved in Nigeria progressively grew from 2000, reaching 200 trillion cubic feet in 2020. Gas production reached 3000 billion cubic feet, with 22% consumed and 31% exported (Figure 3Fc).

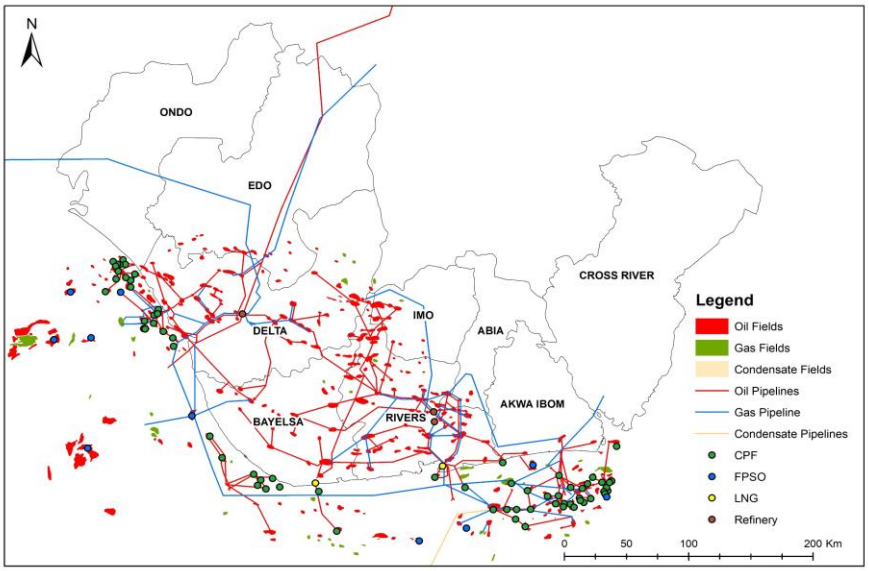

Figure 3Fa: Oil and Gas infrastructure network[20]

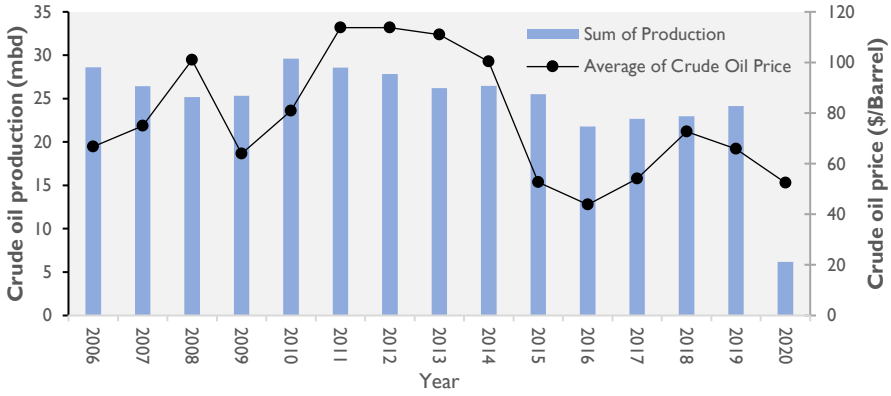

Figure 3Fb: Annual Crude oil production and cost per barrel[21]

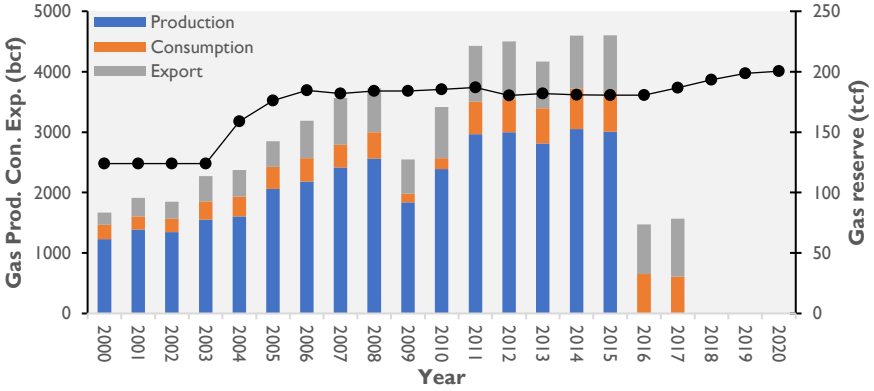

Figure 3Fc: Gas reserve, production, consumption and export[22]

[19] Mmom and Chukwu-Okeah, 2011: Factors and Processes of Coastal Zone Development in Nigeria: A Review, Department of Geography and Environmental Management, University of Port Harcourt, Rivers State, Nigeria.
[20] https://www.google.com/maps/d/viewer?mid=1ASj7EoDpSqVuZESDe2zJlPIoL-M&hl=en_US&usp=sharing.
[21] CBN, Crude oil production and price: https://www.cbn.gov.ng/rates/crudeoil.asp.
[22] US Energy Information Administration: https://www.eia.gov/international/overview/country/NGA.

3.7. ***Agriculture (products and processing areas)***: The Agricultural sector contributes to 20% of GDP and 31%of employment in the region. Figure 3Ea presents the spatial distribution of harvested area and yield for all crops cultivated in the Niger Delta region in 2017. 11 dominant crops are identified, and the cultivated area and yield per state is presented in Figure 3Eb. These include Fruits, Roots, Cereals, Vegetables, Plantain, Cocoa, Oil palm, Cassava, Yam, Maize, and Rice.

The total harvested area in the Niger Delta is estimated as 9,187,766 (Ha). Orhionmwon LGA, Edo, is the most harvested in region (241,034 (Ha)) and Akuku Toru, River the least harvested (1,566 (Ha)).

The average agricultural productivity in the Niger Delta region is estimated as 29,676 Kg/Ha. Akamkpa LGA, Cross River is identified as the most productive farming area in the Niger Delta, with an estimated total yield 39,4541 Kg/Ha, while Abia North LGA is the least productive are, with an estimated yield of 959 Kg/Ha.

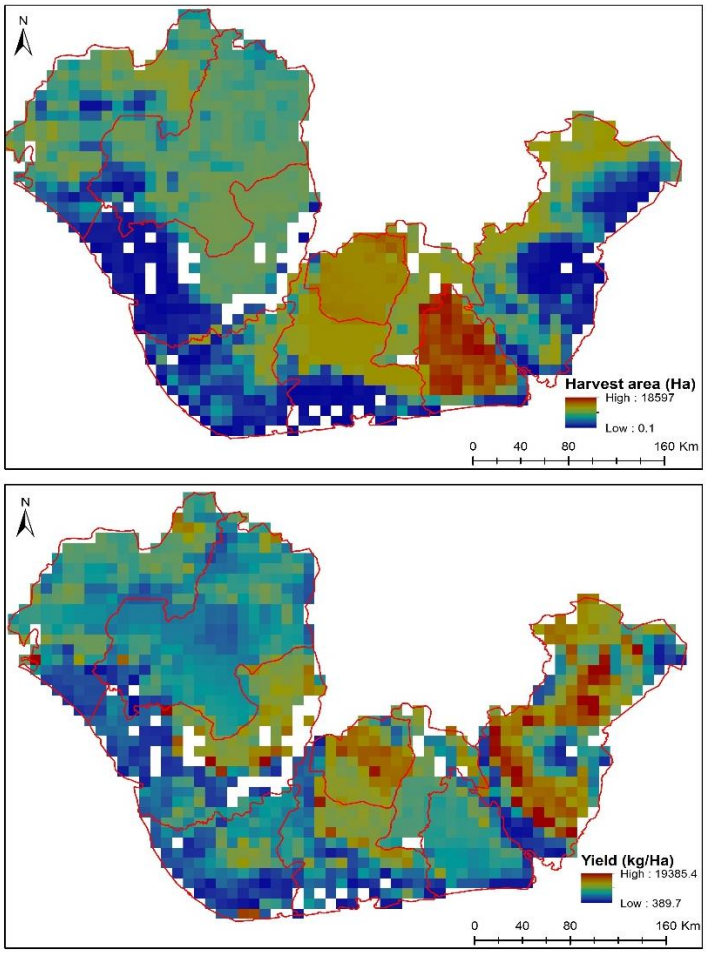

Figure 3Ea: Spatial distribution of total harvested area and yield for various crops[23]

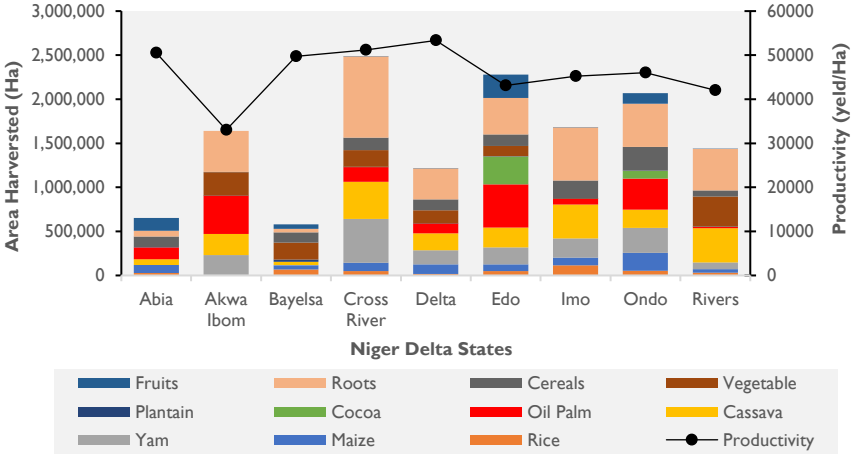

Figure 3Eb: Harvested area and yield for top 11 crops in the Niger Delta[24]

[23] International Food Policy Research Institute, 2020, "Spatially-Disaggregated Crop Production Statistics Data in Africa South of the Saharan for 2017", https://doi.org/10.7910/DVN/FSSKBW, Harvard Dataverse, V1 and
[24] Spatial Production Allocation Model, 2020: https://www.mapspam.info/data/

3.8. ***Telecommunication: voice and internet connectivity (infrastructure and usage):***

The Spatial distribution of telecommunication and internet coverage is presented in Figure 3G. GSM coverage provided by all 4 major telecommunication companies (GLO, 9 Mobile, Airtel and MTN) abounds in the region, and the 3G network is mostly provided in state capitals and major cities, while LTE coverage is dominantly available in Port Harcourt, Rivers state.

The 2006 Niger Delta human development report estimated that 38 per 1,000 people in the region have access to telephone lines. Recent data in the first quarter (Q1) of 2020 (Figure 3Gb) shows 39 million persons (81% of the population) actively used voice services in the Niger Delta Region, and 29 million persons (60% of the population) used the internet.

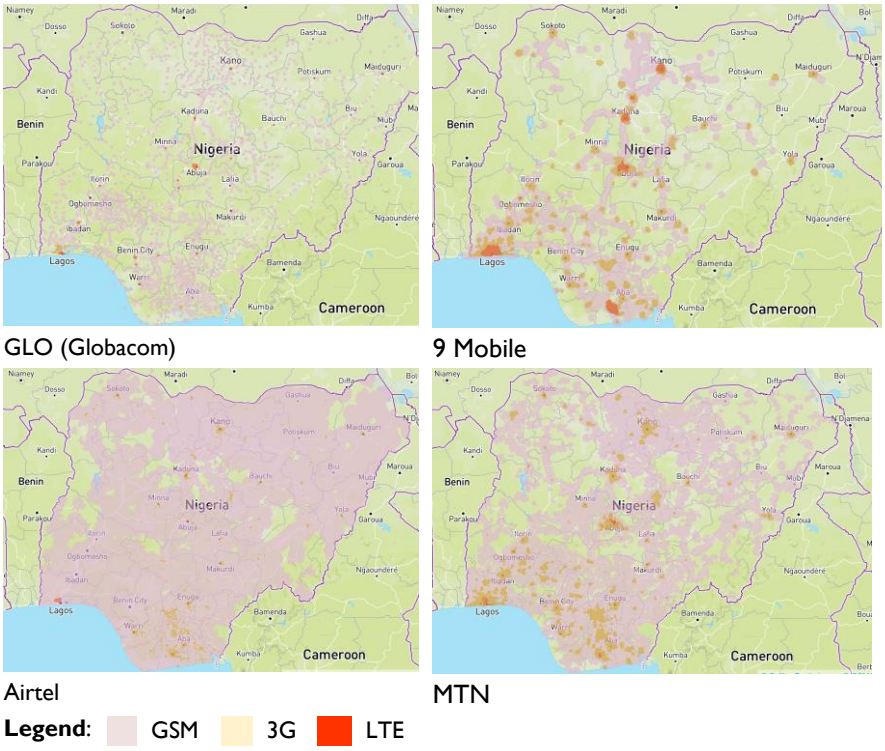

Figure 3Ga: Telecommunication and Internet Coverage Maps of Nigeria[25]

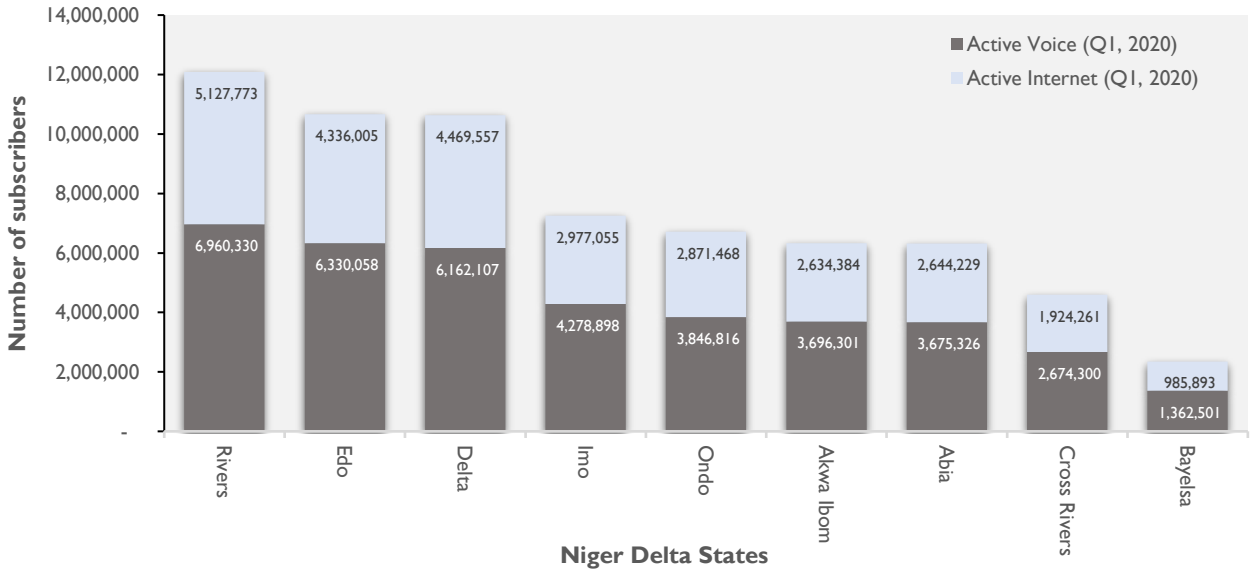

Figure 3Gb: Analysis and plots of Active Voice and Internet Statistics[26]

[25] GSMA and Collins Bartholomew, 2020. https://www.gsma.com/coverage/.

[26] Nigeria Bureau of Statistics, 2020 - Telecoms Data: Active Voice and Internet per State, Porting and Tariff Information.

3.9. ***Corruption***: The prevalence of bribery in the Niger Delta states in 2019 ranged from 21% (Ondo) to 43% (Rivers state). The prevalence of bribery represents "the number of adult Nigerians who had at least one contact with a public official and who paid a bribe to a public official, or was asked to pay a bribe by a public official, on at least one occasion in the 12 months before the survey, as a percentage of all adult Nigerians who had at least one contact with a public official". Abia and Ondo state experienced a significant reduction in the prevalence of bribery between 2016 and 2019, and Akwa Ibom State experienced a significant increase. Other states experienced no significant difference, but the prevalence of bribery in 2019 was highest in Rivers state (43%) and least in Imo state (17.6%).

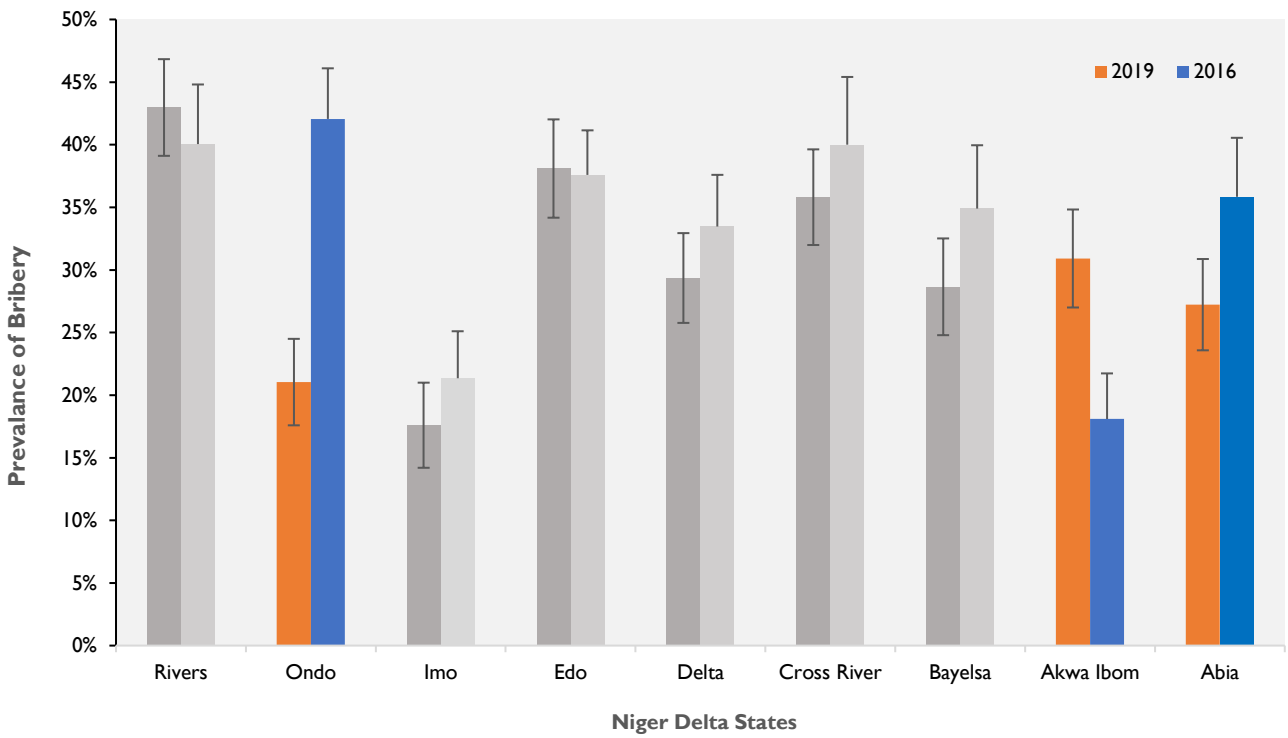

Figure 3H: Prevalence of bribery at the state level (significant changes only), Nigeria, 2016 and 2019[27,28]

[27] Nigeria Bureau of Statistics, 2010, Corruption in Nigeria: Patterns and Trends Second Survey on Corruption as Experienced by the Population, https://nigerianstat.gov.ng/download/1031.

[28] Colored bars represent a statistically significant change since the 2016 survey, grey bars signify not statistically.

3.10. **Micro, Small, and Medium *Enterprises* (MSMEs)**: The 2017 National Survey for MSMEs reported 10.4 million MSMEs in the Niger Delta region, a reduction from 10.7 million enterprises in 2013 (Figure 3I). Rivers state experienced the highest reduction in the number MSMEs between 2013 and 2017 (379,869).

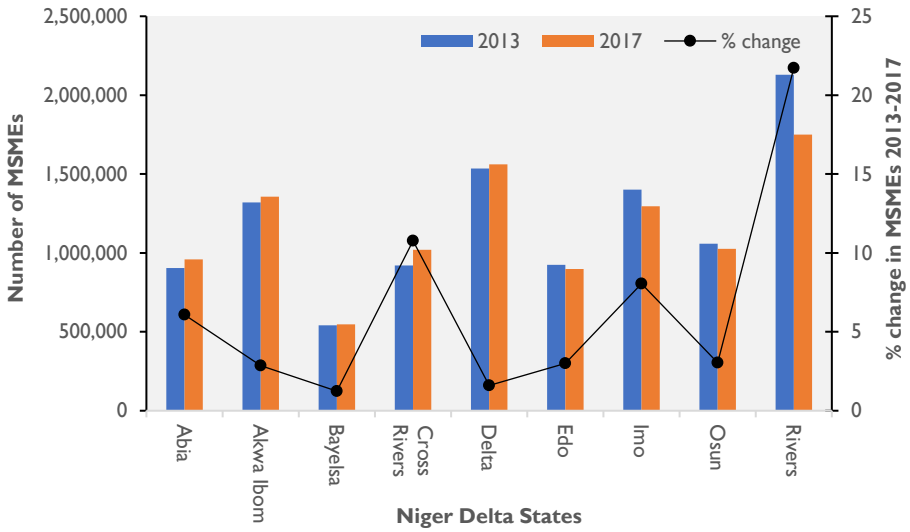

Figure 3I: Analysis and plot of the number of MSMEs in the Niger Delta (2013, 2017)[29]

3.11. ***Labor (Employment and unemployment)***: The 2011 Economic Opportunities in the Niger Delta report[30] presented that 84% of employment in the Niger Delta region are in the private sector, comprising of Agriculture (31%), Whole Sale and Trade (28%), Manufacturing (6%), Transportation (5%), Education (4%), Food and Accommodation (4%), Construction (3%), Public Administration, and Defense and Security (2%).

The 2018 job survey reported an average unemployment rate of 29% for the Niger Delta region, with 17 million persons in active employment and 7.2 million unemployed out of a labour force population of 24.4 million persons (Figure 3J).

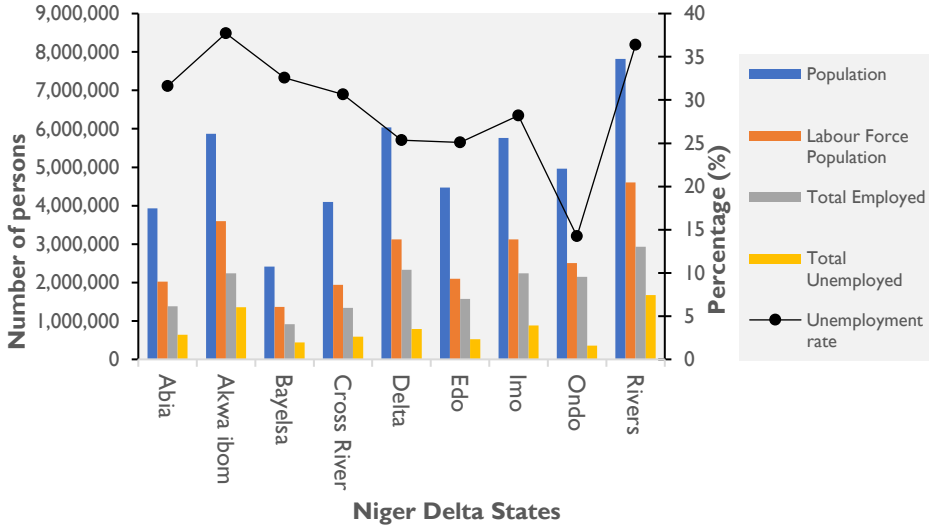

Figure 3J: Analysis and plot of Population and Labour (employed, unemployed) in the Niger Delta[31]

[29] Small and Medium Development Agency of Nigeria and the National Bureau of Statistics, 2012. National Survey of MSMEs Report.
[30] https://www.ndpifoundation.org/wp-content/uploads/2018/09/Economic-Opportunities-in-the-Niger-Delta.pdf
[31] NBS, 2018, Job Creation Survey, Labour Force Statistics.

4. Build form:

4.1. ***Land cover***: The land cover in the Niger Delta region is dominated by forest (49.6%) and croplands (43.1%), followed by water bodies (3.5%), shrubland (2.1%), urban/built-up areas (1.5%), wetland (0.1%), grassland (0.1%) and bare land (0.0%). Figure 4Aa-b presents the spatial and quantitative distribution of land use in the Niger Delta region.

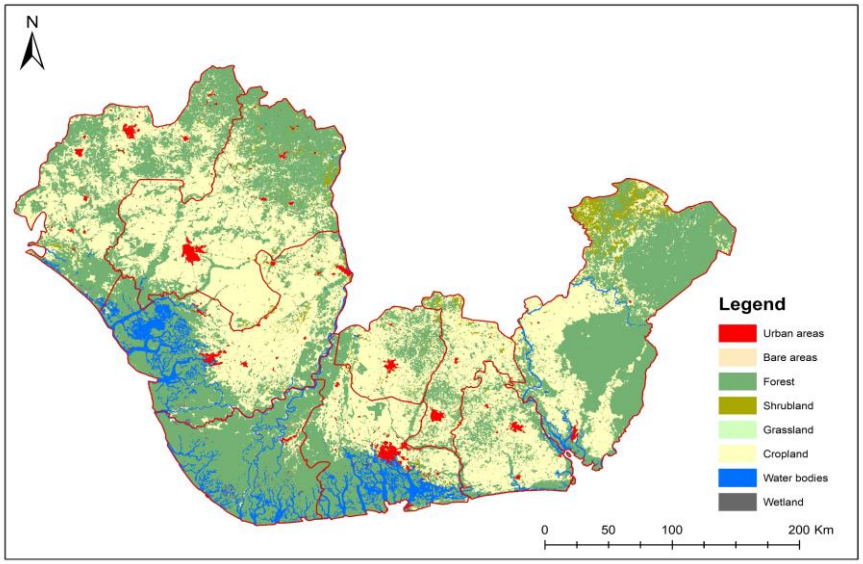

Figure 4Aa: Land cover of the Niger Delta[32]

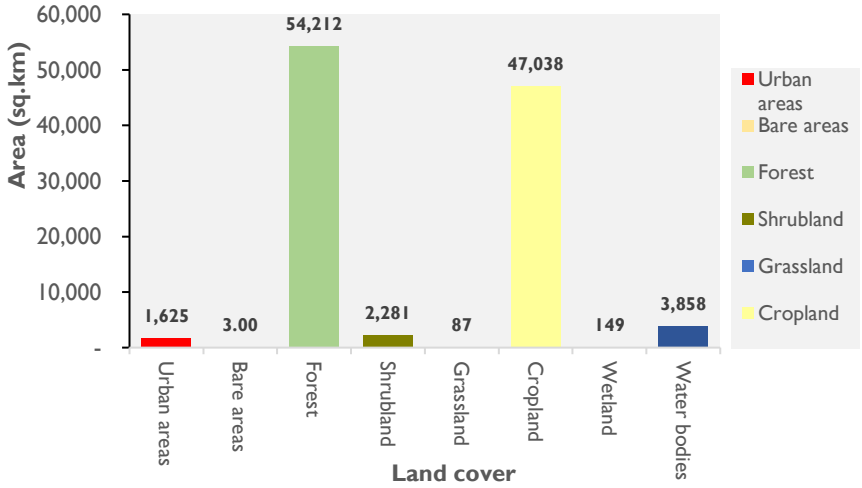

Figure 4Ab: Analysis and plot of the Land cover of the Niger Delta

[d] ESA. Land Cover CCI Product User Guide Version 2. Tech. Rep. (2017). Available at: maps.elie.ucl.ac.be/CCI/viewer/download/ESACCI-LC-Ph2-PUGv2_2.0.pdf

4.2. ***Heritage and Tourism:*** Several tourism locations are distributed across every state in the Niger Delta region, including Ekpemi Hill (Ondo), The Walls of Benin (Edo), Ovie of Agbarha Kingdom (Delta), Akassa Slave transit hall (Bayelsa), Kind Jaja of Opobo Memorial (Rivers), Amaw Uzu Hill (Imo), Museum of Colonia history (Abia), Ibeno beach (Akwa Ibom), Obudu Cattle Ranch (Cross River), as well as protected areas across various states (Figure 4C).

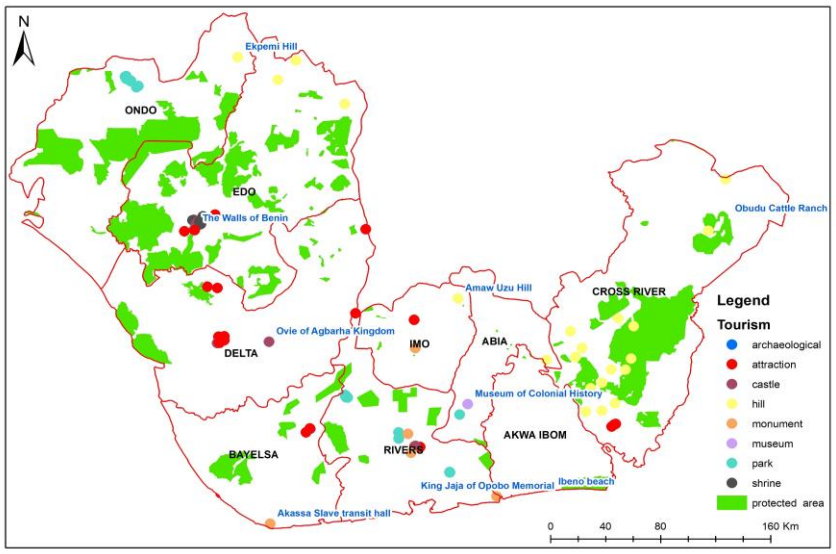

Figure 4B: Spatial distribution of Heritage and Tourism locations in the Niger Delta[33]

4.3. ***Mangrove:*** In 1995, the National Commission for Museums included in its submission to the World Heritage Centre, the Niger Delta Mangrove, for consideration as a World heritage. Mangroves protect vast areas of freshwater swampland in the Inner Delta. The trees and roots provide rich habitats for a wide range of flora and fauna.

As of 2000, 53% of the Niger Delta was tree cover; by 2016 only 4.8% of Niger Delta's tree cover was intact-forest (58Kha), with the remaining tree cover disaggregated as other-tree (12.0Mha) and non-forest (10.7 Mha). From 2001 to 2019, Niger Delta lost 1.14Mha of tree cover, equivalent to a 9.4% decrease in tree cover since 2000. During this time, a total of 274Mt of carbon dioxide (CO_2) was released into the atmosphere as a result of tree cover loss in Niger Delta. This is equivalent to 14.4Mt per year.

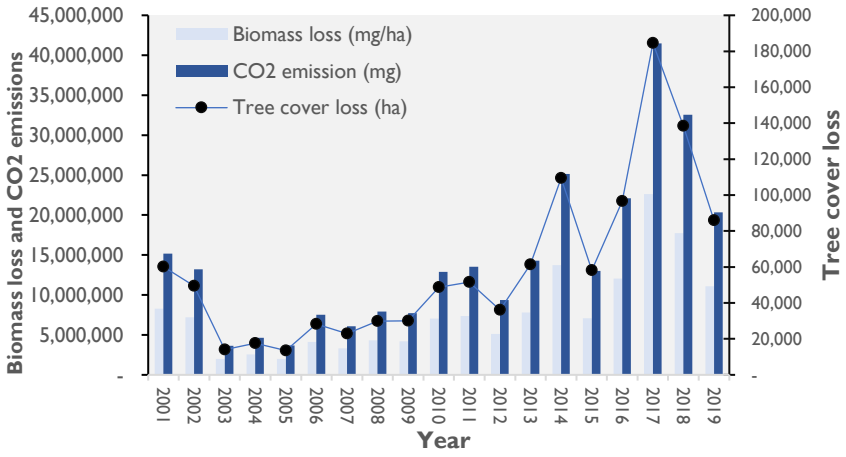

Figure 4C: Analysis and plots of tree cover, biomass loss and associated emission[34]

[33] OSM (OpenStreetMap) and World Database of protected areas: https://www.protectedplanet.net/.
[34] Global Forest Watch. "Tree cover in Niger Delta, Nigeria": www.globalforestwatch.org.

4.4. ***Elevation and Hydrology***: The 2million km^2 Niger Basin discharges to the Atlantic Ocean through the Niger Delta. In 2012, peak discharge reached 31,312m^3/s at Lokoja (Niger river), inundating the floodplains and other low-lying areas in the Niger Delta – Delta, Bayelsa, Rivers and Edo state were amongst the most impacted by the 2012 flood event. Major rivers in the region include Silko, Osse, Ossimo, Niger, Forcados, Nun, Orasi, Imo, Cross and Okpanku; and are under the management of the following river basins authorities Benin/Owena River Basin Development Authority (BORBDA), Niger Delta River Basin Development Authority (NDRBDA), Anambra-Imo River Basin Development Authority (AIRBDA), and Cross River Basin Development Authority (CRBDA). Out of the 15 hydrological gauging stations in the region, only 2 are functional.

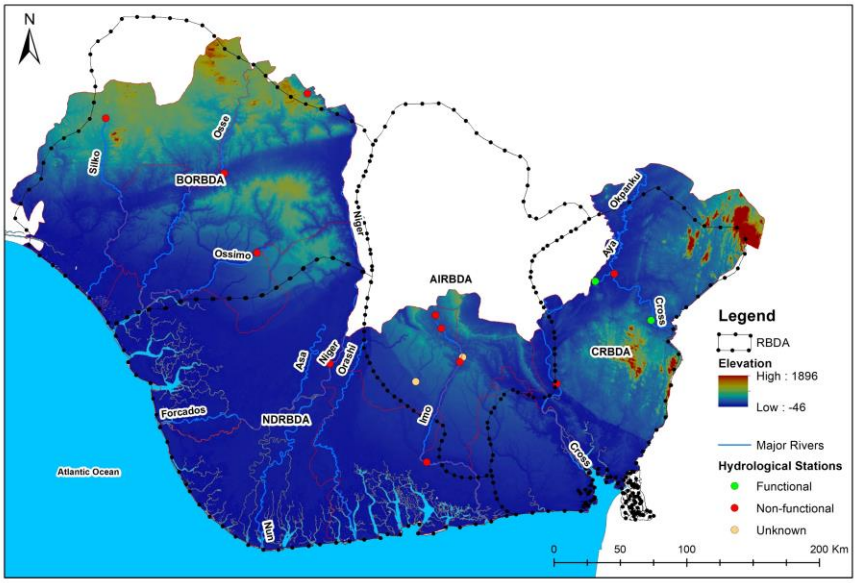

Figure 4D: Elevation and Hydrology of the Niger Delta (including RBDA, hydrological stations)

4.5. ***Geology, Mines and Quarries***: The Niger Delta was initially built over an older transgressive Paleocene prodelta. Delta construction proceeded in discrete mini basins ranging in tectonic configuration from extensional, through translational to compressional toe-thrust regions.

Geological units of the Niger Delta include the Imo Formation and the Ameki Group consisting of the Ameki, Nanka, Nsugbe, and Ogwashi-Asaba formations. The subsurface lithostratigraphic units are the major transgressive marine Akata Shales, the petroliferous paralic Agbada Formation, and the continental Benin Sands[35]. Seven mines and quarries are identified across the region for minerals such as iron/steel, aluminum, ammonia, cement, and petroleum products (Figure 4E).

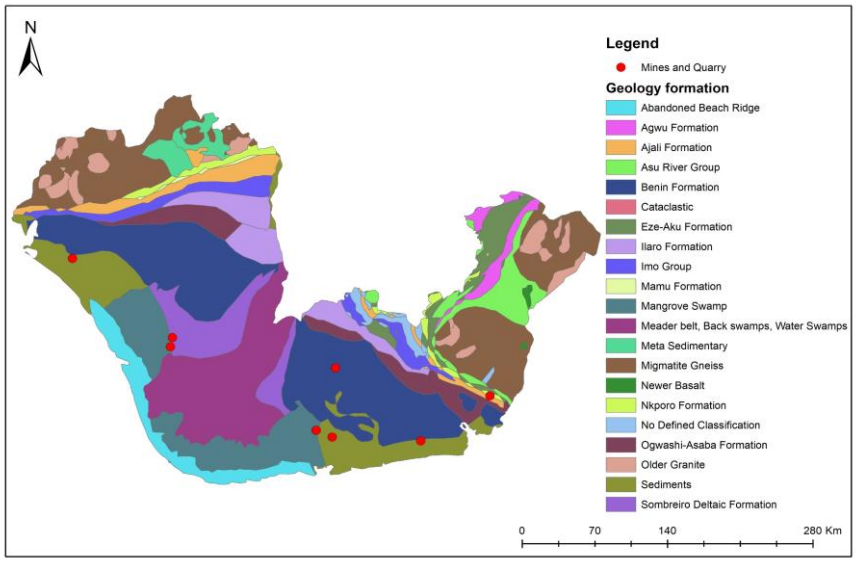

Figure 4E: Spatial distribution of the geological form of the Niger Delta (including mines and quarries[16])

[35] Adegoke, O. S., Oyebamiji, A., Edet, J. J., Osterloff, P., & Ulu, O. K. (Eds.). (2016). Cenozoic foraminifera and calcareous nannofossil biostratigraphy of the Niger delta. Elsevier.

5. Environment and climate

5.1. ***Flooding***: The Niger delta region is prone to flooding. In 2012, 4 Niger Delta states were identified as the most impacted, with total loss/ damage estimated by the post-disaster needs assessment[36] as Bayelsa (₦402 billion), River (₦ 397 billion), Delta (₦ 47 billion), and Edo (₦ 10 billion).

The 2020 Annual flood Outlook[37] also identified Niger Delta states (LGAs) amongst the probable and highly probable locations to be flooded in 2020. These include Bayelsa (8), Delta (9), Edo (17), Imo (11), Rivers (14), Ondo (7), Abia (8), Akwa Ibom (13), Cross River (16).

Figure 5A and 5B show the spatial extent and depth for areas likely to be flooded by a 1-in-100year flood event (a flood event that has a 1 in 100 chance (1% probability) of being equaled or exceeded in any given year). The extent and depth of fluvial (river) and pluvial (rainfall) flooding are presented, and the impact (in terms of flood depth) of the fluvial flood is expected to be greater than pluvial in the Niger Delta region. The total expected inundated area by a 1-in-100year flood is estimated as 5,959 Km^2 (fluvial) and 18,013 Km^2 (pluvial).

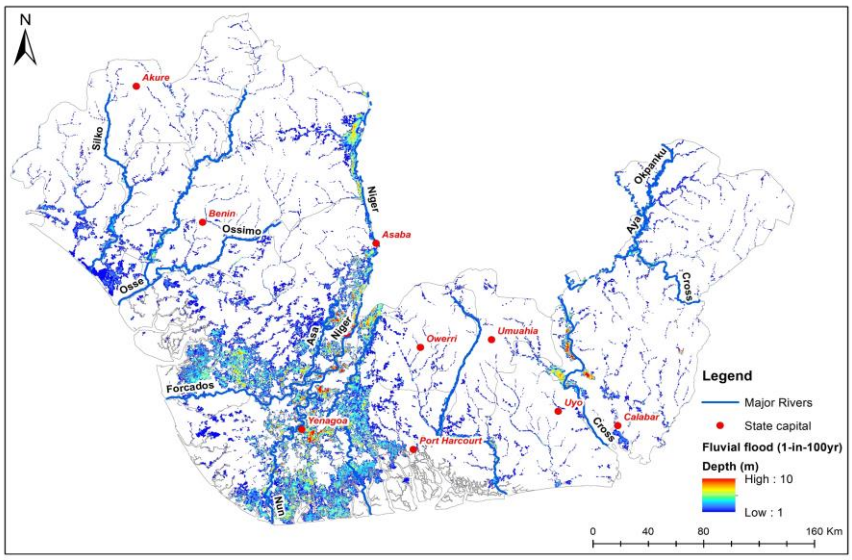

Figure 5A: Fluvial flooding (1-in-100year)[38]

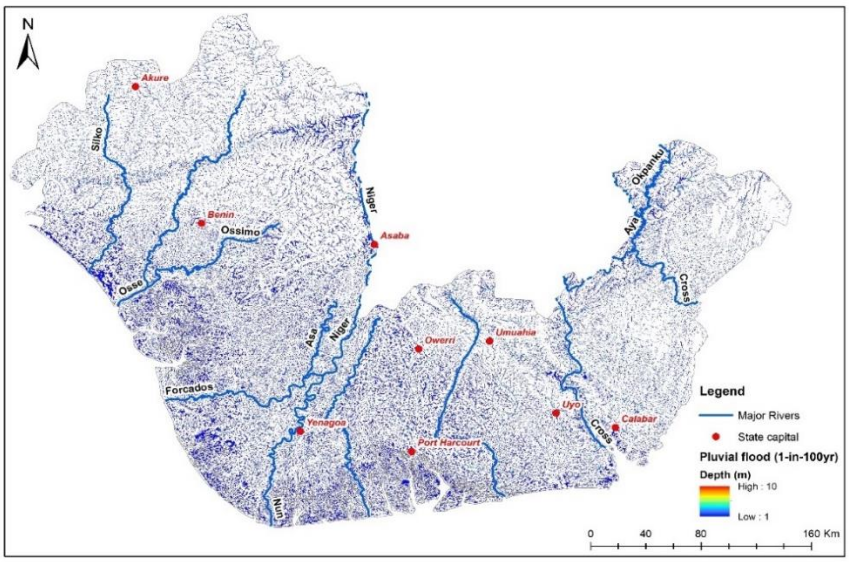

Figure 5B: Pluvial flooding (1-in-100year)[22]

[36] PDNA, 2013: /https://www.gfdrr.org/sites/gfdrr/files/NIGERIA_PDNA_PRINT_05_29_2013_WEB.pdf
[37] NISHA, 2020: http://nihsa.gov.ng/wp-content/uploads/2020/06/2020-NIHSA-Annual-Flood-Outlook-AFO-5-2.pdf
[38] SSBN Global Flood Hazard Model data, based on Sampson et al. (2015): https://doi.org/10.1002/2015WR016954

5.2. ***Coastal Erosion and sea level rise***: The Niger Delta coastline stretch 560 Km from Ondo to Cross River. Figure 5C shows the spatial distribution of coastal erosion, at rates varying from 5 to 50 m/year (erosion) and -105 -8 (accretion). LGAs at high risk of coastal flooding include Ilaje Eseodo (Ondo); Burutu and Warri South-West (Delta); Brass, Ekeremor and Southern Ijaw (Bayelsa); Bonny, Degema, Andoni, Akuku Toru and Opobo/Nkoro (Rivers); Mbo and Ikot-Aba (Akwa Ibom); and Bakassi and Akpabuyo (Cross River).

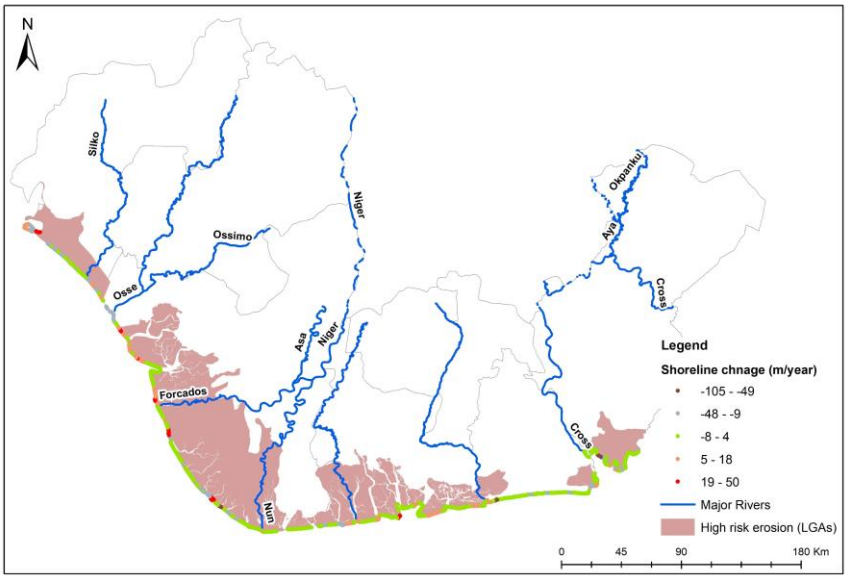

Figure 5C: Coastal Erosion[39]

SLR scenarios and projected impact on land area, population, and GDP for 2010 are presented in Table 3. Estimates are derived from the percentage that the Niger Delta constitutes or contributes to impact indicators, e.g. land area (83%), population (65%), and GDP (30%).

Sea-Level Rise Scenarios				
1 meter	2 meter	3 meter	4 meter	5 meter
Impacted area (in sq.km.)				
538	1076	2087	3532	5144
Impacted Population				
295,886	632,300	107,591	1,643,017	2,278,546
Impacted GDP (in million USD)				
75	153	520	625	908

Table 3: Sea level risk scenarios and impact analysis for the Niger Delta[40]

[39] Luijendijk, et al (2018). The state of the world's beaches. Scientific Report: http://shorelinemonitor.deltares.nl
[40] Susmita Dasgupta et al. Sea-Level Rise (SLR) 2006. Ref. WLD_2006_SLR_v01_M. Dataset downloaded from https://datacatalog.worldbank.org on [26 August 2020]

5.3. ***Particulate Matter (PM)/ Air Quality***: The annual PM 2.5 measurements derived from satellite-based measurements in the Niger Delta for 2015 varied from 19 to 34 µg/m^3, two to three times higher than the WHO AQG of 10 µg/m^3, resulting in an attributable death of 8,1691, the economic cost of 4,125.9 (million US$) and an average loss in life expectancy of 3 years.

Satellite-derived PM from AOD (aerosol optical depth) method is known to under-estimate PM levels in comparison on to ground-level measurements; thus, pollution levels in the Niger Delta are likely higher than the estimates above.

In 2016, the WHO (World Health Organization) identified Aba and Umuahia (Abia) amongst the top-20 most polluted cities in the World. Annual PM10/PM2.5 levels of 373/49 µg/m^3 was recorded at Aba (ranked 6) and 274/40 µg/m^3 at Umuahia) ranked 16. Other highly polluted Niger Delta cities identified were Orlu and Owerri, Imo with PM10/ PM2.5 levels of (52/16µg/m^3) and (158/44µg/m^3) respectively.

Since 2017, episodes of black soot pollution have been observed and reported in the Niger Delta region, particularly Portharcourt, attributable to the operation and destruction/ burning of artisanal refineries[41].

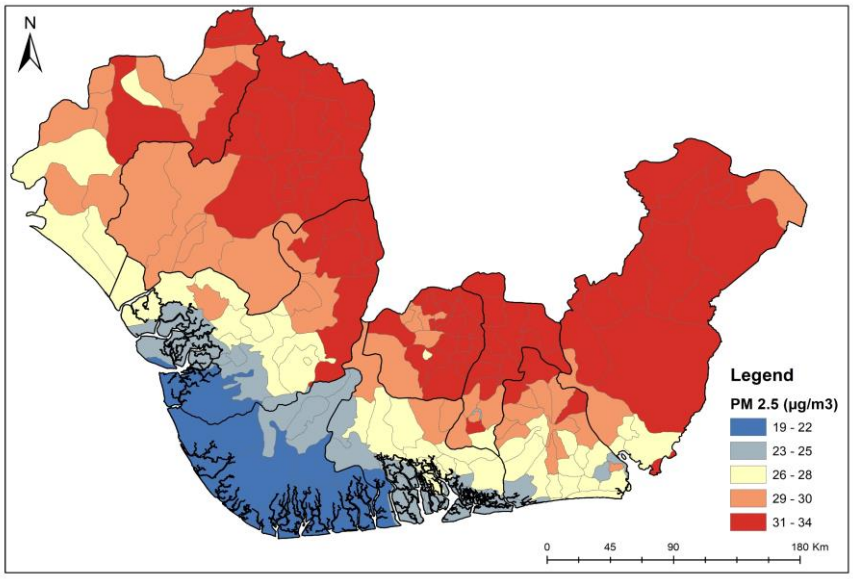

Figure 5D: Air pollution[42]

[41] Yakubu, O. H. (2018). Particle (soot) pollution in Port Harcourt Rivers State, Nigeria—double air pollution burden? Understanding and tackling potential environmental public health impacts. Environments, 5(1), 2.
[42] Etchie, T. O., Etchie, A. T., Adewuyi, G. O., Pillarisetti, A., Sivanesan, S., Krishnamurthi, K., & Arora, N. K. (2018). The gains in life expectancy by ambient PM2. 5 pollution reductions in localities in Nigeria. Environmental Pollution, 236, 146-157.

5.4. ***Oil spillage***: Oil spill is a major cause of environmental degradation in the Niger Delta region. Figure 5Ea shows the distribution of oil spill about population density. Between 2005 and 2020 (15 years) approximately 451,552 barrels of oil were spilt from 1,178 incidences (Figure 5Eb). 81% of all oil spill incidences in the Niger Delta was caused by sabotage resulting in the spillage of 371,397 barrels. Based on an average crude oil price of US$45/Barrel, Nigeria has lost US$20,319,840 due to oil spillage, in addition to the cost of oil spill clean-up/ remediation and socio-economic loss.

Preliminary analysis based on an ongoing unpublished study on the cost of oil spill on Delta state alone based on 7,457 barrels of oil spilt in 2018, and accounting for Cost of oil lost, Cost of oil clean-up, Cost of oil recovery, and economic and environmental damages was $66 million. The proportional cost for 451,552 barrels of oil spill since 2005 should be approximately $4 billion.

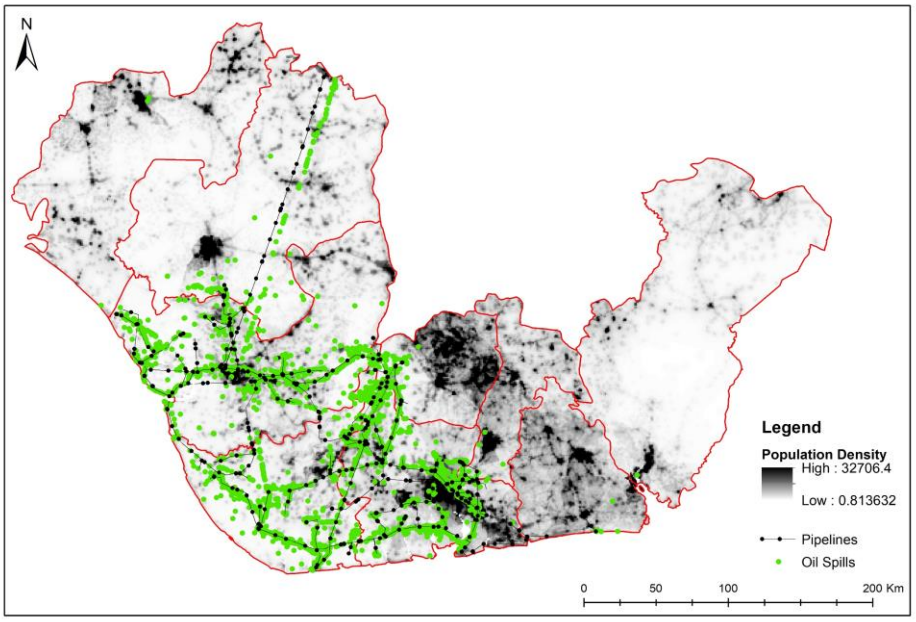

Figure 5Ea: Spatial distribution of oil spills in the Niger Delta region

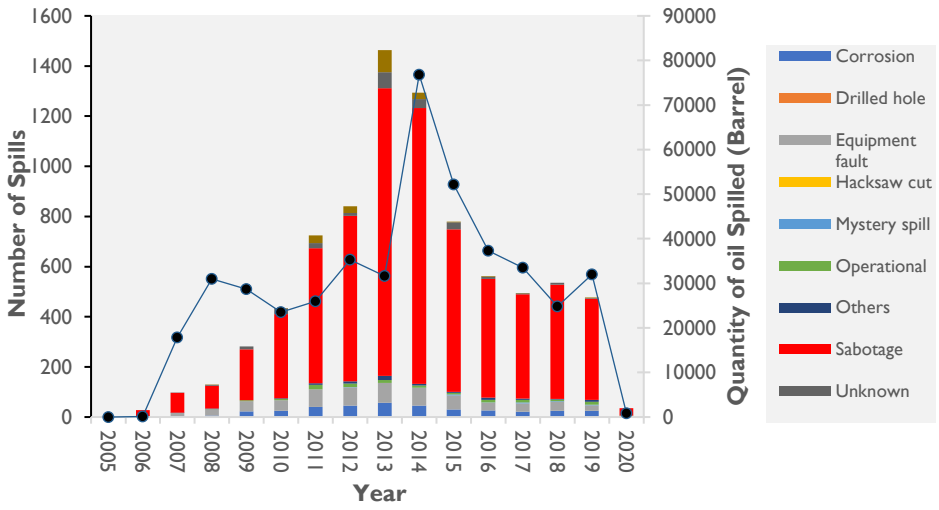

Figure 5Eb: Analysis and plot of oil spillage by cause and quantity in the Niger Delta

5.5. ***Gas flare***: A total of 1.5 billion mscf of gas was flared in the Niger Delta from 2012 to 2020, at an average rate of 170 million mscf/year. Based on an average gas price of $3.50 per mscf, Nigeria lost an equivalent of $5.4 billion due to gas flaring during this period. Figure 5Fa shows the spatial distribution of oil and gas infrastructure in the region, including 112 off/on-shore flare points, while Figure 5Fb shows the distribution of gas flared and financial loss in each state.

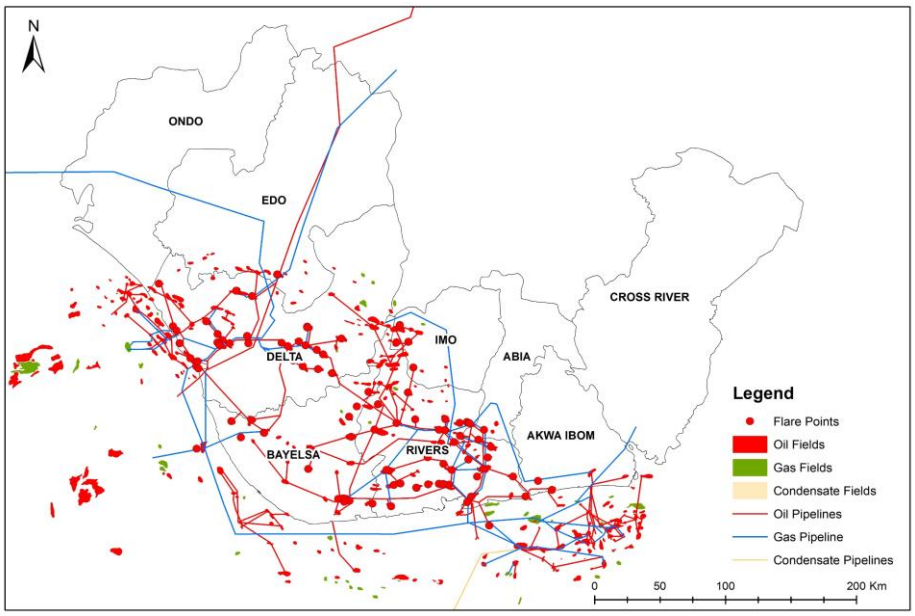

Figure 5Fa: Spatial distribution of gas flare and pipelines in the Niger Delta[43]

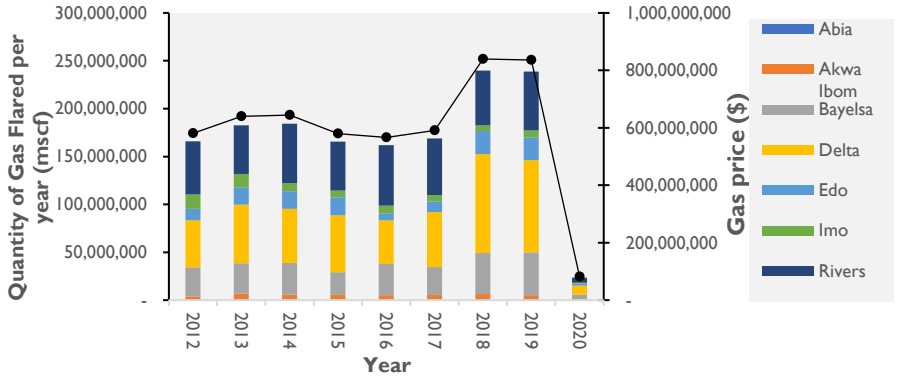

Figure 5Fb: Analysis and plots of gas flare quantity and cost of flared gas[25]

[43] Gas Flare Tracker: https://gasflaretracker.ng/

5.6. ***Land Degradation***: Figure 5Ga presents the spatial distribution of land degradation in the Niger Delta region, while Figure 5Gb presents quantitative estimates, dominated by the loss of topsoil (49,639 Km^2), swamp/floodplain (23,753 Km^2) and water bodies (5,179 Km^2).

Gully erosion constitutes a major threat to the safety and livelihood Niger Delta residents, with hotspots with a total surface area of 475 Km^2 dominant in south-east and western states, including Ondo, Delta, Imo, Abia, Akwa Ibom and Cross River.

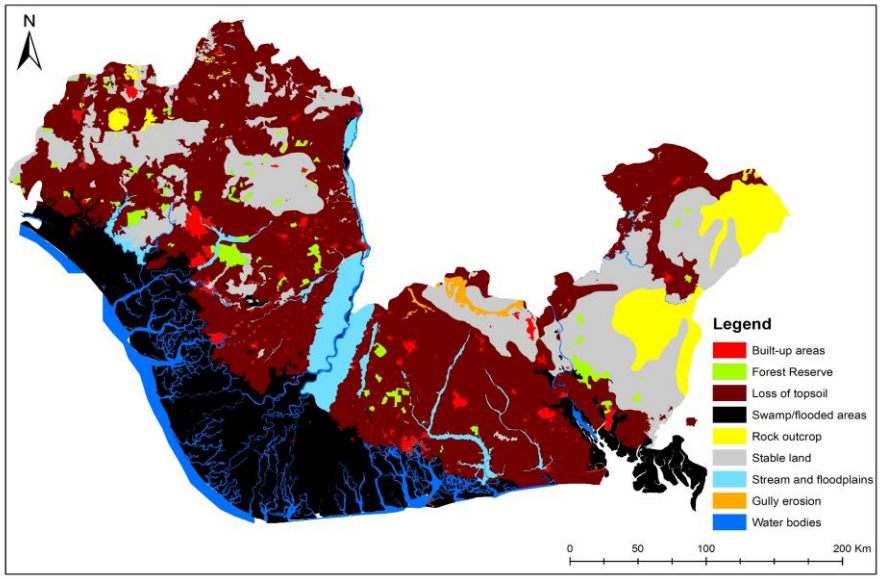

Figure 5Ga: Spatial distribution of land degradation in the Niger Delta[44]

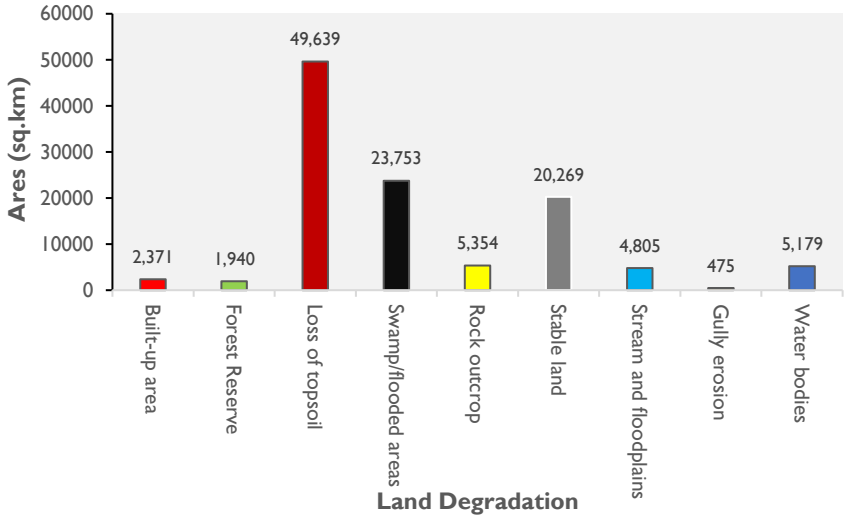

Figure 5Gb: Analysis and plot of degraded land area in the Niger Delta

[44] Review and update of Nigeria National Water Resources Masterplan, 2013

5.7. ***Waste management***: population growth, urbanization and industrial activities contribute to the growing challenge of waste generation and management in the Niger Delta region. Based on 2020 population estimates and daily waste generation rates (Figure 5H), the quantity of waste generated by each Niger Delta state daily are as follows: Abia (1,661 Mtons), Akwa Ibom (3,392 Mtons), Bayelsa (1,279 Mtons), Cross River (1,129 Mtons), Delta (6,694 Mtons), Edo (2,171 Mtons), Imo (3,688 Mtons), Ondo (2,844 Mtons) and River (9,707 Mtons). Figure 5H also shows the composition of waste, dominated by compostable (54%) and plastic & nylon (15%).

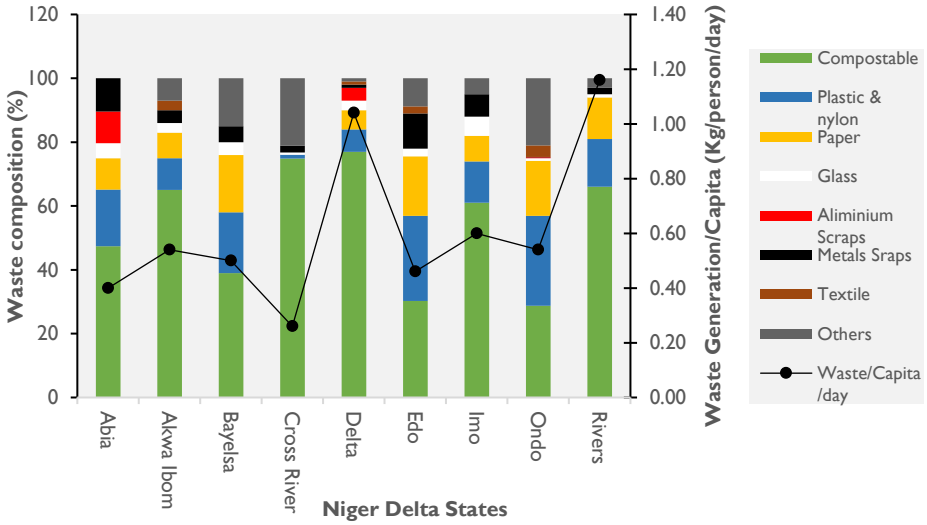

Figure 5H: Waste management (Waste generation, characterization, and dumpsites) [45, 46, 47, 48, 49, 50, 51, 52, 53]

[45] Ajero, C. M. U., & Chigbo, U. N. (2012). A study on the evaluation of industrial solid waste management approaches in some industries in Aba, South Eastern Nigeria. West African Journal of Industrial and Academic Research, 4(1), 103-112.

[46] Okey, E. N., Umana, E. J., Markson, A. A., & Okey, P. A. (2013). Municipal solid waste characterization and management in Uyo, Akwa Ibom State, Nigeria. WIT Transactions on Ecology and the Environment, 173, 639-648.

[47] Angaye, T. C., Konmeze, O., Gbodo, E. A., & Apollos, U. (2019). Characterization of Commercial Solid Waste Stream in Bayelsa State, Nigeria. Journal of Experimental and Clinical Toxicology, 1(2), 12.

[48] Oko, M. E. A. Quantification and Characterization of Hotel Solid Waste in Calabar (Unpublished Thesis).

[49] Owamah, I. H., Izinyon, O. C., & Igbinewekan, P. (2017). Characterization and quantification of solid waste generation in the Niger Delta Region of Nigeria: a case study of Ogbe-Ijoh community in Delta State. Journal of Material Cycles and Waste Management, 19(1), 366-373.

[50] Uwadiae, S. E., Nwube, P., & Aluyor, E. O. (2017). Characterization, Disposal and Management Options of Municipal Solid Waste in University of Benin, Benin City, Nigeria.

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[53] Babatunde, B. B., Vincent-Akpu, I. F., Woke, G. N., Atarhinyo, E., Aharanwa, U. C., Green, A. F., & Isaac-Joe, O. (2013). Comparative analysis of municipal solid waste (MSW) composition in three local government areas in Rivers State, Nigeria. African journal of environmental science and technology, 7(9), 874-881.

5.8. ***Soil***: Figure 5Ia shows the spatial distribution of soil in the Niger Delta region and Figure IGb presents the proportion of land covered by the various soil groups in the region. Major soil groups include i) Nitosols (44%) – fertile and nutrient-rich soil for agriculture; ii) Gleysols (18%) – waterlogged due to groundwater, useful for rice cultivation, field crops and trees; iii) Ferrasols (12%) – filled with iron and aluminum oxide and not widely used agriculture, except for tree plants (e.g. Palm, Rubber and Cocoa; iv) Fluvisols (10%) – mainly river floodplains, deltas and coastal lowlands, can be cultivated for dryland crops or rice and are used for grazing in the dry season; and Luvisols (8%) - mixed mineralogy, high nutrient content, and good drainage of these soils make them suitable for a wide range of agriculture, from grains to orchards.

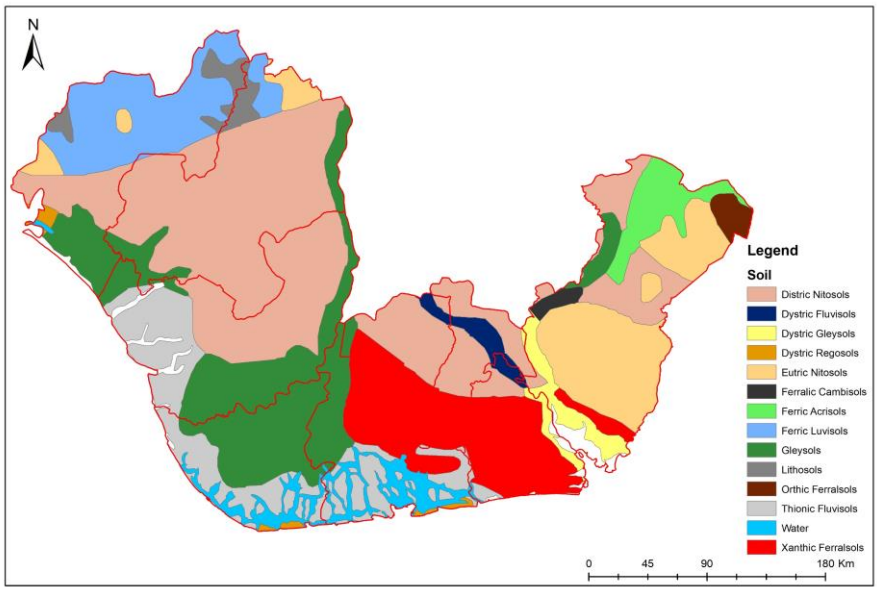


Figure 5Ia: Spatial distribution of Soil in the Niger Delta Region[54]

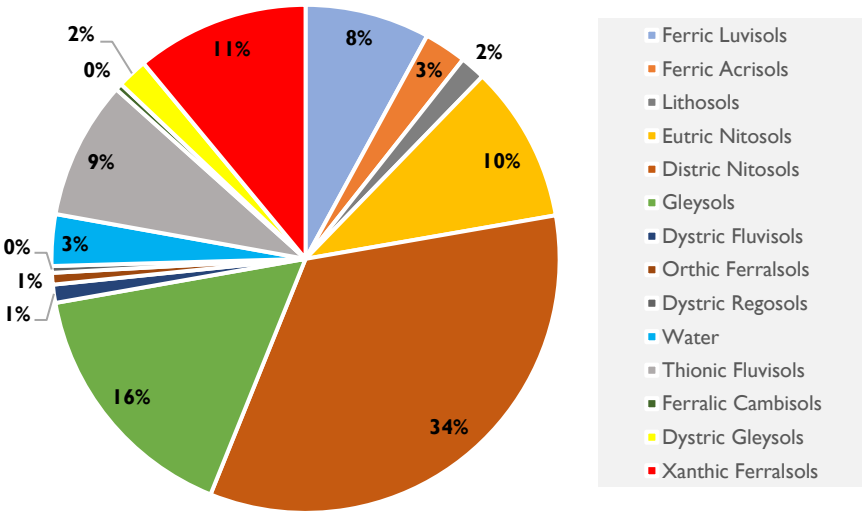


Figure 5Ib: Analysis and plot of soil composition in the Niger Delta

[54] Digital Soil Map of the World, 2003, Food and Agriculture Organization of the United Nations

6. Security - Conflict and restiveness:

6.1. ***Conflict, violence and pipeline sabotage***: Figure 6Aa shows the spatial distribution of conflict and violence activities in the Niger Delta, including oil spillage caused by pipeline vandalization. Between 2005 and 2020 81% of the 8,178 oil spill incidences (Figure 6Ab) was caused by sabotage; totaling 371,397 barrels of oil (Figure 6Ac) and US$ 16.7 million in financial loss, in addition to the loss of livelihood and environmental impacts.

Pipeline sabotaged activities peaked in 2013 and is presently declining (Figure 6Ab). Most pipeline sabotage activities occurred in 3 states, Rivers (44%), Delta (28%), and Bayelsa (23%).

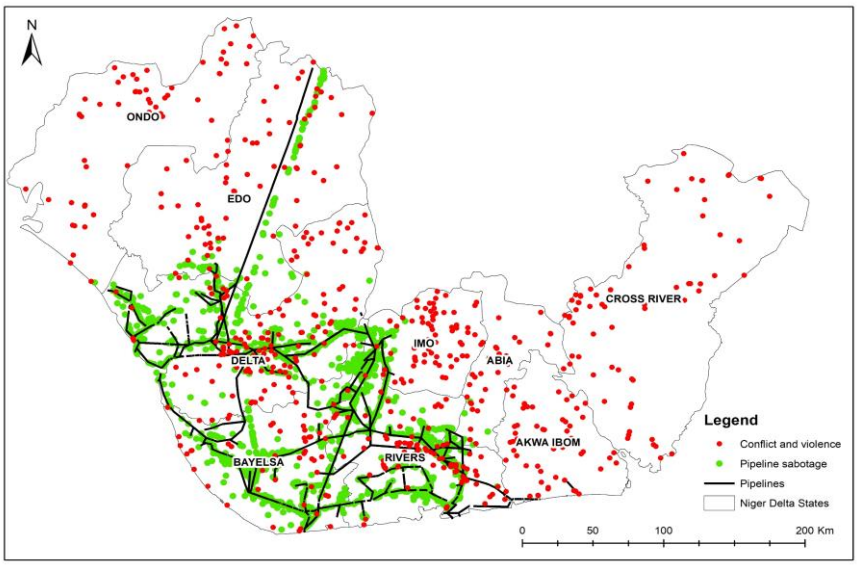


Figure 6Aa: Spatial distribution of conflict, violence and pipeline sabotage[55, 56]

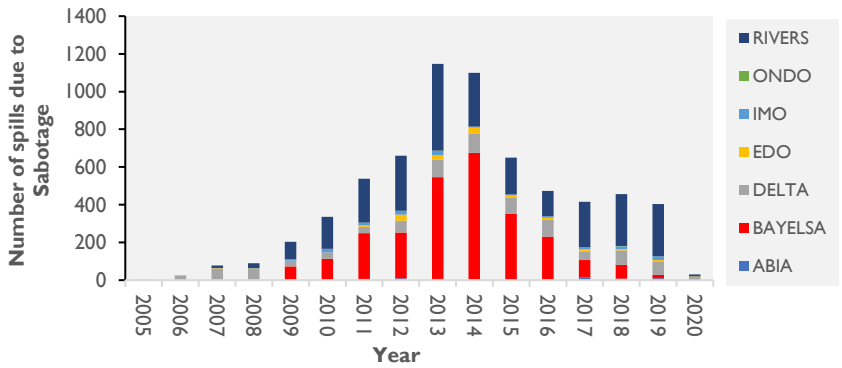


Figure 6Ab: Analysis and plot of the number of spills due to sabotage 2005 - 2020

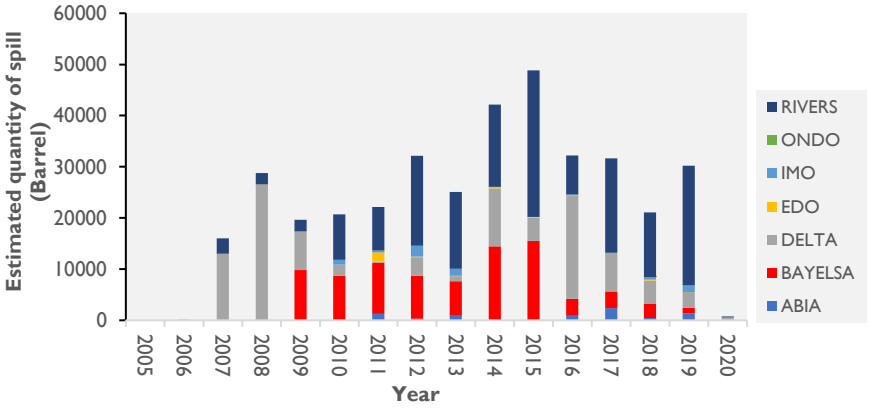


Figure 6Ac: Analysis and plot of estimated Spill quantity due to sabotage impact 2005 – 2020

[55] Partners-4-Peace (Conflict data for the Niger Delta region): https://p4p-nigerdelta.org/peace-map/
[56] Nigeria oil Spill Monitor: https://oilspillmonitor.ng/

A total of 8,431 conflict and violence-related activities were reported in the Nigeria Delta Region of Nigeria from 2016 to 2020 by the Partners-4-Peace programme, and the following top-10 activities accounted for 86% of these activities: Shootings and Killings (59%), Riots and Protests (14%), Abductions (6%); Domestic Violence (5%), Crime (5%), Sexual Violence (3%), Inter-Communal Tension or Violence (3%), Tension or Violence between Political Groups (2%), Election Irregularities (2%) and Child Abuse (2%). Violence in the region peaked in 2018 and has been on the decline in all states (Figure 6Ba)[51].

Figure 6Ba shows the trend conflict and violent activities in the region, with most activities occurring in Rivers, Delta and Bayelsa. Figure 6Bb shows the Shooting and killings constitute the top-10 conflict and violent activities in the region (Figure 6Bb).

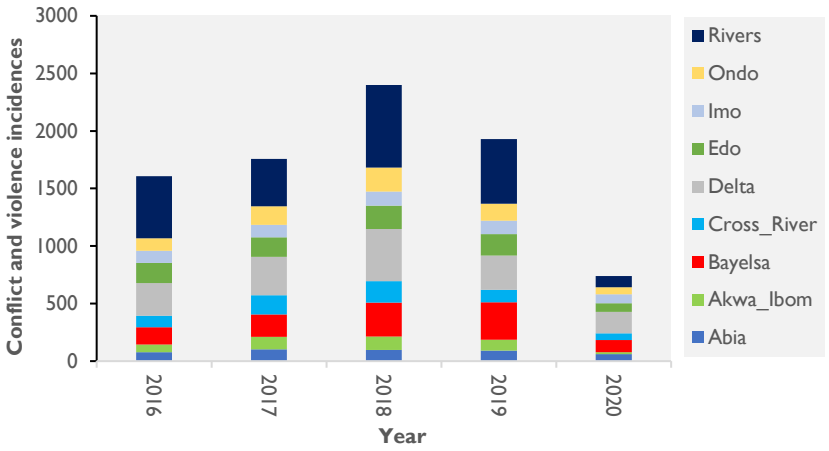


Figure 6Ba: Analysis and plot of conflict and violence trend in the Niger Delta

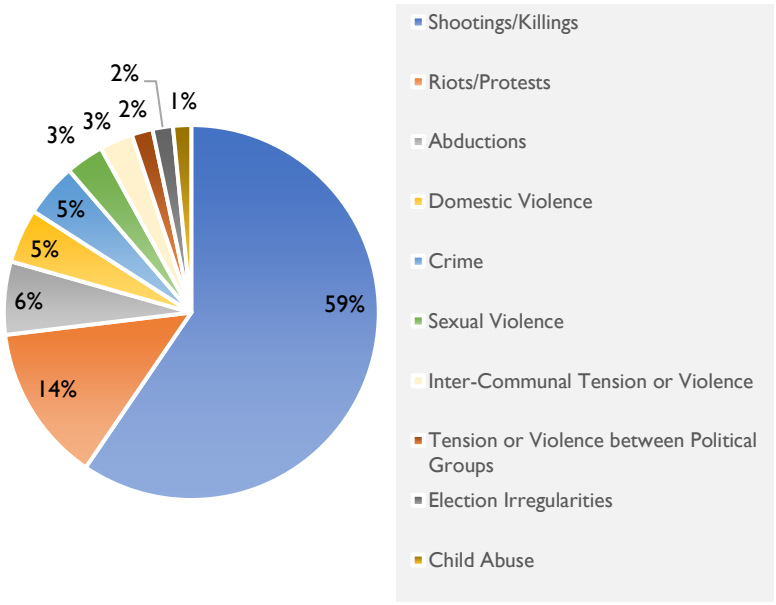


Figure 6Bb: Composition of top-10 major crimes in the Niger Delta

7. Social Services

7.1. ***Health***: The Nigeria Living Standard Survey 2018-2018 revealed 16% of Niger Delta residents were not visiting health facilities due to the high cost, 2% due to poor quality of care and 1.6% because health facilities are too far.

Grid3 data identifies 6,378 health facilities in the Niger Delta region, constituting Tertiary hospitals (31), secondary/ specialist hospitals (337), and primary hospitals (6,010).

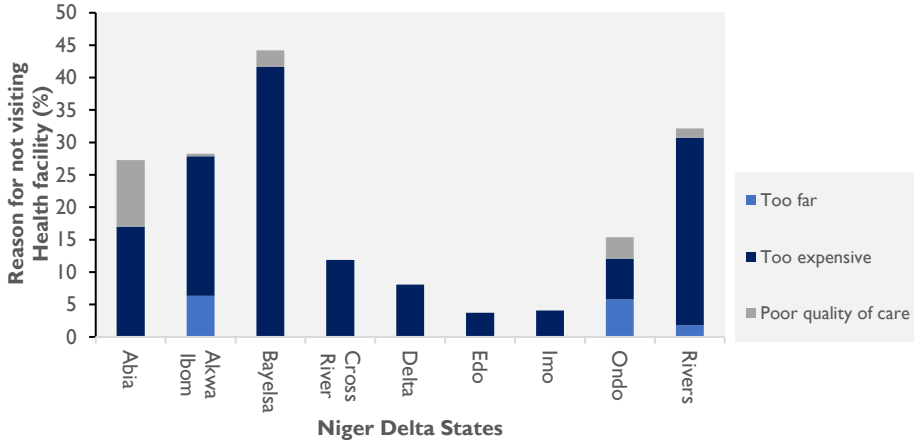


Figure 7A: Analysis of reasons why Niger Delta residents do not visit Health facilities[57]

7.2. ***Education***: The Nigeria Demographic and Household Survey (DHS), 2018-2019 shows an average of 85.6% and 78.8% male and female literates respectively in the Niger Delta region. Based on the Nigeria Living Standard Survey, in the Niger Delta, an average 6% of persons aged >6 have never attended school, 33% have do not attend school because it is 'too expensive', 3% 'too far' and 3% 'too young'.

Grid3 data shows there out of 22,245 academic institutions in the Niger Delta region, tertiary = 185, secondary = 6,849, primary = 15,039, pre-primary = 55 others = 77, and mixed = 40.

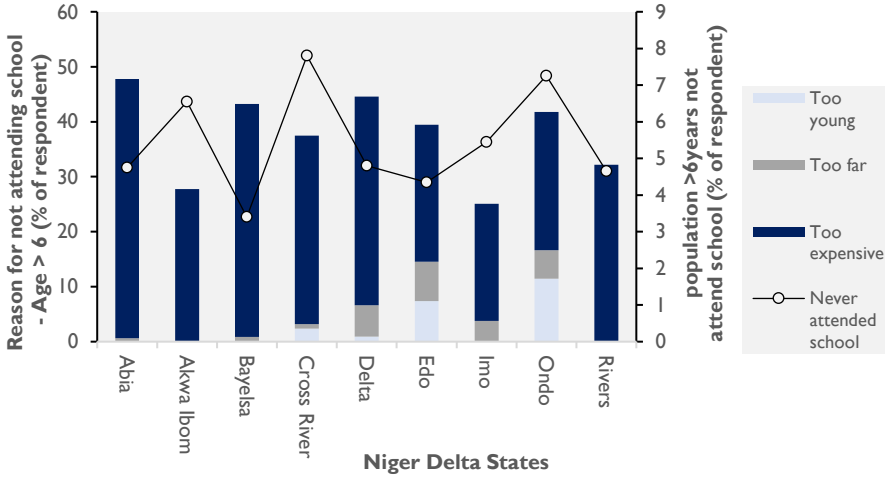


Figure 7B: Analysis of reasons why Niger Delta residents do not attend school[55]

[57] Nigeria Living Standards Survey, 2018-2019: https://www.nigerianstat.gov.ng/nada/index.php/catalog/64

7.3. ***Water, Sanitation and Hygiene (WASH)***: Based on a survey of 30,317 persons for the 2018 Nigeria DHS, 72.5% of respondents have access to improved drinking water, and 27.3% unimproved drinking water in the Niger Delta (Figures 7Ca). Imo state has the most access to drinking water in the region (89.6%) and Bayelsa has the least (52.8%). Access to drinking water services follows similar trends in the region, 69.5% have access to basic drinking water services and 3.2% have limited access to basic drinking water services.

GRID3 data identifies 4,994 public water points in the Niger Delta region, consisting of boreholes (3,303), water works (1,183), and wells (508).

The Nigeria DHS also revealed that 66% of respondents have access to an improved sanitation facility, 10.1% unimproved sanitation facility, 23.9% practice open defecation (mainly in Bayelsa, Ondo, Delta and Rivers), 40.3% have basic sanitation service and 25.6% have limited sanitation service (Figures 7Cb).

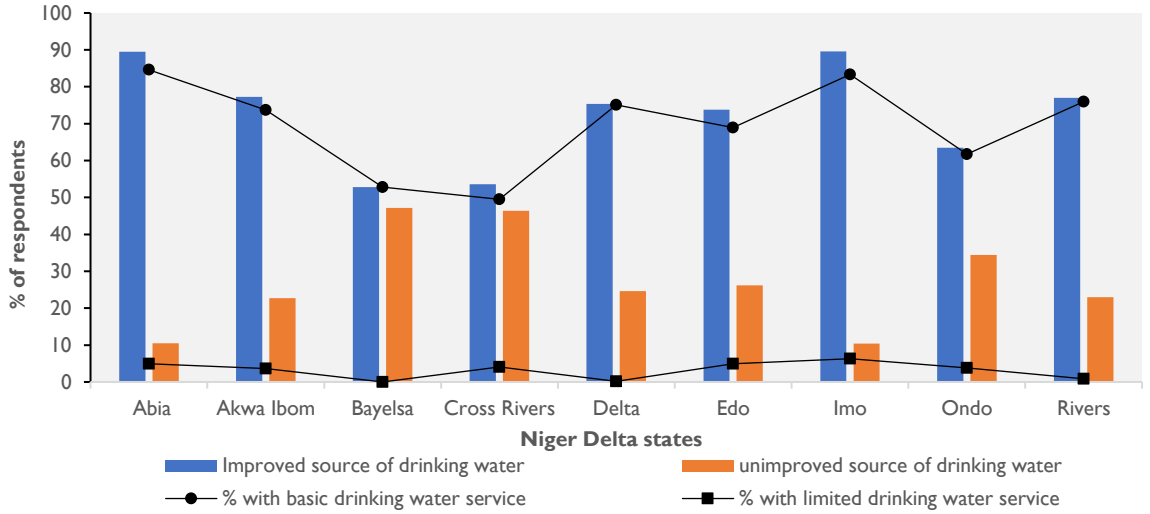


Figure 7Ca: Figure 7Cb: Analysis and plot of access to drinking water and service, by State, 2019[58]

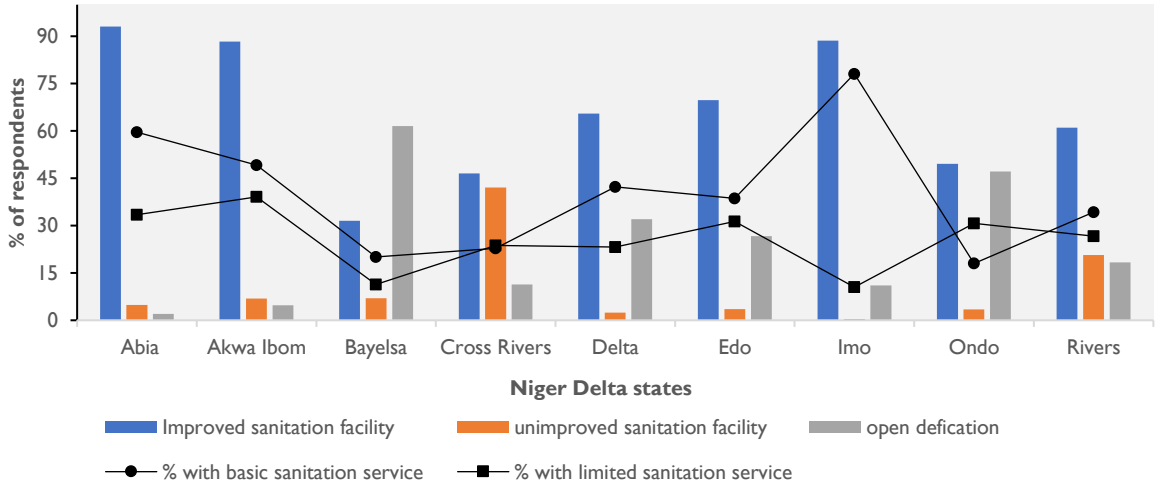


Figure 7Cb: Analysis and plot of access to sanitation facility and service, by State, 2019[53]

[58] Nigeria Demographic and Household Survey, 2018: https://dhsprogram.com/publications/publication-FR359-DHS-Final-Reports.cfm

7.4. ***Electricity demand***: The 2018 Nigeria DHS revealed that 81.7% of the urban population in Nigeria has access to electricity and 37.1% of the rural population. Figure 7Da shows the spatial distribution of energy demand in the Niger Delta in 2015, totaling 1.3 million KWh/year (rural = 831,070, urban = 467,454). Locations of high energy demand correspond with local government areas with high economic activities (Figure 3B). The state with the highest energy in the region is Akwa Ibom and the lowest Edo (Figure 7Db).

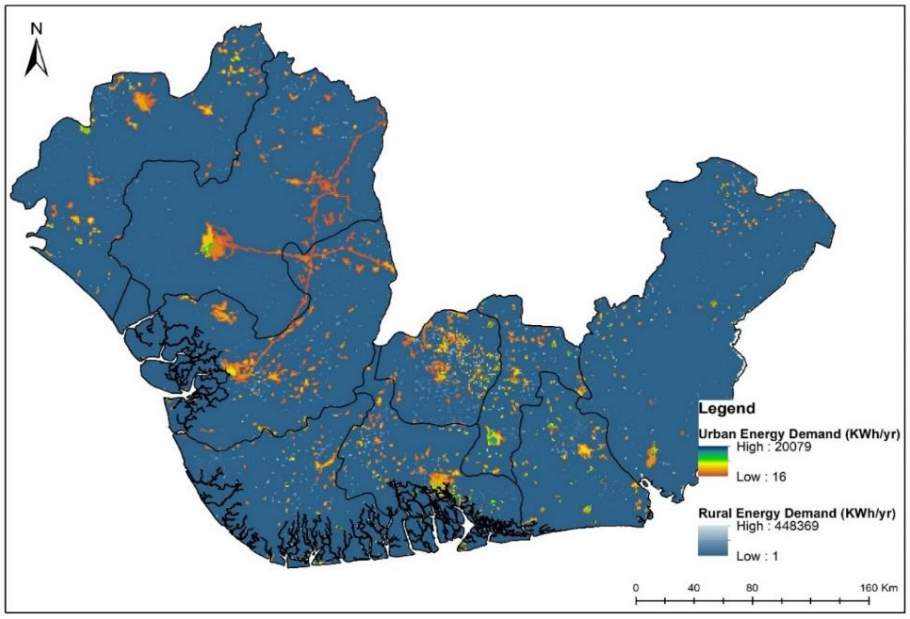


Figure 7Da: Energy demand (urban and rural)[59]

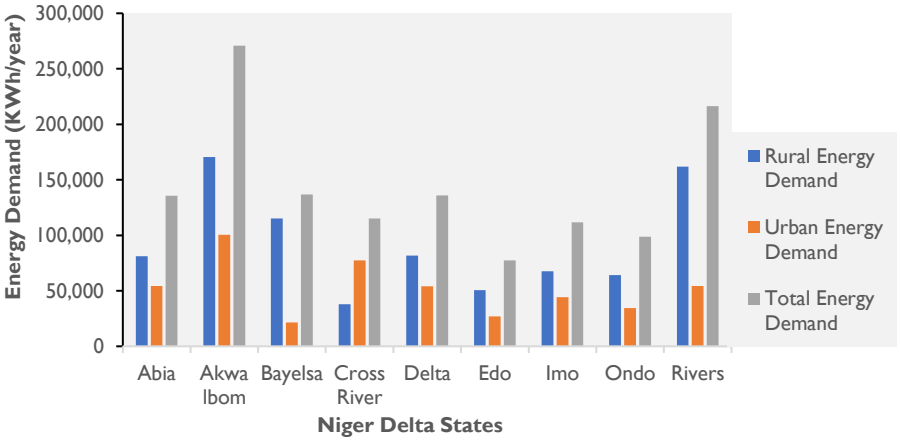


Figure 7Db: Analysis and plot of energy demand in the Niger Delta region

[59] ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE): http://www.ecowrex.org/page/maps

7.5. ***Power infrastructure (transmission and distribution network) and energy potential (solar, wind and hydro)***: Figure 7Ea-c shows a visual display of the power infrastructure network (distribution and transmission), power plants (45), generators (8), as well as energy potential from renewable sources, including solar (3.3 – 4.3 KWh), wind (1506 – 0.28 W/m^2) and hydro (0 – 15.4 MW); Niger and Cross Rivers showed the highest hydro-power in the region, while solar and wind energy potential is highest in the hilly areas of Ondo, Edo and Cross Rivers states (see elevation data Figure 4D).

The capacity of the major gas-powered generating plants in the Niger Delta region are presented in Table 3A[60]. All power generating plants in the Niger Delta are operating below optimal capacity.

Station, Location	Installed capacity (MW)	Available capacity (MW)
Afam, Rivers	726	60
Ughelli, Delta	900	300
Sapele, Delta	1020	90
Omotosho, Ondo	304	76
Total	2960	526

Table 3A: Niger Delta power stations and capacity.

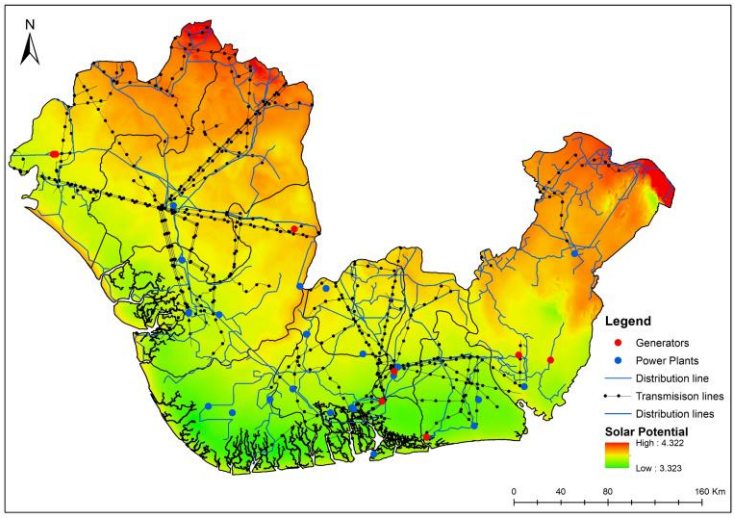


Figure 7Ea: Solar potential of the Niger Delta (kWh)[61]

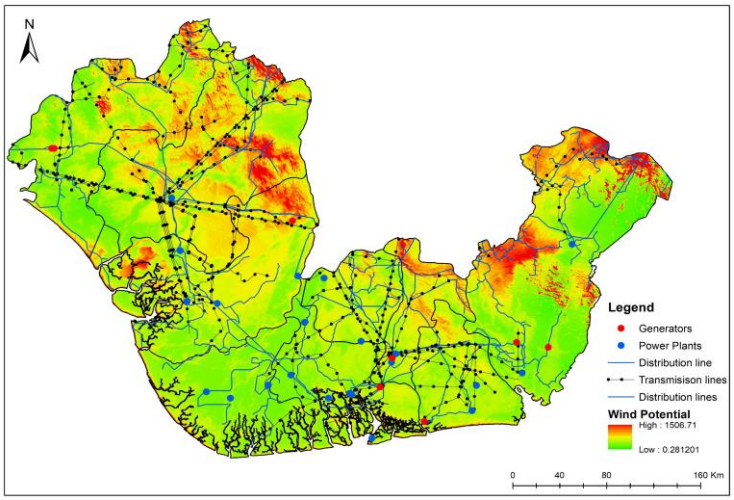


Figure 7Eb: Wind potential of the Niger Delta (W/m^2)[62]

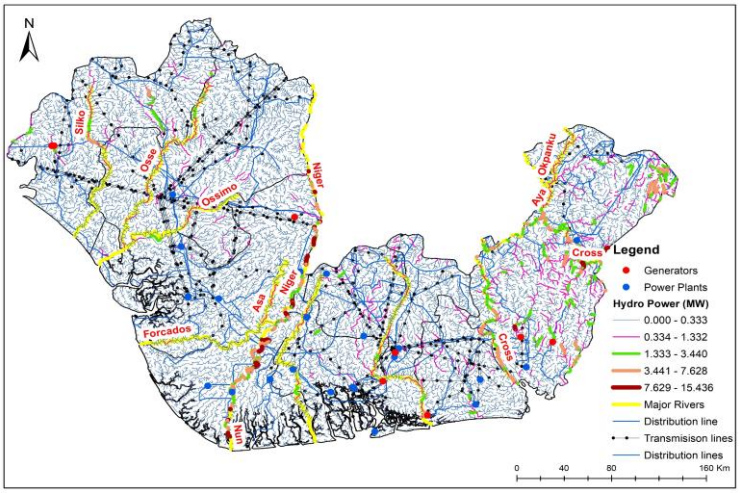


Figure 7Ec: Hydropower potential of the Niger Delta (MW) [63]

[60] Nigeria Vision 2020: https://nairametrics.com/wp-content/uploads/2013/06/nigeria-vision-20_2020_draftetb.pdf
[61] World - Photovoltaic Power Potential (PVOUT), Global Solar Atlas: https://globalsolaratlas.info/download
[62] Global Wind Atlas: https://globalwindatlas.info/
[63] Hydropower potential in West Africa – ECOWAS: http://www.ecowrex.org/smallhydro

8. Social vulnerability and Physical exposure to geophysical risk

8.1. ***Social Vulnerability Index (SVI)***: is an indicator of defenselessness to coastal impacts, considering poverty, education, and conflict levels the population is exposed to.

The specific data applied in the development of SVI are population density (2010), population growth (2000–2010), subnational poverty and extreme poverty (2005), maternal education levels (circa 2008), market accessibility (travel time to markets), and conflict data for political violence (1997 - 2013). High values on the raw scale for each of the indicators result in higher vulnerability scores on the 0–100 scale (Figure 8Aa). A combination of high population density, high population growth, and conflict make the Niger Delta a "hotspot" of vulnerability in the Low Elevation Coastal Zone (LECZ).

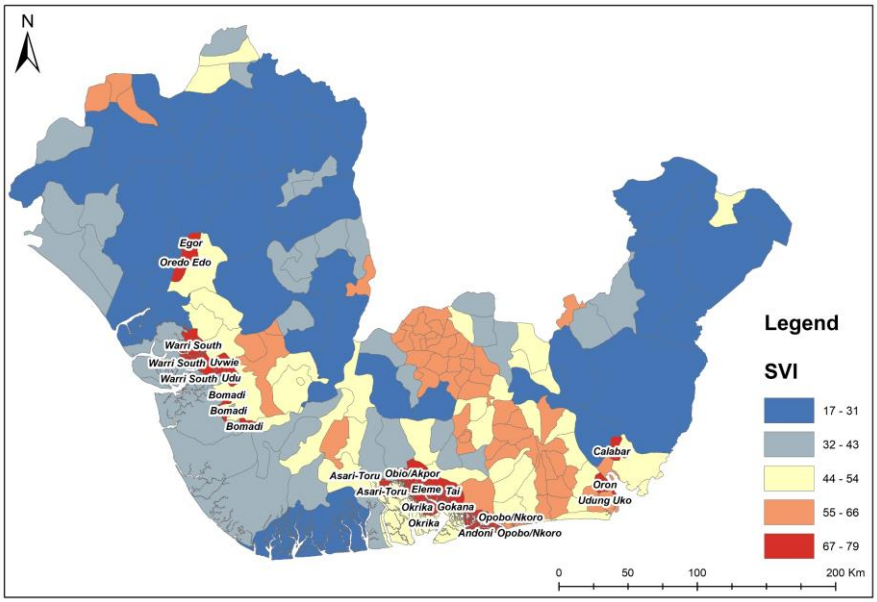
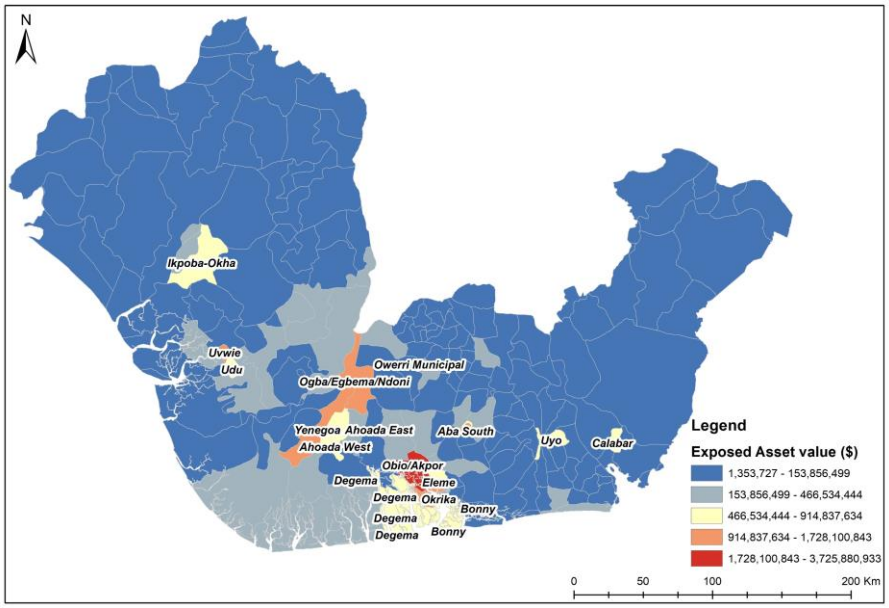


Figure 8Aa: Spatial distribution of Social vulnerability index[64]

8.2. ***Asset exposure to geophysical hazards***: The total value of assets exposed to geophysical assets in the Niger Delta is estimated at $33 billion. Obio/Akpor (Rivers) is identified as the LGA with the highest asset exposure to geophysical hazards ($3.7 Billion), and Bakassi (Cross River) the least ($1.4 million). Other LGAs with high asset exposure is presented in Figure 8Ab. Asset exposure analysis takes into account: i) nightlight, ii) population data, iii) lit population, iv) GDP/gross regional product (GRP) and v) CLIMADA (CLIMate ADAptation).



[64] de Sherbinin, A., Chai-Onn, T., Jaiteh, M., Mara, V., Pistolesi, L., & Schnarr, E. (2014). Mapping the Exposure of Socioeconomic and Natural Systems of West Africa to Coastal Climate Stressors. Report for the USAID African and Latin American Resilience to Climate Change (ARCC) project.

Figure 8Ab: Asset exposure due to geophysical hazards[65]

9. Development Indicator

9.1. ***Human Development Index***: The Sub-national Human Development Index (SHDI) for the Niger Delta States are is an average of the subnational values of three dimensions: education, health and standard of living. The 3 indices are measured with the following indicators: Education (mean years of schooling of adults aged 25+ and expected years of schooling of children aged 6); Health(Life expectancy at birth) and Standard of living (Gross National Income per capita (PPP, 2011 US$)). For the Niger Delta region, the average health index = 0.61, education = 0.65 and income = 0.63 (Figure 8A). All indexes are above the national average of 0.53, 0.49 and 0.60 respectively. The HDI in the region is 0.63, greater than the national average of 0.53. The state with the highest HDI is Delta 0.66 and the least Akwa Ibom 0.60.

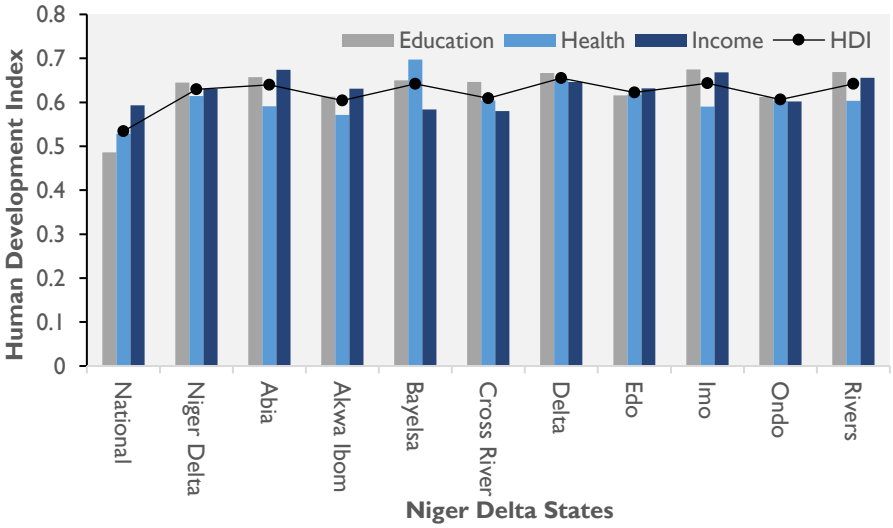


Figure 8A: Human Development index[66]

[65] Eberenz, et al., 2020, exposure data for global physical risk assessment, Earth Syst. Sci. Data, 12, 817–833, https://doi.org/10.5194/essd-12-817: https://www.research-collection.ethz.ch/handle/20.500.11850/331316

[66] Human Development Index: https://globaldatalab.org/shdi/about/

10. Interventions:

10.1. ***Projects by the Niger Delta Development Commission (NDDC):*** The NDDC PMIS captures 21,071 projects/ programs (Figure 10A), comprising of electricity (39%), roads/ bridges (38%), buildings (9%) and water supply (8%) and others (7%). NDDC project distribution by states are as follows (Rivers (33%), Delta (15%), Akwa Ibom (12%), Imo (8%), Ondo (8%), Bayelsa (7%), Abia (7%), Edo (6%), and Cross River (6%))

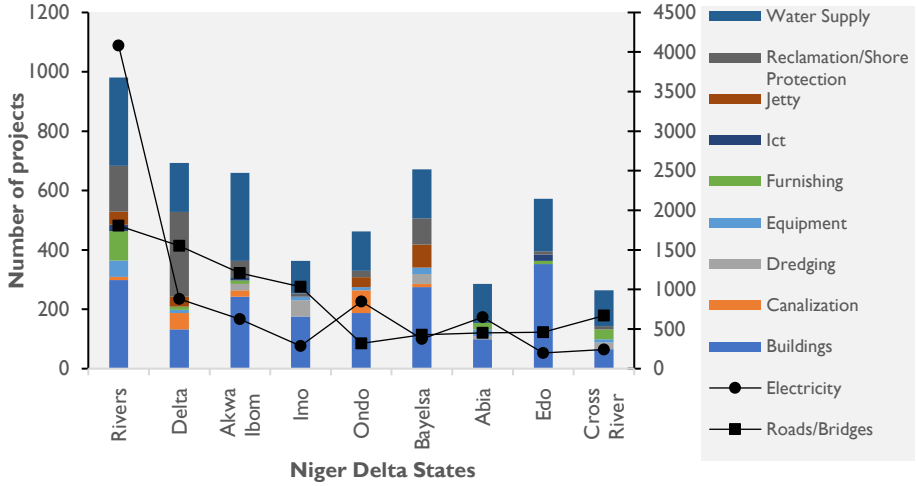


Figure 10A: Indicative patter on areas of interventions in the Niger Delta region by NDDC[67]

10.2. ***Projects by the Ministry of Niger Delta Affairs (MNDA) and other agencies***: The Niger Delta Strategic Implementation Work Plan (SIWP) captures 233 MNDA's projects with an estimated budget of 528 billion. The sectors of intervention include infrastructure (23%), capacity building (16%), consultancy (15%), education (14%), environment (7%), health (7%), job creation (7%), agriculture (6%), power and others (4%). MNDA project and programs are distribution by states are as follows Delta (21%), Cross River (19%), Edo (12%), Akwa Ibom (10%), Abia (9%), Ondo (9%), Imo (9%), Bayelsa (6%) and Rivers (4%).

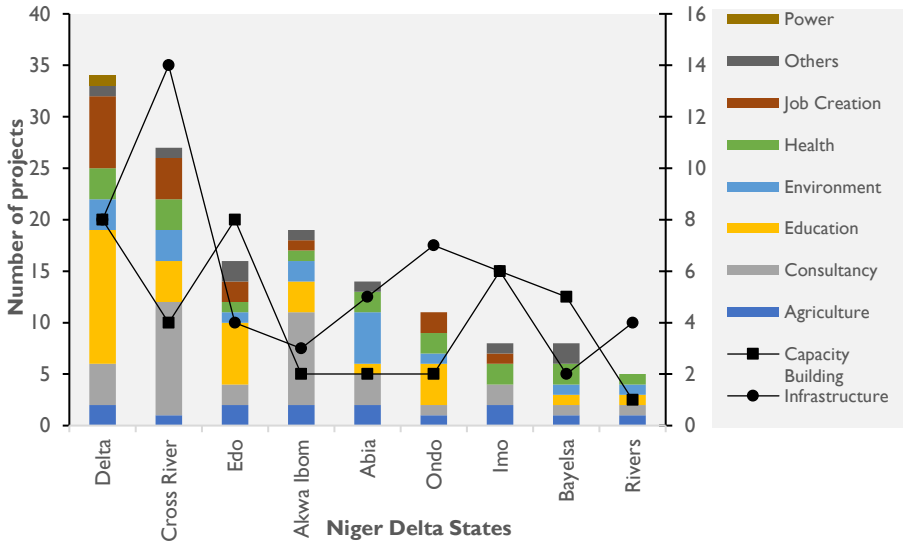


Figure 10B: Indicative patter on areas of interventions in the Niger Delta region by MNDA[68]

[67] NDDC Project Information Management System (PIMS): https://nddcproject.nddc.gov.ng/
[68] Niger Delta Strategic Implementation Work Plan (SIWP): https://www.siwp.ng/

V. Conclusion:

This report presents preliminary baseline data and information for 10 core sectors relevant to the development of the Niger Delta region, solely based on secondary geospatial and quantitative data sources presented in references. The resultant maps, plot and analysis provide an indication on the extent and location of challenges and opportunities for development in the Niger Delta Region required to advance on a more diversified, inclusive and resilient basis and development to be sustained in the long term. Primary data collection through field visits and stakeholder consultation will be important to help validate the results presented in this report, as well as a review of data sources and methodology to understand any underlying epistemic or aleatory uncertainties and data completeness. The data and information presented will help in the development a roadmap and spatial decision support system to update the Niger Delta regional action plan and the preparation of a monitoring and evaluation framework to track progress in relation to sector-specific indicators.