Participatory three dimensional modelling of the watershed at the Soufriere-Scotts Head-Gallion area, Dominica

Report of activities

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w/ Caribbean Public Health Agency (CARPHA) - Environmental Health and Sustainable Development Department

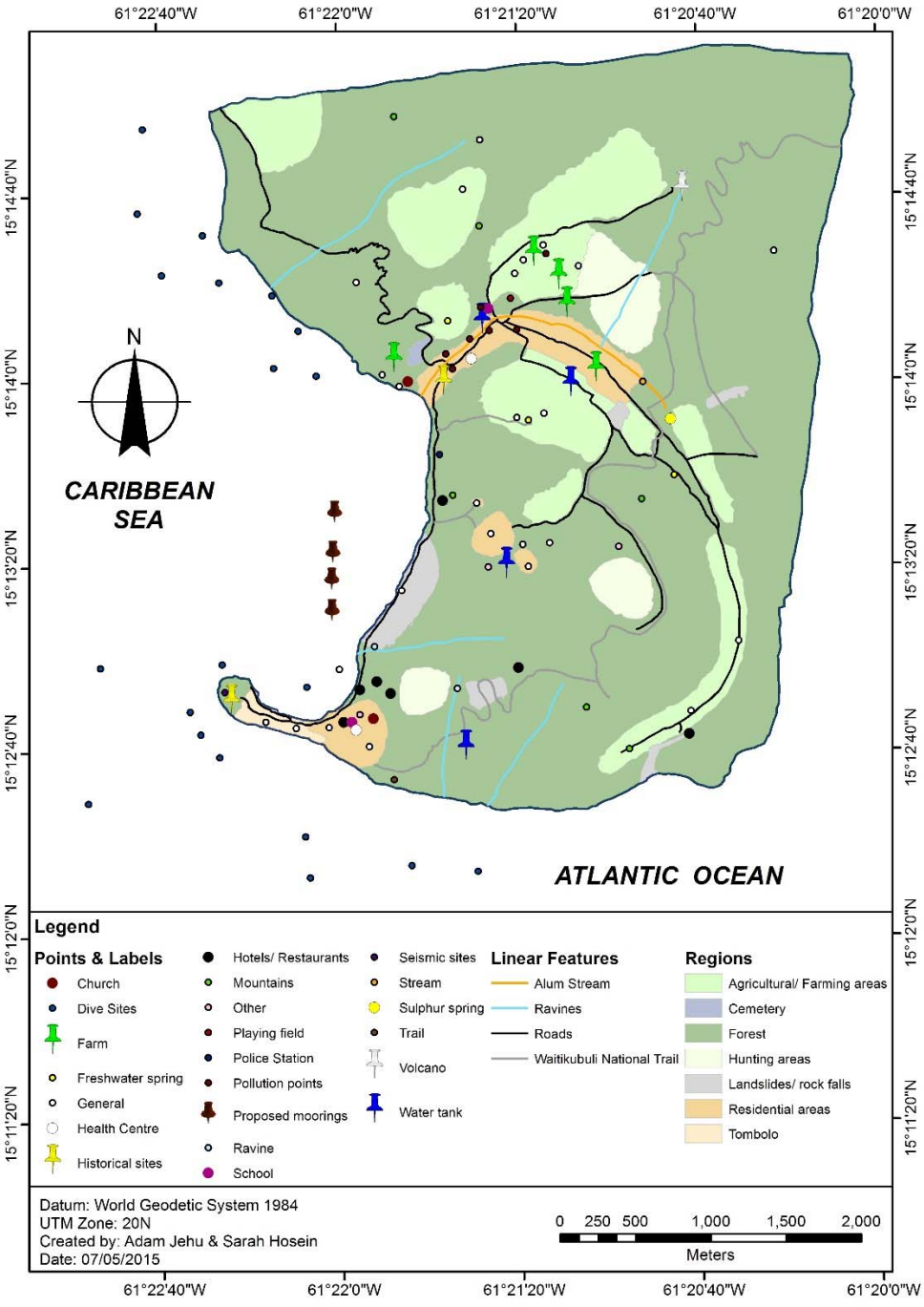

Figure 1: GIS image of the completed map

Introduction

The Caribbean Aqua-Terrestrial Solutions-Programme (CATS), through its component "Adaptation of Rural Economies and Natural Resources to Climate Change (focus Agriculture, Forestry, Water Management)" seeks to assist eight countries in the Caribbean - namely Belize, Dominica, Guyana, Grenada, Jamaica, St. Kitts and Nevis, Saint Lucia and St. Vincent and the Grenadines. This component is aiming at the identification, realisation and scaling up of integrated land use systems that are capable of presenting best practice potential in the field of resilience raising, diversification, adaptation to climate change and conservation of natural resources.

Initial assessments conducted under CATS national planning workshops identified potential areas requiring participatory spatial planning and development of land utilisation strategies. In the Soufriere Scotts Head Gallion area spatial planning is required and should address the need for disaster management and risk reduction.

Participatory three-dimensional modelling (P3DM) was used to facilitate participatory spatial planning and development of land utilisation strategies for enhancing adaptive capacity of rural economies, in particular with regards to agriculture and forestry in Dominica, under the CATS programme. This integrated indigenous spatial knowledge with data on elevation of the land and depth of the sea to produce a stand-alone, scaled and geo-referenced relief model[1]. P3DM engages stakeholders to ensure inclusion of perspectives from all relevant sectors and incorporation of scientific with local and traditional knowledge. It engages stakeholders in the analysis and decision-making and therefore builds capacity and commitment for implementation.

Objectives

The project facilitated participatory three dimensional modelling (P3DM) processes for spatial planning to improve resilience to climate change and extreme events in the Soufriere Scotts Head Gallion area in Dominica.

The objectives were:

a. To facilitate engagement of key stakeholders in building a model of the Soufriere-Scott's Head Gallion area incorporating scientific, local and traditional knowledge on resources, land uses, impacts of climate change and extreme events (including on economic activity), and existing and potential resilience building measures.
b. To use the completed model to facilitate participatory analysis of management recommendations in the Soufriere Scotts Head Gallion area to improve resilience to climate change and extreme events.
c. To promote the project results, lessons learnt and recommendations from the use of P3DM as a tool for spatial planning and land utilisation to improve resilience to climate change and extreme events.

[1] Rambaldi, G. and Callosa -Tarr J., 2002. Participatory 3-Dimensional Modelling: Guiding Principles and Applications. Los Baños, Laguna, Philippines: ASEAN Regional Centre for Biodiversity Conservation (ARBC).

Participants

More than 32 adults and 36 children participated in the building of the three dimensional (3D) model between April 10 and April 13, 2015. Most were from the communities of Soufriere, Scotts Head and Gallion. While most of the adults' names are listed in Appendix 1, the names of the children were not included. CANARI was unable to capture the names of all the persons who attended since there were not enough facilitators to ensure that all names were written down.

The workshop was attended by:

- *More than 9* representatives from government agencies/ divisions with the responsibility for management in the Soufriere-Scotts Head-Gallion area inclusive of fisheries department, environmental authorities, physical planning, lands and surveys, agriculture and water. Representatives from the Forestry Department were unable to attend on the model-building days but participated in the closing ceremony.
- *More than 18* resource users such as farmers, fisherfolk, tour guides and their organisations.
- *More than 5* small and medium sized business owners and employees in the tourism, agriculture and other relevant sectors contributed information to the model.
- *More than 4* representatives from the village council.
- *13* members of the Soufriere Primary School and 23 other children who helped to put the layers of the base model together.
- More than 10 local community residents whose names do not appear on the list.

Key activities

Mobilisation of participants and stakeholders

- A stakeholder identification and analysis was conducted in collaboration with community mobiliser, Mr. Brendan Defoe, to determine which stakeholders were critical the process. The analysis identified organisations based on sectors (e.g. forestry, fishing, and environment). The list was sent to others so that they could include other stakeholders that may have been omitted. The key stakeholders were identified and invited to model building.
- A mobilisation plan was drafted to guide activities to get the participants/ stakeholders to attend the activities.
- Mr. Defoe held several meetings with groups and individuals in the communities and from government agencies to ensure their participation in the model building. He attempted to schedule groups to participate in the activities at different times so that there would not be too many persons around the scaled model at any one time. His meetings were followed up with calls to the relevant persons on days they were scheduled to attend.

Facilitating the model building and hand over

The model was built over the course of four days; the handing over took place on the fifth day.

On day one more than 20 children between the ages of six and 18 along with several adults used the base maps that were produced to trace each contour. Each contour represented an elevation. These were then cut out and glued onto the table in stacks beginning with the 0metre (m) contour and ending with the highest elevation of 880m. Each contour was traced twice to give the model the vertical exaggeration needed to depict a true representation of the Soufriere-Scotts Head-Gallion area. Later in

the day when the 90 layers were glued together and the model allowed to dry, the participants and facilitators glued crepe paper onto the cardboard to smoothen the edges of the cardboard. This was left to dry overnight.

Figure 2: Children from the communities tracing the contours onto cardboard layers. April 2015.

On the second day, facilitators glued more crepe paper to the cardboard and painted the model white with two coats of oil paint. This was then left overnight to dry. Facilitators used the opportunity afforded to speak with stakeholders in the communities of Scotts Head and Soufriere and invite them to place their local knowledge on the model. On day three, participants used different coloured yarn, pins and tacks to place their local knowledge on the model. These "informants" as they were known, shared their knowledge with each other and described places and activities occurring in the communities that were not known to all. The legend was created as the informants determined what features they wanted to add on the model.

Day four saw several government ministries and their departments participating to place their information on the model. They discussed activities with community members who were open to sharing their information with them. Later in the evening, once all of the information had been placed on the model, the yarn was removed and replaced by paint to permanently mark the features identified by the informants. The legend, north arrow and scale were printed, laminated and placed on the completed model. The model was again left overnight to dry.

On the last day an informal handing over ceremony was held to give the model to the Soufriere Scotts Head Gallion Village Council with the understanding that it can be used by organisations (e.g. government, civil society, etc.) to facilitate spatial planning in the area. The handing over was attended by informants, many of the government departments that participated in the process, the facilitating organisation (CANARI) and GIZ representative, Ms. Eva Naeher. Pictures were taken of the model after its completion and it was later digitised.

Findings

The following information is presented on the different sectors. It shows the information that was collected on the model and major gaps that still exist.

Agriculture/ farming

Symbol	*Meaning*
	Traditional farms
	Organic farms
	Animal farms
	Large farming areas

- Community members and representatives from the Ministry of Agriculture were able to broadly identify locations of traditional farms, animal farms and organic farms. The exact number of farms was not indicated; it is known that there are several squatters in the area. Several traditional farms are in the process of becoming organic farms but these were not identified.
- The informants identified areas where farms have flooded in the past. Their coping mechanism was to wait for a few months until the area had recovered and then re-establish the farm in the same place. They believe that there is little scope for their farms to be re-located unless the state-owned lands such as the areas around the sulphur springs are given to the communities.
- Most farmers providing information on the model have other sources of income (e.g. fishing, construction, painting, teaching, etc.).
- The community members were not able to identify areas to source water for their farms in the event of a severe drought. They also indicated that should the area be severely impacted by natural disasters there would be no place for them to move to. Some mentioned using the fertile land around the sulphur springs as a possible relocation sites.

Major gaps in information

- *Exact type and number of each type of farms in the area*: this is especially so for animal farms that may need to be relocated and organic farms that may act as demonstration farms for others in the area.
- *Illegal farms (e.g. squatters, marijuana farms)*: although informants pointed out the location of some illegal farms, this information was considered sensitive and was not placed on the map. It is suggested that the Ministry of Agriculture and Fisheries facilitate a process such as this with the stakeholders in the communities using the model.
- *Location/ distribution of plant and animal diseases in the area*: this information was not known to informants.
- *Meteorological information used in farming for the area*: High rainfall areas coupled with steep terrain can increase the vulnerability of the farms located on steep slopes by making them susceptible to landslides.

Forestry

Symbol	*Meaning*
	Mountain peaks
	Trails
	Alum Stream
	Ravine
	Forested areas
	Hunting areas

- Much of the area covered by the three communities is forested. The informants were able to identify trails (including the Waitukubuli National Trail), ravines, hunting areas and mountain peaks.
- All informants indicated that illegal cutting of trees does not occur in the area. Illegal hunting, however, does occur.
- The informants located ravines that they indicated were subject to landslides and rock falls.
- Much of Soufriere is located on the banks of the heavily-polluted Alum Stream.

Major gaps in information

- *Charcoal production areas*: this information was not given though the activity is known to occur on the island.
- *Hunting areas and types of animals found in each area:* Information was given which can help foresters with wildlife protection (pro) but also help hunters target species (con).

Fishing/ diving

Symbol	*Meaning*
	Dive sites
	Proposed moorings

- Many fisherfolk in the area have other jobs to supplement their incomes; several have small farms.
- Popular dive sites were identified in the SSMR.

Major gaps in information

- *Fish nursery areas*: a major fish nursery area was identified by fisherfolk and representatives of the Fisheries Division and it was suggested that, as an exercise, both stakeholders meet to discuss its exact location and possible use using the model.
- *Types of fishing occurring in the SSMR*: informants identified bait fishing in the area; no other type of fishing was identified for the area shown on the model.

Tourism

Symbol	*Meaning*
	Freshwater springs
	Volcano (sulphur spring)
	Mountain peaks
	Dive sites
	Hot mineral bath
	Historical sites
	Trails/ tracks
	Roads (primary and secondary)
	Ravine
	Landslides/ rock falls
	Tombolo[2]

- The area is one of the major tourism areas in the country.
- There is potential for many tourism activities in the Soufriere-Scotts Head- Gallion area. As an example, the Soufriere-Scotts Head- Gallion Community Centre was the site of a citrus factory that was used to produce items for sailors to prevent scurvy. Some of the equipment can still be found around the area. This can be developed as a historical site where tourists visit. Several such areas exist around the three communities. There is also potential for agritourism on some of the larger farms in the communities.

[2] A sandbar connecting an offshore island to the mainland. The tombolo is a major attraction in Scotts Head.

Major gaps in information

- *All restaurants, bar, inns, guesthouses in the areas*: few were identified and placed on the model.
- *Potential location of new attractions e.g. interpretation centres, signs etc.*: these were not known to those present so were not identified.

Climate change and disaster risk management

Symbol	*Meaning*
	Schools
	Sulphur springs
	Volcano
	Health centre
	Hot mineral bath
	Police station
	Seismic stations
	Trails/ tracks
	Roads (primary and secondary)
	Ravine
	Residential areas

- The three communities are highly vulnerable.
  - They sit upon a volcano that causes seismic activity in the area.
  - The bathymetry (very steep drop off near the shoreline) means that unless a warning system is put in place, the communities will not see the water retreating as a warning of an impending tsunami. Soufriere, located along the Alum Stream, is particularly vulnerable to tsunamis since the stream forms a funnel through which a potential tsunami can reach further upstream.
  - Because of the topography of the area, there are frequent rock falls and landslides; this is exacerbated by the seismic activity.
  - Like the rest of the island, the three communities are threatened by tropical storms and hurricanes that can disrupt livelihood activities.

- Seismic stations were placed to monitor that activity.
- A wall has been built along the road where it abuts the coastline to stabilise the road and reduce the impact of storm surge from hurricanes and storms.
- There was very little awareness of climate change and the potential impacts on the communities among residents. The government representatives were also not aware of this. Residents also did not know the evacuation zones. The Office of Disaster Management (ODM) representative did not have the information so that it could be placed on the model.
- The ODM representative also indicated that in his opinion because the area is highly vulnerable, it is not a priority for climate change adaptation action[3]. He also indicated that disaster awareness is only conducted during the hurricane season and mostly by request. No one was able to recall the last time awareness building activities took place in the communities.
- The communities have very little awareness of the policies, plans and strategies developed to cope with climate change and natural disasters, e.g. the National Hurricane and Disaster Preparedness Plan for the Agriculture Sector.

Major gaps in information

- *Reliable bathymetry information*: no one present had access to this information despite previous requests for this information.
- *Storm surge data to plot the potential impact of climate change and sea level rise on the community*: storm surge flood risk mapping is being planned by the government.
- *Evacuation zones*: the ODM representatives present did not have this information.

Lessons learnt

One of the most important lessons was that there needed to be more time to complete all the processes. The minimum suggested time for a model of similar size is: model building (3 days), information gathering and drying time (4 days), facilitating further discussions and handing over (2 days). Below are other specific lessons learnt.

Lessons on mobilising the community

- Meeting the community members at their homes and in individual groups (e.g. individual meetings with the farmers' group or fisherfolk organisation) can help to improve participation in the process.
- Sending text and WhatsApp messages to participants the day before and a few hours before they are scheduled to arrive will remind them about the process and help them to appreciate their importance to the process.
- If working in several communities make the time to visit each community to mobilise participants.

Lessons on model building

- Place different types of maps of the area to be constructed around the room to orient the informants to the landscape.
- Place information about climate change around the work area to build awareness of its impacts. This can be in the form of posters or videos.

[3] This was the opinion given by one of the ODM representatives present.

- Include additional time for the model to dry after the layers are pasted together (0.5 day), after paper is glued to the base model (0.5 day) , after the model is painted white (1 day) and after the information is painted onto the model (1 day). The latter is especially important if facilitating further processes after the model is completed. While CANARI was able to facilitate sharing of information on climate change adaptation and natural disasters in the area, this would have been more successful had there been more time allotted for model building.
- Have (hair) dryers and fans available will help to speed up the drying process.
- If the cardboard to produce the contour layers is thin, use several pieces to represent a layer to produce the vertical exaggeration of the area to be modelled.
- As well as providing oral orientation sessions, have information about the process and its objectives readily available in the room so that people coming in can be oriented.
- Have at least six facilitators working in teams to share the workload and improve effectiveness. The facilitation team should ideally be interdisciplinary with a range of expertise relevant to the goal and objectives (for example natural resource management expert, sociologist, climate change expert, agricultural expert, etc.) to facilitate sharing and analysis of different types of information of that type.
- Ensure that all participants write their names in the register that should be located in a visible place and regularly checked by facilitators.
- When children under the age of 12 are present there should be an appropriate number of adults present in the room to provide supervision. Limit the ratio of children working on the model to adults helping them to 4 children: 1 adult.
- Having the informants work in shifts helps to keep the process structured and helps participants to remain engaged.
- It is very important that the stakeholders are involved in all aspects of model building so that they can take ownership of the model.

Conclusion

The model facilitated sharing of information between the government representatives and the community residents. The community members were able to give local names of places and show places that do not appear on maps. They were able to point out tracks that were unknown to the government representatives present. There was also inter-generational knowledge exchange; some of the older community members shared history of the area with younger members.

Despite the process being very rushed due to the limited time available to complete all of the steps, the persons who participated in the process took ownership of the model and the information that it contained. The informal atmosphere allowed for rich sharing of information and dialogue even on sensitive topics. The community members in particular were able to dialogue with each other and with government representatives and improve their spatial understanding of land use issues and the impacts of climate change and extreme events on natural resources, livelihoods and economic activities in the Soufriere-Scotts Head- Gallion area. There was also improved understanding of and appreciation for the value of local and traditional knowledge in building resilience to climate change, and in land use planning in the Soufriere-Scotts Head-Gallion area.

Appendix 1: List of informants/participants

Cencile Stafford -
Painter – Soufriere

John Adams -
Fisherman – Scotts Head

Francois Thomas -
Fisherman - Soufriere

Vivian Winston -
Fisherman – Soufriere

Delbert Zavier -
Fisherman – Soufriere

Cecil Tavernier -
Driver/Public Works – Soufriere

Glen Bellot -
Fisherman – Soufriere

Frankie Parquette –
Fisherman – Soufriere

André Charles-
Farmer – Soufriere

Weefers Jules -
Diving Shop – Soufriere

Ketura F. St. Ville -
Councillor – Soufriere

Mackey Paquette -
Fisherman – Soufriere

Bernadine Tavernier -
Teacher – Scotts Head

Valens O'Brien -
Farmer/Teacher – Scotts Head

Euvilla Lewis -
Teacher/Farmer – Soufriere

Anne Marie Williams -
Farmer – Gallion

Malika Williams -
Soufriere/Gallion

Vaughn Lewis -
Dive Master – Soufriere

Kadeem Thomas -
Student – Soufriere

Benjamin Pascal -
Councillor – Soufriere

Justin Letang -
Mason – Soufriere

Festus Dalrymple -
Councillor/Farmer – Soufriere

Celianne Tavernier -
Secretary SSHGLRC – Scotts Head

Michael Lewis -
Farmer – Soufriere

Zethra Baron -
FO – Fond St. Jean

Candy Stoute -
FLO – Sansauveur

Michael Theophille -
Physical Planning Division – Bath Estate

Mandela Christian -
Office of Disaster Management – Salibury

Bernard Joseph -

Office of Disaster Management – Bellevue Chopin

Ricky Brument -
Division of Agriculture

Elijah Ajnolewis -
Farming/Fishing – Soufriere

Ray Robinson -
Environmental Health Department

Ian Pinard -
Ministry of Public Works – Rep for Area

Johnson Drigo -
Ministry of Agriculture and Fisheries

13 Children: Soufriere Primary School
23 children- Soufriere-Scotts Head-Gallion residents