



DPSIR Framework Handbook GRENADA

Driver-Pressure-State-Impact-Response (DPSIR) Framework for Grenada





OVERVIEW

This handbook summarizes the Driver-Pressure-State-Impact-Response (DPSIR) Framework conducted for Grenada, under the CSIDS-SOILCARE Phase 1 Project. It provides an overview of the methodology, assessments, and description of the five (5) intervention sites selected for Grenada. Importantly, the DPSIR results of each intervention site were highlighted along with the recommended interventions to address the land degradation issues. Through the various interventions, the project aims to have 29,000 hectares of land restored and 26,000 hectares of landscapes under improved practices. Consequently, for Grenada, the project will target approximately 3000 hectares of land in Grenada under Component 3 and 2000 hectares under Component 4.

The recommended interventions will be further discussed with stakeholders to determine the most effective interventions for each selected site. Additional information on the DPSIR Framework for Grenada, its sister island Carriacou, and the other participating countries can be found in the detailed DPSIR report and the country-specific reports.

INTRODUCTION

*The Partnership Initiative for Sustainable Land Management (PISLM) is implementing **the Caribbean Small Island Developing States (SIDS) Multicountry Soil Management Initiative for Integrated Landscape Restoration and Sustainable Food Systems: Phase 1, referred to as the PISLM CSIDS-SOILCARE Phase 1 Project.** This project is being implemented in eight (8) participating countries, Antigua and Barbuda, Barbados, Belize, Grenada, Guyana, Haiti, Jamaica, and St. Lucia. The project's primary objective is to "strengthen Caribbean SIDS with the necessary tools for adopting policies, measures, and reforming legal and institutional frameworks to achieve Land Degradation Neutrality (LDN) and Climate Resilience".*

In this regard, five (5) components were established under the project to address and reverse land degradation in CSIDS. Furthermore, the Driver-Pressure-State-Impact-Response (DPSIR) Framework is one such intervention. This was coupled with the National Soil Surveys, Climate Risk Assessment, and Land Suitability Analysis conducted in participating countries. This handbook, however, will focus on the results of the DPSIR framework for Grenada intervention sites as highlighted by the DPSIR report.

The DPSIR framework is considered valuable for assessing soil degradation in CSIDS given its cause-effect approach which can determine appropriate management responses (Francis, 2023).

Under the CSIDS- SOILCARE Phase 1 Project, three components will be addressed in Grenada as follows:

Component 2: *Addressing the drivers of land degradation through the rehabilitation of land and soil degraded areas; the promotion of integrated landscape management and restoration and the identification and implementation of livelihood alternatives for communities. **This component would be executed in Lest Avocates and Belle Vue South***

Component 3: *Resilience Building to Land Degradation, Natural Disasters and Climate Change through Climate Smart Agriculture and Drought Risk Management. **This component would be executed Chambord and Dumfries.***

Component 4: *Enhancement of Food Systems and Alternative Livelihoods through the promotion of innovations in agriculture and livestock production systems and mobilization of the Private Sector in Support of LDN Special Climate Change Fund (SCCF). **This component would be executed Limlair.***

METHODOLOGY



The research was conducted in four (4) stages as follows:

1. Comprehensive review of the Land Degradation Neutrality-Target Setting Process for Grenada's mainland and Carriacou..
2. Identification of hot spots affected by land degradation.
3. Participatory qualitative analysis was conducted within the locations identified as Intervention Sites.
4. Evaluation of the drivers, pressures, state, impacts, and possible responses (DPSIR) to land degradation of the Intervention sites.

NB. A land capability survey and a visual soil analysis were conducted based on the Protocol for the Assessment of Sustainable Soil Management. However, the findings are captured briefly in this handbook but details can be found in the DPSIR report.

A GIS analysis was conducted for each location to ascertain the nature of the land use and vegetation health through the Normalized Difference Vegetation Index (NDVI).

SOILCARE INTERVENTION SITES

MAINLAND GRENADA



NO. 1: LEST AVOCATES FOREST



The Lest Avocates intervention site which spans 152.91 hectares is the first site selected for Grenada's mainland. A significant portion of the land is designated as a forest reserve within the Lest Avocates watershed. It also functions as a hiking trail and houses the water extraction plant of the National Water and Sewage Authority (NAWASA).

Historically timber harvesting was conducted at the site, however, it is now managed by the Ministry of Economic Development, Planning, Tourism, ICT, Creative Economy, Agriculture and Lands, Marine Resources & Cooperatives. The main land degradation issues include soil erosion on the forest floor and in riparian areas. Furthermore, reductions in vegetation quality, influenced by the *Bambusa Vulgaris* and Blue Mahoe species, contribute to soil erosion beneath the canopy. Fallen logs blocking channels and lack of re-vegetation efforts since 2005 accelerate soil erosion and sediment load in the channels, intensifying land degradation.

LEST AVOCATES FOREST DPSIR FRAMEWORK

Table 1: Driver-Pressure-State-Impact-Response (DPSIR) Framework

Framework	Indicator
Driving Forces	Increase in frequency, strength and intensity of hurricanes, climate variability, droughts.
	Lack of forest and riparian area management
	Increasing demand for water from Lest Avocates watersheds due to increased population growth
Pressures	Exploitation of water catchment Extraction of water from the watershed by NAWASA
	Exploitation of vegetation Use of timber for craft and construction, Lack vegetation in riparian areas
	Exploitation of fauna Wildlife hunting

LEST AVOCATES FOREST DPSIR FRAMEWORK

Framework	Indicator
State	Increased soil erosion and formation of rills and gullies
	Reduction in above ground and below biodiversity due to changing forest species, reduction in wildlife population
	Removal of topsoil from ecosystem
Impacts	Decline in extractable water quantity and quality during dry season

RECOMMENDED INTERVENTIONS FOR LEST AVOCATES FOREST

Table 2: Recommended interventions for Lest Avocates Forest

Agronomic measures	Managing forest for increased aesthetics and timber supply
	Replacement with indigenous viable agroforestry species
Vegetative measures	Removal of 10 acres of invasive bamboo species, marketing of bamboo for use in craft and in construction industry Management measures: Management of forest species, selective pruning and thinning of invasive Blue Mahoe species.
Structural measures	Clearing of fallen logs, planting of river-bank stabilizing grass (Vetiver grass).

NO. 2: CHAMBORD



Chambord is the second selected intervention site in Grenada's mainland. It is known for agricultural activities such as crop production and to a lesser extent grazing of animals. Subsistence agriculture is practiced, including root crops and vegetables such as tomatoes, cabbage, and sweet peppers. In addition, some areas are used to tether cows, goats, and sheep.

A few patches of forested areas that are uncultivated and provide habitat for wildlife. The residential properties are located on the periphery, however, there were greenhouses and water catchment facilities within the site. Chambord exhibits evidence of soil erosion. The main impacts of the land use change are vegetation reduction and loss of wildlife habitats.

CHAMBORD DPSIR FRAMEWORK

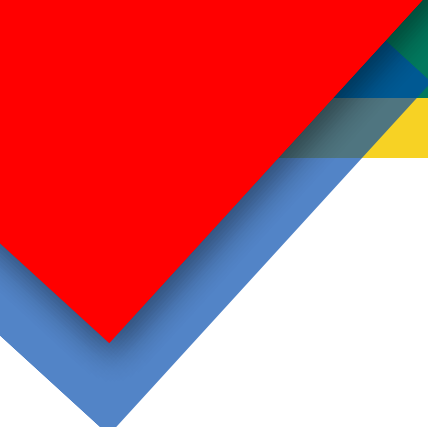
Table 3: Driver-Pressure-State-Impact-Response (DPSIR) Framework

Framework	Indicator
Driving Forces	Human population growth
	Small farm size 0.5-3 ha
	Increasing intensity of droughts, hurricanes, and flood events due to climate change
	Lack of technical capacity and training
Pressures	Poor farming practices. cultivating crops that mine nutrient from soil annually,
	Unsustainable farming practices like slash and burn
	Increased demand on water supply for irrigating crop growth
	Poor understanding of irrigation systems operation and management and inability to maintain an efficient system



CHAMBORD DPSIR FRAMEWORK

Framework	Indicator
Pressure	Emissions to air, water, and land. Transfer of agrichemical pollutants to ecosystems due to leaching and volatilization
State	Removal of topsoil from ecosystem due to poor ground cover, extensive reduction in arable topsoil, loss of nutrients and organic matter resulting in decline in agriculture output
	Soil biodiversity decline
	Loss of productivity
	Decline in water quality.



CHAMBORD DPSIR FRAMEWORK

Framework	Indicator
Impacts	Household economic decline, poverty
	Food insecurities because of increase demand on food imports
	Social vulnerabilities including increasing risk of hunger and praedial larceny.

RECOMMENDED INTERVENTIONS FOR CHAMBORD

Table 4: Recommended interventions for Chambord

Agronomic measures	Introducing soil reformation practices such as amending soils with fresh residue and compost; organic mulching and swale terraces, grass strips.
Structural measures	Repair Nursery Greenhouse
	Establish rainwater harvesting; construction and repair of water storage pond, Repair irrigation systems; instillation of drip irrigation lines.
Management measures	Composting to improve fertility, setting up of composting units.
Other measures	Capacity building; training in climate-smart agriculture and post-harvesting techniques, plant nursery preparations, formation of farmers associations.

SOILCARE INTERVENTION SITES

CARRIACOU



NO. 3: LIMLAIR AGRICULTURE FIELD STATION



The Limlair Agricultural Field Station is located on Grenada's sister island Carriacou. It functions as a research and development facility, especially for pigs and small ruminants mainly sheep and goats. The animals reared at the facility are supported by the cultivation of feedstock crops, forage grass, and various shrub species. The ruminants are grazed in rotation within paddocks while pigs are housed in multiple small stalls situated in one corner of the facility. The Field Station utilizes water harvesting facilities and a solar farm within its boundaries.

The main land degradation challenges at this site are in a decline in water availability and soil erosion. Moreover, these issues have resulted in limited water availability, which has affected forage and short-crop irrigation.

LIMLAIR AGRICULTURE FIELD STATION DPSIR FRAMEWORK

Table 5: Driver-Pressure-State-Impact-Response (DPSIR) Framework

Framework	Indicator
Driving Forces	Agricultural policy
	Limited policy on livestock: limited livestock regulations
	Poor investment in facility and improper management of resources, poor grass species, non-drought resistant, pasture management
	Changing climatic conditions
Pressures	Overstocking of animals to improve earnings
	Increased intensity of droughts and sea water spray

LIMLAIR AGRICULTURE FIELD STATION DPSIR FRAMEWORK

Framework	Indicator
State	Proliferation of undesirable forage due to limited paddock management
	Sheet and rill erosion
	Decline in land productivity
	Inhumane animal violations and mutilation of animals, mauling by dogs
Impacts	Conflict between land stakeholders and livestock owners leading to decline in community spirit
	Loss of capital
	Reduction in earning from small ruminants as well as dairy and beef industry

RECOMMENDED INTERVENTIONS FOR LIMLAIR AGRICULTURE FIELD STATION

Table 6: Recommended interventions for Limlair Agriculture Field Station

Vegetative measures	Rehabilitation of paddocks, improved forage species, drought resistant species and pasture management, live fencing.
Structural measures	Rehabilitation of Rainwater harvesting; restoration of water tank on Limlair Agriculture Station.
Management measures	Compositing to improve fertility, setting up of composting units
Other measures	Training in livestock management and fodder production, utilization of existing lands used for of solar farm infrastructure which creates shade for small grazing ruminants, training in soil testing and fertilizer application.

NO. 4: DUMFRIES



This intervention site comprises approximately 250 residents in a dispersed settlement pattern. Semi-subsistence agricultural practices are common in Dumfries. The main livelihood activities are agriculture and livestock farming.

Soil erosion is mainly due to soil contamination, declining water quality from a nearby landfill, and poor farming practices, such as seasonal tillage and overgrazing. Burning for pest and pasture management also occurs. Additionally, vegetation reduction is caused by a lack of rotational grazing or rangeland enclosure. Land degradation in Dumfries is also a result of population growth, changing climatic conditions, and a lack of technical training in irrigation and land management.

DUMFRIES DPSIR FRAMEWORK

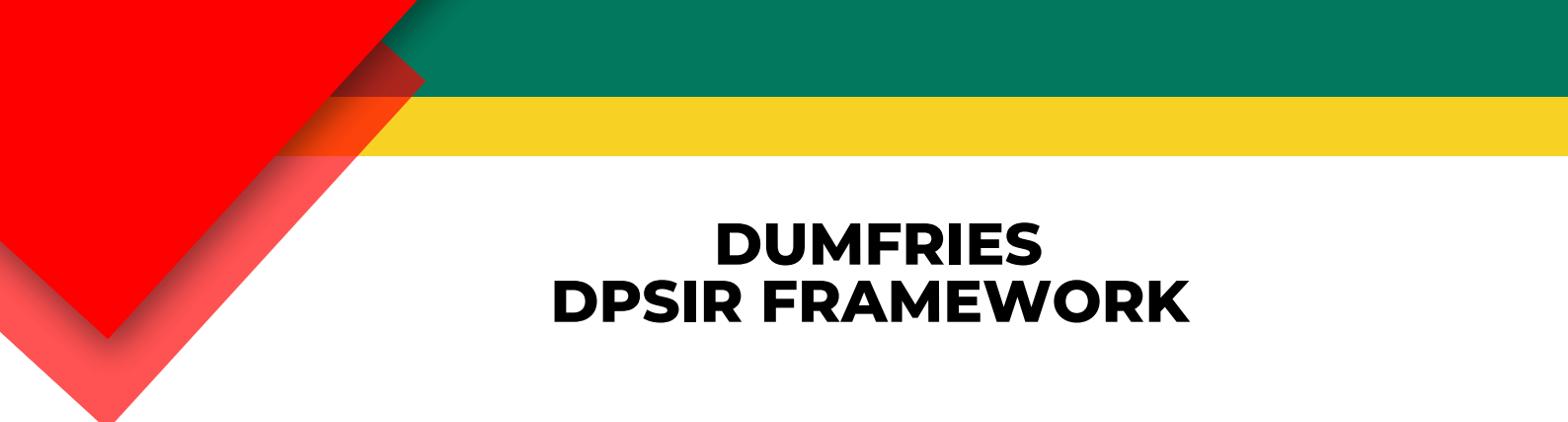
Table 7: Driver-Pressure-State-Impact-Response (DPSIR) Framework.

Framework	Indicator
Driving Forces	Human population growth resulting in increased burden on land for food products
	Increasing intensity of droughts, sea spray due to changing climatic conditions
	Lack of good irrigation systems that instigates water loss, unsustainable farming practices like slash and burn and seasonal ploughing
	Small farm size (0.5 - 3 ha)
	Lack of expertise and technical capacity



DUMFRIES DPSIR FRAMEWORK

Framework	Indicator
Pressures	Intensification of cropping systems
	Increase demand on irrigation water supply for crop growth
	Poor understanding of irrigation systems and inability to maintain an efficient system
	Emissions to air, water, and land. Transfer of agrichemical pollutants
State	Reduction in arable topsoil, surface crusting and increased soil salinity
	Soil biodiversity decline
	Decline in agriculture output and loss of land productivity.
	Decline in water quality



DUMFRIES DPSIR FRAMEWORK

Framework	Indicator
Impacts	Household economic decline, poverty due to reduce income
	Increase demand on food imports
	Social vulnerabilities including increasing risk of hunger and praedial larceny

RECOMMENDED INTERVENTIONS FOR DUMFRIES

Table 8: Recommended interventions for Dumfries

Agronomic measures	Introducing soil rehabilitation practices such as amending with fresh plant residue and compost; organic mulching, bio-pores, intercropping and agroforestry; establish wind breaks on coastline, swale terracing.
Structural measures	Training in repairing of irrigation systems, instillation of drip irrigation systems, installing nursery greenhouse to improve productive capacity.
	Construction and repair of wells in Dumfries.
Management measures	Composting to improve fertility, setting up of composting units
Other measures	Training in climate smart agriculture and post-harvesting techniques, plant nursery preparations.

NO. 5: BELLE VUE SOUTH



This intervention site is a small dispersed settlement on Carriacou's southeastern coastline with approximately 300 to 500 residents. Belle Vue South is characterized by exposed bare rock, sparse shrubs, and deep gullies associated with severe erosion.

The land degradation issues in this intervention site include land slippage, soil erosion, and vegetation reduction. These are mainly associated with land mining and overgrazing in the area. Deforestation resulted in a decline in vegetation composition and quality. Additionally, there have been changes, including drying up of water points, water level alterations, and water quality shifts.

BELLE VUE SOUTH DPSIR FRAMEWORK

Table 9: Driver-Pressure-State-Impact-Response (DPSIR) Framework

Framework	Indicator
Driving Forces	Population growth
	Changing climatic conditions
Pressures	Improper drainage networks and housing planning
	Increase burden on land for housing construction and recreational activities
	Increasing intensity of droughts, hurricane, and coastal erosion



BELLE VUE SOUTH DPSIR FRAMEWORK

Framework	Indicator
State	Reduction in arable topsoil, surface crusting
	Development of rill and gully erosion, exposure of bare rock
Impacts	Decline in land productivity and value
	Social vulnerabilities such as increase larceny

RECOMMENDED INTERVENTIONS FOR BELLE VUE SOUTH

Table 10: Recommended interventions for Belle Vue South

Structural measures	Gully plugging, bamboo gully, check dams, construction of a pond for irrigation purposes
Management measures	Reforestation and agroforestry



REFERENCE

Francis, R. (2024). DPSIR Framework Analysis

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