PARTICIPATORY WATER SCIENCE FORUM

14-15 NOVEMBER 2022

Report - March 2023

Fondation ECHO Foundation

Université de Montréal

ROBVQ
Regroupement des organismes de bassins versants du Québec

DataStream

"A **participatory science** network for **water** health, recognized for the **sustainable** engagement of communities, the diversity of **actors**, and for the **sharing** of scientific and traditional knowledge. »

This report summarizes the two days of the participatory science forum on water which was held on November 14 and 15, 2022 in Quebec City. About sixty participants from various backgrounds came together to discuss citizen science programs taking place in Quebec, but above all, to define a vision of what citizen science should be. An action plan emerged from these two days rich in presentations, networking, and discussions. This report reflects the contribution of the participants and presents the elements that emerged during the forum.

ACKNOWLEDGMENTS

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1. Introduction and background

With tens of thousands of rivers and more than three million bodies of water, Quebec has 3% of the planet's renewable freshwater reserves. Nearly 40% of all this water is concentrated in the St. Lawrence watershed. 80% of Quebecers use surface water for drinking; 45% of this water comes from the Saint Lawrence and 35% from lakes, rivers, and streams (cf. MELCCFP, https://www.environnement.gouv.qc.ca/eau/inter.htm)

Aquatic environments are subject to many sources of pressure: urbanization, intensive agriculture, algae blooms, deforestation, pollution, invasive species, etc. Added to this are the impacts of climate change: rising water temperature, increased evaporation during dry periods, and increased intensity and frequency of floods, in particular. Although representing only 0.8% of the Earth's surface, but supporting 6% of species, freshwater aquatic environments and their biodiversity are highly vulnerable to climate change (IPCC, 2007) and are considered as sentinels of those changes' impact on biodiversity (Woodward, Perkins and Brown, 2010).

Built around this abundance of water, Québec depends on this resource and the ecological services that freshwater ecosystems provide it with. Ensuring that we conserve this resource in the form of freshwater ecosystems, and becoming more resilient to climate change are more than essential in the process of identifying solutions.

To achieve this, it is important to acquire data to understand the impact of our actions, positive or negative, as well as the impact of climate change on freshwater ecosystems.

Traditional data sources compiled by government and academic institutions are the first documents to be consulted for environmental reporting. Although valuable, these data sources are no longer sufficient: they are expensive, the data collection cycles are often interrupted and quickly become obsolete, and the collection sites are a small sample compared to the vast expanse of the territory.

Citizen science organizations have emerged to fill gaps in government programs. The advancement of technologies and the data collected by these organizations support, complete, and improve environmental reporting for decision-making at all levels: federal, provincial, and municipal.

A study published in 2021 by the International Institute for Sustainable Development (IISD) presents a business case for investing in community-based water monitoring in Canada. These same organizations that support the achievement of federal and provincial water strategies offer a range of reliable water monitoring programs. The main criticism addressed to the practice of participatory science regards the quality of the data collected. Although this subject is less and less discussed, numerous publications by recognized researchers demonstrate that the contributions of citizen science organizations and citizens are scientifically valid (Hoyer, M., and D. Canfield. 2021). We can for instance cite the contribution of amateur ornithologists to the production of the Atlas of Quebec Breeding Birds.

The same goes for participatory water science, which is a major movement in Quebec. There are a number of organizations, from NPOs to citizen groups, university researchers, research laboratories or government entities that are looking into community water monitoring.

The Education and Water Monitoring Action Group (EWAG), the Environmental Chemistry Research Group of the University of Montreal, the Regroupement des organizations de bassin versant du Québec (ROBVQ), and the DataStream organization met and proposed that a forum be organized thanks to the financial support of the Echo Foundation, so as to review the subject.

The objective of this first **Forum on Participatory Water Science in Quebec** is to bring together water stakeholders in Quebec, to assess the situation, to form a space of convergence or even a dynamic and formal network of participating organizations, and to establish, if possible, a common vision and an action plan in order to support all the work of the water monitoring practice in Quebec.

2. State of participatory water science in Quebec

2.1 DEFINITION

Participatory science has existed in Quebec for a very long time. environmental monitoring activities by citizens were already reported in the 1800s. This is without considering the ancestral monitoring traditions and practices of the First Nations, whose scientific value is undoubtedly rooted in traditional knowledge.

> The term "**participatory science**" could be broken down into several formulations: citizen science, community science, collaborative science, active observation, environmental monitoring by citizens, etc. We can for instance think about the network of **amateur ornithologists** or **weather observers**, two networks that have existed for a very long time.

The term "participatory science" applied to water is more recent. The 1990s saw the emergence of citizen monitoring projects such as Adopt a River, RiverWatch, freshwater fish watching, the Acid Rain Project, and later the Lake Monitoring Network (to cite a few).

In the context of this report, participatory science includes all projects and actions involving citizens in research, from sampling to involvement in defining issues or actions to be undertaken.

2.2 CHARACTERISTICS

Today, dozens of organizations do participatory science in Quebec and are divided either by region, by theme, or by types of participants.

During the forum, nine projects and programs were presented, but many others have been implemented in almost all regions of Quebec. Online, you will find some 14 summaries of presentations and lectures delivered during the forum as well as the full presentations.

Almost all regions of Quebec are covered, although fewer projects are currently ongoing in Quebec's Far North. All types of water bodies are being studied: small streams, lakes, watersheds and even rivers.

Different groups participate in citizen science programs or projects on water: elementary and secondary school youth, CEGEP and university students, citizens from different localities, community groups, indigenous communities, university researchers , researchers from provincial and federal levels of government.

The main actors of citizen science in Quebec, those who implement various monitoring programs, are NPOs, indigenous communities as well as university researchers, research institutes and governments.

2.3 WHY DO PARTICIPATORY SCIENCE?

Beyond the data, the advantages are numerous: acquisition of expanded data, awareness, education, commitment to the natural environment, better understanding of the impacts of climatic events as well as data, development of a critical mind, better understanding of decision-making, influence on decisions, assessment of the impacts of a given disturbance, production of a portrait of a given territory, decision support tool, protection of the territory, etc.

The results of citizen science can be used in different ways:

- A longitudinal database helps paint an evolving portrait of a given environment.
- Scientific data enables science-based decision-making.
- The stakeholders can focus on a specific case and ensure follow-ups following the steps taken and the results obtained by citizens.
- The results serve as a lever at the municipal level for the application of regulations.
- Data is a tool for raising awareness among peers and is also useful as a basis for discussion with individuals.
- Participatory science also enables dialogue with researchers.

3. Some citizen science projects

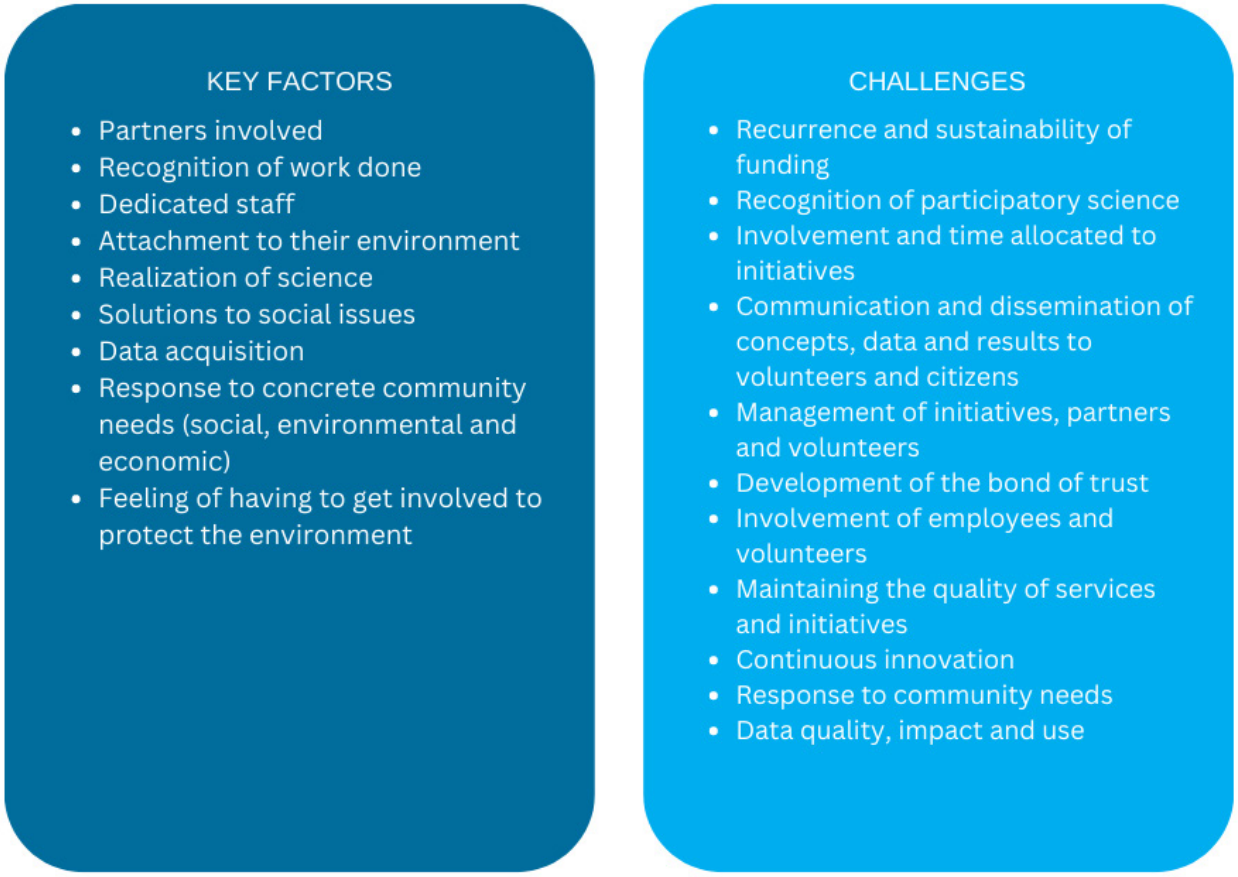
Although half a day was far from enough to present all the participatory science programs and projects taking place in Quebec, the forum was an opportunity to discover some of them. In addition to a short presentation of the projects, each presenter also had to name the critical factors for the success of their initiative, the benefits of their project, the challenges encountered, and their wishes for the coming years. Here is a summary of the various items presented.

3.1 NINE PARTICIPATORY WATER SCIENCE PROJECTS IN QUEBEC

PROJECT	DESCRIPTION
VOLUNTARY LAKE MONITORING NETWORK	The MELCCFP has set up a Voluntary Lake Monitoring Network for nearly 20 years. Over 772 lakes are monitored by thousands of citizens to monitor the eutrophication of lakes.
ADOPT A LAKE	More recently, the Environmental Chemistry Research Group of the University of Montreal also began monitoring the health of lakes by detecting cyanotoxins and cyanobacteria responsible for the presence of toxins. The analysis of caffeine is used as a very useful anthropogenic tracer to detect if there are issues (septic tank, sanitary aspect of waste water).
ITRACK-DNA	INRS-ÉTÉ, on their end, is working on a new kind of project: Itrack-DNA: detecting the invisible. Thanks to the environmental DNA found in the water, it is possible to detect the presence of certain species and to better monitor the level of biodiversity.
ADOPT A RIVER	Many citizen projects have emerged, all over Quebec. The Adopt A River youth program has been collecting temporal data on the health of watercourses for more than 20 years, with participants engaging year after year.
PROCESS FOR REVITALIZING THE VACHER STREAM WATERSHED	Citizen initiatives such as the Ruisseau Vacher make it possible to redevelop a watercourse.
THE SENSE OF BELONGING AT THE SERVICE OF CITIZEN SCIENCE	A community takes charge of its waterways in the Matapédia region in order to protect fish resources, reduce agricultural pressure, improve riparian strips, monitor water quality, etc.
SURVOL BENTHOS	The SurVol Benthos program, with 45 participating organizations, has been monitoring watercourses' health for over 16 years. The Benthos Overview project contributes to research and ensures the development of field expertise. In this case, the project also demonstrates the relevance of bio-indicators.
WATER RANGERS	Other projects, such as Water Rangers, raise awareness among the population about monitoring the quality of watercourses using accessible testing kits.
DATASTREAM	The DataStream program offers a water-quality data portal accessible to all.

3.2 THE KEY SUCCESS FACTORS OF THESE INITIATIVES

Several factors have enabled these initiatives to achieve their intended goals. These key factors are a source of inspiration for future citizen science projects. On the other hand, several issues were encountered by some of these projects, issues that are important to keep in mind for any future initiative. An exhaustive list of the key success factors, the challenges encountered, and the benefits of these projects can be found in Appendix III.



3.3 THE WISHES EXPRESSED

From the initiatives presented, a number of wishes emerged. Although some are specific to a given initiative, several are common and very much in line with the challenges set out above. In general, these wishes were taken into account when developing the vision and the action plan resulting from the forum. Annex IV presents a detailed list but here are the main wishes expressed by the speakers of the projects presented.

OUR WISHES

- Ensure the sustainability of citizen science by ensuring the sustainability of the network of organizations that partake in citizen science
- Ensure sustainable funding for programs and projects
- Ensure the sustainability of the projects and the work carried out over time
- Develop a greater mobilization of citizens and local governments
- Recognize the expertise of networks and programs
- Develop decision-making tools that lead to relevant and effective actions
- Promote participatory science
- Promote our partners at the provincial level
- Develop and maintain a sense of belonging
- Recognize the importance of youth participation in citizen science
- Invest in hands-on science education programs
- Provide better support for volunteers at the local leve

4. A planning exercise

The forum brought together for the first time representatives from several sectors practicing citizen science. Following the presentations and conferences of the first day, the objective of the meeting was to share the elements of a preliminary common vision for this new grouping of actors of participatory science.

4.1 TOWARDS A COMMON VISION

Participants agree on several common elements of a vision, namely the importance of:

- Water, the notion of health which encompasses all aspects: fauna, flora, ecosystem, etc.
- The notion of network which implies multidimensional, intersectoral, collaborative aspects, the gathering, by the environment, for the environment
- Data, knowledge, insights, action
- Dialogue, resonance, support, evolution, complementarity, commitment
- Durability
- Recognition

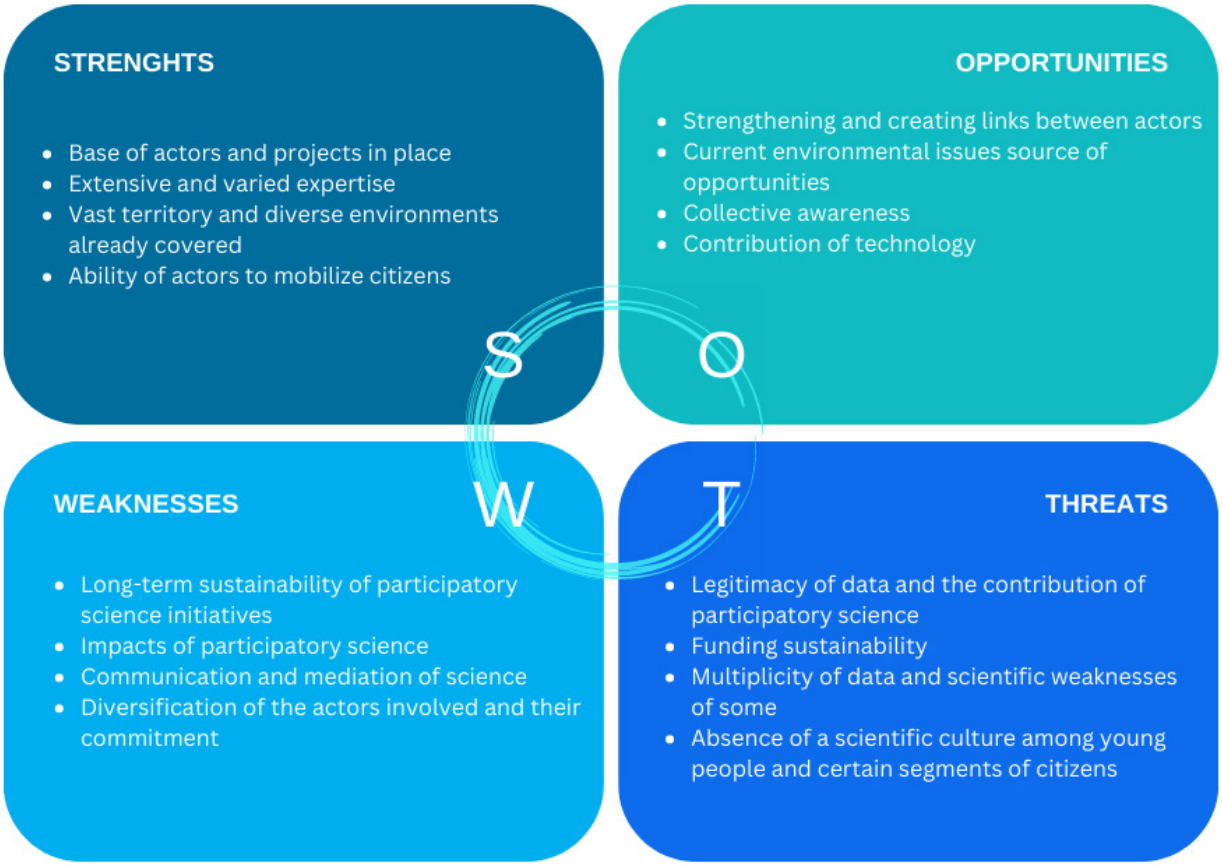
These common elements are collected in a few tentative sentences reflecting their common visions, which remain to be refined:

- "A multidisciplinary and complementary network recognized in the field of water which is constantly evolving when it comes to citizen science. »
- "A constantly evolving water-related citizen science network is at the heart of actors and communities committed to the health of aquatic ecosystems. »

"A **participatory science** network for **water** health, recognized for the **sustainable** engagement of communities, the diversity of **actors**, and for the **sharing** of scientific and traditional knowledge. »

4.2 THE STRENGTHS, ISSUES AND CHALLENGES OF PARTICIPATORY SCIENCE

The current analysis of participatory water science in Quebec has identified the strengths, weaknesses, opportunities and threats that are important to take into account when setting up a group of participatory science actors. This first exercise is essential in order to highlight the issues, orientations and actions to establish participatory science as a key element of water management in Quebec.



a. There are many strengths.

There is a base of citizen science actors with abundant, important and varied expertise. Coming from various regions and backgrounds, these actors are passionate, committed and have valuable knowledge of their environment. They have the ability to engage people in citizen science programs and inspire them to participate. Meanwhile, there is currently a base of very varied participatory science projects and a great complementarity of expertise.

b. Opportunities

It is clear from the forum that everyone wants to promote participatory science throughout Quebec. The current and future links between the different actors are significant opportunities to put forward initiatives and develop joint projects. The contribution of digital technologies makes it possible to maximize the work, to disseminate it, and to communicate the successes.

Current environmental issues such as the climate situation are key elements in raising awareness among governments and citizens of the importance of the contribution of citizen science as one of the many solutions to these issues. In addition, the collective awareness of the growing environmental issues of water and the awakening of citizens to these challenges are opportunities on which it is essential to work.

Various programs and actions planned by government authorities such as the Canadian Water Agency and the Blue Fund that involve elected municipal officials open up interesting and essential partnership opportunities in order to advance citizen science.

c. Weaknesses

The good will of the actors cannot make up for the major shortcomings in terms of both funding and human resources. On the other hand, it is difficult to engage citizens as long as there are no urgent or catastrophic situations that would lead them to get involved. However, one of the interesting elements of participatory science resides in the possibility of collecting data ahead of potential events, precisely allowing to predict, to find solutions or even to adapt to inevitable situations.

Citizen science initiatives are mainly the result of two categories of actors: organizations and researchers. We also note that it is mostly the same types of actors who promote citizen science programs: organizations and the research community. In order for participatory science to become sustainable and adequately meet the needs of the community, it is important to include community members: the private, industrial, and financial sectors, elected officials, citizens, cultural and indigenous communities, etc.

The impacts of participatory science are difficult to quantify and demonstrate; there is currently a lack of indicators of success and clues allowing the economic value of this science to be quantified. Difficulties in adequately disseminating the knowledge acquired and transferring data to aid in decision-making are major issues for long-term funding and sustainability.

The diverse terminology used as well as the scientific terms attached to this science are obstacles to the adequate and understandable dissemination of data to citizens, and by extension, their involvement. From a scientific point of view, the diversity of protocols and methodologies used is a source of challenge.

d. The threats to citizen science

Although citizen science is becoming more democratic and more accepted, there is nevertheless a mistrust on the part of scientists vis-à-vis the data collected by citizens.

This questioning of the legitimacy of acquired knowledge as well as past community and traditional knowledge can have a direct effect on the sustainability of activities, although most initiatives use validated and recognized protocols. The absence of a scientific culture in the population and among young people also undermines initiatives, both in terms of involvement and sustainability.

Funding, which is the cornerstone of any project, remains a major threat that has a direct impact on the stability of follow-up programs. Several funding programs base their criteria on novelty, the short term with rapid benefits, and quantified indicators. This goes to the antithesis of environmental monitoring, which is essential for decision-making.

Without current cohesion in the diversity of initiatives, there is a surplus of information, a multiplicity of data as well as a certain weakness in the quality of this data. This is the result of inadequate funding but it is clear that some initiatives are led to deal with the issues on the surface, thus harming the valuation of data from participatory science. Moreover, the slowness in decision-making affects the performance of initiatives and is a source of demobilization for citizens and initiating organizations.

The territory of Quebec is immense with many regional particularities both in the areas covered and in the social and economic aspects. The lack of university resources outside of the main population centres and the emotional tie with the environment also affect citizen science efforts in these territories.

And finally, although water is an essential resource, the fact that this unique good has no monetary value because of its abundance in Quebec hinders participation in citizen science programs and the urgency to invest in such initiatives.

What emerges from this exercise is a desire to **take advantage of the momentum** of the forum to further the reflection on the future of participatory science in Quebec. The participants share similar goals and needs as well as a common desire **to advance and promote** citizen science. The needs are clear and can be grouped into four main categories:

- Find new sources of **funding**
- Identify one or several groups that will take the **leadership role** for the network
- Disseminate **data and knowledge**
- Raise **awareness and recognition** of citizen science

4.3 THE CHALLENGES OF PARTICIPATORY SCIENCE

After having analyzed the strengths and weaknesses of citizen science, the participants raised the issues encountered in their practice.

- Information: inventory of existing knowledge
  a. Ensure the sharing of knowledge that is well targeted, made easy to understand, and standardized
  b. Accessible, discoverable, interoperable (different sectors and distribution system), reusable.
- Validation of the value of citizen science for government, experts and the community
- The people involved
  c. Concerted action (no redundancy)
  d. Risk of disengagement due to lack of coordination and availability of community resources and at various levels of organizations
- The credibility and recognition of participatory science

- The necessary resources ($, HR, tools) to feed the network and its evolution
- An inclusive vision that represents the diversity of all actors and their respective knowledge
- The communications
- A definition of citizen science versus community science (in non-scientific language)
- Network inclusiveness
- A collective awareness of the intrinsic value of water
- The sustainability of participatory science and stakeholder engagement
- Alignment with local issues. How to be present in the issues experienced by the communities? How can citizen science help address local issues?

From this list, the ideas that complemented each other were grouped together. The participants selected five main issues with the aim of exploring the subjects in greater depth and arriving at recommendations for action. The other issues raised will still be taken into account for future discussions.

The issues were dissected and the participants suggested several possible solutions which were then grouped into orientations to facilitate reflection on the desired results and the actions to be taken to achieve them.

ISSUE 1 - Sustainability

How to perpetuate this group of actors of participatory science both financially and human resources and in terms of the commitment of citizens, young people, municipalities and organizations.

ISSUE 2 - Inclusive vision

The importance of all stakeholders agreeing on a direction, a common goal to achieve before taking specific actions to resolve other issues.

ISSUE 3 - Commitment

Ensure the commitment of citizens, young people, municipalities and organizations that are sometimes struggling.

ISSUE 4 - Validation and credibility

How to perpetuate this group of actors of participatory science if the practice is not recognized and if the data is not accepted by the decision-makers?

ISSUE 5 - Knowledge sharing and inventory

Find solutions for data inventory and knowledge sharing, so that all this monitoring and data collection work can be used for decision-making and, ultimately, for the protection and conservation of aquatic ecosystems.

5. Towards an action plan

The participants worked to materialize the steps to be taken to meet the needs expressed and achieve the group's ambitions. Each of the teams translated the achievement of each of the issues into action by prioritizing each of the intentions over time. This highlights the need for one or more leaders who take charge of all the needs that were mentioned and broken down, in order to achieve the goals.

Participants were unanimous relative to certain actions which appeared in several issues:

1. the need for an **inventory** of actors, networks, projects, and **data** to be conducted in order to establish a **more complete portrait** of citizen science in Quebec;
2. **citizen engagement** and **retention**, the need for effective, ongoing **communications** through all kinds of means and tools available;
3. the **valorization** and **credibility** of data and knowledge for the sustainability of participatory science.

The proposed efforts could be summarized as follows:

- Bring the participants together through a shared vision and a leader.
- Draw up an inventory (list) of actors, projects, existing networks, and data, and then map who does what, where, and how.
- Standardize protocols and set up a scientific committee.
- Set up a strategic committee to propose new medium- and long-term funding plans.
- Promote knowledge and disseminate data.
- Promote projects and scientific research for and by the community.
- Establish an ongoing dialogue with decision-making bodies (governments, local elected officials, researchers).
- Communicate, popularize, and establish continuous feedback using multiple tools (web, reports, portals, training, media kits, databases, interactive maps, etc.).

Action plan for the implementation and promotion of participatory water science in Quebec (2023-2028)

OBJECTIVES	MEANS / ACTIONS TO BE IMPLEMENTED	TIMETABLE			MANAGER/ WHO IS INVOLVED	SUCCESS INDICATORS / RESULTS
		SHORT TERM 1 YEAR	MEDIUM TERM 1-3 YEARS	LONG TERM 3-5 YEARS		
ORIENTATION 1 - HAVE AN INCLUSIVE VISION						
Structure the organization	Set values	x				Developed common vision
	Promote a shared vision around water	x				Organizational structure implemented
	Define an organizational structure	x				
	Create a database of current and potential actors (representativeness by sector, organizations, etc.)	x				Shared list and database of potential actors and needs
	Create a geo-located map of said actors	x				Map of current and potential actors # of memberships (individuals and organizations)
Ensure two-way communication between all	Collaborate with existing networks		x			Set up platforms, websites, and discussion forums
	Recruit new members and/or actors		x			# of new actors
	Listen and respond to individual and organizational needs		x			# of workshops, meetings, consultation activities, and documents produced..
Ensure adequate learning and training for all members	Establish webinars for members of the network (workshops, toolboxes) on different concepts according to the needs expressed		x			# of webinar series for network members
	OCAP Trainings		x			# of training sessions given
	Forum		x			# of forums carried out

OBJECTIVES	MEANS / ACTIONS TO BE IMPLEMENTED	TIMETABLE			MANAGER/ WHO IS INVOLVED	SUCCESS INDICATORS / RESULTS
		SHORT TERM 1 YEAR	MEDIUM TERM 1-3 YEARS	LONG TERM 3-5 YEARS		
ORIENTATION 2 - COMMITMENT						
Identify and get to know the actors	Analyze the needs of current and potential actors	x				Needs analysis carried out # meetings held # of consultations conducted Developed action plan
	Organize consultation tables, online surveys, various communications to reach stakeholders and properly target the efforts to be invested.		x			
	Make an action work plan in collaboration with the actors		x			
Develop strategies and means of engagement	Plan for varying levels of engagement		x			# of recruiting tools developed Framework developed # of new commitments Network stability % of actors who continue their commitment Duration of the commitment
	Define the rules of the game for the commitment (nature, duration, etc.)		x			
	Develop a concerted reference framework			x		
Support the continuity of efforts and the recognition of these actors	Develop a retention strategy			x		Annual impact report # recognition events/activities Project team in place # of valuation tools developed
	Pool the results of all the programs in order to establish an overall picture and derive standard indicators			x		
	Plan recognition activities			x		

OBJECTIVES	MEANS / ACTIONS TO BE IMPLEMENTED	TIMETABLE			MANAGER/ WHO IS INVOLVED	SUCCESS INDICATORS / RESULTS
		SHORT TERM 1 YEAR	MEDIUM TERM 1-3 YEARS	LONG TERM 3-5 YEARS		
ORIENTATION 3 - SUSTAINABILITY (FUNDING, HR, COMMITMENT)						
Develop and implement a funding mechanism to ensure the sustainability of citizen science projects and initiatives	Set up a strategic committee to propose a new medium- and long-term financing mechanism	x				A trust is set up # of new financing mechanisms for all network actors
	Develop a methodology to quantify the value of citizen science investment (see for a research project)		x			Tool for evaluating the value of a participatory science initiative developed Inventory of Data on the Value of citizen science in Quebec
	Foster partnerships and rely on collaboration		x			
	Promote the benefits and results of citizen science		x			
Valorize citizen science and its results	Set up tools for promoting and communicating with citizens		x			# of communication tools developed Brand image developed # of uses of brand image
	Develop communication tools to popularize, adapt and sort data from citizen science			x		
	Create a brand image (label, logo) to support a sense of belonging	x		x		
Invest in scientific culture among young people and the general public	Promote the deployment of citizen science in schools (decision-makers and workers of tomorrow)		x			# of young people involved # of educational institutions involved % increase in interest in science among young people # of citizens involved
	Encourage activities involving citizens in one or the other of the stages		x			

OBJECTIVES	MEANS / ACTIONS TO BE IMPLEMENTED	TIMETABLE			MANAGER/ WHO IS INVOLVED	SUCCESS INDICATORS / RESULTS
		SHORT TERM 1 YEAR	MEDIUM TERM 1-3 YEARS	LONG TERM 3-5 YEARS		
ORIENTATION 4 - VALIDATION AND CREDIBILITY OF DATA						
Establish citizen science in scientific rigor	Form a scientific committee		x			Scientific committee established
	List the existing protocols and standards (possible research project)		x			# of standardized, recognized, and simplified protocols (accessible to the public, by video, etc.)
	Prioritize the protocols to be produced, popularized, and implemented		x			# of scientific committee meetings or participation rate
	Standardize the collection of data and the aggregation of this data		x			# of protocols that comply with international protocols
	Create a process for pooling and retrieving data		x			# of citizen data generated
Have an equal relationship with partners (governments, experts, community, academics)	Have a government representative sit on the scientific committee		x			# of government representatives and citizens
	Have citizens and partners within the scientific committee					# of committees on which stakeholders sit
	Sit on other scientific or advisory committees					
Ensure the credibility of citizen science data	Create training or adapt existing training		x			# of training sessions given
	Provide training to citizens and provide them with adequate tools			x		# of participants in training
	Create a metadata template by involving the government and the developers of similar systems (eg Datastream, etc.)			x		Metadata template developed All metadata is completed
Highlight insights from citizen science data	Map the uses of citizen data to show they are being used			x		# of actual uses resulting from citizen-gathered data
	Create a protocol for sharing data, best practices and feedback among all partners			x		Protocol developed
	Participate in the Canadian Open Data Society and other similar events or groups			x		# of participations in scientific data sharing conferences or committees
Contribute to data access procedures	Develop the culture of open data (collect)	x	x (colliger)			# of data collected
	Collect everything that is done in terms of open data (collect)	x	x (colliger)			# of meetings with the Canadian Open Data Society

OBJECTIVES	MEANS / ACTIONS TO BE IMPLEMENTED	TIMETABLE			MANAGER/ WHO IS INVOLVED	SUCCESS INDICATORS / RESULTS
		SHORT TERM 1 YEAR	MEDIUM TERM 1-3 YEARS	LONG TERM 3-5 YEARS		
ORIENTATION 5 - KNOWLEDGE SHARING AND KNOWLEDGE INVENTORY						
Have an inventory of all the knowledge acquired by the actors	Inventory of resources: data, organizations, sources of transferable knowledge (web), communicators, etc.		x			# of tools and inventories Database # of new projects addressing missing needs # of data and initiatives promoted
	Join forces with data managers		x			
Make accessible and facilitate knowledge transfer and understanding in communities	Adequately train actors on data transfer and communication tools		x			# of training sessions given # of training participants # of platforms adapted # tools developed and used to demonstrate the integration of citizen science into decision-making Validation seal in place
	Propose adaptations to existing platforms to effectively reach the various target audiences and users		x			
	Popularize the information according to the different actors it targets		x			
	Distribute and share existing platforms			x		
	Categorize the data by specifying its level of complexity			x		

6. Conclusion

The forum on participatory water science allowed, for the first time, a majority of actors involved to open up a reflection on the importance of this practice in Quebec.

The conclusion speaks for itself:

- Participatory water science is **very much alive** throughout the territory.
- **Many initiatives** are taking place; the actors are numerous and come from all sectors: academics, governments, NPOs, young people, indigenous communities, businesses, elected officials, etc.
- Databases show a **significant temporal evolution** for certain environments
- Almost **all regions of Quebec** are covered.

The benefits are numerous, among others, on the social, scientific, spatial, temporal and economic levels. Citizen science gives a spatial dimension to data collection: remote areas are accessible, data is abundant and the collection frequency is increased. Citizen science also offers a temporal dimension: the duration of monitoring is longer and more frequent and therefore can play the role of a precursor system for the evolution of environmental issues. The social dimension brings undeniable advantages: the education of young people and citizens, the development of eco-responsibility, a feeling of empowerment in taking charge of the environment, etc.

We note that the network is made up of several components: the research component, the citizen component with the support of NPOs, the youth component, etc.

Forum participants would like this conversation to continue. However, a legitimate question arose: what can the network do that individual actors cannot do alone?

According to the participants, the network:

- Allows for an understanding of what is happening among the participants because it brings together and promotes dialogues between governments, NPOs, citizens, young people, researchers;
- Highlights the initiatives, the actors, and the results of each and every one;
- raises awareness and recognition of the importance of citizen science;
- defines interactions and opportunities for synergy;
- breaks down silos and fosters collaboration between different sectors;
- contributes to ensuring the sustainability of the practice.

Some issues emerged as a priority.

- How to be **recognized** by the scientific community and decision-makers?
- How to ensure the **sustainability** of this practice?
- How to ensure the **inventory** and the **sharing** of data, knowledge, and know-how?
- How to **engage and maintain** citizen engagement? How to **integrate** participants right from the beginning of a project? How to **build** partnerships with cultural communities?
- What is the **vision** of this new network?

Many possible solutions have been proposed by people in the community and translated into concrete actions.

There are many priorities for a new group. In order to take charge of the needs and wishes expressed, the group should have a leader (an organization or a committee made up of organizations) who would be responsible for carrying out the action plan initiated by the actors.

Here is a summary of the priority actions that have emerged from this meeting:

- Draw up an **inventory** (list) of actors, projects, existing networks, and data.
- Propose a **new medium** and long-term **funding mechanism**.
- Work on **protocols**, and **data**.
- Highlight the **practice**, the **data** collected, and communicate the **results**.
- Establish **strong links** with decision-making bodies.

The work carried out during these two days where the stakeholders pooled their energy, their vision, their solutions enabled this new group to define a common vision and an action plan to be carried out to develop participatory water science in Quebec.

The forum's web page, set up to present the citizen science community, is a first step towards asserting a living force for citizen science in Quebec.

In collaboration with partners such as Datastream, which offers a pan-Canadian platform for disseminating environmental data on water, we can meet the objectives of Quebec's water policy and the Canada Water Agency

It is also important to strengthen the interface between governments and citizen science organizations, scientists, and citizens. Leadership is expected on the part of governments and real openness on the part of the scientific community.

Some research and environmental monitoring projects carried out by citizens already contribute to the achievement of the objectives of certain government and university programs. An initiative launched by Quebec's Chief Scientist aims to develop citizen science in Quebec.

Various avenues are opening up when it comes to sustaining this network and its actions: a Blue Fund and the Nature Plan were announced by the Government of Quebec in the fall of 2022 to protect lakes and rivers as well as biodiversity; the Canada Water Agency will work with provinces, territories, indigenous communities, local authorities, scientists and other stakeholders to find the best ways to ensure the safety, cleanliness and good management of our water resources.

Quebec and Canada are facing major climate challenges. A sustainable future requires governments to be able to rely on citizen science organizations that have built relationships of trust with communities and are committed to protecting their environment. These organizations actively participate in community actions that maintain an effective long-term monitoring network and both POSSESS and DELIVER evidence for decision-making.

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APPENDIX I - LIST OF PARTICIPATORY SCIENCE STAKEHOLDERS PRESENT AT THE FORUM

TYPE OF ORGANIZATION	NAME OF THE ORGANIZATION
ORGANIZING COMMITTEE	Groupe d'éducation et d'écosurveillance de l'eau (G3E)
	Montreal University
	DataStream
	Regroupement des organismes de bassin versant du Québec (ROBVQ)
VARIOUS ORGANIZATIONS	Water Rangers
	AquaAction
	Fondation David Suzuki
	Observatoire international des droits de la nature
	Observatoire global du Saint-Laurent
	Ottawa Riverkeeper
	Our Living Waters
	Fonds mondial pour la nature (WWF)
	Fondation Rivières
	Centre d'interprétation de l'eau
	Agiro
BASIN ORGANIZATIONS	Comité de concertation et de valorisation du bassin de la rivière Richelieu (COVABAR)
	Organisme de bassin versant Matapédia-Restigouche (OBVMR)
	Comité de bassin de la rivière Chaudière (COBARIC)
	Organisme de bassins versants de Kamouraska, L'Islet et Rivière-du-Loup (OBAKIR)
	Organisme de bassin versant de la Yamaska (OBVY)
	Conseil de l'eau du nord de la Gaspésie (CENG)
ZIP COMMITTEES	Comité ZIP Saguenay-Charlevoix
MINISTRIES	Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs
	Environnement et Changement Climatique Canada
	Société des établissements de plein air du Québec (SÉPAQ)
UNIVERSITY AND RESEARCH	Chaire Eau potable de l'Université Laval
	INRS-ETE
	Groupe de recherche interuniversitaire en limnologie (GRIL)
	Génome Québec
	Institut de recherche et de développement en agroenvironnement (IRDA)
MUNICIPALITIES	SADC Achigan-Montcalm
	Communauté métropolitaine de Québec

APPENDIX II - LIST OF PROJECTS PRESENTED

To see the complete presentations (online, in French), click here.

PROJECTS PRESENTED	ORGANIZATION
Voluntary lake monitoring network	Manon Ouellet, MELCCFP
Adopt a lake	Sébastien Sauvé, Montreal University
Itrack-DNA	Valérie Langlois, INRS-ÉTÉ
Adopt a river	Nathalie Piedboeuf and Lydia Duranleau, G3E
Revitalization process for the Ruisseau Vacher watershed	Martin Thibault, SADC Achigan-Montcalm
The community's sense of belonging at the service of citizen science.	Mireille Chalifour and Rébecca Gagnon, Organisme de bassin versant Matapédia-Restigouche (OBVMR)
Promoting citizen science : SurVol Benthos	Alexandra Gélinas, Groupe d'éducation et d'écosurveillance de l'eau (G3E)
Water Rangers	Laura Gilbert, Water Rangers
DataStream	Cristina Cismasu and Carolyn Dubois, DataStream

ANNEXE III - PARTICIPATORY SCIENCE INITIATIVES

Key factors, benefits, and challenges that emerge from the 9 citizen science projects presented during the first day of the forum.

Key factors

- Involved collaborators: teachers, non-profit organizations, scientists, granting agencies, and regional coordinators.
- Recognition of the work done.
- Accessible staff, stable over several years.
- The development of an attachment to one's environment.
- A more practical science.
- Programs that make it possible to counter the nature deficit, eco-anxiety, and help develop the power to act.
- Initiatives that are useful because they provide data on aquatic ecosystems, on climate change, which can then help make decisions, and take action.
- Committed partners: industries, municipalities, educators.
- The objective of the projects meets concrete needs, whether it's a salmon river that needs to be protected, young people and citizens that need to be educated, or biodiversity that's in danger...
- Projects that respond to economic dimensions: activities to preserve, for example, salmon fishing.
- The notion of "duty" regarding the protection of the environment.
- The sustainable development of ressources, the collection of data, and indicators related to climate change require monitoring.

The impacts of citizen science

The benefits of these nine projects are numerous, both quantitatively (number of waterways monitored, number of samples collected, etc.) and qualitatively.

- More than 300 watercourses studied
- More than 75,000 young people involved
- More than 80 lakes were monitored for cyanobacterial blooms and 772 lakes are part of the RSVL
- Organizations coordinating monitoring projects in 5 provinces
- Indigenous nations involved
- Unique educational experimentation opportunities
- A more accessible science / Introduction to scientific methods
- A way to counter the nature deficit and the eco-anxiety
- Discovery and awareness-raising projects that help develop a sense of belonging, and of being able to act
- Data acquisition on aquatic ecosystems
- Documentation of the impacts of climate change
- Participants better informed about environmental issues
- A high-level science

- Uncovering unsuspected issues – thanks to the help of participants
- Data going back up to 20 years in some locations
- Data used by the research community, the government, and the educational sector
- Local responses to organizations' objectives
- Documentation of the impacts of climate change (Monitored rivers, adapting for the future)
- Developing field expertise
- Demystifying bio-indicators and their relevance
- The establishment of a major network for monitoring the health of waterways throughout the province.

The challenges encountered

- Funding for monitoring and management
    - Stop relying on sporadic and uncertain grants and subsidies
    - Long-term financing
- Recognition:
    - Inclusion of follow-ups in the various action plans of organizations, municipalities, and ministries
    - |Recognition of bioindicators
- Demanding long-term involvement
- Constantly changing context
- Network management and maintenance
- Remote training
- Communications:
    - Provide accurate, adequate and sufficient information: get to the point without distorting the information;
    - Choose simple and specific words and be consistent in the terminology used;
    - Use different ways of communicating the same message to reach the greatest number;
    - Find the balance in the frequency of communications;
    - Remain accessible and easily reachable even in periods of high traffic;
    - Listen to willing peopler: adapt to their level of knowledge.
- Operations and Logistics:
    - DDevelop tools that can be applied to all the ecosystems studied and for a large majority of volunteers;
    - Obtain representative data: quality control mechanisms;
    - Find solutions with the participants to the problems that arise and that vary based on the territory;
    - Act as a link between all the parties involved and ensure the performance of each: managing organization, volunteers, carrier, analysis laboratory team and liaison organizations in the community.
    - Respond to demand

- Human:
    - Develop a relationship of trust and a sense of belonging: the volunteer is not a volunteer, he is a partner. The official is not a scientist in an ivory tower, he is a teammate.
    - Maintain volunteer involvement over many years;
    - Recognize and use traditional knowledge while educating;
    - Use the scientific approach to go beyond perceptions.
- Organizational:
    - Maintain the quality of services in a context of expansion and insufficient resources;
    - Stay in tune with the needs of participants while responding to the mandates of governments, organizations, etc.;
    - Keep pace and meet expectations;
    - Innovate
    - Open up and adapt to better reach targets through social media, podcasts, etc.
- Partnerships:
    - Consultation
    - Split partnership
    - Integration of new partners and misunderstanding of roles
    - Accept not having control over everything (partners, projects, and communications)
    - Maintain citizen participation and involvement
    - Find partners connected to the living environment (institutional, municipal and private) to join the team and invest in environmental awareness.
- Data :
    - Types of environments sampled
    - That the data collected from these stations be usable as environmental indicators to maintain the quality of their watercourses
    - Scientifically document the project's benefits
    - Access data from analyses and studies
    - Identify effective indicators

Scientifically demonstrate that the project has an impact on improving water quality.

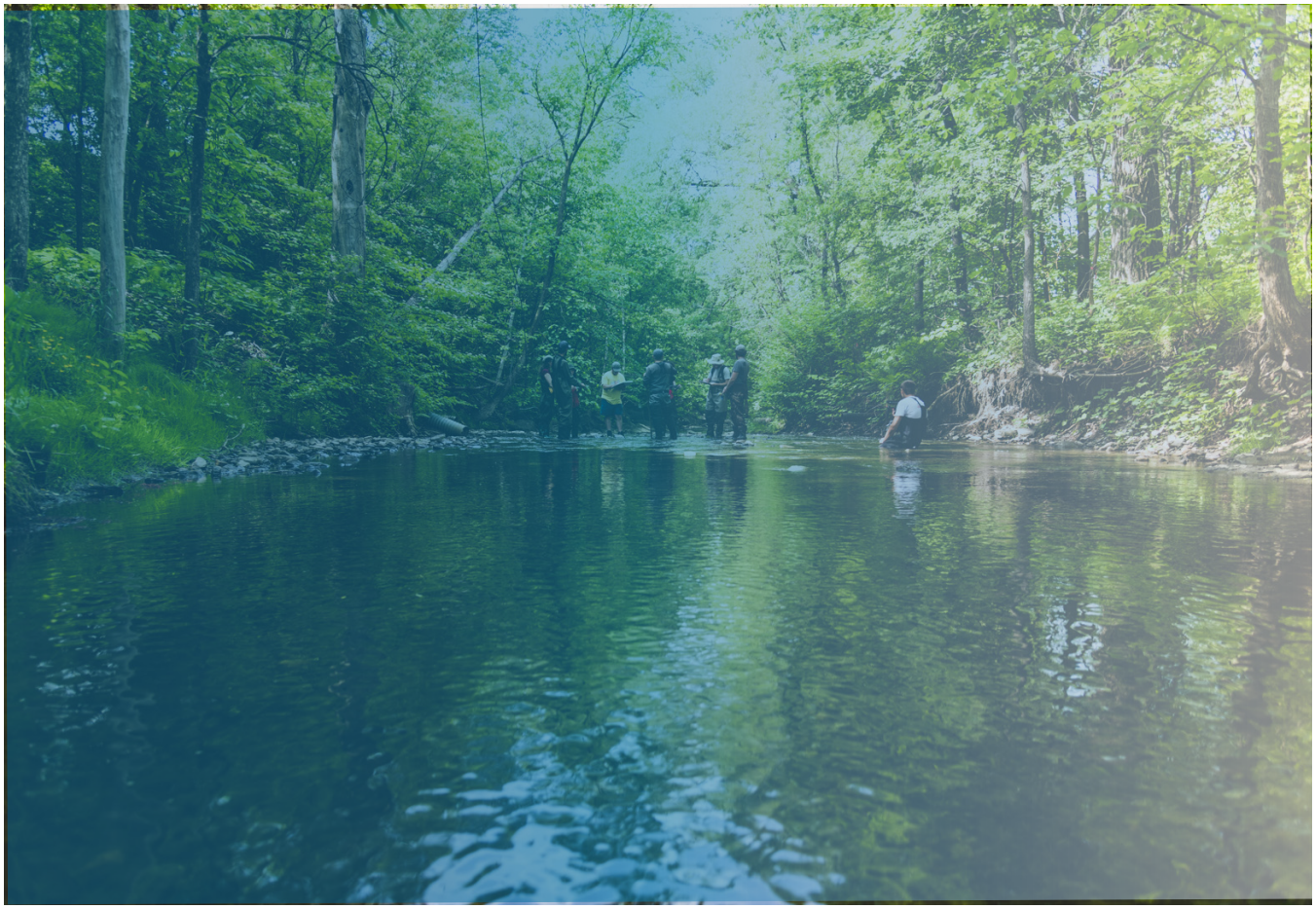
APPENDIX IV. WISHES EXPRESSED

- Ensure the sustainability of citizen science by ensuring the sustainability of the network of organizations that do citizen science
- Ensure sustainable funding for programs and projects
- Recognizing bio-indicators as a management and decision support tool
- Ensure the sustainability of projects and work carried out over time
- Ensure the monitoring and maintenance of the developments
- Develop a greater mobilization of citizens and local governments
- Recognize the expertise of networks and programs
- Improve lake-specific diagnosis and knowledge.
- Develop decision support tools that lead to relevant and effective actions
- Promote participatory science
- Promote our partners at the provincial level
- Develop and maintain a sense of belonging
- Continue to highlight our wealth: WATER
- Recognize the importance of youth participation in citizen science
- Investing in practical science education programs
- Offer better support to volunteers at the local level
- Highlight new water analysis methods

APPENDIX V. THE CHALLENGES OF PARTICIPATORY SCIENCE

Exhaustive list of participatory science issues highlighted by participants during the forum:

1. Information: Inventory of existing knowledge
    a. Ensure the sharing of well-targeted, popularized, and standardized knowledge
    b. Accessible, discoverable, interoperable (different sectors and distribution system), and reusable.
2. Recognition of the value of citizen science by government, experts, and the community
3. The people
    a. Concerted action (no redundancy)
    b. Risk of disengagement due to lack of coordination and availability of resources
        i. Community
        ii. Different levels within organizations
4. The credibility and recognition of participatory science
5. The necessary resources ($, HR, tools) to feed the network and its evolution
6. An inclusive vision representing all actors' diversity and their respective knowledge
7. Communications
8. A definition of citizen science versus community science (in non-scientific language)
9. Network inclusiveness
10. A collective awareness of the intrinsic value of water
11. Sustaining Citizen Science, Commitment, and Funding
12. Commitment
13. Alignment with local issues. How to be present in the issues experienced by the communities? How can citizen science help address local issues?
14. Funding / sustainability



PARTICIPATORY WATER SCIENCE FORUM

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Report - March 2023

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Université de Montréal

ROBVQ
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DataStream