GSC Advanced Research and Reviews

eISSN: 2582-4597 CODEN (USA): GARRC2

Cross Ref DOI: 10.30574/gscarr

Journal homepage: https://gsconlinepress.com/journals/gscarr/

(Research Article)

Socio-environmental problems of granite mining in the urban commune of Manéah (Coyah Prefecture, Guinea)

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GSC Advanced Research and Reviews, 2026, 28(01), 016-030

Publication history: Received on 21 March 2026; revised on 30 June 2026; accepted on 02 July 2026

Article DOI: https://doi.org/10.30574/gscarr.2026.28.1.0100

Abstract

Like many human activities, mining operations are frequently criticized for their environmental impacts. In this context, this study was conducted to identify the environmental problems associated with granite extraction by blasting in the urban commune of Manéah. Granite extraction is essential for infrastructure development, particularly in developing countries like Guinea. However, this extractive activity generates significant socio-environmental impacts, especially in areas with a high concentration of quarries. This study addresses this issue and aims to analyze the environmental and social effects of granite extraction in the urban commune of Manéah, located in the Coyah prefecture. The methodology employed is based on a mixed-methods approach combining field observations, surveys of local residents, and laboratory analyzes of dust and rock samples. Environmental measurements, particularly regarding air quality and noise levels, were also carried out. Furthermore, an analysis of the spatio-temporal dynamics of land cover between 1980 and 2024 was conducted using satellite imagery. The results reveal that mining activities, particularly blasting, crushing, and material transport, generate significant dust emissions, noise pollution, and vibrations. These disturbances significantly impact the biophysical environment, especially air quality, soils, and the landscape. From a health perspective, local populations experience recurring ailments such as coughs (25%), respiratory infections (18%), and eye irritations, linked to exposure to fine particles and gases from explosions. The study also highlights a significant transformation of land use, marked by the expansion of built-up areas and quarries at the expense of vegetation. From a socio-economic perspective, although granite mining contributes to job creation, a significant proportion of the population (45%) believes that the economic benefits remain insufficient. In conclusion, this research underscores the need to strengthen environmental and social management measures to limit the negative impacts of granite mining and ensure sustainable development in the municipality of Manéah.

Keywords: Granite; Mining; Environmental Impacts; Quality of Life; Manéah

1. Introduction

Granite is a plutonic igneous rock characterized by a granular texture and a mineralogical composition dominated by quartz, mica, and feldspar. Thanks to its remarkable mechanical properties, particularly its high resistance to compression and abrasion, it is a material of choice in the construction industry, used in the building of infrastructure, roads, railway ballast, and decorative structures.

In the current context marked by the implementation of the Sustainable Development Goals (SDGs), particularly SDG 11 on sustainable cities, the use of construction materials appears as a key lever for meeting growing infrastructure and housing needs (Kollie, L. 2024). However, this development dynamic is accompanied by major environmental and social challenges, especially in developing countries where regulatory mechanisms often remain inadequate (Ikeoluwa, 2024).

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In Africa, and particularly in Guinea, the exploitation of mineral resources, including granite, contributes significantly to economic growth and job creation (Songanaba et al., 2023). However, the intensification of extractive activities leads to significant environmental impacts, such as air, water, and soil pollution, as well as noise pollution affecting local populations (Azzeddine, 2015).

Furthermore, the crushing and grinding of aggregates generates significant quantities of siliceous dust, including fine particles (PM10) that pose high health risks due to their ability to penetrate deep into the respiratory system (Benselhoub , 2015; Kharytonov, 2017). These exposures can lead to serious illnesses such as silicosis and pneumoconiosis (Campos, 2016).

Faced with these challenges, it appears necessary to assess the environmental and health impacts linked to granite mining, in particular through monitoring air, water and noise quality, in order to better understand their effects on populations and to propose appropriate management measures.

2. Methodology

2.1. Presentation of the study area

The study area is located in the Republic of Guinea, more precisely in the urban commune of Manéah, in the prefecture of Coyah in Lower Guinea. This area constitutes an important granite mining center, marked by the presence of several industrial quarries, notably that of the SOMIAG company.

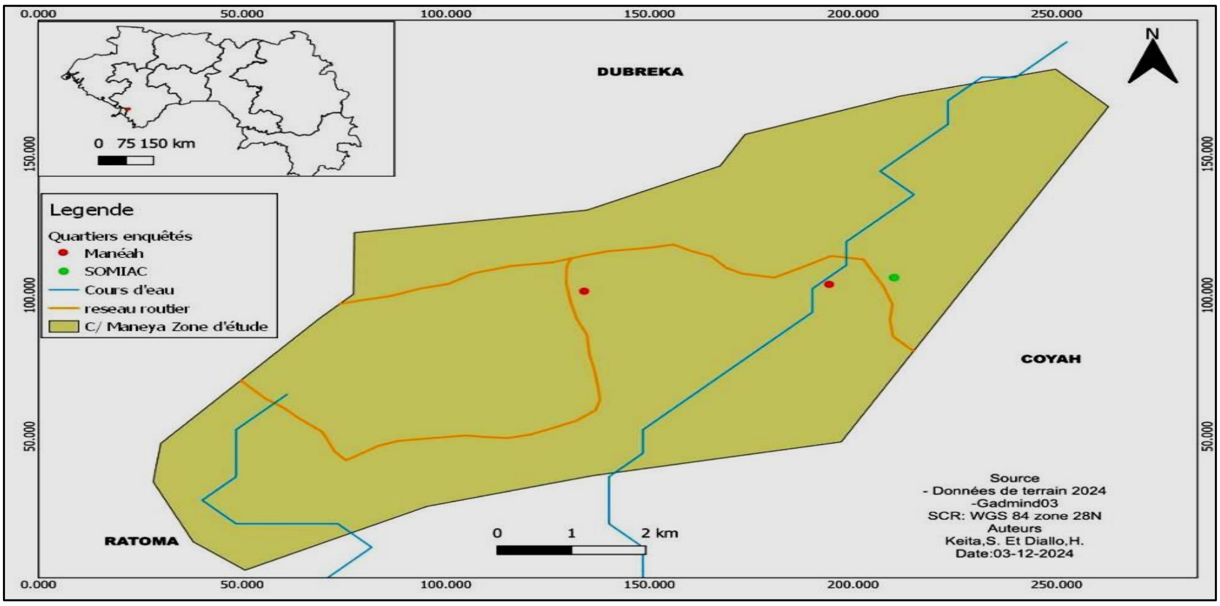

Figure 1 Location map of the study area

The study site is characterized by a diverse biophysical environment including a relatively varied relief, an active hydrographic network and a vegetation cover subjected to increasing anthropogenic pressure linked to extractive activities.

Climatically, the area belongs to the humid tropical zone, with two main seasons: a dry season and a rainy season. The latter is marked by abundant rainfall that strongly influences surface runoff and quarrying conditions.

The area's hydrographic network consists of streams and lowlands that play a vital role in agricultural activities and the domestic needs of local populations. However, these water resources are likely to be affected by granite mining activities, particularly through siltation and pollution.

Geomorphologically, the area features formations dominated by granite outcrops, with a landscape characterized by hills, plateaus, and valleys. These characteristics favor quarrying but also make the environment vulnerable to degradation processes such as erosion and landscape alteration.

Thus, all these elements together provide the urban commune of Manéah with a favorable environment for granite mining, while exposing the natural environment and the population to significant environmental and social risks.

2.2. Equipment

The equipment used in this study includes both field equipment and laboratory instruments adapted for characterizing the environmental impacts of granite quarrying. In the field, a global positioning system (GPS) was used to precisely locate sampling points and the study area. Survey forms and structured questionnaires were used to collect socio-economic data from local residents. In addition, an air quality monitoring system was used to assess fine particulate matter (PM2.5 and PM10) concentrations. All of this equipment enabled the collection of reliable and relevant data for analyzing the environmental and health impacts of granite quarrying.

2.3. Methods

Data acquisition was carried out at two (2) levels through fieldwork and laboratory work.

- The data was obtained by:
- surveys of the population;
- direct observations;
- laboratory analyses (air);
- environmental measures.

2.4. Impact Analysis

2.4.1. Fieldwork

In addition to reviewing documents, public consultations were conducted. This socio-environmental survey was carried out using a single method: individual interviews. These interviews involved employees, local residents, and local authorities. The purpose of these interviews was to discuss concerns with residents regarding nuisances and other impacts generated by the quarry's activities. The survey was conducted using a questionnaire and took place over a one-month period. The survey population was selected based on predefined criteria such as gender, occupation, and whether or not they were employed by the quarry. The results were analyzed using impact matrices.

2.4.2. Method for assessing the significance of impacts

Impact assessment is based on observed facts, while evaluation involves a value judgment. This evaluation can not only help establish thresholds or levels of acceptability, but also determine impact mitigation criteria or monitoring and follow-up needs. Assessing the significance of an impact depends first on the affected component, that is, its intrinsic value to the ecosystem (sensitivity, uniqueness, rarity, reversibility), as well as the social, cultural, economic, and aesthetic values of the population with respect to the affected components. The significance of an impact also depends on the degree of change experienced by the affected environmental components. Here, the impact assessment was based on a matrix approach to the interrelationship between the project activities, the sources of impacts, and the elements of the receiving environments, namely the physical, biological, and human environments. The purpose of impact assessment is to assign relative importance to the impacts associated with the project and thus determine the order of priority according to which impacts should be avoided, mitigated, or offset. Three (3) criteria are used to determine and assess impacts: intensity, scope/extent, and duration.

2.4.3. The intensity

This refers to the magnitude of the impact on the component being studied. The intensity can be high, medium, or low, depending on the degree of modification of the element of the social or environmental context being studied. Three intensity classes have been defined:

- High intensity (Fo): the source of impact significantly affects an element of the environment, alters its integrity, or greatly reduces (or increases) its use, specific character, or quality. It greatly improves the element or significantly increases its quality or use;
- Medium intensity (Mo): when the induced changes are visible but do not compromise the normal functioning of the component;
- Low intensity (Fa): when the induced changes are slight or zero.

2.4.4. The scope/extent

This indicator measures an area where a proportion of the population corresponds to the spatial reach of the change or the number of individuals likely to perceive this change in the study area. Several classes are defined to define the reach:

- Regional scope (Re): the source of impact modifies a substantial portion or all of an environmental feature within the primary study area. The affected feature is used, or the effects of the change on it can be perceived by the entire human or animal population of the primary study area;
- Local scope (Lo): the source of impact modifies a portion of the environmental element located within the work area and in the immediate adjacent space. The affected element is used or the effects of the change on it can be perceived by the human or animal population located within the area circumscribed by the work area or in the immediate adjacent space;
- Point impact (PO): The source of impact modifies a portion of the environmental element located within the work area. The affected element is used, or the effects of the change on it can be perceived by a portion of the human or animal population located within the area enclosed by the work area.

2.4.5. The duration

- During the implementation of a phase, the duration of an impact refers to the assessment of the period during which the effect of an activity or project component will be felt. Impact duration is divided into three categories:
- Long duration (Log): it applies to an impact whose effect is felt continuously or intermittently, but regularly, throughout the life of the infrastructure and even beyond; the effects are also considered irreversible;
- Average duration (Mo): it expresses an impact whose effect is felt continuously or intermittently, but regularly, for a period shorter than the lifespan of the infrastructure, i.e. a few years;
- Short duration (Co): This refers to an impact whose effect is felt over a limited period of time, generally corresponding to the period of construction of the infrastructure or operation, or a period shorter than this.
- The assessment of the significance of the impact depends on the combination of the different indicators defined above; the correlation established between each of the indicators allows for the following classification:
- Impact of major importance (Ma): this means that the integrity of the nature of an element and its use are significantly altered. The impact endangers the life of a human, animal or plant species;
- Medium impact (Mo): A medium impact means that the integrity of the nature of an element and its use are partially modified
- The impact does not endanger the lives of individuals or the survival of any animal or plant species;
- Minor impact (Mi): A minor impact means that the integrity of the nature of an element and its use are slightly altered.

2.4.6. The spatio-temporal evolution of granite quarries in Manéah

To determine the spatiotemporal evolution of the quarries, we used Landsat TM (Thematic Mapper) satellite imagery, which offers the advantage of spatial comprehensiveness and highlights the dynamics of land use in Manéah, allowing us to assess the impacts of quarrying activity on the population and their homes. Three images (1980, 2020, and 2024) will be used for this purpose. We will use a GPS to collect the geographic coordinates of the study area.

3. Results

3.1. Environmental Impacts

3.1.1. Observations on the dynamite blasting process at the Somiag quarry

Explosive felling is a technical operation that unfolds through a series of steps strictly governed by specific standards, adherence to which is crucial to ensuring the effectiveness and safety of the blast. Conversely, any failure to comply with these requirements can lead to malfunctions and increase the risk of damage.

Analysis of compliance with procedures on the ground reveals incomplete application of the applicable rules. At the quarry level, significant discrepancies were noted, particularly regarding drilling and packing parameters.

Thus, although the recommended drilling depth is 15 m, values reaching 18 m were observed, indicating an exceedance of the technical specifications. Furthermore, for a standard depth of 15 m, the packing is normally between 1.5 and 2 m.

However, on the site, it varied between 1.5 and 1.7 m for depths ranging from 10 to 18 m, according to information provided by the mining supervisor.

These deviations from established standards could explain the block projections observed beyond the initially defined security perimeter.

Figure 2 Drilling machine on site

3.2. Problems related to the dynamite blasting of the Somiag granite massif

The exploitation of the granite massif is altering the natural environment, which is becoming increasingly human-modified. The main impacts recorded at the quarry are dust emissions and noise pollution. Fieldwork at the industrial quarry identified three sources of airborne dust emissions: drilling, crushing, and blasting. The loading of dump trucks, their movement, and the movement of heavy equipment also contribute to dust emissions. Noise pollution originates from blasting, the operation of engines (machinery, crushers, and trucks), and drilling. Table ***1*** presents an analysis of the significance of these impacts. This analysis shows that dust and gas emissions constitute a major impact on the receiving environment, while noise pollution remains minor to moderate. Indeed, the operation of the engines of the machines and trucks mixes nitrate with diesel fuel, and the explosion generates gases as well as odors.

Table 1 Assessment of the significance of the impacts

Source of impacts	Impacts	Intensity	Scope	Duration	Importance
Drilling activities	-Noise pollution -Emission of Dust and Gas -Vibration	Average Forte Average	Local Local Local	Short Long Short	Minor Major Minor
Mine blasts	-Dust and gas -Vibration -Noise pollution	Forte Forte Forte	Local Local Local	Long Short Short	Major Minor Minor
Vehicle traffic	-Emission of Dust and Gas	Forte	Local	Long	Major
Crushing, grinding and screening	-Noise pollution -Dust emission	Average Average	Local Local	Short Short	Minor Minor

Table 2 Blasting Results

Measurement site	GPS coordinates	Altitude (Al)	Vibration in m/s^2	Measurement time	Measurement duration	Standard (m/s^2)
Building under construction	L: 9°42'29.79'' W: 13°25'8.78''	11 m	∞ m/s2 (>>1.5)	2:38 PM	1 minute	**1.5**

Interpretation: The shock is strong, there is a large exceedance of the threshold according to ISO 4866 standards for effects on structures, and ISO 2631 for exposure of the human body.

The blasting of explosives also causes **debris to be projected** over 100 meters, with risks of injury to the population and damage to nearby crops.

3.3. Air pollution from dust generated during crushing

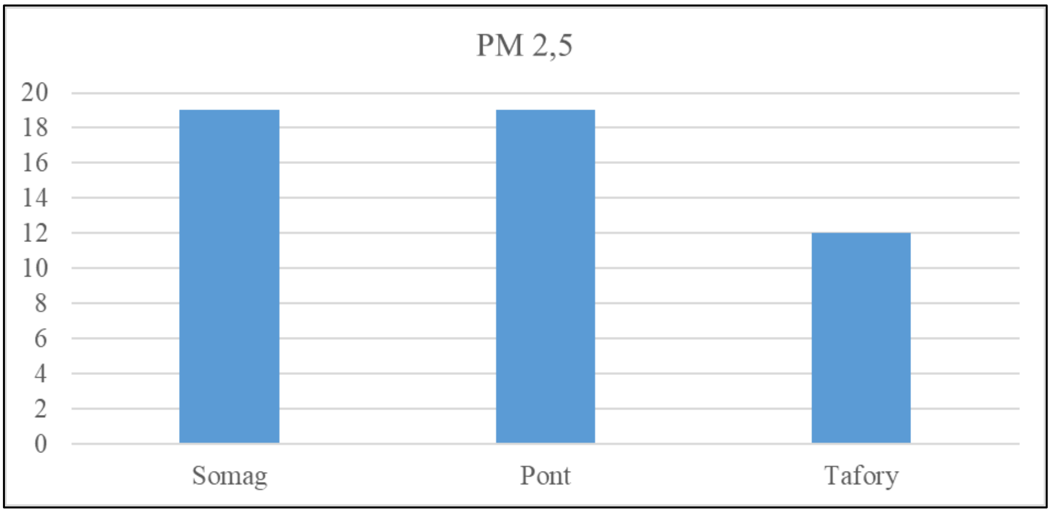

Figure 3 PM 2.5 values (Daytime)

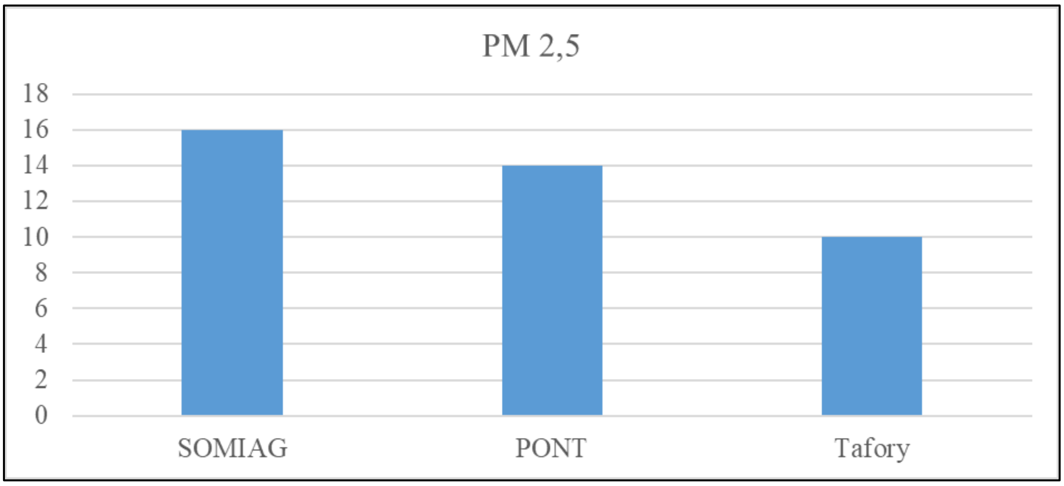

Figure 4 PM 2.5 values (Nighttime)

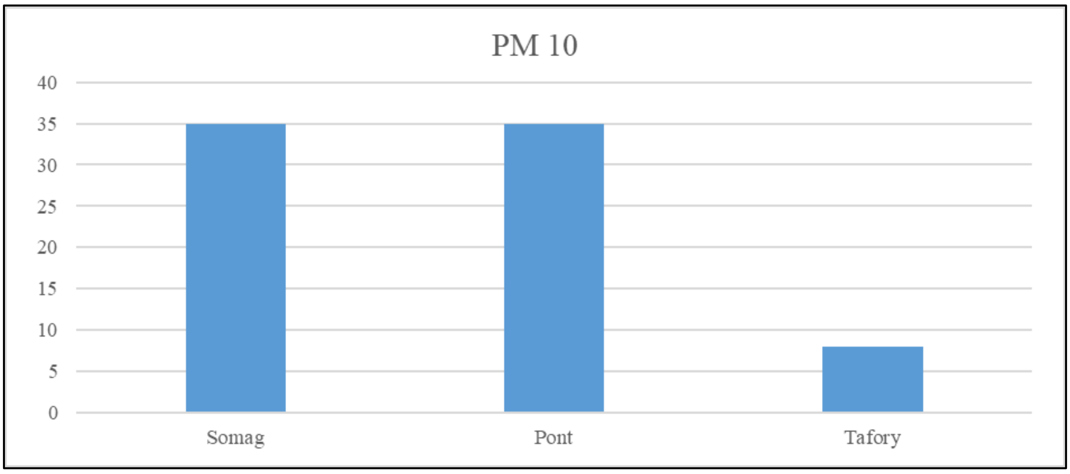

Figure 5 PM10 values (Daytime)

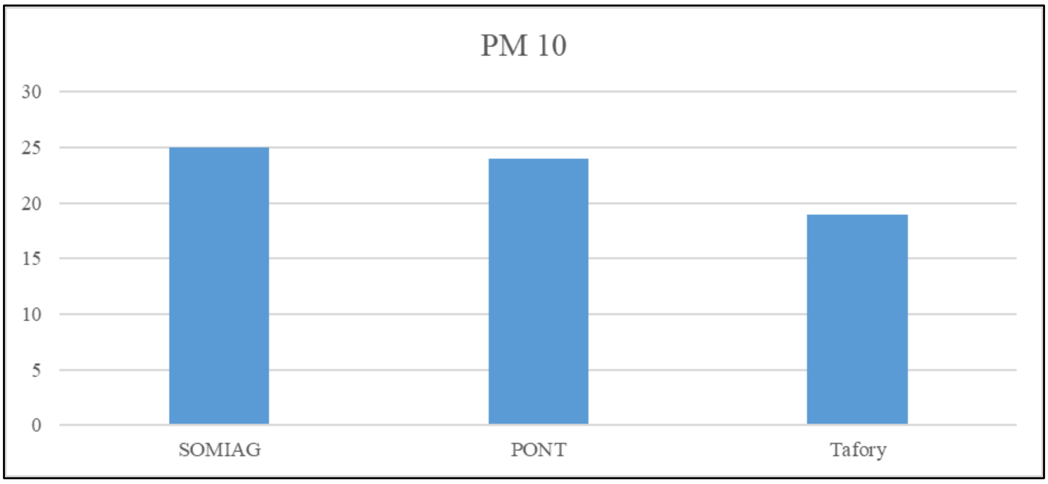

Figure 6 PM10 values (Nighttime)

Table 3 Impact Identification Matrix

Phase	**Sources of impact (activities)**	**Environmental components potentially affected**							
		Natural environment (biophysical)					**Human environment**		**Landscape**
		Ground	**Water**	**Air**	**Flora and fauna**		**Health and safety**	**Job**	
					Species	**Habitat**			
Quarry operation	Stripping	-	-	--	-	-	-	+	-
	Ore extraction (Drilling, Mining, (detonation, transport)	--	-	-	-	-	---	+++	-
	Processing (grinding, crushing), Screening		-	--		-	--	+++	-

	Transport of crushed granite	-		--		-	--	+++	-
	Equipment maintenance and administrative management operations	-	-	-			--	+++	

3.3.1. Health Impacts

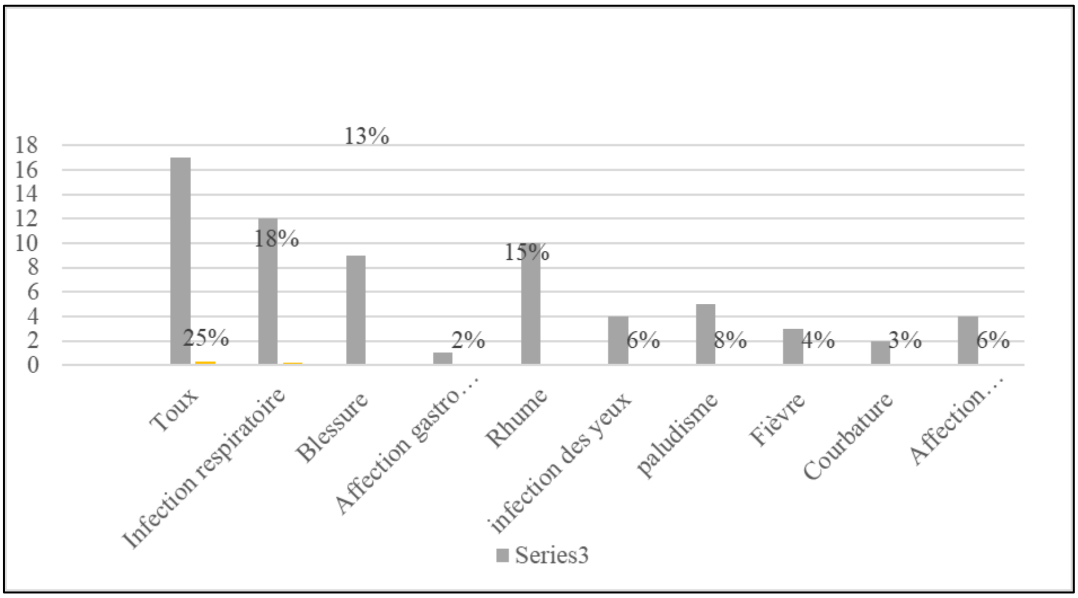

Figure 7 Diseases found among the surveyed individuals caused by blasting

- 25%: cough
- 18%: respiratory infections
- 15%: common cold
- other conditions (ocular, dermatological)

3.3.2. Socio-economic impacts

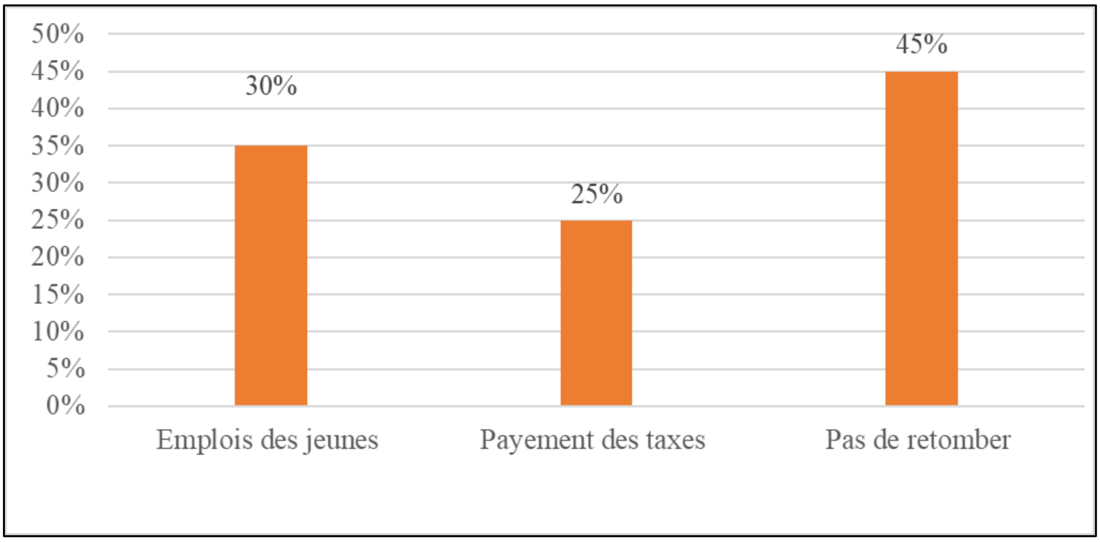

Figure 8 Economic Impacts (Benefit of exploitation)

3.3.3. Positive effects

- Youth employment (30%)
- Income for households

3.3.4. Negative effects

- 45% of the population is dissatisfied
- Potential conflicts
- Degradation of the living environment

3.4. Spatio-temporal dynamics of land use in Manéah

3.4.1. Spatiotemporal variation in land cover

The statistical results from image classifications and their cartographic representations show several changes in the surface areas of land cover entities (Figure 3.10). The graph in Figure 10 summarizes the changes in land cover area based on image classifications. This figure presents several trends in land cover evolution according to the defined study periods. The land cover status in 1980, 2020, and 2024 shows a significant expansion of transitional shrubland and buildings. The year 2024 was marked by intense human activity that contributed to habitat destruction.

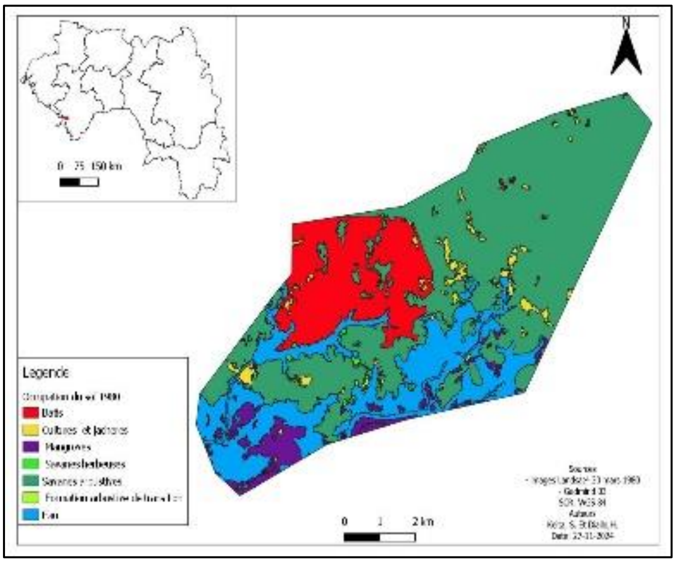

Figure 9 Land use map of Manéah, 1980

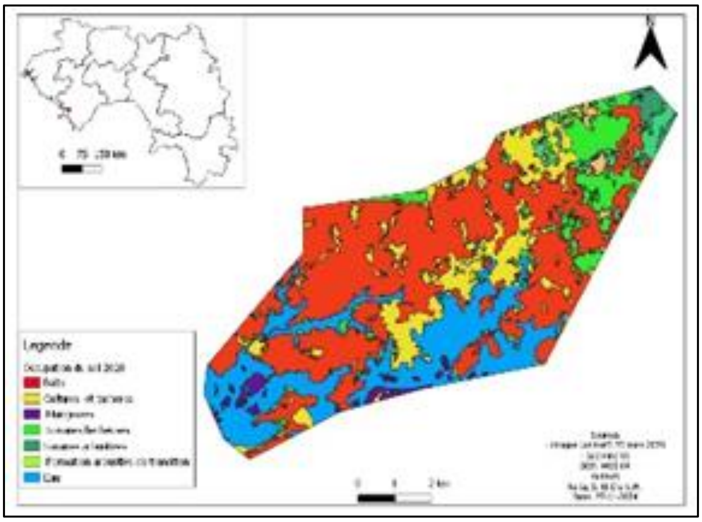

Figure 10 Manéah Land Use Map 2020

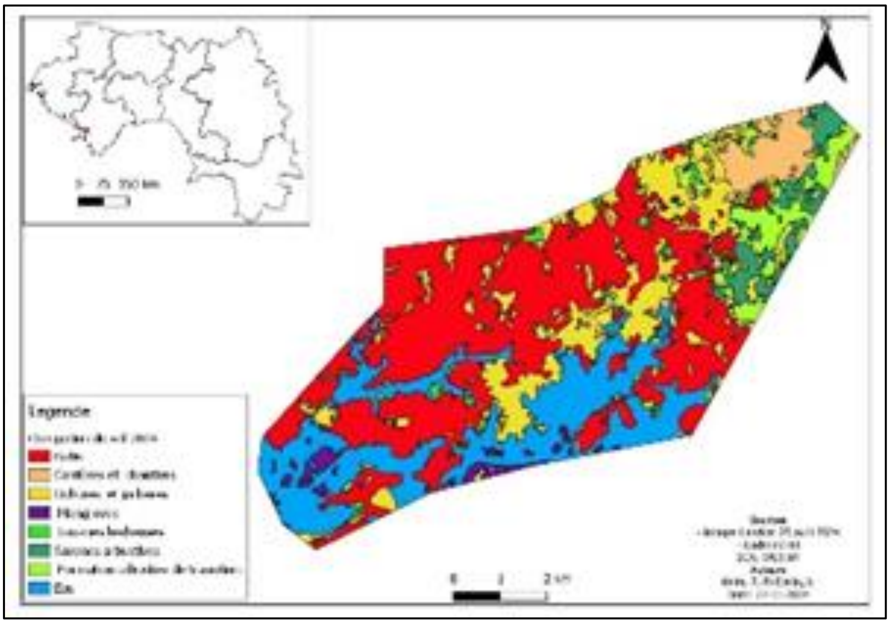

Figure 11 Manéah Land Use Map 2024

3.5. Change Matrix

Observations for 1980 show that shrub savannas occupied the largest portion in terms of area, 40.50%, or 5,401,819 ha, followed by water bodies at 31.46%, or 4,195,911 ha (Table **4)**. Mangroves accounted for 8.85% of the average area of the study zone, or 1,180.54 ha (**Table 4**). Cultivated land and fallow land, including built-up areas, occupied 8.73% (1,163,812 ha) and 7.22% (963,406 ha), respectively (**Table 4**). Next come the transitional shrub formations, covering 2.29% with 330,308 ha (**Table 4**), and finally the grassy savannas, occupying 126,637 ha, or 0.95% (**Table 4**). Analysis of the 2020 results shows that crops and fallow land occupy the largest portion in terms of area, 33.75%, or 4,501,903 ha, followed by built-up areas, representing 30.20%, or 4,028,124 ha (**Table 4**). Water bodies account for 14.25% of the average area of the study zone, or 1,901,403 ha (**Table 4**). Shrubby savannas and quarries/construction sites occupy 7.63% (1017.212 ha) and 7.50% (1000.629 ha) respectively in terms of area (**Table 4**). Next, the transitional shrubland, covering 305.115 ha (2.48%), is followed by grassy savannas, which occupy 126.637 ha (3.32%) (**Table 4**). In 2024, buildings predominate, occupying 32.67% of the study area, amounting to 4357.55 ha. Crops and fallow land occupy 27.31% of the area, or 3642.01 ha (**Table 4**). Transitional shrubland represents only 23.40% of the area in the Manéah zone. which is equivalent to 3119,654 ha (**Table 4**). Next water with 1506,639 ha or 11.30%, quarries and construction sites 273,738 ha or 2.05%, shrub savannas 230,389 ha (1.73%), mangroves 112,247 ha (0.84%), and finally grassy savanna with 94,082 ha or 0.71%.

Table 4 Land use statistics for 1980, 2020 and 2024

Classes	**1980**		**2020**		**2024**	
	Area (ha)	**Proportion (%)**	**Area (Ha)**	**Proportion (%)**	**Area (Ha)**	**Proportion (%)**
Water	4195,911	31.46	1901,303	14.25	1506,639	11.30
Buildings	963,406	7.22	4028,124	30.20	4357.55	32.67
Mangroves	1180.54	8.85	114,252	0.87	112,247	0.84
Shrubby savannas	5401,819	40.50	1017,212	7.63	230,389	1.73
Grassy savannas	126,637	0.95	442,575	3.32	94,082	0.71
Quarries and Construction Sites	0	0	1000,629	7.50	273,738	2.05
transitional shrub formation	305,115	2.29	330,308	2.48	3119,654	23.40
Crops and fallow land	1163,872	8.73	4501,903	33.75	3642.01	27.31

Total	13337.3	100.00	13336,306	100.00	13336,309	100

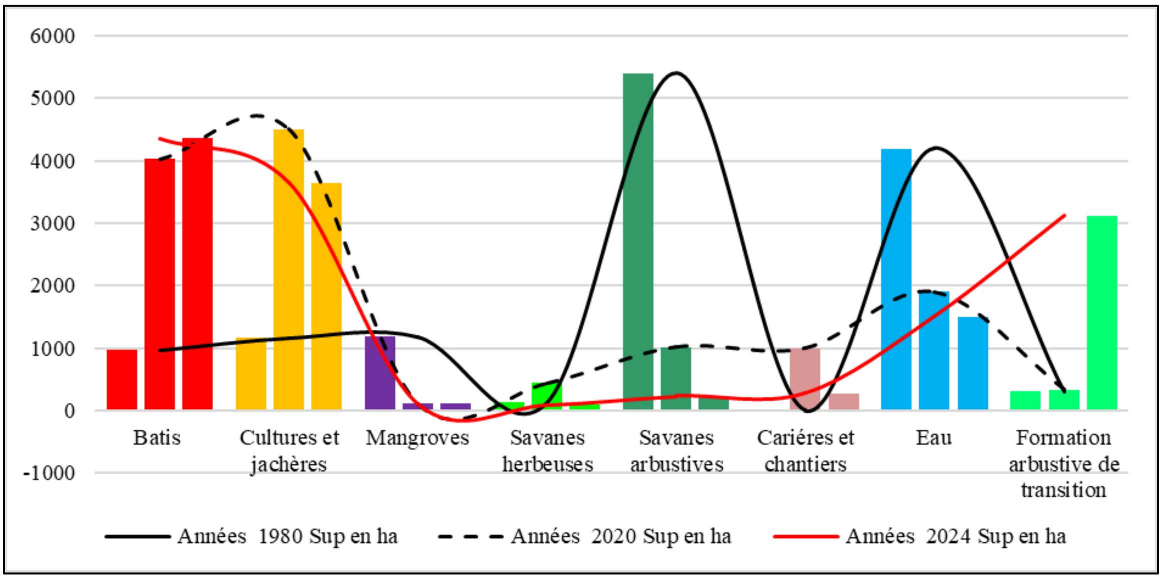

Figure 12 Spatiotemporal variation of occupation

Table 5 Change matrix

Classes	Years	Years	Years
	1980	2020	2024
	Sup en ha	Sup en ha	Sup en ha
Buildings	963,406	4028,124	4357.55
Crops and fallow land	1163,872	4501,903	3642.01
Mangroves	1180.54	114,252	112,247
Grassy savannas	126,637	442,575	94,082
Shrubby savannas	5401,819	1017,212	230,389
Quarries and construction sites	0	1000,629	273,738
Water	4195,911	1901,303	1506,639
transitional shrub formation	305,115	330,308	3119,654
Total	13337.3	13336,306	13336,309
KPA Index	0.76	0.79	0.82

3.6. Detection of land-use changes between 1980, 2020 and 2024

Progressive and regressive trends have been observed in the transformation process of the environmental environments in the Manéah area (**Table 6**). Thus, from 1980 to 2020, increases were observed in the classes of Built-up Areas (+22.98%) and Grassy Savannas. (+2.37%), Transitional shrubland (+0.19%), Quarries and Construction Sites (+7.50%), and Crops and Fallow Land (+25.02%) and a decline in the Water class (-17.21%), shrub savannas (-32.87%) and Mangroves (-7.98%) **(Table 6)**.

Table 6 Percentages of land cover classes in the Manéah area

Class	**1980-2020**			**2020-2024**			**1980-2024**		
	Proportion (%)	**Proportion (%)**	**Gap 1 (%)**	**Proportion (%)**	**Proportion (%)**	**Gap 2 (%)**	**Proportion (%)**	**Proportion (%)**	**Gap 3 (%)**
Water	31.46	14.25	-17.21	14.25	11.30	+2.95	31.46	11.30	-20.16
Buildings	7.22	30.20	+22.98	30.20	32.67	+2.47	7.22	32.67	+25.45
Mangroves	8.85	0.87	-7.98	0.87	0.84	-0.03	8.85	0.84	-8.01
Shrubby savannas	40.50	7.63	-32.87	7.63	1.73	-5.90	40.50	1.73	-38.77
Grassy savannas	0.95	3.32	+2.37	3.32	0.71	-2.61	0.95	0.71	-0.24
Quarries and Construction Sites	0	7.50	+7.50	7.50	2.05	-5.45	0	2.05	+2.05
transitional shrub formation	2.29	2.48	+0.19	2.48	23.40	+20.92	2.29	23.40	+21.11
Crops and fallow land	8.73	33.75	+25.02	33.75	27.31	-6.44	8.73	27.31	+18.58

From 2020 to 2024, an increase was observed in the Built (+2.47%), Water (+2.95%), and Transitional Shrub Formation (+20.92%) classes, and a decrease in the Grassland Savannas class. (-2.61%), Quarries and Construction Sites (-5.45%), Crops and Fallow Land (-6.44%), Shrubby Savannas (-5.90%) and Mangroves (-0.03%) **(Table 6** From **1980** to 2024, an increase was observed in the classes of Built-up Areas (+25.45%), Quarries and Construction Sites (+2.05%), Crops and Fallow Land (+18.58%), and Transitional Shrubland (+21.11%), and a decrease in the class of Grassland Savannas **(-0.24%), Water (-20.16%),** shrub savannas (-38.77%) and Mangroves (-8.01%) **(Table 6)** .

4. Discussion

4.1. Environmental Impacts

4.1.1. Impacts on population health

According to our results, of all those surveyed, 25% suffer from coughs, 18% from respiratory infections, 13% from injuries, 2% from gastrointestinal problems, 15% from colds, 6% from eye infections, 8% from malaria, 4% from fever, 3% from body aches, and 6% from dermatological conditions. This indicates that the mining operation is a source of illness for both the local population and the employees.

Our results corroborate those of Kassi kadjo (2020), the dust emitted during crushing, screening, drilling in granite quarries contains silica, alumina, ferric oxides, potash, lime, soda and magnesia, it has adverse effects on the population near the site and employees causing skin and eye irritation and respiratory diseases such as coughs and colds.

According to these authors, the artisanal extraction of lateritic stones in the urban commune of Dédougou has negative consequences on the health of the miners and residents living near the sites due to the arduous nature of the work and the recurrence of respiratory illnesses at the sites due to dust inhalation (Rouamba, S. et al., 2023), findings which are consistent with our results.

Our results also corroborate those of Kouadio (2023): granite mining is harming the health of populations living near the quarry, specifically in the village of Koyampleu . During the survey, illnesses such as coughs and colds were recorded among this population.

The activity also has consequences for the human health of workers in laterite quarries and residents living near the studied sites. Recurring illnesses include muscle pain, respiratory illnesses, cases of malaria, dengue fever, and other health problems related to the operation of artisanal quarries.

These results corroborate those of (A. SOMA et al. 2021, p. 108) who highlight in a study on gold panning an almost irreversible degradation of natural resources, health risks and diseases contracted by gold panners, riverside populations and animals in the Mouhoun watershed.

Surveys conducted among riverside populations reveal a prevalence of certain conditions, including coughs, respiratory infections, eye irritations and certain dermatological diseases.

These health problems may be linked to exposure to dust generated by mining activities, as well as to gases emitted during blasting operations.

According to Xavier (2000), the gases produced during explosions contain, in particular, carbon monoxide, nitrogen oxides and carbon dioxide, which can contribute to the degradation of air quality and affect the health of exposed populations.

4.1.2. Socio-economic impacts

Our results show that 30% support job creation, 25% support tax payments for the municipality and 45% support that there are no benefits.

The results obtained from the respondents revealed that: 30% support job creation, Adjoussi et *al* . (2016) are in the same vein, granite mining creates jobs for local populations.

However, despite these economic benefits, local residents also report several nuisances related to this activity, including air pollution, noise, vibrations and the risk of accidents related to the movement of machinery.

These results are similar to those obtained by Kouadio et al. (2017), who showed that quarrying can contribute to local economic development while generating significant environmental and social impacts.

4.1.3. Spatio-temporal dynamics of land use in Manéah

The analysis of the spatio-temporal dynamics of land use in the urban commune of Manéah highlights a progressive transformation of the landscape between 1980 and 2024. This evolution is mainly marked by the expansion of quarrying areas as well as by the increase in urbanized areas.

These changes reflect the intensification of economic activities related to granite mining and urban development in the Coyah region. However, this expansion is accompanied by a gradual reduction of certain plant formations and a change in land use.

These observations are consistent with the work of Hund et al. (2013), who emphasize that the expansion of mining activities in Africa often leads to significant transformations of landscapes and ecosystems, particularly through deforestation and soil degradation.

5. Conclusion

The exploitation of mineral resources is a key driver of economic development, particularly in developing countries where the demand for construction materials is growing rapidly. Among these resources, granite plays a significant role in the building and public works sector due to its favorable physical and mechanical properties. However, activities related to its extraction and processing can generate significant environmental and social impacts, especially for populations living near mining sites.

Analysis of land-use dynamics also revealed a gradual transformation of the landscape in the urban commune of Manéah, marked by the expansion of quarrying areas and the increase in urbanized land. This evolution reflects the intensification of economic activities related to the extraction of construction materials in this area.

Furthermore, environmental analyses have shown that certain environmental components, particularly air quality, are affected by granite quarrying activities. Dust emissions generated by crushing, material transport, and blasting operations contribute to air quality degradation.

Thus, although granite mining represents an important economic opportunity for the urban commune of Manéah, it also generates environmental and social impacts that require special attention.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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