

EFFECTIVELY COMMUNICATING SCIENTIFIC AND ECOLOGICAL IDEAS TO Non-SCIENTISTS

(A Case Study in the Cormier Watershed Leogane, Haiti)



Capstone Fall 2014

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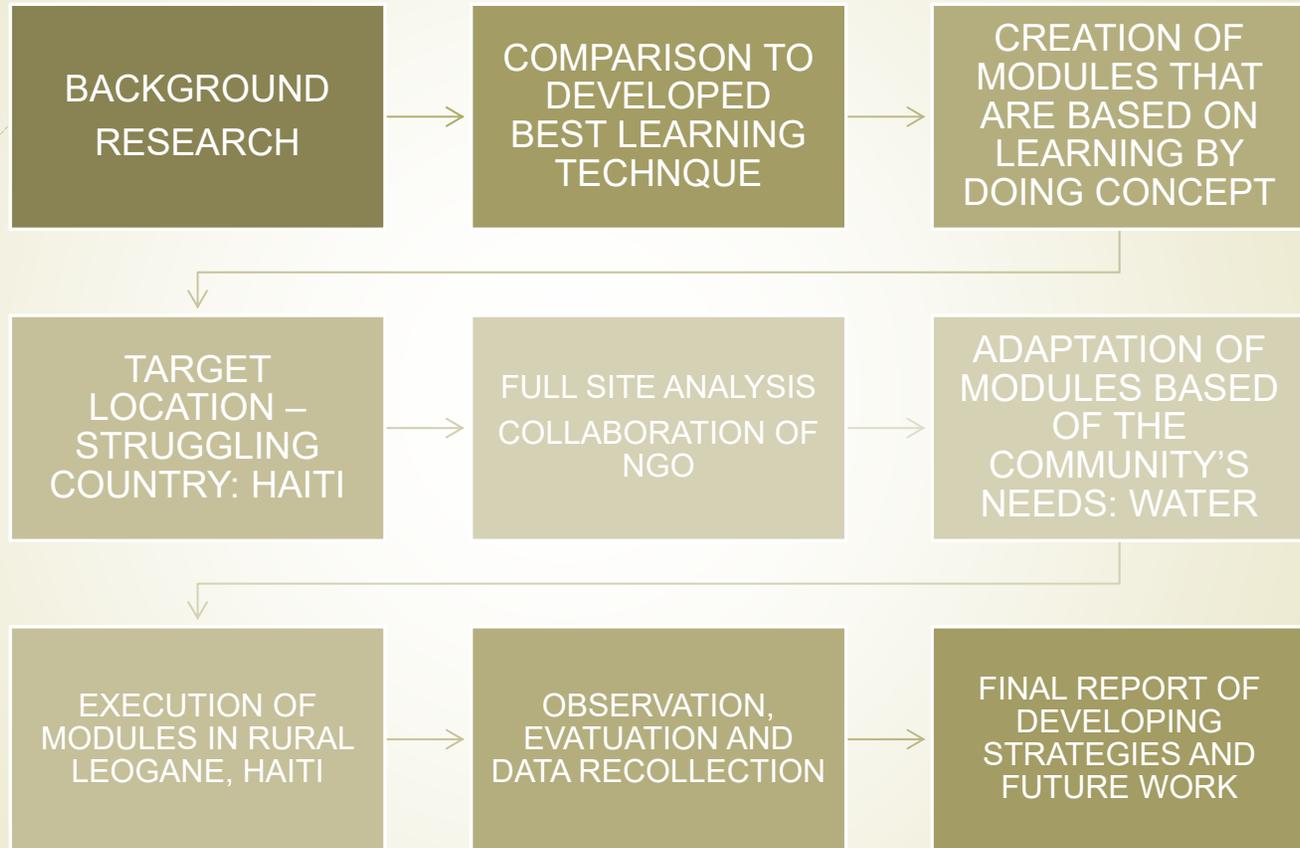
Professor Michael Piasecki



GENERAL OBJECTIVE

To review “best practices” for communicating scientific concepts in developing-nation contexts; and to develop, test, and implement communication/education strategies for students and citizens of Leogane, Haiti with respect to environmental sustainability issues such as the proper utilization of their water cycle.

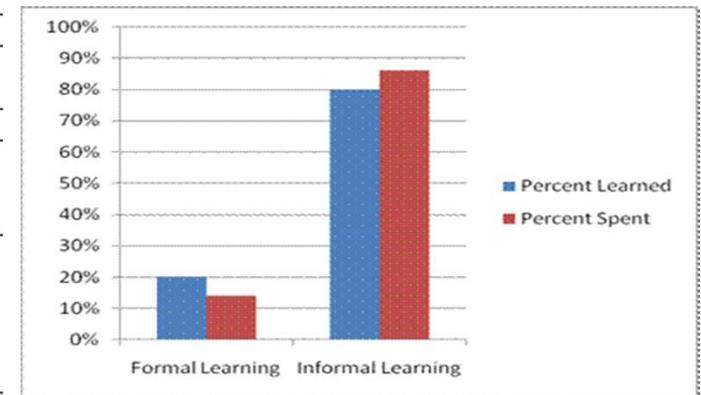
OUTLINE



BACKGROUND RESEARCH

FORMAL EDUCATION VS NON-TRADITIONAL

	BAREFOOT COLLEGE (NON-TRADITIONAL)	FORMAL TEACHING
socio-economic drive	voluntary	Compulsory: structure driven
subject	personal interest	curriculum-based
control	self-directed or community mentor/democratic	teacher-directed/ hierarchical
purposes	personal interest/ specific non-credential-based	set times/ long-term and general credential based
	all ages, lifelong	ages 5-18 sequence
location/delivery system	ubiquitous, environment-based, community related. flexible, learner-centred and resource saving	classrooms, institution-based, isolated from environment. rigidly structured, teacher-centred and resource intensive
timing	no test or grades. Recurrent. Self-paced : individual or the group sets their own pace; occurs out of a refusal to have an authority figure set the pace and impose rules. Self-evaluation	full time/ long cycle assessment: proof of apparent success
format	output centred practical. on demand, forums for discussion,	standardized. advanced self-paced learning courses, planned, content related surveys and learning journals.
creates	empowerment	monotony
	experimental knowledge	theoretical knowledge



BACKGROUND RESEARCH

Education and involvement of rural communities



CHARRETTE

Empowerment
Ownership
Respect
Localization
Enjoyment
Inclusiveness



ADAPTIVE RESOURCE MANAGEMENT



PARTICIPATORY RURAL APPRAISAL



CONTEXT : Haiti

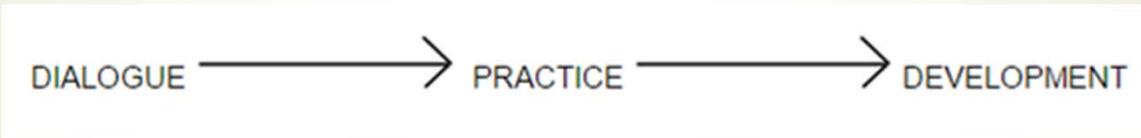




Cooperative Labor and community spirit - Natural Resources management



1. Analysis	2. Conception	3. Evaluation/feedback
<ul style="list-style-type: none"> a) Planning b) Study of receivers c) Training needs d) Content and context analysis 	<ul style="list-style-type: none"> a) Selection of training techniques b) Cost and budgets analysis c) Required equipment d) Activity schedule e) Elaboration of pedagogical materials 	<ul style="list-style-type: none"> a) Self assessment b) Evaluation by experts c) System test and re-evaluation d) Final evaluation



PROCEDURE

**LEARNING BY DOING:
VISUAL APPROACH**



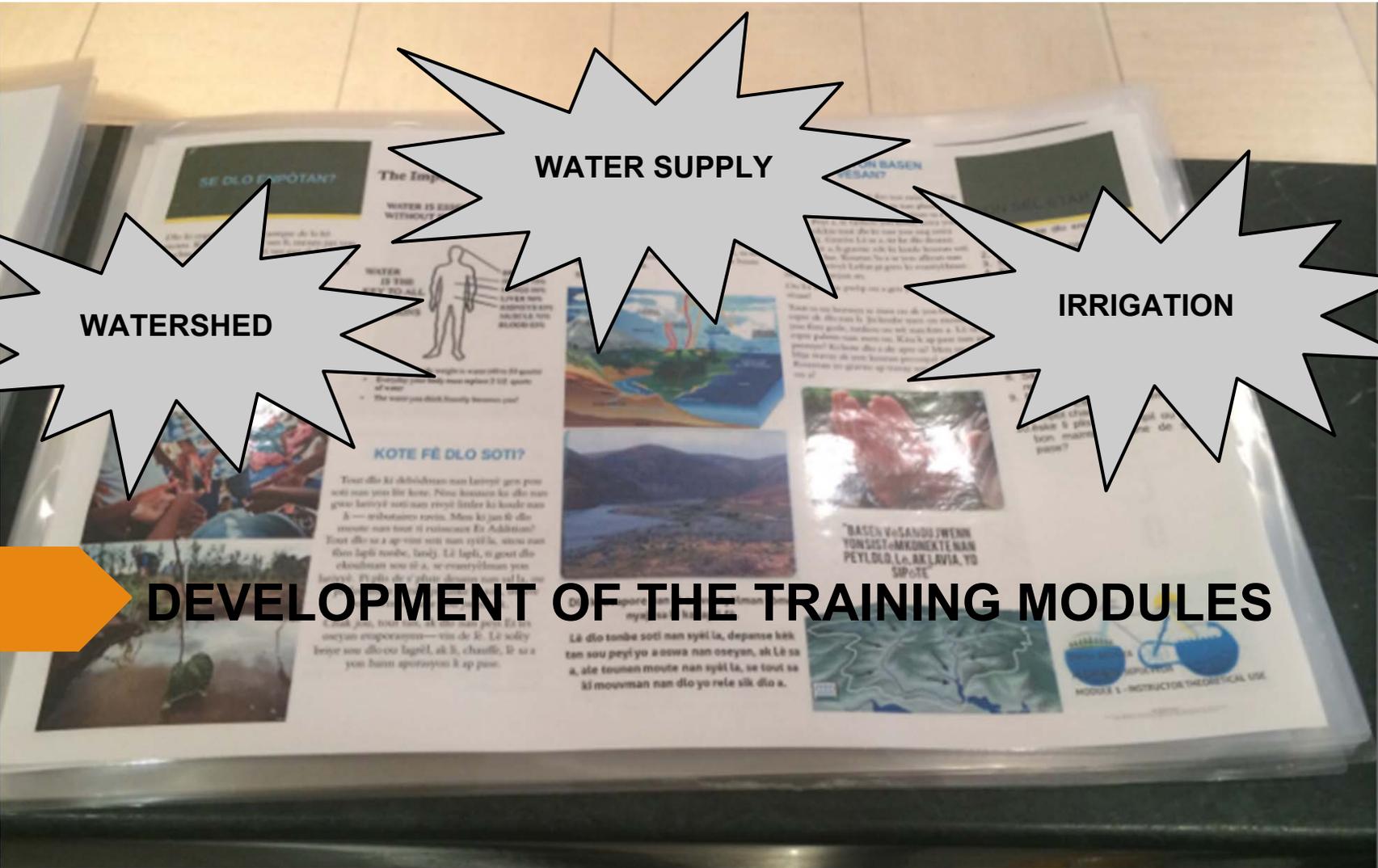
**NON MONETARY INCENTIVES
USING LOCAL RESOURCES**

WATERSHED

WATER SUPPLY

IRRIGATION

DEVELOPMENT OF THE TRAINING MODULES



W A T E R S H E D

COMPONENTS OF A WATERSHED

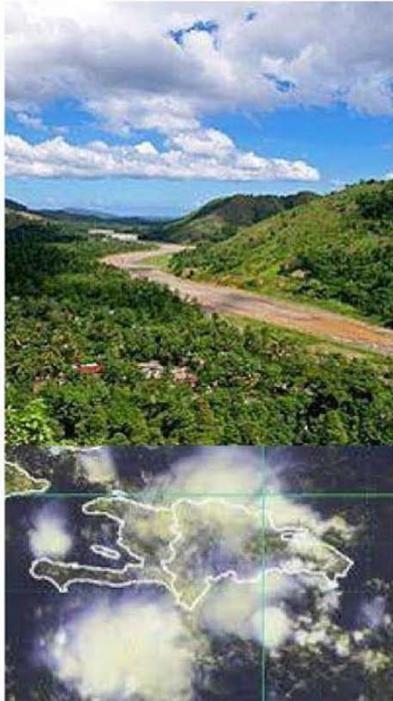
Physiographic: Geologic, relief and soil properties.

Climate: Rainy and dry seasons

Hydrology: Streams, rivers and lakes.
Water flux.

Ecological resources: Ecosystems
(native forest and animals) Riparian Areas

Land alteration and pollution sources:
Deforestation, erosion and biodiversity loss.



One of the most important parts of a watershed is the land right next to the stream, called the riparian area.

First, these trees, shrubs, and tall grasses can shade a stream to keep it cool. These plants can also provide habitat for land animals that like to spend time near water, such as raccoons, hawks and herons. Leaves and other plant parts fall into the stream and become food for a lot of the insects that live there.

Finally, these plants and their roots act as a screen for the stream.



HOW CAN A WATERSHED BE AFFECTED?

DEFORESTATION

RIVER BANK DEGRADATION

RIPARIAN AREAS

SANITATION

You can help your watershed by understanding that you are part of the solution to water quality problems. Your actions affect the water and environment around us. Keeping your lawn healthy is beneficial to water quality.

Plant and maintain grass and natural vegetation to help water quality by soaking up rainfall, reducing runoff, and retaining sediment.



IS OUR WATERSHED HEALTHY?

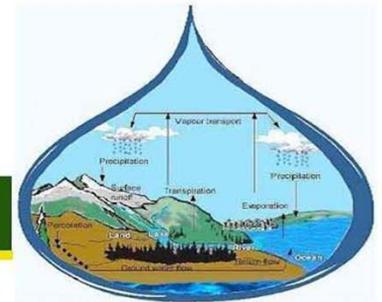
- > What problems can you say are present in our watershed?
- > What do you think you can do in order to solve those problems?
- > Talking about water quantity and quality, have you notice any change? is it more abundant or more clean now than years ago?

Activity: walk around the water sources to identify problems.

Explain Water cycle and climate chart .Show different water collection sources upstream vs lower (quality)



"A sustainable water management program should be designed in order to keep in balance the inputs and outputs of water into the water cycle"



IS WATER IMPORTANT?

Water is important to the mechanics of the human body. The body cannot work without it, just as a car cannot run without gas and oil. In fact, all the cell and organ functions that make up our entire anatomy and physiology depend on water for their functioning.

Water serves as a lubricant

Water regulates body temperature

Water removes harmful toxins from the body

Water transports valuable nutrients to the body

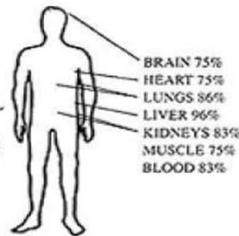
And also fundamental for **crops, livestock** and to be used in **hygiene** activities.



The Importance of Water

WATER IS ESSENTIAL TO LIFE... WITHOUT IT THERE IS NO LIFE!

WATER IS THE KEY TO ALL BODILY FUNCTIONS



- 2/3 of your body weight is water (40 to 50 quarts)
- Everyday your body must replace 2 1/2 quarts of water
- The water you drink literally becomes you!

WHERE DOES WATER COME FROM?

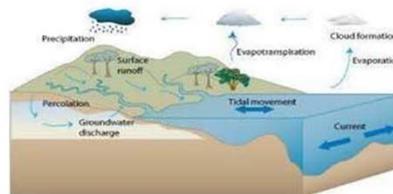
All the water that flows in streams has to come from somewhere. We know that water in big streams comes from little streams that flow into tributaries to the stream. But how does water get into those little creeks and brooks?

All of this water comes from the sky, mostly in the form of rain and snow. When it rains, some water flows over the ground, eventually joining a stream. Much more of the rainwater seeps down into the soil, moving slowly underground until it, too, finds a stream or lake to join.

Every day, all the time, water from the land and the oceans is evaporating becoming air. When the sun shines on water or ice, and it warms up, then a lot of evaporation is happening.

The next time it rains, notice the puddles on the ground. One day they're there, and the next day they're gone! Especially on sunny days, the water in a puddle can evaporate very quickly.

Plants and animals let water into the air, too. Put your hand close over your mouth and breathe out. Did you feel the moisture a tiny bit of water on your hand? Water comes out of your mouth with every breath. When you "see your breath" on a cold day, that is water, too. In fact, those breath clouds are a lot like the clouds that form high up in the sky.



Water that evaporates into the air eventually forms clouds, which can make rain.

When water falls from the sky, spends some time on the land or in oceans, and then goes back up into the sky, all that movement of water is called the water cycle.

WHAT IS WATERSHED?

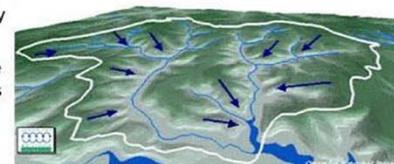
Look at this picture of a valley in the mountains. A stream flows at the bottom of the valley. The valley land and the mountainsides are the watershed of that stream. The land is like a basin, or a bowl, that collects all the water from a rainstorm or snowstorm. Gravity then drags that water down into the stream, and gravity helps that stream flow out of the valley. This stream is a tributary to a larger river that eventually flows into the ocean.

You can make your own hand be a miniwatershed!

All you need is your hand and a spray bottle with water in it. Just hold your hand up in a cup shape, like you see in the picture. Then, spray the palm of your hand. What happens at first? Where does the water go next? Does your hand have tributaries and a main stream? How is gravity working on the water in your hand?



"WATERSHED IS AN INTERCONNECTED SYSTEM OF LAND, WATER, AIR, AND THE LIFE THEY SUPPORT"



STEP ONE

1. Why is the water important in our lives?
2. Where the water comes from?
3. What is a watershed?
4. How does a watershed work, and what are its components?
5. How can we affect our watershed, or how can we affect our water bodies?
6. Is our watershed healthy, or are our water bodies healthy?
7. What problems can you say are present in our water bodies (watershed)?
8. What do you think you can do in order to solve those problems?
9. Talking about water quantity and quality, have you notice any change? is it more abundant or more clean now than years ago?



W A T E R S U P P L Y

HOW TO PROTECT SPRINGS?

To protect the area surrounding the spring, we can build a natural fence (with trees or shrubbery), 10 meters radius from the spring, this will prevent to animals getting in contact with the water source.

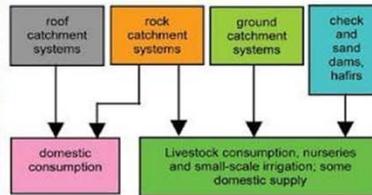
At the same time, it is good to dig a ditch in order to divert the runoff that can contain chemicals and waste and pollute the water.



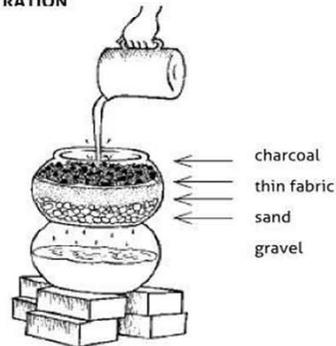
The rainwater is one of the safer drinking water source, because it comes directly from the clouds and have not have any contact with pollution sources.

Harvesting rainwater we can solve our drinking water scarcity problems, and ensure a good quality of it.

To ensure a long term drinking water source we can built a storage system, like a cistern, to keep the water far away from pollution sources. Also it is important to schedule the cleaning activities of the system according with the rainy seasons.



FILTRATION



DISINFECTION

It is always better to protect and use secure sources of water, however, if the water you are taking for drinking and cooking comes from a not secure source like a stream, river or pool, you must disinfect it.

The first step towards water disinfection is the filtration, here all the sediments and small animals contained in the water are going to be eliminated.

Then, the disinfection is going to kill the viruses and bacteria to make your water completely safe for drinking.

DESINFECTION



“Sustainable water systems should provide adequate water quantity and appropriate water quality for a given need, without compromising the future ability to provide this capacity and quality”

ACTIVITY 1- METHOD OF COLLECTING WATER: RAINWATER COLLECTION SYSTEM VS WALKING LONG DISTANCE (REFERENCE GRAPH) 2- CARE OF WATER SUPPLY: PROPOSE SINGLE PIT SYSTEM 3- WATER PURIFICATION with moringa

WHERE DOES THE WATER YOU USE FOR CONSUMPTION COME FROM?

SURFACE WATER:

Springs, rivers and streams .

THE FOREST:

Most of the remaining natural forests in Haiti occur in the mountains where the rainfall is highest. Forests "sweep" the clouds and the fog drip adds to the water table. The springs, streams and rivers flow through hundreds of communities where Haitians collect water to drink, wash their clothes, irrigate their gardens and catch their fish and crabs. Without these precious sources of freshwater, life in Haiti would not be possible! And it all starts with the forests that make the difference.



CLEAN WATER?

Drinking water or potable water is water safe enough to be consumed by humans or used with low risk of immediate or long term harm. Surface water can be contaminated with sediments, bacteria, viruses and chemicals, some of those not visible for human eyes, that is why it is so important to know where we are taking the water from and what are the possible contamination of it. Taking care of our sources is the easiest way to ensure the good quality of our water.

CLEAN WATER?

Is the water you drink clean?

Where do you usually take your drinking water from?



SPRING- SO FAR?



STREAM OR RIVER..



Bacteria, viruses (from human or animal feces) and **chemicals**(soaps, fertilizers): not visible



Sediments: coming from eroded soil, are usually visible

WATER CONTAMINATION

In order to guarantee enough drinking water availability, it is so important to know how to preserve, protect, storage and purify it. At the same time, the community must engage with the idea of changing what is not working through organization and community action.



CHEMICAL Soaps Fertilizers

BIOLOGICAL Bacteria Viruses



STEP ONE

1. Where the water you use for consumption comes from?
2. Do you think is a good quality water? Is it tasting? Does it has any color?
3. How often do you think you or your family members get sick because water consumption?
4. How much time do you spend every day for water collection activities?
5. How much time are you willing to spend every day in order to get water with better quality?
6. Is there any period on the year where the water is less available or with poor quality?
7. Do you have any water storage system in your house, or near to you?
8. Are you in favor of built a water storage system for you and your closest neighbors?
9. Why do you think is important to have access to clean water for human consumption?
10. Do you know what is water disinfection, do know any disinfection method?

I R R I G A T I O N

BUILD A DAM

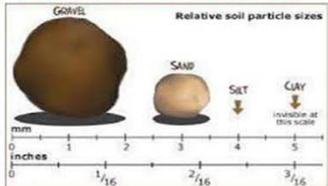
The best sites for constructing dams are in natural depressions where rainwater either flows or accumulates during the rainy season. The soil should, preferably, be deep clay, or silty soil. Coarse textured sandy soils should be avoided as these are highly permeable and water will drain through them. If seepage is high in charco dams, they can be plastered with clayey soil and compacted using compactors made of tree trunks.

Ideally, a dam should be located near to a gully or a natural waterway, which carries water during and after rainfalls, as this water can easily be diverted into the dam.

Farmers dig their ponds during dry seasons and enlarge them every year.



SOIL IDENTIFICATION



Differentiate fine sand and silt by placing a spoonful of the soil in a deep jar (or test tube) and shaking it to make a suspension. Sand settles out in 1.5 minutes or less whereas silt may take 5 or more minutes. This test may also be used for clay, which takes usually more than 10 minutes. The relative quantities of materials can be obtained by observing the depths of the several materials in the bottom sediment.

WATER DISTRIBUTION CHANNELS



After the dam construction, we should dig channels where the water is going to pass by until reach the crops. We can manage the water entrance in order to obtain the exact quantity of water, all depending on what kind of plants we are cultivating.

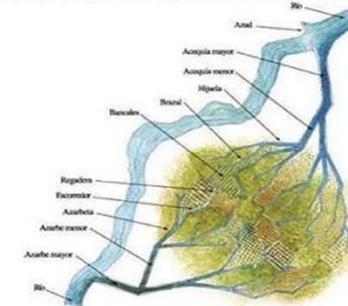
It is a good option when we are harvesting short or creeping plants, like melon, pumpkins, tomatoes, etc. Also it can be used when we are planting in rows (corn, potatoes, beets, lettuce, etc)



RIVER WATER DIVERSION

Once we understand how our watershed works, we will be capable to manage our water, even, we will know when is it better to use a rain water reservoir to irrigate our crops or if we can diverge the closest river with no flooding risk.

"All together can work to maximize our land capacity and at the same time take care of it, understanding that it supports all forms of life"



HOW IMPORTANT IS WATER FOR OUR CROPS?

Plants absorb water from the soil through their roots. The water contains nutrients from the soil and this mixture is transported through the plant tissues. After the plant absorbs those nutrients, the remaining water is released through the leaves to the atmosphere as vapor.

When there is not enough water and the environment is too dry, the water is released earlier and the nutrients transportation is not completed, so the plant starts to stop growing and produce fruit (similar to when you stop eating).

Water applied throughout several short cycle irrigation events can lower crop temperature and raise the humidity of the air as the water evaporates. This reduces the water loss by transpiration.

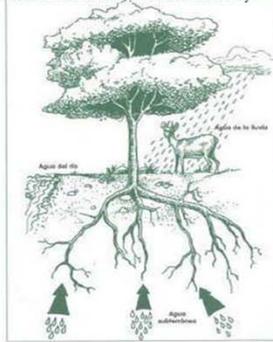


WHERE DOES THE WATER YOU USE FOR CROPS COME FROM?

Plants can take advantage of the different water sources surrounding them:

- ▶ Water from streams, rivers or floodings, that comes above the ground.
- ▶ Rainwater that comes from the sky and penetrates the soil superficially.
- ▶ Groundwater that reach deep zones because the excess of water during the rainy season.

This is why preserving the health of our watershed we also will ensure water availability for our crops.



HOW DO YOU WATER YOUR CROPS?

Have you thought about what would happen if we can store the water during the rainy season and use it during the dry season...

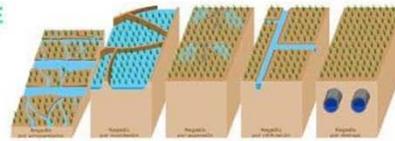
Instead of one harvest, may be tree!

Healthy crops

More food

Healthy people

How to do it? Irrigation system to storage rain water and diverge surface water



IRRIGATION TYPES



WORK TO REACH IDEAL CONDITIONS

DAMS

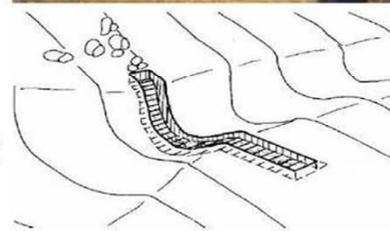
You can build a dam by excavating a depression for the water reservoir and depositing the excavated soil on the lower side of the water reservoir as an embankment that will increase the storage volume of the excavated water reservoir. It should be situated at the lowest point in the locality, so rainwater runoff flows naturally towards the water reservoir by gravity.

Charco dams: for almost flat land.

Hillside dams: for rolling and hilly land.

Valley dams for seasonal water courses and valleys

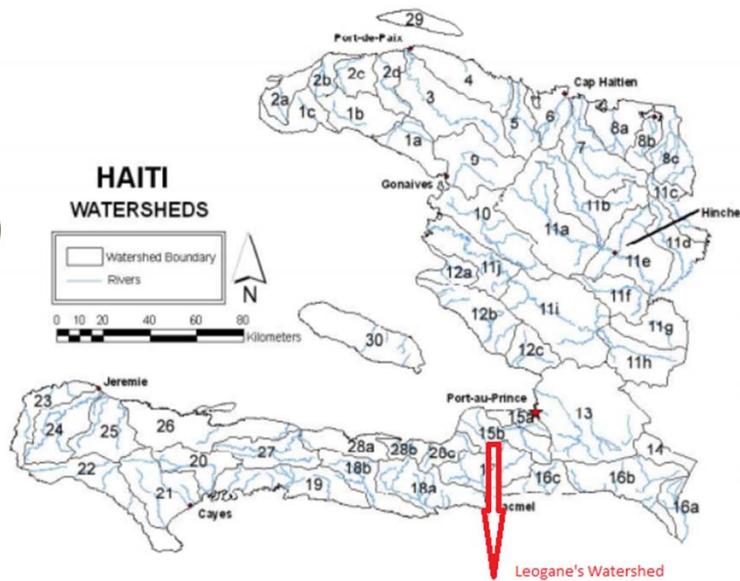
Which one of this list do you think is better for your community? why?



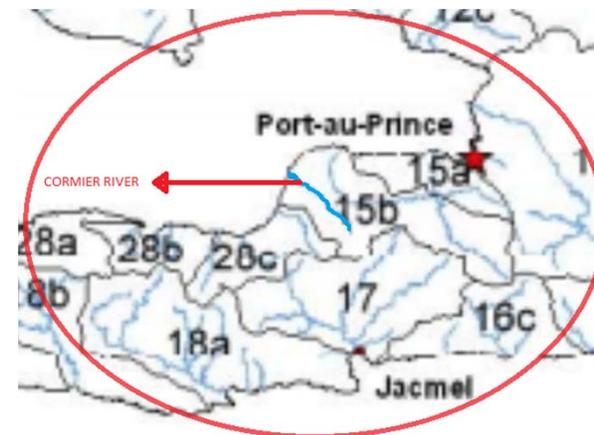
STEP ONE

1. How important is water for our crops?
2. Where does the water that you use for crops come from?
3. How do you water your crops?
4. Are the rainy and dry season constant? have they been constant during the last decades?
5. Have you had to change your crops because of problems with water availability? if yes, what was that change?
6. What is your ideal condition in order to ensure productive and healthy land?
7. Are you willing to work in order to reach this ideal condition?
8. Does the soil play any role in water accessibility and crops productivity?
9. Are trees important to our crops, to our lives and how are they related with water?
10. Have you heard about any issue that downstream communities face with water?
11. Can you do something in order





6 sub-basins



WORKING WITH NGO: CODEP. Cormier river basin



A total of three days of modules presentation and discussion were done to put into effect our program. each day was diverse and full of lessons. We found in this attempt a real level of uncertainty, same as the one you can find in any social project. The only certainty we had was the time in the day we will have access to the transport to go upland and make the presentations, morning time.

Procedure of workshop:

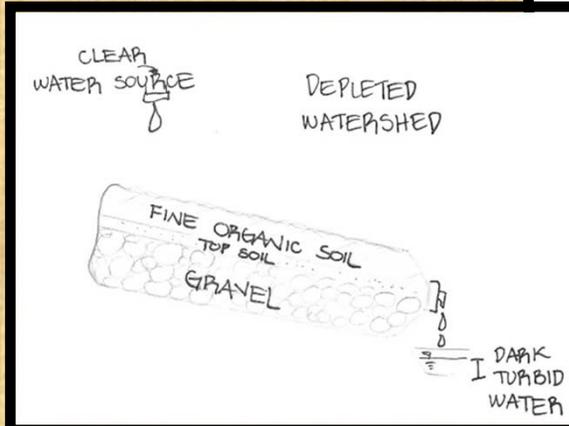
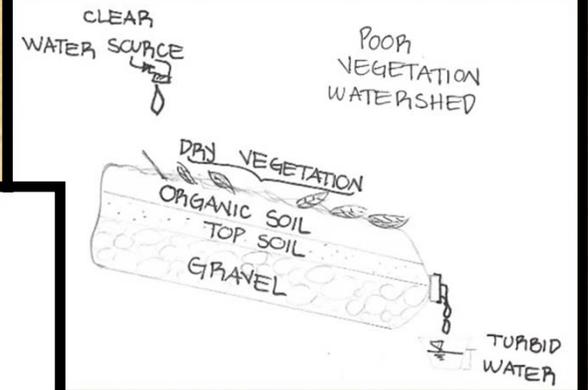
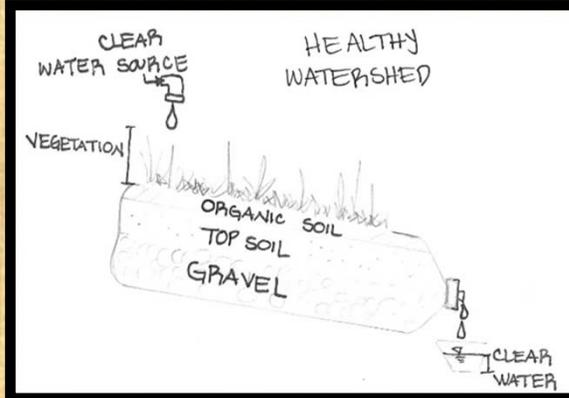
- 1st explanation + demo
- Talk of diagrams
- 2nd explanation + demo
- Response with more questions and comments. Followed by talk between the animators and community.

Activities:

- used as a mechanism to reinforce theoretical concepts.
- More female participation as they are the foundation of the household.
- Q & A after each activity to make the group think/understand their current situation.

WORKSHOPS AND ACTIVITIES





BASED ON :

Stage 1. METHODOLOGY AND REACTIONS: Did the people enjoy the workshop? Level of active participation.

Stage 2. KNOWLEDGE: What and how much did the participants learned?

Stage 3. BEHAVIOR: What are the changes on behavior product of our program? (Long term)

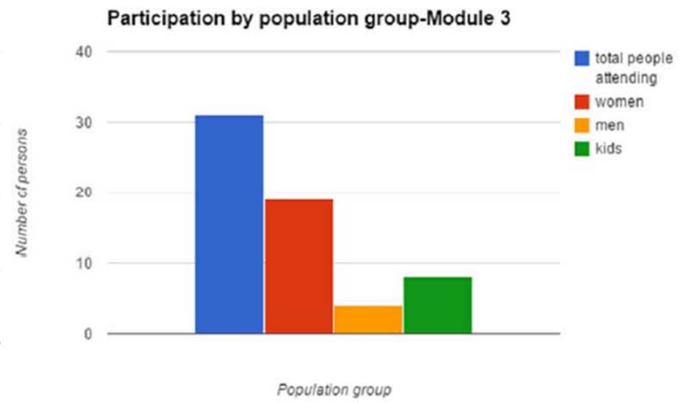
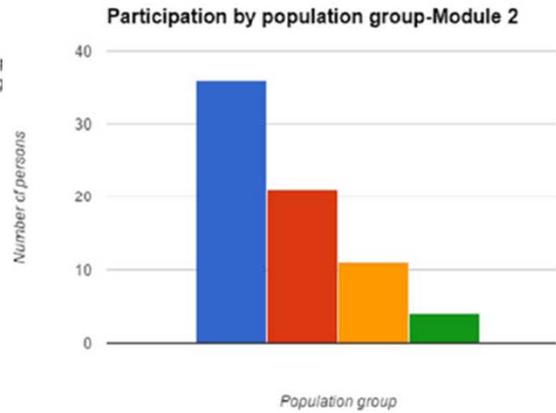
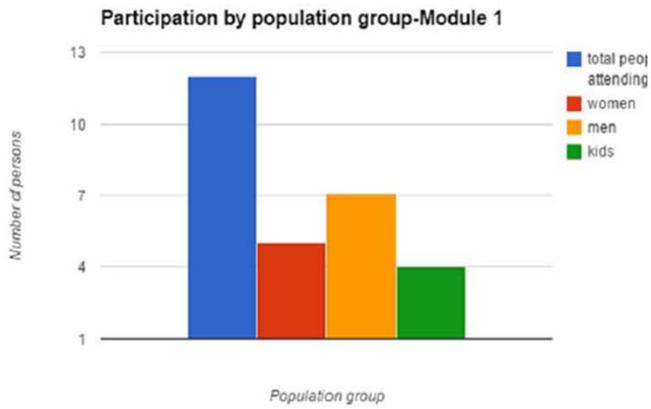
Index for Success Measurement of Modules

1. *Efficiency and accuracy of the module design*
2. *Individual change: Individual level of motivation, attention, and contribution from personal experience.*
3. *Group change: Collective participation and discussions*
4. *Community change (long term): Is there any change in the living conditions of the community?*

QUANTITATIVE RESULTS

Stage 1

MODULE 1	OBJECTIVES			
	#1	#2	#3	#4
<i>Efficiency of the module design (usage of time and resources)</i>	5	4	5	5
<i>Individual change: Individual level of motivation, attention, and contribution from personal experience.</i>	3	3	3	3
<i>Accurate and suitable information gived to the community</i>	4	5	5	5
<i>Group change: Collective participation and discussions</i>	3,5	3,5	3,5	3,5
FOR LONG TERM EVALUATION: Change in the living conditions	N/A	N/A	N/A	N/A
AVERAGE BY OBJECTIVE	3,875	3,875	4,125	4,125
ASSIGNED LETTER	A	A	A+	A+



Active participation percentage

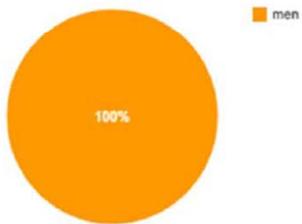


Chart 1 & 2. Participation Workshop 1

Active participation percentage

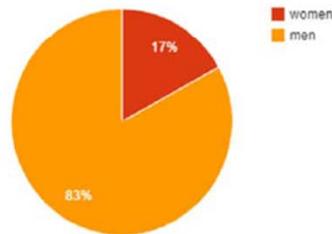


Chart 3 & 4. Participation Workshop 2

Active participation percentage

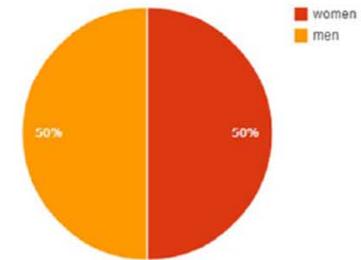


Chart 5 & 6. Participation Workshop 3

Stage 1. Methodology and Reactions

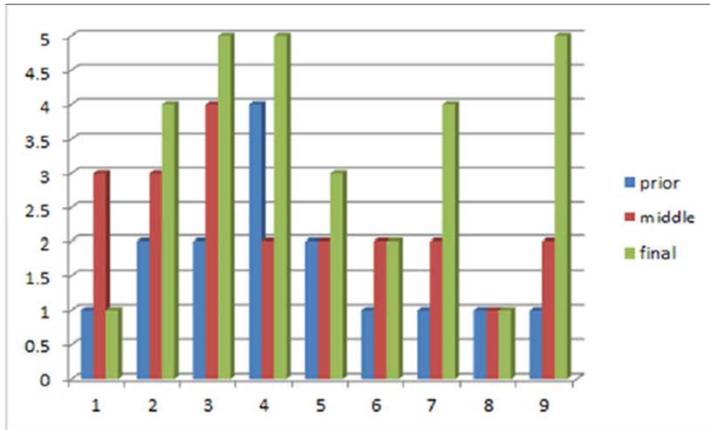


Chart 7. Watershed progress indicator, final questioner done after 3 months

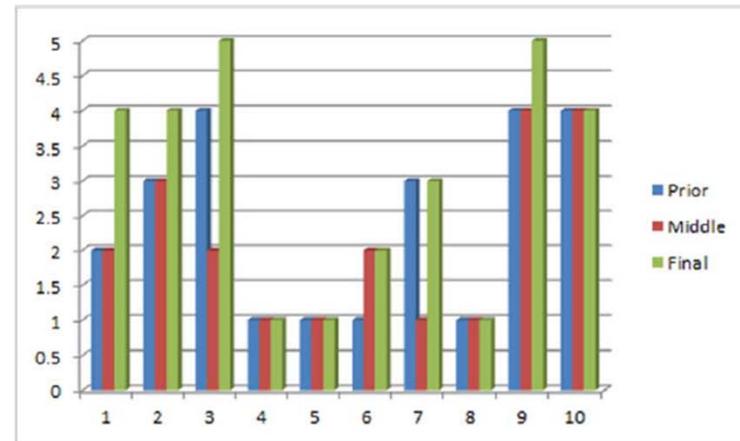


Chart 8. Water supply progress report indicator, no significant improvement however no drawbacks were seen.

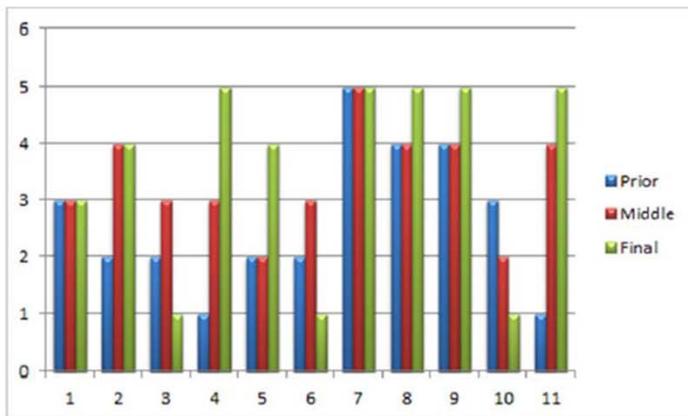


Chart 9. Irrigation progress report indicator, proved the impact of the modules after the sessions and months after.

Stage 2. Knowledge

VISUAL OBSERVATION OF PARTICIPANTS

Due to the language barrier we tested our workshops in different ways in order to comprehend better the functionality and the progress of understanding of our audience.

Observation:

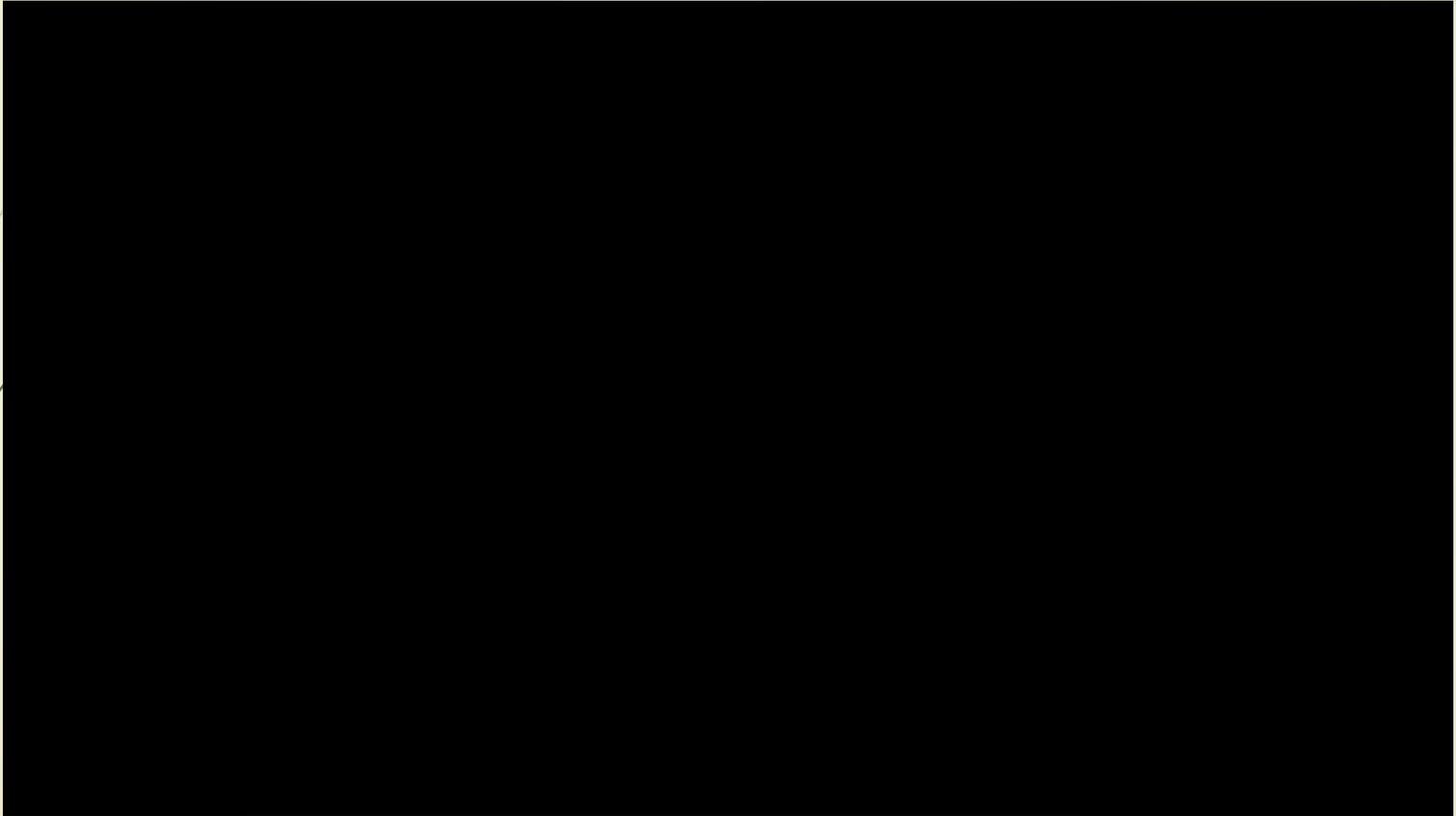
- Curious
- Others laughed (mostly women,) which we later understood was a sign of shyness instead of mockery as initially thought.
- The audience was in a stage of waiting eagerly to see what the animators had to say. Never the less, the women remained quiet.
- The leader of the lakou (male) talks for all.
- The men speak more freely due to culture.



QUALITATIVE RESULTS



VISUAL OBSERVATION



- Language Barrier.
- Different Culture.
- Low Budget
- Overcoming the predisposition of having a third party provide all their material needs.
- Lost of accurate data recolection due to third party aid.

CHALLENGES



- By using creativity and analyzing the community's real needs; the lack of budget and technology is not an impediment. In order to develop a model that would effectively be approachable for different situations and framework scenarios, its necessary the understanding of the culture, language and expectations of the target area.
- Constant evaluation, auto-evaluation and feedback acceptance is a key driver during the development of a training or communication project.
- Despite to the preconception of rural Haitians as bad natural resources managers, peasants in Leogane showed a good understanding of their surroundings and its physical properties. This is why there is a huge opportunity when integrating rural traditional wisdom with modern scientific knowledge.
- Visual and tangible examples are the most successful tools when talking about pedagogical strategy.

CONCLUSIONS



- Primarily, Future workshops NEED be developed in order to create reinforcement of theoretical concepts in the community and promote behavioral changes are needed.
- The conducted Pilot provided a lot of positive feedback, however in order to produce this technique in other environments further testing is required.
- One week of training and learning program is a good start but is not enough for the establishment of cultural and behavioral changes.

FUTURE WORK





MESI ANPIL!