DPSIR Framework

Handbook

BARBADOS

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

OVERVIEW

This handbook summarizes the Driver-Pressure-State-Impact-Response (DPSIR) Framework conducted for Barbados, under the CSIDS-SOILCARE Phase 1 Project. It provides an overview of the methodology, assessments, and description of the seven (7) intervention sites selected for Barbados. 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 restore 29,000 hectares of land and have 26,000 hectares of landscapes under improved practices. Consequently, for Barbados, the project will target approximately 3000 hectares of land under Component 3 and 1500 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 Barbados and the other participating countries can be found in the detailed collated 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 Barbados 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 Barbados 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 Sedge Pond, Greenland Over Hill, and Coggins Estate.**

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 at Nature Fun Ranch.**

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 at Misty Woods Farm, Mystic Valley Farm, and Codrington College.**

METHODOLOGY

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

1. Comprehensive review of the Land Degradation Neutrality-Target Setting Process for Barbados.
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

NO. 1: NATURE FUN RANCH

The Nature Fun Ranch intervention site spans a total area of 20 acres and serves a dual function, as both a recreational and agricultural exposition park. The site is known for grazing and agricultural activities such as crop production and the rearing of cows, pigs, and rabbits.

This intervention site's main resulting land degradation issues are soil erosion and reduced water availability. Additionally, soil erosion has led to diminished land productivity and vegetation cover. The presence of invasive plant species is also a concern. The land is also utilized for rotational grazing, ranching, range enclosures, and animal stall feeding activities.

NATURE FUN RANCH
DPSIR FRAMEWORK

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

Framework	Indicator
Driving Forces	Tourism
	Climate change
Pressures	Replacing natural vegetation for livestock paddocks
	Overgrazing and seasonal ploughing of paddocks
	Drought and increase intensity of storm systems
	Exposure of bare soil for crop production

NATURE FUN RANCH
DPSIR FRAMEWORK

Framework	Indicator
State	Increased sheet and rill erosion
	Decline in agriculture output and reduced land productivity.
	Proliferation of undesirable forage
Impacts	Loss of ecosystem services such as water supply
	Loss of livelihood for ranchers resulting in reduced farmer income

RECOMMENDED INTERVENTIONS FOR NATURE FUN RANCH

Table 2: Recommended interventions for Nature Fun Ranch

Agronomic measures	Improved farming practices; introduction of rotational grazing, mixed cropping systems, organic mulching.
Vegetative measures	Rehabilitation of paddocks; improved forage species and pasture management.
Structural measures	Water harvesting and irrigation; establishment of pond (30,000 gallon – 26' x 26' x 6') and instillation of irrigation lines for crop production.
Management measures	Capacity building: establishment of a plant nursery and training in seedling preparation, compositing to improve fertility, setting up of compositing units.

NO. 2: CODRINGTON COLLEGE

Codrington College is Barbados' second intervention site. The area is known for its dispersed settlement and diverse land uses. Agricultural activities include crop production and grazing of animals which is the more dominant activity. The main land degradation issues at Codrington College include biological deterioration, vegetation reduction, and soil erosion. Moreover, regular mechanical tillage and diminished ground cover are the main causes of land degradation.

A major contributor to soil degradation at Codrington College is the lack of windbreaks. Furthermore, the impacts include crop loss, poor water retention in the soil, and increase in pests and diseases.

CODRINGTON COLLEGE
DPSIR FRAMEWORK

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

Framework	Indicator
Driving Forces	Population growth
	Climate change
Pressures	Poor management converted plots
	Drought and increases intensity of tropical systems
	Poor farming practices and limited inputs into cropping systems

CODRINGTON COLLEGE
DPSIR FRAMEWORK

Framework	Indicator
State	Decline in agriculture output and reduced land productivity
	Increased soil erosion
	Decline in vegetation cover.
Impacts	Reduction in ecosystem services
	Increased economic loss.

RECOMMENDED INTERVENTIONS FOR CODRINGTON COLLEGE

Table 4: Recommended interventions for Codrington College

Agronomic measures	Compositing and mulching practices, bio-pores.
Vegetative measures	Climate-smart agriculture, the establishment of climate-smart model farm, greenhouses.
Management measures	Change of land use type, management, timing of activities and species composition, compositing to improve fertility, setting up of compositing units

NO. 3: THE MISTY WOODS FARM

Misty Woods Farm is a small linear settlement with approximately sixty (60) inhabitants. Livestock rearing and crop production are the main livelihood activities. The major challenges with land degradation include a decline in water availability, soil erosion, and an increase in pests.

Insufficient rainfall, the geological nature of the area, farming practices, and invasive monkey species are the main causes of land degradation in the area. This results in low crop productivity and local wildlife pressures. Additionally, monkeys have contributed to in excess of 50% crop loss.

THE MISTY WOODS FARM DPSIR FRAMEWORK

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

Framework	Indicator
Driving Forces	Climate change
	Small farm size (0.5 -2 ha)
	Lack of technical capacity in irrigation technology
	Lack of capital to invest into the land
Pressures	Intensification of agriculture activities on small plots
	Increase demand on water supply for crop growth
	Increase demand for irrigation water
	Transfer of agrichemical pollutants to air, water, and land due to leaching and volatilization

THE MISTY WOODS FARM DPSIR FRAMEWORK

Framework	Indicator
State	Rill and sheet erosion
	Loss of land productivity
	Reduction in vegetation cover
	Decline in water quality
Impacts	Household economic decline, poverty
	Increase demand on food imports

RECOMMENDED INTERVENTIONS FOR MISTY WOODS FARM

Table 6: Recommended interventions for Misty Woods Farm

Agronomic measures	Vegetation soil cover: organic mulching, grass strips and bio-pores.
Structural measures	Check dam with bamboo to reduce erosion.
	Water harvesting/irrigation equipment; instillation of drip irrigation lines,
Management measures	Change in intensity level, rotational cropping and farm enterprise selection, compositing to improve fertility, setting up of compositing units.

NO. 4: THE MYSTIC VALLEY FARM

The main livelihood activities in this nucleated settlement are livestock rearing and subsistence farming. The land degradation issues within the Mystic Valley Farm are a decline in water availability, land slippage, and soil erosion.

Increased temperatures and reduced water availability, impact agricultural activities within the intervention site. This has caused a reduction in food production and the inability to grow water-intensive crops. The site has also recorded a proliferation of invasive species and severe forest fires.

THE MYSTIC VALLEY FARM DPSIR FRAMEWORK

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

Framework	Indicator
Driving Forces	Small farm sizes (0.5 – 2 ha)
	Lack of technical capacity in irrigation technology
	Climate change
Pressures	Intensification of agriculture activities on small plots
	Increase demand on water supply for irrigating crops.
	Transfer of leachate from compositing unit and manure pile downstream water and land

MYSTIC VALLEY PARK
DPSIR FRAMEWORK

Framework	Indicator
State	Rill and sheet erosion, land slippage
	Decline in agriculture output and loss of land productivity.
	Decline in water quality and quality.
Impacts	Household economic decline, poverty
	Increase demand on food imports

RECOMMENDED INTERVENTIONS FOR MYSTIC VALLEY FARM

Table 8: Recommended interventions for Mystic Valley Farm

Agronomic measures	Vegetation soil cover: organic mulching, grass strips and bio-pores, setting up of composting units.
Structural measures	Water harvesting/irrigation equipment, instillation of drip irrigation lines.
Management measures	Change in intensity level, rotational cropping and farm enterprise selection, compositing to improve fertility, setting up of compositing units.

NO. 5: SEDGE POND

Sedge Pond is 12.3 acres of abandoned uninhabited coconut orchard. The land is used for agriculture and cottage industries. Livestock rearing, crop production, and cottage industries are the main livelihood activities.

The land degradation challenges in Sedge Pond include land slippage, soil contamination, soil erosion, and vegetation reduction. This has diminished land productivity, leading to reduced access to arable land. Agricultural practices, overgrazing of animals, and deforestation are the main causes of soil erosion at the intervention site. The site is also affected by invasive species and fires.

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SEDGE POND
DPSIR FRAMEWORK

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

Framework	Indicator
Driving Forces	Demand for agriculture products (coconut orchard)
	Population growth
	Climate change
Pressures	Replacing natural vegetation for agroforestry
	Poor orchard management
	Seasonal fires influence by anthropogenic practices

SEDGE POND
DPSIR FRAMEWORK

Framework	Indicator
State	Rill and sheet erosion
	Increase in Leucaena leucocephala (River Tamarind) as an invasive species
	Decline in agriculture output and loss in land productivity.
	Reduction in vegetation health
Impacts	Reduction in earnings due to poor output from coconut stands.

RECOMMENDED INTERVENTIONS FOR SEDGE POND

Table 10: Recommended interventions for Sedge Pond

Agronomic measures	Climate Smart Agriculture, establishment of agroforestry, rehabilitation of coconut plantation, establishment of grass barriers
Structural measures	Clearing of gabion baskets in dams for increased water outputs
Management measures	Improved management of soil moisture by improved irrigation.

NO. 6: GREEN LAND OVER HILL

Green Land Over Hill has similar characteristics to Sedge Pond. It is also an abandoned uninhabited and has an area of 7.3-acre acres of mango orchard. The main land uses are agriculture and cottage industries.

The land degradation types within this site include soil erosion and vegetation reduction. This resulted in diminished land productivity, thereby reducing access to arable land. Invasive species and fires are also prevalent at the site.

GREEN LAND OVER HILL
DPSIR FRAMEWORK

Table 11: Driver-Pressure-State-Impact-Response (DPSIR) Framework

Framework	Indicator
Driving Forces	Demand for agriculture products (mango orchard)
	Population growth
	Climate change
Pressures	Replacing natural vegetation for agroforestry
	Poor orchard management
	Seasonal fires influence by anthropogenic practices

GREEN LAND OVER HILL DPSIR FRAMEWORK

Framework	Indicator
State	Rill and sheet erosion
	Increase in Leucaena leucocephala (River Tamarind) as an invasive species decline in agriculture output and loss in land productivity.
	Reduction in vegetation health
Impacts	Reduction in earnings due to poor output from mango stands

RECOMMENDED INTERVENTIONS FOR GREEN LAND OVER HILL

Table 12: Recommended interventions for Green Land Over Hill

Agronomic measures	Climate Smart Agriculture, establishment of agroforestry practice.
Structural measures	Establishment of swale terraces, clearing of pond for water harvesting, improved irrigation practices.
Management measures	Control and change in species composition; reduction of invasive species.

NO. 7: COGGINS ESTATE

Coggins Estate is an abandoned estate similar to Green Land Over, and Sedge Pond. It spans 12.3 acres of uninhabited mango orchard. that The main land use activities are agriculture and cottage industries.

The land degradation challenges are similar to Sedge Pond and Coggins Estate; these include soil erosion and vegetation reduction. This has led to diminished land productivity, causing reduced access to arable land. Invasive species and forest fires also pose a serious threat to the site.

COGGINS ESTATE
DPSIR FRAMEWORK

Table 13: Driver-Pressure-State-Impact-Response (DPSIR) Framework

Framework	Indicator
Driving Forces	Demand for agriculture products (mango orchard)
	Population growth
	Climate change
Pressures	Replacing natural vegetation for agroforestry
	Poor orchard management and ant infestation
	Seasonal fires influence by anthropogenic practices

COGGINS ESTATE
DPSIR FRAMEWORK

Framework	Indicator
State	Rill and sheet erosion
	Increase in Leucaena leucocephala (River Tamarind) as an invasive species decline in agriculture output and loss in land productivity
	Reduction in vegetation health
Impacts	Reduction in earnings due to poor output from mango stands

RECOMMENDED INTERVENTIONS FOR COGGINS ESTATE

Table 14: Recommended interventions for Coggins Estate

Agronomic measures	Climate Smart Agriculture, establishment of agroforestry.
Structural measures	Establishment of swale terraces
Management measures	Baiting and ant barriers installation.
	Control and change in species composition; reduction of invasive species.

REFERENCE

Francis, R. (2024). DPSIR Framework Analysis

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