Water: environmental knowledge and rural life in Belize

Report of a multi-stakeholder workshop, 23 July 2018, Belmopan

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Report of a multi-stakeholder workshop on *Water: environmental knowledge and rural life in Belize*, conducted as a knowledge exchange/impact activity for the project: 'Envisioning Emergent Environments: Negotiating science & resource management in rural communities', funded by the UK Economic and Social Research Council [ES/N016084/1]

The workshop was held on 23 July 2018, at the George Price Centre, Belmopan, Belize.

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Table of Contents

Introduction

This document reports on the workshop held on 23 July 2018 with participants from a range of organisations and communities with an interest in water knowledge in rural Belize. The workshop was convened as part of the project: 'Envisioning Emergent Environments: negotiating science and resource management in rural communities', funded by the UK Economic and Social Research Council. The workshop constituted a knowledge engagement/impact activity, following a period of anthropological research in Stann Creek and Toledo districts during 2017. The workshop brought together a range of people and organisations to update them about the project progress and to explore different views and perspectives on issues surrounding water resources and practices across government bodies, NGOs, research organisations and rural communities.

Aims and objectives

The primary aim of the workshop was to foster multi-way knowledge exchange among a range of stakeholders with interests in the research project themes of water, knowledge and rural life in Belize. The rationale is to engage relevant stakeholders on an ongoing basis throughout the research project and to increase the potential for the research having a positive impact on current negotiations in this policy area.

The objectives were:

- to inform a range of relevant organisations and individuals about the research project and its current status;
- to present preliminary findings from the 2017 research, obtain feedback on work-in-progress, and discuss appropriate formats for research outputs and potential future work;
- to elicit multi-way discussions with government, NGO, private sector and community members about perspectives and experiences with rural water practices and projects; and
- to provide a forum for conversation and to foster connections among people and organisations interested in rural water issues in Belize.

Design

In line with the aims listed above, the workshop was designed to facilitate knowledge exchange, rather than dissemination only. Principles for engagement included an emphasis on co-learning whereby all participants were on an equal footing and had the opportunity to contribute to discussions. Presentations and activities were designed to take account of the diverse backgrounds of participants and to enable conversations among everyone regardless of these differences. Permission was sought from participants to record the proceedings and take photographs. It was agreed that speakers would be named in the report, and that other contributors' comments could be used without direct attribution. To continue the learning from this event, participants were asked to complete an evaluation form before leaving.

Organisers and participants

The workshop was initiated by the 'Envisioning Emergent Environments: negotiating science and resource management in rural communities' project (EEE), led by Dr Sophie Haines at the University of Oxford. The workshop followed on from anthropological research carried out in Belize in summer of 2017. Workshop organisation was aided significantly through informal collaborations with staff at the Natural Resources Management programme of the University of Belize (Belmopan campus) and members of the Belize Water Task Force. Potential participants were identified with the help of these contacts and through existing networks established during the EEE project and in Dr Haines' previous research in Belize since 2006. Government departments, universities, NGOs, private sector organisations and rural communities were represented at the workshop (see Appendix 1).

Method and agenda

In alignment with the aims of the workshop, the agenda comprised various components including presentations, activities and discussions (see Appendix 2). Introductory items presented the EEE project and the aims, objectives and format of the workshop, to give participants a background to the study and an idea of what to expect from the event. Next, a series of three 'stakeholder talks' provided an opportunity to hear from government, university and community representatives about current work around rural water issues, giving insights into the diverse perspectives, priorities and challenges facing different sectors.

The group activity was organised around a 'conversation mapping' exercise. The aim was to engage participants in an interactive activity in which each person would have the opportunity to express their perspective, and which would produce a visual record of the multiple viewpoints put forward for discussion. The technique of conversation mapping has been documented by McKenzie[1] as a method for producing a diagram of a complex situation in which multiple perspectives hold sway.

According to McKenzie, the conversation maps can contribute the following:

1. Articulate different perspectives of a situation and the interaction (relationships) between the several perspectives that are captured;
2. Generate an opportunity for all stakeholders to understand the different perspectives of a situation and to modify their personal understanding in the light of others perspective; and
3. Enable stakeholders to mutually identify emergent properties of the problematic situation that were not previously available and which may be the basis for new probes to explore and improve the situation.

For the purposes of this workshop, the focus was on creating a space for a wide range of people to document different viewpoints on particular aspects of rural water decision-making, to share ownership of the co-created maps, and to generate discussion about challenges and opportunities for the future.

[1] McKenzie, B. (2005) Conversation Mapping. Available at http://cognitive-edge.com/articles/conversation-mapping/ [accessed 15.11.2018]

No prior knowledge of the method was assumed, so the activity was introduced and explained before the mapping started (see fig 1). The mapping was undertaken by three teams of 5 to 6 people, drawn from a mix of sectors, each with a large sheet of paper and a set of multi-coloured pens. Each group was to work on a specific 'trigger' which was written in the centre of their paper. The activity proceeds with the groups discussing their responses to that trigger, based on their own experiences. As each person speaks they also record their contribution on the page (using different coloured pens helps the group and facilitators to check that all members of the group are having the chance to contribute). Other respondents can respond to these contributions as well as to the original trigger.

The three triggers (one for each group) were:

- **Knowing about water**: how do we know when there are water problems, or if the water situation is good in a rural community?
- **Decision-making in rural communities**: Who makes decisions about water in rural communities; what decisions are they making; what resources do they use and need?
- **Connecting water to other responsibilities**: How does water management connect with your other responsibilities/decisions?

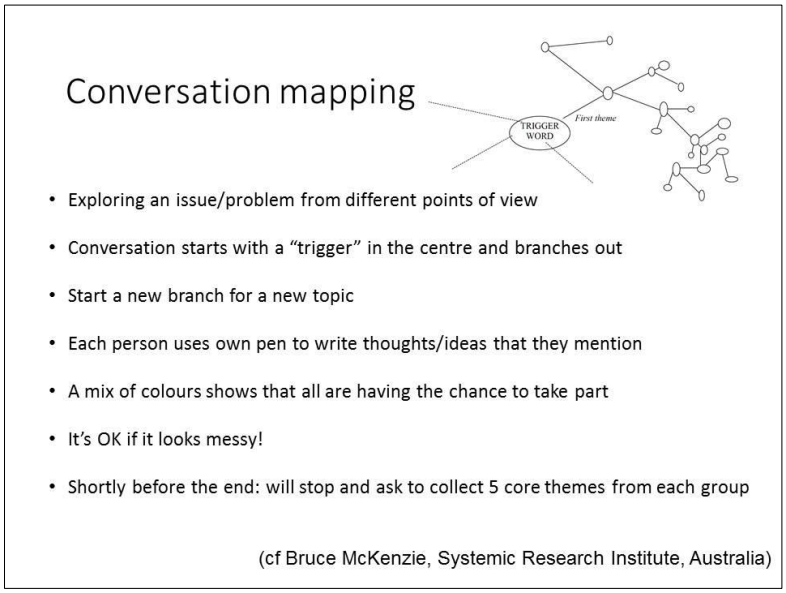

Figure 1: Slide explaining the conversation mapping exercise

During the activity, the workshop facilitator and assistants circulated around the groups, to ensure that conversations were being recorded on the maps. After 20 minutes, the groups were given a further 5 minutes of teamwork to distil 5 key themes from their discussions, which they were asked to write on sticky notes and affix to the maps. These could be areas of broad agreement, surprising insights, or connections across different perspectives. According to McKenzie's methodology, this moves the activity from the 'divergent' practice of recording diverse opinions toward an 'assimilation' stage that starts to make sense of the maps to gain new insights.

The final stage of the exercise was for each team to nominate a rapporteur to present their map and emerging insights to the whole group. The maps themselves constitute a visual record of the activity; these plenary discussions were also recorded and transcribed.

Following the group activity, Dr Haines presented some preliminary findings from the 2017 study. This was scheduled after the group activity to avoid the research findings influencing the discussions. The presentation was followed by time for questions and a discussion of the possible next steps. The event closed with closing remarks from the Institute for Social and Cultural Research and an event evaluation.

Background to the project

Mr Leonel Requena, the Global Environmental Fund small grants co-ordinator at UNDP Belize presented opening remarks, in which he welcomed the opportunity for engagement between research and practice in the environmental sector. He noted that Belize's water resources appear healthy for now, but that changes in climate and demography mean there is a need for careful thought and planning with respect to environmental stewardship. For him, some of the most exciting developments are in the domain of nature-based solutions and infrastructures (including ideas such as green roofs and sponge cities) that see people working with nature to avoid conflict and move towards achieving the Sustainable Development Goals.

Dr Sophie Haines then provided some background on the EEE project – a continuation of her research in environmental anthropology in Belize since 2006. Broadly, the programme of research seeks to better understand social and cultural dimensions of how people perceive, value, and use resources. The 'data' in this research is less about numbers; more about people's stories, ideas and narratives. As well as working with rural communities the projects involve working with scientists and other kinds of organisations – social relationships and cultural practices are important in these settings too.

Recent years have seen an increase in the availability and technical quality of environmental data and models increased. Global frameworks of integrated water resources management have identified the 'watershed', or catchment basin, as a unit of analysis. The EEE project explores what science-led programmes and practices such as IWRM mean for rural people in developing countries. These questions are particularly relevant in countries like Belize. As in other countries characterised within the UN system as small (island) developing states, resource decision-making is complex. There are legacies of colonialism and external technical assistance, vulnerabilities to climate change, indigenous rights issues, and other territorial disputes. Now is an important time to engage, given current policy developments on sustainability issues like climate change and water resources management.

Increasingly, community engagement is required by funders for development and conservation projects – they recognise that projects are unlikely to work without involving people who live in affected areas. But it is not always clear how to do this effectively. The purpose of this research is not to advise what to do, but to contribute to explaining and learning from the past, and to help clarify negotiations between different viewpoints. People in this room have a lot of expertise relating to different parts of this puzzle, so the hope is that this workshop will be helpful for processes of

learning from each other. For rural residents, there is an opportunity to document hopes, concerns, and experiences of environmental/social change. For the Belizean government, there is potential to help identify key issues for 'ground-level' understandings. The UK funders of the project do not get directly involved in the studies, but broadly speaking they are also interested in how development funding and practice can be socially and environmentally sound.

As attested by the people in the room, this project is by no means alone in attending to watersheds in Belize. There has been previous and ongoing work in various fields, including assessments of water quality/quantity (surface or groundwater), aquatic life, protected areas, and human impact. However, to date much of this has been quite fragmentary, and the social/cultural dimension has been limited. It is important to look into place and history: watershed management doesn't happen in a vacuum. NGOs, government, companies and communities often have different priorities.

Anthropological approaches to water can help draw attention to these multiple perspectives. One approach to this has been set out by Orlove and Caton,[2] who have identified three ways of approaching water:

1. Watersheds (a unit of analysis based on hydrological science of river catchments)
2. Water regimes (the rules and regulations that govern water)
3. Waterscapes (cultural and spiritual engagements and senses of place).

The project research questions include:

1. How do culture and power affect decision-making: what social values and choices are involved in development and conservation projects?
2. How do scientists and non-scientists interact?
3. Are the issues shifting with new technologies and scientific practices?

Stakeholder presentations

This set of presentations aimed to highlight perspectives from government, research and community sectors. Summaries of the presentations are included below.

Water Resources Management in Belize

Ms Tennielle Williams, Principal Hydrologist in the Government of Belize National Hydrological Service, commonly referred to as the Hydrology Unit, presented an update on the current work of the service and the status of the National Integrated Water Resources Authority (NIWRA).

The presentation highlighted that water management in Belize is still fragmented; yet, united to a certain extent. There are multiple Government agencies who are tasked with some form of water management as outlined: Hydrology Unit is responsible for operational management (water inventory and data management); with the introduction and commencement of the National Integrated Water Resources Act, the Unit reviewed the mandate of the National Integrated Water

[2] Orlove, B, and S. Caton (2010) Water Sustainability: Anthropological Approaches and Prospects. *Annual Review of Anthropology 39(1):* 401–15.

Resources Act objectives and identified an overlap with the Unit's current objectives; thus, it has taken on responsibility for aligning its objectives with that of the Act in order to collect data that would inform the development of the water rights system; the Ministry of Health (recreational and drinking water monitoring and standards); the Department of Rural Development (rural water supply); the Department of the Environment (pollution); and the Public Utilities Commission (utilities regulator – tariff setting, monitoring, enforcement). In line with the Government's water policy, based on the sustainable management of water for economic, environmental and social benefits, the aim is for the National Hydrological Service to become the sole entity responsible for water resources management in the country in the absence of the NIWRA Act being fully implemented. Clarification that needs to be made is that some of the functions of the Unit overlap with that of the National Integrated Water Resources Authority.

In terms of operational hydrology, the Unit covers the installation and maintenance of 29 manual hydrological stations monitoring river levels. Additionally, there are several stations which are automated to enable near real time transmission of water levels to the office via ftp website. Discharge/Stream flow measurements are done manually by the Unit's Hydrological Technicians. This is useful for flood forecasting, and as information for public works, planning and development. Data is crucial: the unit is one of few government sections to employ a dedicated data analyst. Another dimension of the work involves hydrological investigations and inspections. In the past this was mainly for structures such as bridges and roads; with the introduction of the NIWRA law in 2015 it was determined that measuring the water demand is crucial especially for those users wanting to abstract large volumes. This is challenging given the shortage of data or reluctance of people to share data: implementation of the NIWRA will involve establishing a central information repository thereby possibly reducing the reluctance to share data among entities and the general public. In addition, a function of both the Unit and the NIWRA (Authority) is to increase public awareness which would include activities such as today's workshop and other events such as World Water Day which the Unit uses as its annual Public Relations campaign on the importance of water and its management.

Since 2015, partnerships with UNDP and the Ministry of Agriculture have created opportunities for us to improve on water resources management. In this regard, the Ministry is currently engaged in a consultancy to develop regulations to implement the NIWRA (Act). First steps in work on water rights and allocation include finding out who is using water, how much and what for. These are also functions of the current Hydrology Unit. Data collection consists of: stage (river height levels); discharge/velocity/ streamflow measurements; and water quality (water quality monitoring is basic: employing a handheld YSI probes for in situ measurements of 12 parameters including pH, dissolved oxygen, temperature, salinity and turbidity). Currently, there is no groundwater monitoring system; despite this challenge, information is being collected through persons who wish to abstract water from wells. At the moment, usage data relies on integrity of those users reporting. By using GPS in association with their data collection practices, the Unit is developing a spatial overview which is very helpful for management. For example, they are paying attention to factors such as increased urban-rural migration which is potentially shifting pressure from surface water to groundwater sources.

Future priorities include further expansion of the Surface Water Hydrological Observation Monitoring Network and establishing a Ground Water Hydrological Observation monitoring network. Automated and solar powered stations are promising because, in Ms Williams' words: "We don't have people; we have 3 technicians responsible for little yet big Belize; we can't get everybody that we want so we have to use technology"; however, automation does not dispense with the necessity for the human check and balance required with data validation. Given the historical data management issues experienced, coupled with the new data being collected, equates to the necessity of starting with a new, comprehensive water resources inventory (of both quantity and quality) for both surface and groundwater. All hydrological data captured would then be stored in a National Water Resources Management Information System. The NIWRA Act once implemented and the Unit subsumed under that structure as per the considerations within that Act for same to be done, this will then strengthen the legal framework for the Unit's work to be executed. Noteworthy is that implementation of the Act and associated regulations require a mixture of legal as well as technical professionals. A relationship that the Unit found very beneficial for data collection is the use of the hydrological observers. There is sometimes a need to go beyond the government bodies and engage civil society. For example, the Unit relies on hydrological observers throughout the country to read the manual gauges and call the office with water levels from stations across the country (often they are very enthusiastic). The presenter thanked the audience for their attention and closed indicating that they are open to enquiries from the public by email or in person at their offices.

Belize River Watershed Management Plan

Mr Antonio Cano of the University of Belize updated participants on the recent consultancy project to develop a management plan for the Belize River Watershed, undertaken by the University of Belize and funded by WWF.

The project involved four main activities. The first was a characterisation of the hydrological, socioeconomic and institutional dimensions of the watershed, based mainly on a review of the existing Belize River Diagnosis study commissioned by WWF in 2014. The second was a human impact assessment along the banks of the Belize, Macal and Mopan rivers, based on direct observation combined with satellite imagery, and surface and aerial (drone) photographs. The third was stakeholder engagement and mapping, via consultation meetings and an analysis of what was at stake for different groups (financially and emotionally) and the kind of data they might be able to contribute. The fourth was a SWOT analysis of the strengths, weaknesses, opportunities and threats associated with the watershed.

Key findings for the team included identifying priority areas for intervention. For example, the headwater areas are less impacted and are therefore higher priority for conservation activities to continue serving their role in maintaining the hydrological cycle. The middle reaches were identified as a higher priority for restoration activities to rectify impacts from agricultural activities. Consultations across sectors revealed that key concerns included for example forest degradation, soil and water contamination, biodiversity loss, human and animal health, lack of environmental law enforcement, and the maintenance of the riparian buffer. The project work has categorised some of these concerns according to different stakeholder groups.

The management plan aims to guide programmes and projects over a 10 year period, with a total investment of about US$3.5m. There are seven planned projects; it would be overly ambitious to claim to be able to solve all the identified problems in the 10 year time frame, so they have prioritised particular areas for intervention. The projects are envisaged on different timescales and fall under four broad categories: 1) conservation of the upper reaches (e.g. maintaining forest cover in protected areas); 2) restoration of the middle reaches (e.g. green agricultural technologies and best practices for soil protection); 3) harmonisation and enforcement of relevant legislation; and 4) collecting and monitoring baseline data. In the short term the emphasis will be on 'socialisation' of the plan, particularly in terms of getting buy-in from key stakeholders, building institutional capacity and strengthening public education to develop the concept of environmental stewardship. The aim is to work with stakeholders including those present at the workshop to monitor and evaluate the projects and the plan as a whole.

Community-based Watershed Management

Mr Anthony Hislop, Chair of the Steadfast Tourism and Conservation Association (STACA), presented the work of his organisation with respect to the co-management of the Billy Barquedier National Park and the provision of drinking water to rural villages in Stann Creek district.

In contrast to Ms Williams' earlier characterisation of the Hydrology Unit having technology but not people, STACA has people but not technology. The organisation has its roots in a series of events in the mid-1990s. People in the Stann Creek Valley were considering opening up the Mullins River basin for agriculture to ease land pressure along the Valley. The Stann Creek Lands Committee was being advised by technical staff from the Forest Planning and Management Project (FPMP) and the physical planner of the Lands and Survey Department. From the discussions a plan emerged for agricultural development in the Upper Mullins River. A feasibility study was commissioned by Bruce King and conducted by Simon Zisman (an environmental consultant). His report, published in 1994, recommended that the area should be left undisturbed, owing to the erosivity of the soils. The Forest Department and Department of Environment halted the project. The villagers also changed their approach from looking for land to protecting the land – which was the source of potable water for three communities (Alta Vista, Steadfast and Valley Community). Their advocacy led to the establishment of the Billy Barquedier National Park, and the consolidation of the residents' group into STACA. The park was declared in 2001; STACA was registered as an community-based NGO in 2003 and started to co-manage the park. STACA like to think of it as a hydrological reserve, because as well as biodiversity objectives its main importance is the link with water.

Many of the people who organised themselves as STACA had been involved in village councils and water boards. They turned their attention to transforming the park from one that existed on paper to a functioning park, obtaining external funding from PMIIE (Program for Integrated Ecosystem Management in Indigenous Communities[3]) and PACT (Protected Areas Conservation Trust). They are effectively working in the interest of around 2000 people in the villages that access water from the Billy Barquedier Creek. Recent activities include environmental education for schoolchildren, and water quality monitoring with the University of Belize, which has been carried out since 2014. In

[3] World Bank/Inter-American Development Bank.

2015, baseline data was collected with the aim of working towards a water quality management plan for a small portion of the North Stann Creek Watershed (the Billy Barquedier sub-watershed). On the basis that it is surrounded by areas without farming, STACA argue that Billy Barquedier subwatershed might be the only one contributing clean water to North Stann Creek. Activities in other parts of the catchment, including spraying of agrochemicals, mean that the downstream municipality of Dangriga, and indeed the reef, bear the brunt of pollution in different parts of the watershed. The monitoring is done in six sites, including the intake pipe from where water is piped directly to people's homes via a gravity system. The parameters are largely the same as those mentioned by Ms Williams. The University of Arkansas and United States Geological Survey provided support to obtain a stream gauge station, through which STACA has learned that the Billy Barquedier Creek contributes 14 gallons of water per second to the North Stann Creek Watershed. From the testing, the only problem that they have shown concerns levels of E Coli. While residents are used to drinking the water, Public Health standards call for a level of zero. There can be a lack of communication between Public Health inspectors who come to do testing, STACA, and the communities.

STACA has worked to involve the Department of Environment and Ministry of Health. The Department for Rural Development is also key, but it has been more challenging to get their support. STACA has also found it difficult to effectively engage local entities (village councils and water boards), for example in activities such as garbage collection (among the village council's responsibilities) and the maintenance of the water pipes (the responsibility of the water boards). Currently, the villages that get water from the Billy Barquedier system have a flat rate of five dollars a month for water services. Nearby villages that have had wells and pumps installed have seen their rates rise considerably. In 2012, a logging road was opened near to the national park, to give New River Enterprises access to their long-term concession in the Manatee Forest Reserve. STACA referred to the Zisman report in arguing against the road, and confronted the environmental assessment team when they arrived for a site visit. After a road was eventually built, the Forest Department documented the gullies that formed as a result. STACA have been arguing that the regulatory authorities should be doing more to enforce riparian protection, to ensure developments are undertaken responsibly, and to check that village councils and water boards are fulfilling their duties. Because of the current impasses, STACA is considering whether it should get involved in running the water system. They are also spearheading formation of a group – the Southeastern Watershed Alliance Group - to move towards management plans for the whole North Stann Creek Watershed.

Group activities: results and discussion

Trigger 1: Knowing about water

How do we know when there are water problems, or if the water situation is good in a rural community?

The first group chose to report five main themes:

1. Outbreak of illness
2. Biodiversity
3. Complaints
4. Civil society
5. Public education and awareness

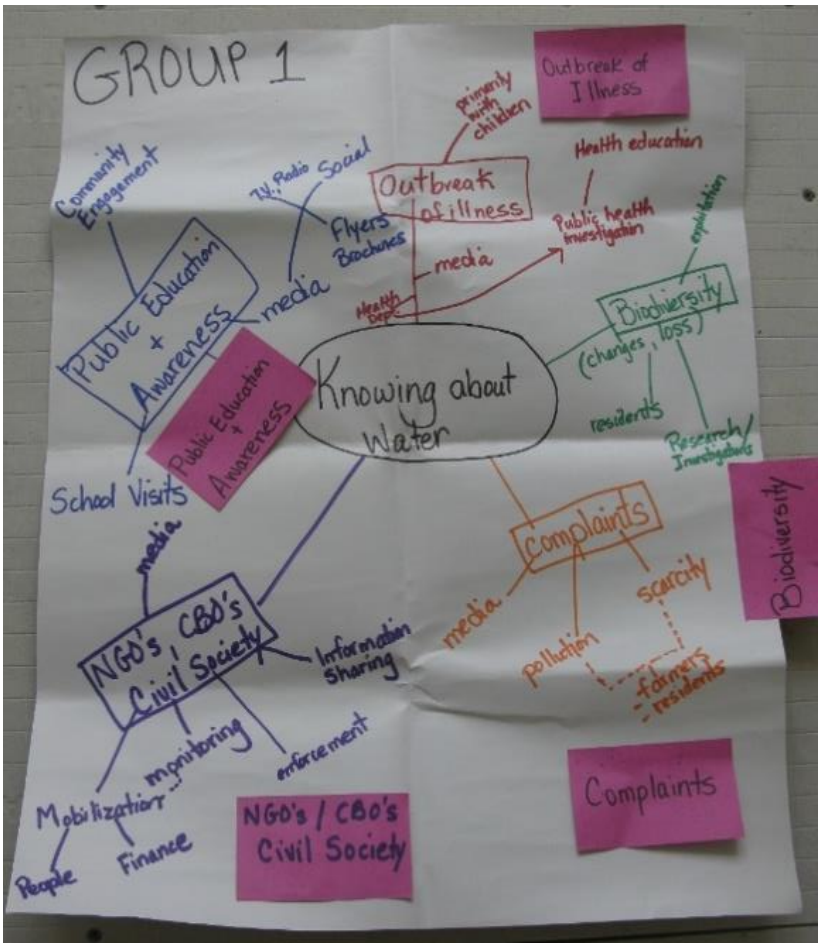

Figure 2: Group 1 conversation map

These were headline categories that they had used to explore different ways that organisations and authorities (for example the hydrology unit, or public health department) would get to know about the status of water in a rural location. The category of *complaints* encompassed those received directly from farmers and/or residents, for example about pollution or water scarcity; and also those that they were made aware of through the media (because sometimes people go to the media in the first instance, rather than the authorities).

The category of *biodiversity* involved indicators of change or loss that reflect the health of the watershed. They noted that this could be related to the kind of work that organisations such as STACA are involved with. If a monitoring project notices a change in species composition, for example, this may be the piece of information that tells them that something is wrong with their water quality. In this sense, the category is also connected to research and investigations in order to identify these pieces of information. There is also a link to exploitation, for example the impacts of practices such as mining and logging.

The topic of monitoring connects to another headline category of *civil society* (including NGOs and CBOs), who may be monitoring for a particular purpose and then mobilising the knowledge (using people and/or finances), through sharing information and sometimes through enforcement.

The category of *public engagement and awareness* included organisations' community education programmes, school visits, use of conventional media and newer lines of communication such as social media, and flyers/brochures.

The fifth category was the *outbreak of illness*. For the health authorities, seeing a spike in gastrointestinal complaints in health centres is often a strong indicator that something is wrong, from which they launch their own investigations and try to narrow down a focus area. They noted that they usually notice this first among children, because parents are likely to take their children to health centres when they might not attend themselves unless they had very severe symptoms.

In sum, the group had compiled a mix of indicators that reach the authorities in direct and indirect ways: some that are proactively sought out by certain organisations (such as NGOs' environmental monitoring); some that are gathered in the course of other/routine organisational activities (for example the health surveillance); and some that are presented to organisations and trigger reactive responses (to complaints from the public/media).

Trigger 2: Decision-making in rural communities

Who makes decisions about water in rural communities; what decisions are they making; what resources do they use and need?

The second group identified the following general themes in their discussions:

1. Points of view
2. Problems/issues to be addressed
3. Resources
4. Solutions

The group found themselves looking at the *problems/issues to be addressed* from two *points of view*: regulatory organisations, and communities. Community organisations such as village councils and water boards may make decisions locally, but the government always overrides. This can cause conflict: if people need water, then sometimes the legal limits (such as prohibiting abstraction from a protected area, or declaring a certain water source unsafe) will not be heeded. There is a lack of communication and clarity about jurisdiction, and no central office for water issues. Village council decisions are made at meetings by majority vote, but this can be problematic if only a few people attend. There can also be complications over water decisions, because these may fall under the water boards, or public health, or the Department of Environment.

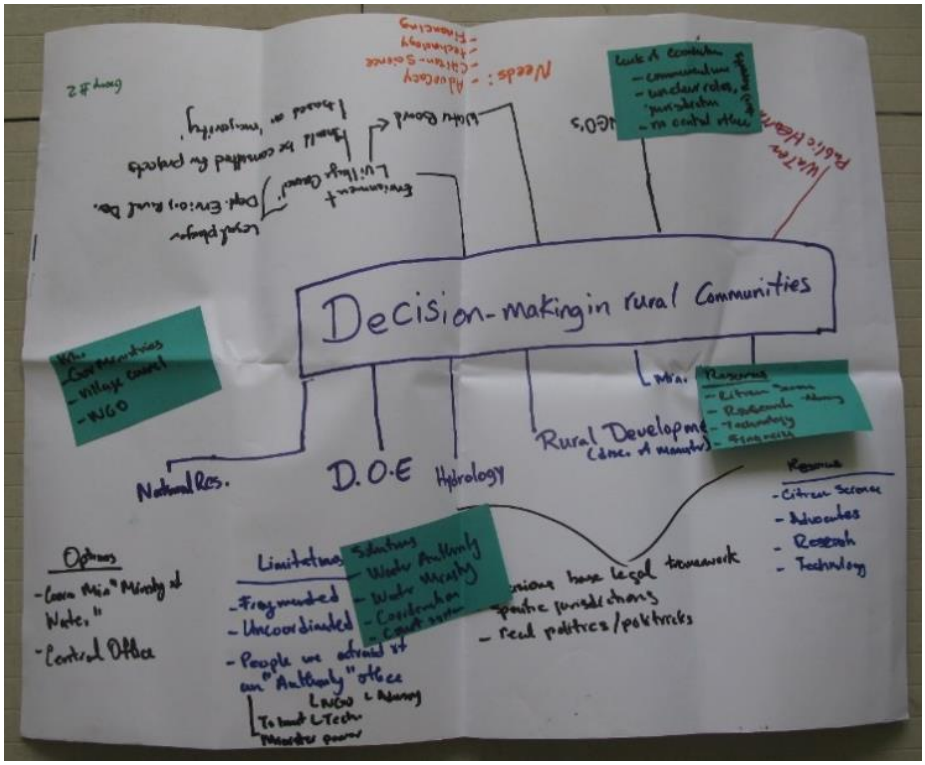

Figure 3: Group 2 conversation map

They next discussed the *resources* they felt were needed to help. One approach that they had heard about today and felt was needed was citizen science, as a way to bring community knowledge to inform decision making and to encourage advocacy. Research should guide both the community and the regulatory level. Technology was another resource that could help make life easier/make better decisions (if applied properly). On both sides, money would be needed.

Possible *solutions* included implementing the water authority (NIWRA); or perhaps even a Ministry of Water to avoid having multiple ministries making separate analyses of water issues. They felt this could ultimately factor into advising at community level. In further discussion of these issues, some participants identified ministerial discretion as a problem with most laws, leading to a debate about whether this could be changed by collective action.

Trigger 3: Connecting water to other responsibilities

How does water management connect with your other responsibilities/decisions?

The third group drew out the following headline themes:

1. Deforestation
2. Public health
3. Public awareness
4. The coral reef
5. Sustainable water management

Figure 4: Group 3 conversation map

The group noted that the diverse backgrounds and responsibilities of its participants contributed the wide range of their discussions. They had discussed issues that they felt affected all of them across their different roles. The first topic was *deforestation*, which can affect microclimates and soil structures. This can also have knock-on effects for public health, for example potential connections to rabies where bats' habitats have been affected. Other *public/animal health* issues include instances of diarrhoea in pigs as a result of *water pollution.*

Across the group they agreed that *public awareness* was something that was critical for all of them in their decision-making roles, whether as community leaders, government scientists or NGO staff. They also noted the extent of water-related issues stretching downstream from local and inland areas all the way to *the coral reef*, for example sedimentation and agricultural chemicals. In closing they surmised that *sustainable management* and education needed to be implemented through all the different organisations and through government. This should involve stakeholders and take into account the next 20-40 years so that future generations can enjoy 'pristine and good water'.

Preliminary findings of the 2017 research

Dr Haines' 2017 study comprised 4 months of ethnographic fieldwork (April to August), involving participant observation, action research focus groups, and semi-structured interviews. The aim was to understand both narrative and practice, and to examine interactions as they occur in the everyday lives of communities and projects. The research methodology was approved by the University of Oxford's ethical review procedure and research permission was granted by the Belize Institute for Social and Cultural Research. Two case studies were identified: one in Stann Creek and one in Toledo. In each site, Dr Haines conducted interviews with residents and relevant others, and observed various aspects of village life, as well as specific observations of events such as water monitoring expeditions and village meetings. In each location, permission was sought from relevant

community leaders, and a focus group was organised to mark the end of the study period. In both locations, a house-to-house survey was conducted with the assistance of a student intern from UB (Stann Creek) and two local research assistants (Toledo). The aim of the survey was to gather background information on village composition and to gauge the range of experiences with environmental projects and water provision.

Preliminary analyses of the data by Dr Haines are starting to show how water negotiations in rural Belize are not only a question of resource management, narrowly defined, but also about senses of place and belonging; about bodily health; and about the influence of history and power.

Case study 1: Headwaters protection in the Stann Creek Valley

As its name suggests, the Stann Creek Valley is a watershed feature. It is also a place defined by its shared cultural and economic character, grounded in the citrus industry and influenced by the challenges facing that industry at this time. It is connected by the highway (the Valley Road), by activities including torch runs, and – for many of the villages - by a shared source of water in the surrounding hills. It is a relevant place to study the involvement of rural residents with resource management projects, for example through the activities of the community-based organisation STACA, as we have heard from Mr Hislop. Established in 1994, the organisation has co-managed the Billy Barquedier National Park since 2004. Results from the interviews suggest that most residents of the buffer communities think that the surrounding environment is clean, and also that it needs protecting. When asked specifically about whether rivers and creeks were clean, the answers were more mixed.

This is a place with a very direct link between watershed management practices and human health, because the main potable water sources for the communities are the creeks in the surrounding hills, which supply water to residents' houses via gravity-fed pipe systems. According to the survey, this was the primary drinking water source for most people (a few said that they use bottled water, and some reported using rainwater, particularly when the gravity system water appears dirty following rain). About a fifth of respondents reported that they treat water at home, with some boiling it and some adding a small amount of Clorox. Most reported not having experienced any problems with the water. Some survey answers and interview responses suggested people feel a sense of place and pride in the water from the hills. For many, it was preferred for its taste and cleanliness ('no chemicals') as well as its practicality (cheap, or the only option).

A number of organisations have responsibilities relating to different aspects of the water system. For example, STACA and the Forest Department are tasked with protecting the water source in the national park. The village water boards are responsible for the maintenance of the pipe infrastructure. The Ministry of Health tests drinking water quality. The Department of Environment oversee other water quality/pollution issues. There are also universities (in Belize, USA and Canada) who carry out different kinds of testing and other engineering projects through partnerships with STACA. These responsibilities are not always clear-cut in practice. This was also suggested in survey responses that indicated a lack of clarity about who makes water and land decisions (although most respondents noted that the village council is the body that should resolve conflicts). Examining how these responsibilities are negotiated reveals social values and choices that are important for conservation and development. Emerging issues to explore further in the analysis include: the tension between managing the national park in a way that raises funds through tourism but also

protects certain areas and excludes visitors; the balance of working in a community organisation for 'love' with being able to make a living and seeing such work as labour; and the decisions about whether to focus on issues at the level of the sub-watershed or national park or to expand attention to the wider North Stann Creek watershed (or beyond).

The STACA-UB partnership for water quality monitoring is a productive site for studying how some of these tensions and decisions play out. The monitoring involves UB staff and students, and STACA rangers, and builds on previous monitoring efforts by STACA and other organisations. Decisions that are being made now about the scope of the monitoring programme will affect what it can be used for. Is the purpose to establish a baseline for comparing other sites? For measuring damage or contamination at a particular site? To determine whether a source is safe for a particular purpose? These questions involve considering the boundaries of watersheds, and the ways they are nested (for example the Billy Barquedier sub-watershed within the North Stann Creek watershed). The boundaries between neighbouring catchments are not always as well-defined as they appear on maps. As well as the tests done using field and lab instruments, human judgments of water colour, clarity and odour are important, as is the tactile sensation of skin itching after exposure, for example. These different sources of knowledge are brought together to discuss water quality. The processes of scientific testing also include what some residents are rangers referred to as 'bush engineering', and 'natural GPS'; sometimes the local people must 'supervise' the scientists. As such, the fieldwork of monitoring is practical and situated, not just about scientific theory and data.

Case study 2: Environmental negotiation in Toledo

Toledo is Belize's southernmost district: the most distant from the seat of government and historically the poorest. With government services often perceived to be lacking, NGOs have taken on many services, including agricultural extension. As a 'hotspot' for development projects, many of which have not been satisfactory for their designated beneficiaries, there is a widespread wariness of interventions and broken promises, alongside the ongoing work of several local and international NGOs. These difficult histories are also playing out in the context of debates legal cases and associated activities relating to Maya land rights. This is a complicated political landscape, and one where people often hold mobile and/or overlapping perspectives and roles: an interesting example is of conservation NGOs' rangers, many of whom are from the protected areas' buffer communities and are thus rural residents at the same time as having professional roles to protect certain areas.

Rural Toledo has many Maya (Kekchi and Mopan) villages, and most have an *alcalde* as well as village council. An interesting emerging finding from the surveys/interviews, in comparison with the Stann Creek case, concerns village governance. It is not necessarily the case that people always agree with their leaders, but it did seem that people found it easier to identify local decision-makers in Toledo than in Stann Creek.

While there seemed to be a degree of clarity about decision-making responsibilities, there was also a lot of talk of uncertainty. People that I interviewed talked about uncertainty with reference to the impact of climate change on agriculture, and also to the eventual outcomes of the land rights debates and associated processes. Despite this, people's descriptions of their place of residence emphasised positive attributes of coolness and tranquillity. It was also notable that, when people said that they thought the environment was healthy, they explained that this was because they clean it – suggesting an active engagement.

In terms of drinking water, the study community had two water systems. These are 'old' and 'new', and they come from different sources (a creek and a borehole), have different pricing structures and costs (a cheaper flat rate versus a more expensive meter) and different qualities including taste, cleanliness, and seasonal availability. These factors appear to interact in different ways to inform people's choices about which water sources they use, when and for what purpose. Asking about the notion of 'watershed' also revealed some interesting connections and mismatches. For example, there were several discussions about the upstream and downstream impacts of activities such as farming and chemical use, which emphasised the interconnectedness of watersheds. On the other hand, several respondents referred more specifically to the '66 feet' mandated riparian buffer. It is possible that this is the result of NGO interventions and educational programmes that have focused on practical activities that promote preservations of riparian buffers using the language and concept of the watershed. Another, different definitional connection was drawn by a small number of interviewees who compared the idea of a watershed to the Mayan worldview that identifies the *tzuultaq'a* (often translated as the lords of the mountains and valleys) as guardians or owners of the relevant topographical and hydrogeological features — beings that command respect.

Emerging themes

Across different study areas, key emerging themes identified by Dr Haines were: governance (in principle and practice); entanglement of environmental & human health; negotiation of knowledge.

Governance in principle and practice: further analysis of this theme will explore how water supply, other utilities, and protected areas are important parts of how citizens encounter the state. As discussed in the group activities, some decisions and responsibilities are 'top down' and others are more 'bottom up': an interesting question is what happens in-between? Examples from the research include the perceived problems of garbage accumulation: this is often related to individual behaviours, but also involves authorities, companies and infrastructures. There are also interesting related questions surrounding the phenomenon of co-management: what is the role of the government in these arrangements, is it only a regulator, or something else? Further questions can be raised about the differences and similarities between NGOs and CBOs, particularly relating to whether the work they do is expected to be done out of love and/or undertaken as paid labour. Is there a difference in terms of these organisations' access to resources and authority? The idea of participation (for example in conservation or resource management) alone does not guarantee equity: who is involved in decision-making and what are the implications for those who will be affected?

Environmental and human health: the research shows how water and environmental 'quality' are experienced directly in bodies as well as instruments/lab tests. This can be direct (i.e. effects of bacterial and chemical composition); but there are also more intangible links that draw connections between ideas of health, wellbeing, morality, respect, trust, and home, and those of 'good' water and legitimate practices. For example, if there is mistrust in authorities (whether government/NGOs/companies/leaders), this can impact how people perceive, access and engage with environments and resources. Further analysis of people's perceptions and practices of drinking water will explore further the finding that decisions are based not only on cost and other practicalities, but also matters of taste and trust.

Knowledge negotiation: the research material raises questions about simple oppositions between 'scientific' & 'local' or 'traditional' knowledge. One way of accessing this is through the practices and narratives of the 'brokers' who inhabit and traverse multiple roles: for example activists, rangers, leaders and students. As became clear in the study of the water monitoring programme in Stann Creek, the flow of information and knowledge is not just from technical/scientific experts to others. These are not trivial debates: they concern influential developments in terms of the structure and governance of water systems, national park borders, land use practices, and leadership processes. With the introduction of new technologies, it is important to keep asking: who gets to participate and set agendas for resource management? In research projects such as this, as well as in the processes being researched, care should be taken in seeking permission for these studies, being mindful of whose knowledge and time is given, taken and valued.

Concluding discussions and evaluation

Following the formal presentations, there was time for questions and answers. The topics raised included the following:

- To which office should a member of the public report a concern about pollution near a water source? (This could be the Hydrology Unit or the Department of Environment, depending on the type and source of the pollution)
- How can procedures be put in place to enforce correct practices with respect to the correct use and disposal of agrochemicals? (The Pesticides Control Board arranges training and licencing, but enforcement is more challenging)
- How can education be made more effective, in particular how can it be more than a one-way delivery of information?

This final point reflected broader conversations throughout the event – notable across all three of the discussion groups – about the role of public engagement and awareness.

Closing remarks were presented by **Mr Rolando Cocom** from the Institute for Social and Cultural Research (ISCR). He spoke about the importance of circulating research carried out in Belize to key agencies and improving dialogues with communities and key stakeholders. One recent development in this area has been the new National Research Conference, and also through conversations about the potential to establish a National Research Council that would work across disciplines and involve a range of stakeholders in public and private sectors. Mr Cocom also connected the themes of the workshop to his own personal experience growing up and visiting the river, and reflected on the changes over the years for example in terms of people visiting the river, collecting rain water, or starting to buy bottled water. For the social scientists and historians at ISCR it is important to connect research issues to lived experiences, and to empower people to take action. He called for further conversations about the ongoing detrimental effects of colonialism, and for the issues under discussion today to be understood in the context of history.

The aim of the workshop was to facilitate multi-way knowledge exchange among a range of stakeholders about water, knowledge and rural life in Belize. Overall, discussions and feedback during the day, and written evaluations completed at the end of the event (Appendices 3 and 4), suggested that these were successfully achieved. In particular, participants were pleased with the

interactive activities and with the chance to hear from a range of different perspectives – especially from rural community organisations, leaders and residents – during the presentations and discussions. Some participants offered ideas for how they might take ideas from the workshop forward, for example by sharing with their home communities, designing rural water assessments, supporting citizen involvement, using conversation mapping techniques, and developing networks of expertise for future work.

Key points across the day's discussions included:

- Exploring potential opportunities and challenges of potential 'citizen science' initiatives
- Keeping up to date with the development of NIWRA and associated government programmes
- Pursuing further engagement among residents, community leaders, community organisations and governmental authorities – and paying attention to power dynamics
- Exploring possibilities for information-sharing among different organisations, e.g. under a government authority that brings together the currently fragmented responsibilities within government and other organisations

These points, and the discussions summarised above, provide a base on which to build future engagements among diverse individuals and groups who work and live with the implications of water knowledge and practices in rural Belize.

Figure 5: The workshop participants

Appendix 1: Participant list

Gilbert Andrews, Water Quality Analyst, Coastal Zone Management Authority and Institute

Antonio Cano, Lecturer, University of Belize

Rolando Cocom, Senior Researcher, Institute for Social and Cultural Research

Prudencio Cucul, Village resident from Toledo district

Candy Gonzalez, President, Belize Institute of Environmental Law and Policy

Sophie Haines, Research Fellow, University of Oxford

Anthony Hislop, Chairman, Steadfast Tourism and Conservation Association

Manuel Lanza, Water Manager, Bowen and Bowen/Belize Brewing Co

Rhona Lopez, Data Analyst, National Hydrology Service

Joaquin Magana, Lecturer, University of Belize

Lisa Marin, Senior Public Health Inspector, Ministry of Health

Johanna Pacheco, Climate Change Officer for Adaptation, National Climate Change Office

Victoriano Pascual, Agriculture and Climate Change Specialist, Ministry of Agriculture, Fisheries, Forestry, the Environment, Sustainable Development and Immigration

Jose Perez, Executive Director, Association of Protected Areas Management Organisations

Justin Pook, Educator, Friends for Conservation and Development

John Rash, Alcalde from Toledo district

Leonel Requena, GEF co-ordinator, UNDP

Rudolph Williams, Director, Water and Wastewater - Public Utilities Commission

Tennielle Williams, Principal Hydrologist, National Hydrology Service

Appendix 2: Agenda

Workshop 23 July 2018
George Price Centre, Belmopan

Multi-stakeholder workshop

9am-1pm

Water: environmental knowledge and rural life

A knowledge exchange activity under the research project:
Envisioning Emergent Environments: Negotiating Science and Resource Use in Rural Communities
Funded by the UK Economic and Social Research Council (ESRC)
PI: Dr Sophie Haines, University of Oxford, UK.

9am	Welcome
	Opening remarks
	Mr Leonel Requena, National Coordinator, GEF Small Grants Programme, UNDP
9.20am	Round of introductions
9.30am	Introduction to workshop and research project (Dr Haines, Oxford University)
9.40am	Stakeholder talks
	1. Current work and priorities of the National Hydrological Service (Ms Tennielle Williams, Principal Hydrologist, Department of Natural Resources)
	2. The Belize River Watershed Management Plan (Mr Antonio Cano, University of Belize)
	3. Community-based organisations and watershed management (Mr Anthony Hislop, Chair, Steadfast Tourism and Conservation Association)
10.10am	Snack
10.30am	Group activities:
	Conversation mapping and discussion of priorities
11.10am	Feedback from group activities
11.30am	Report of 2017 study and emerging themes (Dr Haines, Oxford University)
11.45am	Q&A and comments
12noon	Forward-looking discussion about research outputs, networks and future work
12.30pm	Closing remarks
	Mr Rolando Cocom, Institute for Social and Cultural Research, NICH
12.40pm	Evaluation of event
	Lunch and networking

Appendix 3: Evaluation form

Workshop evaluation form 23 July 2018

Water: environmental knowledge and rural life

1) Which of the following describes your role (please circle, more than 1 is OK)

Government | Academic | NGO | CBO | Community resident | Private sector | Other (please specify)

2) What is your overall assessment of the event? (1 = insufficient - 5 = excellent)

1 2 3 4 5

3) Which topics, aspects or contacts made during the workshop did you find most interesting/useful?

- _____
- _____
- _____
- _____

4) Did the workshop achieve its objectives?

Yes No

5) Please explain why or why not:

_____

_____

_____

6) Knowledge and information gained from participation at this event will be useful/applicable in my work/daily life (please circle one)

Definitely Mostly Somehow Not at all

7) Any examples of how knowledge/information from the workshop might be useful in your work/daily life would be welcome: please include here or email sophie.haines@insis.ox.ac.uk

_____

_____

8) Any further comments and suggestions (including activities or initiatives you think would be useful for the future)

_____

_____

You are welcome to leave these comments anonymously, but if you would like to include your name and contact for possible follow-up on your comments, please include them here:

Appendix 4: Evaluation results (aggregated)

Workshop evaluation form 23 July 2018

Water: environmental knowledge and rural life

2) Which of the following describes your role (please circle, more than 1 is OK)

Government (7) | Academic (2) | NGO (3) | CBO (1) | Community resident (3) | Private sector (1) | Other (3) (UN, alcalde, regulator)

2) What is your overall assessment of the event? (1 = insufficient - 5 = excellent)

1 (0) 2 (0) 3 (3) 4 (10) 5 (3)

3) Which topics, aspects or contacts made during the workshop did you find most interesting/useful?

Community-based organisations and watershed management; feedback from group activities; uncertainty of water available in Belize; no control on raw water/source extraction; watersheds; water quality; group activities and feedback; future work; group activities with the triggers – specifically the responses from varied participants; the group discussion; I found the National Hydrological Service very important because of the national water quality standard; the group discussion; presentations from stakeholders; opening remarks from Mr Requena; stakeholder talks; report on 2017 research; information sharing; willingness of participants to be invited speakers; watershed; water management; stakeholder talks; group activity; I found the group activity 'trigger' most interesting because it allowed us to interact with other stakeholders, share ideas and listen to different views; community member presentation; the revitalising of the topic as a whole to key stakeholders and hoping that follow-up reaches our policy-makers and authorities; psychology; governance

4) Did the workshop achieve its objectives?

Yes (16) No (0)

5) Please explain why or why not:

The group was very attentive and provided informative comments in reference to challenges and solutions to water and the environment; great discussion and co-operation from all stakeholders involved; we got information on how the water effects our lives on a daily basis; address the areas of concern for water on the long term to sustain human life; provided real life experiences of challenges associated with water management in rural areas that were often deemed anecdotal with scientific evidence; I liked the interaction – the mapping activity was very interactive; it was good to know how dangerous the water can be if we as locals don't take responsibility for our water; very good interactive discussions with the stakeholders; very informative and excellent knowledge sharing dialogue; we were introduced to the topic, got examples and participated (hands-on) – contributed towards solutions for issues; because we got the knowledge of how to use water on a daily basis; a different approach to water resource assessment in the rural areas; provided more information on rural community perspectives; people articulated their interests and perspectives; I believe it was effective in socialising of the importance of and value of our water resources; made contact with others who may be able to further our objectives.

6) Knowledge and information gained from participation at this event will be useful/applicable in my work/daily life (please circle one)

Definitely (9) Mostly (6) Somehow (1) Not at all (0)

7) Any examples of how knowledge/information from the workshop might be useful in your work/daily life would be welcome: please include here or email sophie.haines@insis.ox.ac.uk

Integrating rural leaders, managers of PAs and citizens in knowledge and information gathering, use and sharing; sharing this information to our friends and family members; conversation mapping is a good tool to engage; educate more about citizen science, help people know more about the importance of preserving our water; more public participation and stakeholder engagement in various communities that are being affected; support citizen science efforts and targeted partnerships; got to know people that can be invited as guest speakers for my class at UB; sharing with community members; hope to use in assessment of rural water operations; all solutions have one common problem – information must come from a network of expertise that can share this information; scientific information will be important for our advocacy work as major developments that can impact headwaters is emerging e.g. in Chiquibul national park; information obtained from this workshop will help make informed decisions at STACA;

8) Any further comments and suggestions (including activities or initiatives you think would be useful for the future)

Conservation of water: educational awareness; more citizen science; research findings/outcomes with recommendations; this is timely, congratulations; we should do it again!; improve the use of waters; sharing the results of the workshop and the final report; earlier start? Follow-up in any form: keep the topic at the forefront is important; an education and awareness campaign would be good e.g. preparation and airing of a 60s video; the workshop concluded that next steps are important.