Project “Development of an approach for the multidimensional analysis of water-insecurity risks in the river sub-basins of the municipality of Cajibío, Colombia”

Guides for the development of seven participatory workshops

WATER SECURITY HUB
UNIVERSITY OF LEEDS
MUISKA
MUltidimensional riSK Analysis for water security

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The ethics conditions of this study were approved by the Ethics Committee of the Faculty of Engineering and Physical Sciences from the University of Leeds Ref. MEEC 22-004.

Cover:

Photos of the research team taken in Cajibío during the development of the project.

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1 GUIDE TO STEP 0: RELEVANT PARTY ANALYSIS IN RIVER BASINS

Total duration: 3.5 hours - 210 minutes

1.1 INTRODUCTION

This document is a guide to carry out an advanced analysis of the relevant parties involved in the use and management of water resources in the sub-basins of the municipality of Cajibío. This analysis is based on the methodology reported by Jensen (2019)[1]. According to the participatory research that the Environmental Studies Group of the University of Cauca has been conducting for years, there is information on the main relevant parties in the municipality of Cajibío. From this information, we distinguish the following main groups of relevant parties: citizens, Community Action Boards, community organisations that provide water supply service, territorial institutions, non-governmental organisations, and the productive sector.

To not demand too much time from the participants, this activity is organised to last a maximum of four hours, so it is necessary to do the relevant party analysis with four to five people who are representatives of key relevant party groups such as community action boards, companies or rural community-based water utilities, municipal and departmental governments, private companies, and farmers' associations.

From the universe of relevant parties identified in this activity, those we have not identified before will be invited to participate in the workshops in steps one to six to include everyone in the MUISKA co-development effectively.

1.2 OBJECTIVE

Identify the relevant parties in the river sub-basins of the municipality of Cajibío who would be interested or not in the development of the MUISKA approach; those relevant parties who could facilitate or block the potential impact of this study and those relevant parties who could benefit or be harmed by their participation in it.

1.3 KEY DEFINITIONS

To carry out this relevant party analysis in the river sub-basins of the municipality of Cajibío, it is necessary to be clear about what is meant by relevant parties with the capacity to influence and who could benefit or be harmed by the MUISKA research project. For this reason, the definitions of interest, influence and impact are summarised in Figure 1-1. Particularly in a context where there are community organisations with their governance mechanisms, it is

[1] Jensen A. Fast Track Impact. 2019 [cited on 28th August 2024]. How to do stakeholder analysis. Available in: https://www.fasttrackimpact.com/post/2019/03/11/how-to-do-stakeholder-analysis#:~:text=Traditional%20%E2%80%9Cstakeholder%20analysis%E2%80%9D%20tools%20tend,your%20work%2C%20or%20work%20with.

necessary to consider these aspects in the analysis of influence, in addition to the mechanisms of the Colombian state.

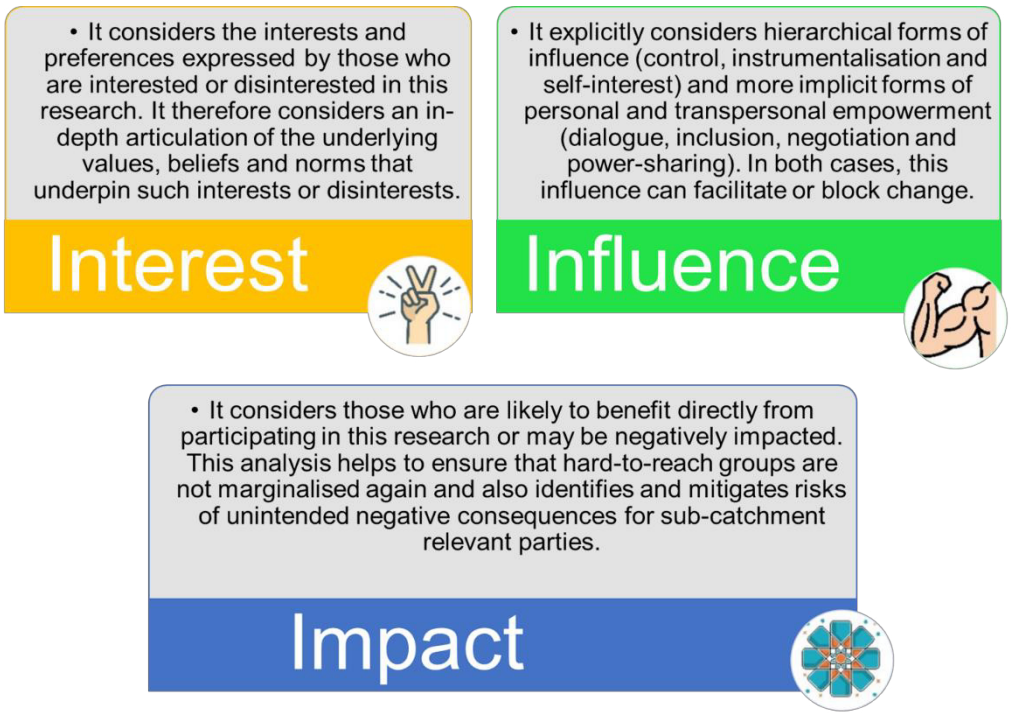

Figure 1-1. Definitions of interest, influence, and impact for relevant party analysis in the sub-basins of the municipality of Cajibío.

Regarding the analysis of the impacts of the MUISKA project on the relevant parties, it is necessary to consider the possible implications of this analysis when it is carried out in the context of violence, conflict, and illegal economies. Given the existence of these conditions in the upper Cauca River basin, which also implies the presence of "hidden actors" (Figueroa-Benitez et al., 2023)[2]. The ethical application of the project determined that individuals participating in the workshops will not be identified in any written and oral publications of the project, and workshop facilitators will not ask participants about activities associated with armed conflict or their relationship to water use.

1.4 DEVELOPMENT OF STEP 0: RELEVANT PARTY ANALYSIS

1.4.1 Supplies

* Two printed copies of this guide
* Copies of informed consent for participants
* 2 or 3 copies of formats 1 - 5 in size A0
* Two glue-sticks
* Markers
* Masking tape

[2] Figueroa-Benitez, A., Nagheeby, M., Figueroa, A. and Amezaga, J. 2023. Disrupted water governance in the shadows: Revealing the role of hidden actors in the Upper Cauca River Basin in Colombia. *Frontiers in Water*. **5**.

- Stickers, symbols, and keywords
- Coloured *Post-it notes*
- Camera
- Refreshments
- Lunches

1.4.2 Explanation of the project and informed consent

Time allocated: 45 minutes

Introduce the participants to the project "Development of an approach for the multidimensional analysis of water-insecurity risks in the river sub-basins of Cajibío, Colombia". Also include in this presentation the ethical conditions of the project and the approval's reference issued by the ethical committee from the University of Leeds. Hand over the consent form to all participants and allow time and space for them to read it and sign it. Collect the signed-off forms and keep them in a secure folder.

1.4.3 Advanced relevant party analysis according to interest, influence, and impact

1.4.3.1 Key definitions

Time allocated: 15 minutes

Explain the key terms included in this guide and allow participants to ask questions to clarify the activities and expected outputs to be achieved in this workshop.

1.4.3.2 Interest

Time allocated: 30 minutes

a) Determine whether each relevant party is interested or disinterested in the MUISKA project. Use format 1 size A0 and *Post-it notes* to describe these aspects for each relevant party. Figure 1-2 illustrates the expected output of this activity.
b) Scope of interest: international, national, regional, or local. Use format 1 size A0.
c) Preferences: aspects of the MUISKA research project in which the actor might be interested. Use format 4 size A0 and *post-it notes*.
d) Level of interest: Use format 5, size A0 and *post-it notes*; see Figure 1-5.

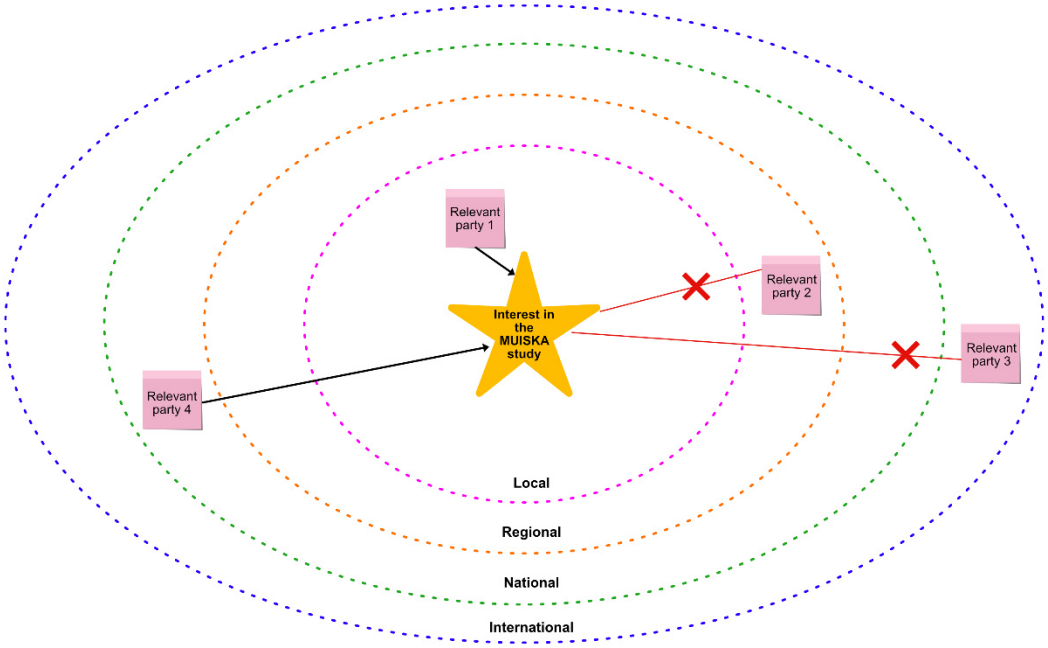

Figure 1-2. Expected output of the graphical depiction of relevant parties' interest in the project

1.4.3.3 Influence

Time allocated: 30 minutes

a) Nature of influence: Identify whether each actor can facilitate or block the research project. Use format 2 size A0 and the stickers provided for this purpose. Figure 1-3 illustrates the expected output of this activity.
b) Ways of influencing: use the keyword package (control, instrumentalisation and self-interest, dialogue, inclusion, negotiation, power-sharing, etc.) and format 4 size A0 to describe how each actor could influence the development of this research project.
c) Level of influence: Use format 5 size A0 and *post-it notes*; see Figure 1-5.

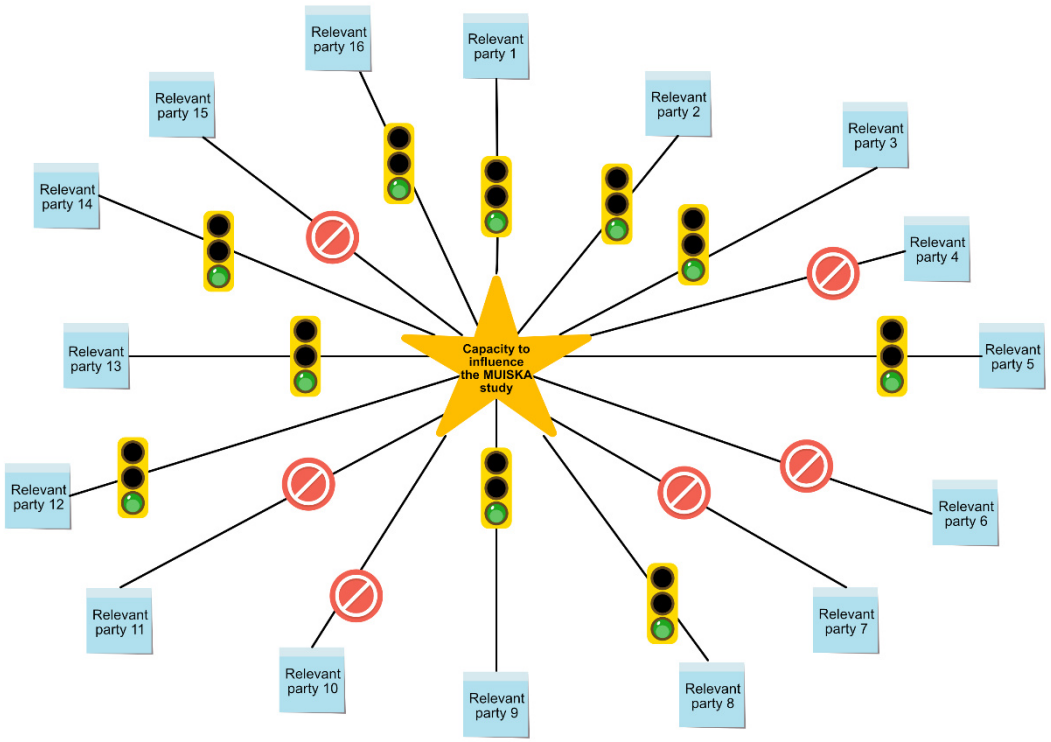

Figure 1-3. Expected output of the graphical depiction of the influence of relevant parties on the project

1.4.3.4 Coffee break

Time allocated: 30 minutes

1.4.3.5 Impact

Time allocated: 30 minutes

a) Type of impact: define whether each relevant party can benefit or be harmed by participating in this research project. Use format 3 size A0 and the stickers provided for this purpose. Figure 1-4 illustrates the expected output of this activity.
b) Description of impact: use format 4 to indicate how each actor benefits or harms from their involvement in the project (e.g., short or long term; local, regional or national level; etc.).
c) Level of impact significance: Use format 5 size A0 and *post-it notes*; see Figure 1-5.

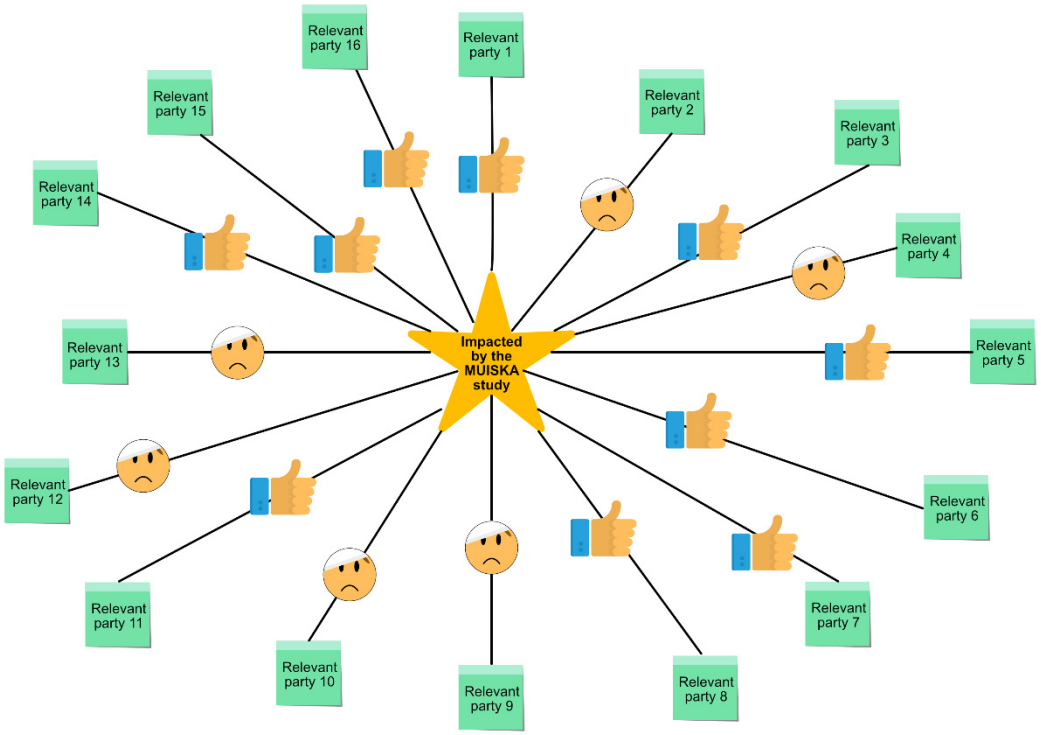

Figure 1-4. Expected output of the graphical depiction of project impact on relevant parties

1.4.3.6 Relevant party ranking according to level of interest, influence and impact

Time allocated: 30 minutes

To classify the relevant parties according to their levels of interest, influence and importance of impact, the format 5 printed in A0 size with the quadrants is used. This is displayed on the wall or table with masking tape, and each relevant party group is identified with *post-it notes* in the quadrant corresponding to the level of interest, influence, or impact (low, medium, high). The result looks like Figure 1-5.

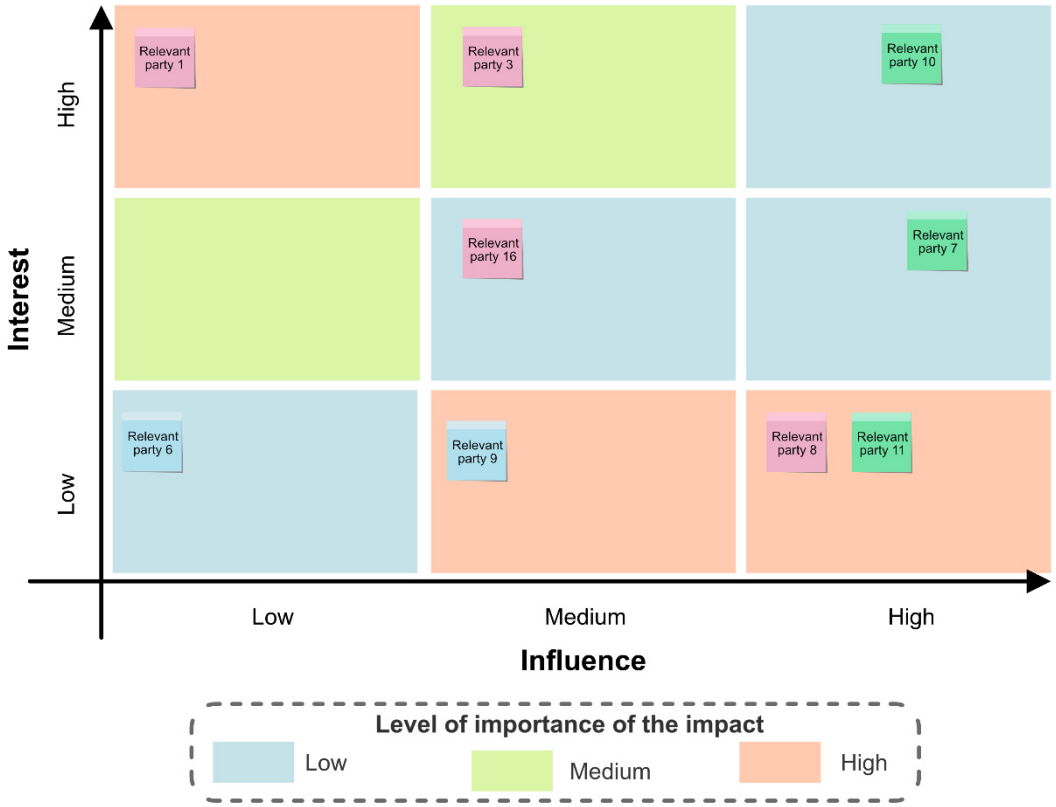

Figure 1-5. Expected output of the analysis of the level of interest, influence, and impact of the relevant parties in the river sub-basins of the municipality of Cajibío.

2 GUIDE TO STEP 1: IDENTIFYING HAZARDS TO WATER SECURITY IN RIVER SUB-BASINS

Total duration: 3 hours - 180 minutes

2.1 INTRODUCTION

This document is a guide to develop step 1 of the MUISKA approach: Identify the predominant hazards to water security in river sub-basins. This step is designed to be developed separately with each relevant party group identified in step 0. These individuals received a formal invitation from the research team, were informed of the ethical considerations of the project and agreed to participate.

2.2 OBJECTIVES

- Develop a rapid understanding of the hazards to water security in the sub-basins of the municipality of Cajibío based on the local knowledge of citizens and representatives of institutions related to the use and management of water resources in these sub-basins.
- Create a network of hazards and their consequences and identify how the subsystems related to water security in the municipality of Cajibío (e.g., economy, agriculture, public services, transport, etc.) are interrelated based on the local knowledge of citizens and representatives of institutions related to the use and management of water resources in these sub-basins.
- Promote systems thinking.

2.3 KEY DEFINITIONS

To carry out this step of the MUISKA approach, it is necessary to establish the river sub-basins covered by this study in the municipality of Cajibío and to define the concepts system, water uses, water-related values and hazards. For this reason, these definitions are summarised in Figure 2-1.

Figure 2-1. Five basic definitions needed to develop step 1 of the MUISKA approach

[1]: Meadows (2008)[3]*; [2]: United Nations* (2021)[4]*; [3] Society for Risk Analysis* (2018)[5]

[3] Meadows, D.H. 2008. Thinking in systems. A primer (D. Wright, ed.). London: Chelsea Green Publishing.
[4] United Nations 2021. The United Nations World Water Development Report 2021: Valuing Water. [Online]. Paris. Available from: https://unesdoc.unesco.org/ark:/48223/pf0000375724.
[5] Society for Risk Analysis 2018. Society for Risk Analysis Glossary, p.9.

2.4 DEVELOPMENT OF STEP 1

2.4.1 Supplies

- Two printed copies of this guide
- Copies of the invitation letter, participant information, informed consent and MUISKA summary newsletter.
- Copies of format 1: A0-size map with the principal rivers of the municipality and the perimeters of the sub-basins that cross the municipality.
- Copies of format 2: List of water-insecurity hazards in the municipality.
- Pencils and erasers
- Coloured *post-it notes*
- Coloured markers
- Masking tape
- Three large glue-sticks
- Newsprint
- Camera
- Refreshments
- Lunches

2.4.2 Explanation of the project and informed consent

Time allocated: 50 minutes

Introduce participants to the basics of risk and the project "Development of an approach for the multidimensional analysis of water-insecurity risks in the river sub-basins of Cajibío, Colombia".

At the end of the project presentation, include the ethical conditions of the project and the ethics approval reference issued by the ethics committee from the University of Leeds. Hand over the consent form to all participants and allow time and space for them to read it and sign it. Collect the signed-off consents and keep them in a secure folder. Participants should also receive a copy of the invitation letter to participate in the project, the mutually informed consent, the participant information sheet and the MUISKA summary newsletter.

2.4.3 Identifying hazards to water security

2.4.3.1 Water uses

Time allocated: 30 minutes

a) Depending on the number of participants, divide the whole group into several subgroups.
b) Give each subgroup a map with the sub-basins and rivers of the municipality and coloured markers (see Figure 2-2).
c) Ask participants to draw on the map of water users and how they use water. Guide them in thinking about the activities in homes, farms, commercial establishments, places where they work, and other relevant activities in the municipality.
d) Guide them to think about other activities that are relevant to them but which are partly or wholly carried out in another municipality—for example, water collection in the Michicao stream.

e) Each group presents its map to the others to identify differences and similarities as they are the same municipality.
f) Ask participants to use a pencil for this activity, as it usually requires adjusting how events or elements are described.

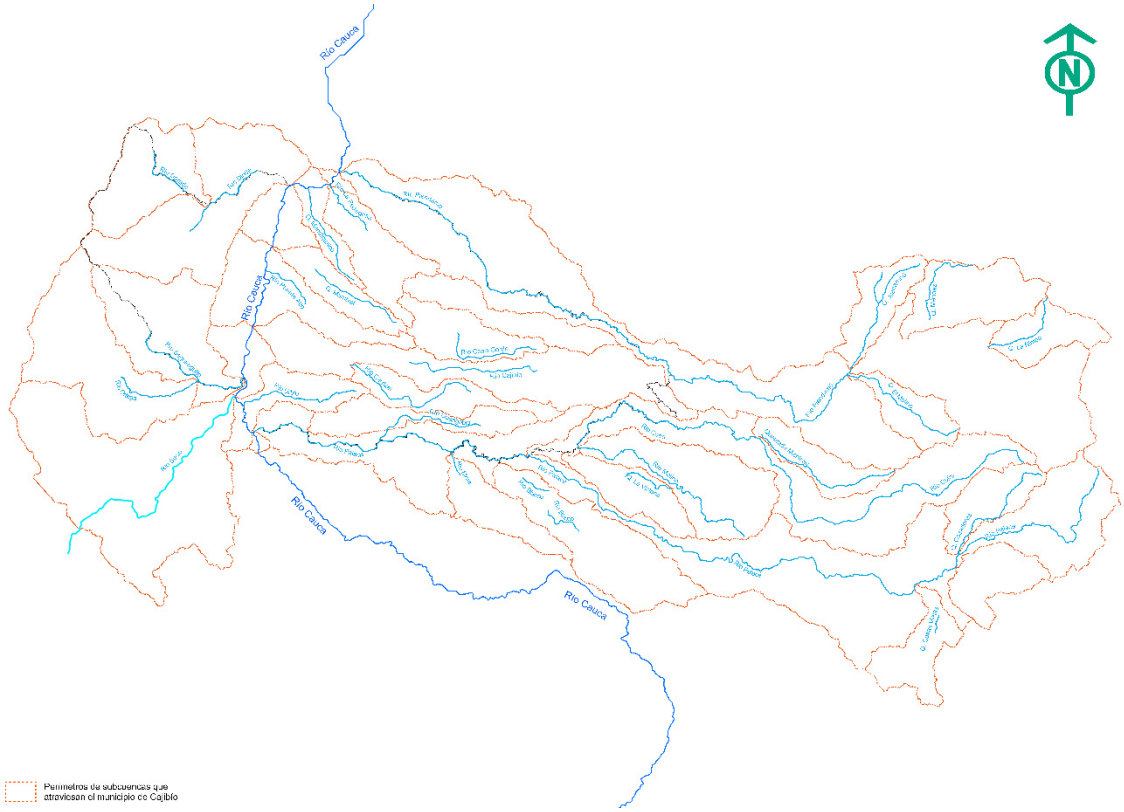

Figure 2-2. Base map for identification of water uses

2.4.3.2 Identification of water use problems or conflicts

Time allocated: 30 minutes

d) Based on the above map, participants are asked to consider the conflicts and problems between and for water users in or outside the municipality.
e) Guide participants in remembering recent events and stories told to them by grandparents, parents, or other older adults.
f) Guide participants in thinking about the unknown or strange. For example, events have happened elsewhere and have not yet occurred in their municipality.
g) From these resources (previous map, known or unknown events), write the problems or conflicts that you manage to identify on post-it notes.
h) Use the board to display *post-it notes* with conflicts or problems. Group similar ones together.
i) Ask participants to use a pencil for this activity as it usually requires adjusting how events or elements are described.

2.4.3.3 Coffee break

Time allocated: 30 minutes

2.4.3.4 Network of Interrelationships

Time allocated: 40 minutes

a) The whole group should construct the network. Group all participants in front of a large wall so that everyone contributes to the construction of the web according to the previous discussions.
b) Once the post-it notes from the previous activity have been grouped, the whole group is asked to discuss how the problems interrelate.
c) Consider the following types of interrelationships:
   a. Cause-effect. Use arrows to indicate such a relationship. If there is difficulty in identifying causes, guide participants to find ways to produce failures. Questions such as "If I wanted to create this type of failure, how could I do it?" help them think creatively.
   b. Other conditions required for a problem to materialise (presence or occurrence of physical elements, institutions, people). This relates mainly to vulnerability.
   c. Consider also benefits.
   d. Mark the direction of impact with arrows. Feedback loops may occur[6] or loops.
   e. Use more post-it notes to describe the types of interrelationships that participants identify. Be as detailed as possible.
d) Use as many paper sheets as necessary. You can build the network on the floor when there is no space on the board.
e) Start building the network from the bottom of the board and moving upwards. This allows finding the roots of the problems (bottom) and the ultimate consequences (top) (see Figure 2-3).
f) Take photos of the process and the result.

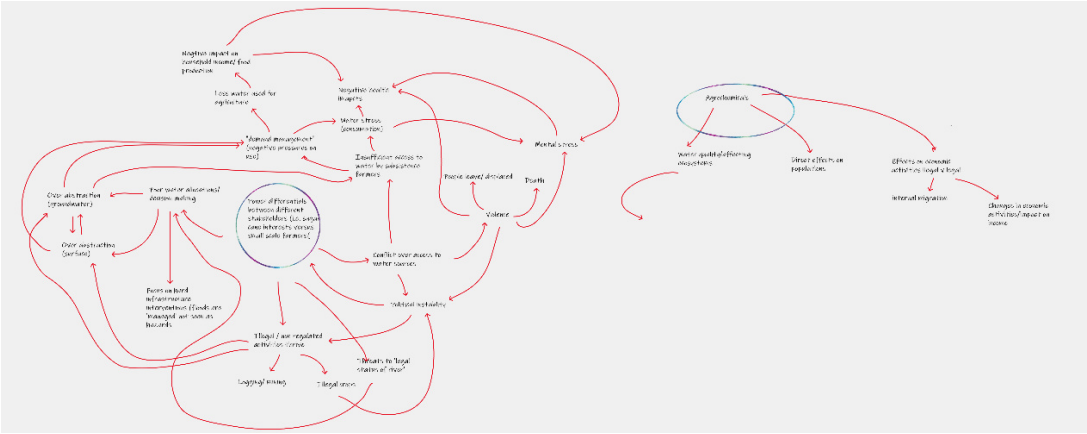

Figure 2-3. Example of a network of relationships between hazards and consequences

[6] *Feedback loops* are those cycles that are formed when an action generates a consequence that was previously established or when there is a monitoring of a variable at a point in the system and the operation of the system depends on the value of that variable.

g) Ask participants to use a pencil for this activity, as it usually requires adjusting how events or elements are described.

3 GUIDE TO STEP 2: CREATING RISK MATRICES ACCORDING TO MUISKA SCALES AND DIMENSIONS

Total duration: 2.5 hours - 150 minutes

3.1 INTRODUCTION

This document guides the development of step 2 of the MUISKA approach: Creating the risk matrices according to the MUISKA scales and dimensions. This step is designed to be developed separately with each relevant party group identified in step 0. These individuals received a formal invitation from the research team, were informed of the ethical considerations of the project, agreed to participate, and signed the informed consent.

3.2 OBJECTIVE

Create the risk matrices according to the MUISKA scales and dimensions, based on the network of hazards and consequences elaborated in step 1 in the river sub-basins of the municipality of Cajibío, as appropriate, and based on the local knowledge of citizens and representatives of institutions related to the use and management of water resources in these sub-basins.

3.3 KEY DEFINITIONS

To carry out this step of the MUISKA approach, it is necessary to define the scales and dimensions proposed in the MUISKA approach. For this reason, these definitions are summarised in Figure 3-1.

Figure 3-1. Scales and dimensions for classifying impacts according to the MUISKA approach

[1]: Donoso et al. (2012)[7], [2]: *UN-Water* (2013)[8]

3.4 DEVELOPMENT OF STEP 2

3.4.1 Supplies

- Two printed copies of this guide
- Hazard and consequence network developed in step 1
- *Post-it notes* in five different colours
- Coloured markers
- Masking tape
- Three large glue-sticks
- Several rolls of paper
- Camera
- Refreshments
- Lunches

3.4.2 Summary of what was done in step 1

Time allocated: 10 minutes

Present participants with a summary of the activities carried out in step 1 and the results obtained. Use the hazard and consequence network to develop this step of the MUISKA approach.

[7] Donoso, M., di Baldassarre, G., Boegh, E., Browning, A., Oki, T., Tindimugaya, C., Vairavamoorthy, K., Vrba, J., Zalewski, M. and Zubari, W.K. 2012. International Hydrological Programme (IHP) eighth phase: Water security: responses to local, regional and global challenges. Strategic plan, IHP-VIII (2014-2021) [Online]. Available from: https://rucforsk.ruc.dk/ws/portalfiles/portal/49711492/2012_IHP_VIII.pdf.
[8] UN-Water 2013. Water Security & the Global Water Agenda. A UN-Water Analytical Brief [Online]. Hamilton. Available from: https://www.unwater.org/publications/water-security-global-water-agenda/.

3.4.3 Creation of risk matrices by MUISKA scales and dimensions

Time allocated: 95 minutes

a) Display on the floor or the board (depending on the size) the network of hazards and consequences developed in step 1.

b) From that network, rank each consequence by scale and dimension according to Figure 3-2. Use single-coloured *post-it notes* for each dimension to help organise the consequences quickly.

c) On one or more paper sheets, simulate the MUISKA matrix (Figure 3-2) and paste it on the wall or spread it out on the floor, depending on the size.

d) Encourage participants to think about the people or elements affected by such consequences and the scales at which such consequences may be perceived. Use Figure 3-3 as a guide.

e) If necessary, modify the network of hazards and consequences developed in step 1, as participants may notice that consequences were missing. Use *post-it notes* for participants to write down the new consequences with the date so that they know that these are adjustments.

f) Describe qualitatively each of the consequences classified.

g) The expected output of this exercise is illustrated in Figure 3-4.

	Individual / Household	Community	Basin	Country
Health and well-being				
Infrastructure and associated services				
Economy and productivity				
Ecosystem services				
Culture, justice and peace				

Figure 3-2. MUISKA matrix of scales and dimensions

Figure 3-3. Aspects to consider when classifying consequences according to the five dimensions of MUISKA

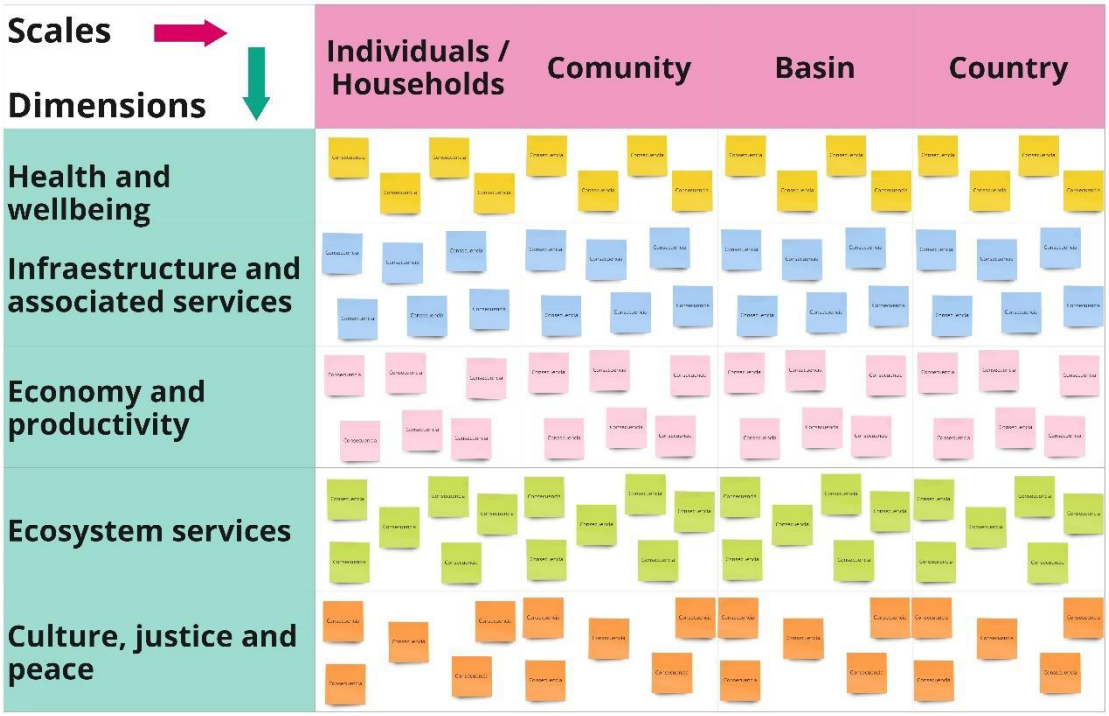

Figure 3-4. Expected output of step 2

3.4.4 Coffee break

Time allocated: 30 minutes

3.4.5 Summary of the activity

Time allocated: 15 minutes

a) At the end of the previous activity, the moderator summarises the network obtained and gives space for participants to correct, clarify or add information.

b) Adjust as necessary.

c) At the end of the day's activity, the research team should *stick* all *post-it notes* together to avoid losing the structure of the matrix.

4 GUIDE TO STEP 3: PRIORITISATION OF CONSEQUENCES WHOSE RISKS WILL BE ASSESSED

Total Duration: 5.5 hours - 330 minutes (Session 1: 90 minutes | Session 2: 240 minutes)

4.1 INTRODUCTION

This document is a guide to develop step 3 of the MUISKA approach: Prioritise the consequences whose risks will be assessed.

4.2 OBJECTIVES

- Prioritise impacts according to various criteria.
- Preliminarily identify potential power relations that influence prioritisation.

4.3 DEVELOPMENT OF STEP 3

4.3.1 Supplies

* Two printed copies of this guide
* Hazard and consequence network developed in step 1
* Copies of format 1 (Table 4-1)
* Copies of format 2 (Table 4-2)
* Copies of format 3 (Table 4-3)
* Coloured markers
* Several rolls of paper
* Camera
* Refreshments
* Lunches

4.3.2 Session 1: Definition of criteria

Time allocated: 90 minutes - Same session as step 2 - Session 1

a) The methodology of this prioritisation is based on criteria that act as filters to discard at each stage a certain number of consequences included in the network elaborated in step 1 (Figure 4-1).

b) Session facilitators should introduce the following criteria and explain their application so that participants can assimilate the general way in which the consequences whose risk will be assessed in step 4 of the MUISKA approach will be prioritised.

c) The discussion is open for participants to comment on whether they agree with these criteria, wish to change them, remove them, or propose additional ones.

d) Consider the following preliminary criteria and sub-criteria:

* Magnitude of consequences according to the network developed in step 1.
* MUISKA scales and dimensions.
* Governance to manage risks:
  - Degree of power the relevant party has to decide what actions are required to manage the risk.
  - Degree of power the relevant party has to influence the design of the actions required to manage the risk.
  - Degree of power the relevant party has to allocate financial resources to design or implement actions required to manage the risk.
  - Degree of power the relevant party has to implement actions required to manage the risk.
  - Relevant party empowerment opportunities.
* Maximum amount of risk that the University of Leeds team can assess.

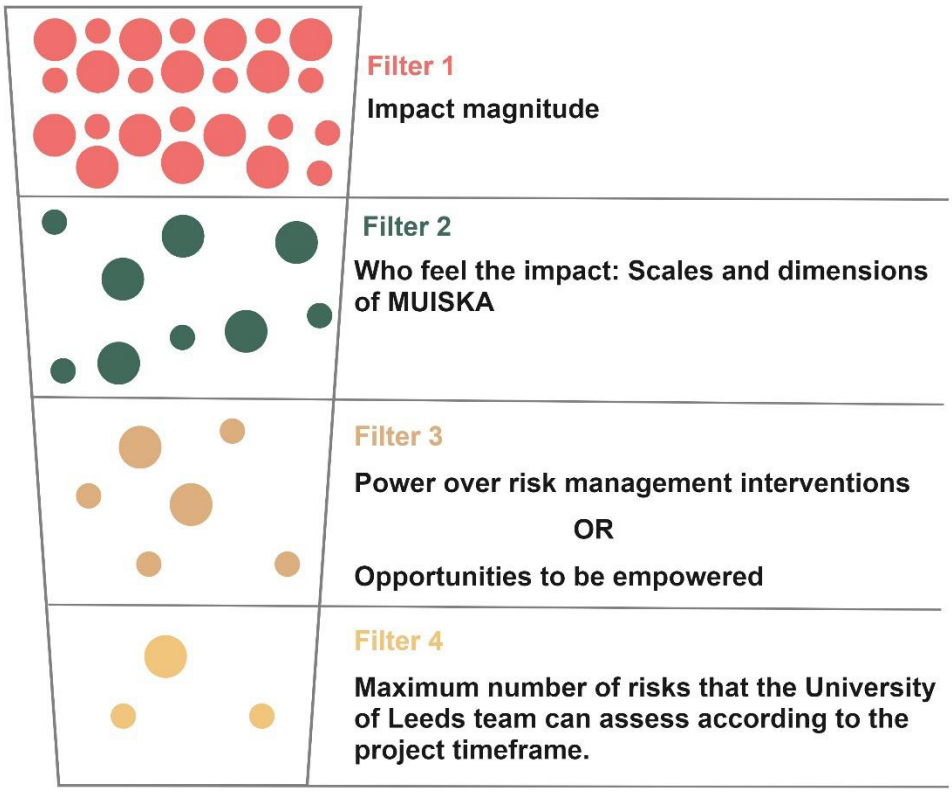

Figure 4-1. Filter criteria for prioritising consequences to be subjected to risk assessment in MUISKA Step 4

e) If participants suggest an additional criterion, define how it will be applied to rule out consequences.

4.3.3 Session 2: Summary of what was done in session 1 of step 3

Time allocated: 15 minutes

Present participants with a summary of the activities carried out in the first session of step 3 and the results obtained.

4.3.4 Session 2: Prioritisation of Consequences

Time allocated: 3.25 hours - 195 minutes - Session 2 of step 2

a) Display the network of hazards and consequences developed in step 1 on the wall or floor of the room according to size.

b) Apply filter 1. Together, we count how many direct and indirect causes each problem has in the network.

c) Use format 1 to record the number of direct and indirect consequences (Table 4-1).

Table 4-1. Format 1 for analysing each network consequence according to the magnitude of the impact

No.	Name / Description of the Consequence	Number of negative consequences with which it is connected		Number of positive consequences with which it is connected		Does it pass for risk assessment ? (Yes / No)	Observations
		Direct	Indirect	Direct	Indirect		
1							
2							
3							
...							
n							

According to the results of Table 4-1, ask participants to analyse the consequences with the most upward connections and, based on that, choose the consequences that, if they could be effectively intervened, would prevent further consequences.

d) Apply filter 2. From the consequences that passed the previous filter, use format 2 (Table 4-2) for participants to rank the consequences by MUISKA scales and dimensions to consider what and who suffers the consequences of hazards.

Based on the above results, ask participants to discuss what and who suffers from each of these consequences. Use format 2 (Table 4-2) to list the consequences they would like to see moved to the next prioritisation stage and describe why they chose them.

Table 4-2. Format 2 for listing the consequences that go to the next phase of prioritisation

No.	Name / Description of the consequence	Dimension	Scale	Does it pass for risk assessment? (Yes / No)	Explain the reasons why they chose this consequence.
1					
2					
3					
...					
n					

e) Apply filter 3. Bearing in mind that the consequences prioritised in this step will be the risks assessed in step 4 and that these will, in turn, be prioritised for outlining a risk management plan in step 6, it is necessary to include as a criterion the degree of power that each relevant party group (as representatives of their organisations) has to influence decision-making on interventions to manage the risk. Include the following sub-criteria and ask each participant to use form 3 (see Table 4-3) to analyse the governance of risk management interventions and decide whether the consequence should be prioritised for risk assessment.

- Degree of power the actor has to decide what actions are required to manage the risk.
- Degree of power the relevant party has to influence the design of the actions required to manage the risk.
- Degree of power the actor has to allocate financial resources to design or implement actions required to manage risk.
- Degree of power the actor has to implement actions required to manage the risk.

Table 4-3. Format 3 for analysing governance on interventions to manage risk from the point of view of participants as representatives of their organisations

No.	Name / Description of the consequence	Institutions - Governance over interventions to manage risk: On a scale of 1 to 10, how much power does the participant have over the following? 1 = No degree of power (there is nothing I can do), 10 = full degree of control (my signature is enough for the following to happen)				Pass for risk assessment? (Yes / No)	Observations
		Decide on interventions	Influencing the design of interventions	Allocate financial resources to design or implement interventions.	Implement the actions		
1							
2							
3							
...							
n							

The results of this last criterion do not correspond to the final list of consequences that will be taken forward to the next step of the MUISKA approach to risk assessment but will be an input to be analysed together with the next and final criterion.

f) Apply filter 4. Based on the number of researchers available in the University of Leeds team to assess the risks and the time remaining in the project, the maximum number of prioritised consequences we can process will be set.

g) Apply the additional criteria that the participants have agreed upon in session 1 of the development of this step.

4.4 COFFEE BREAK

Time allocated: 30 minutes

Take this break 2 hours into the workshop.

4.5 FINAL DECISION ON PRIORITISED CONSEQUENCES FOR STEP 4

Remote working and step 4

a) Based on the workshop results and considering the maximum number of consequences that the University of Leeds team can process, a final list of risks to be assessed will be electronically proposed to the participants of each relevant party group.

b) To be able to do this, it is necessary to cover the entire workshop round of step 3 with all relevant party groups involved before starting the workshop round of step 4.

5 GUIDE TO STEP 4: FULL RISK ASSESSMENT

Total duration: 4 hours - 240 minutes

5.1 INTRODUCTION

This document guides the development of step 4 of the MUISKA approach: comprehensive risk assessment. From the consequences prioritised in the previous step, the University of Leeds team will assess the risks of these consequences, either quantitatively or qualitatively, depending on the type and availability of data required. The initial intention is to continuously develop MUISKA steps 1 - 6 with the relevant party groups that agreed to participate in this study. As the full risk assessment takes considerably longer than the four hours of this workshop, the development of this step with the participants is not focused on assessing risk with them but on further explaining fundamental concepts of risk science and identifying vulnerabilities and resilience with them.

5.2 OBJECTIVES

- Assess some risks of the prioritised consequences quantitatively, qualitatively or a mixture of both. [University of Leeds team]
- Explain basic concepts of risk science with a focus on water security and risk communication. [University of Leeds team]
- Preliminarily identify vulnerabilities related to the consequences prioritised in step 3 [Co-development with participants].
- Understand the state of resilience of the system and how it would act in case of an unknown event in the municipality. [Co-development with participants]

5.3 KEY CONCEPTS

The key concepts for this workshop are vulnerability and resilience, as defined in Figure 5-1.

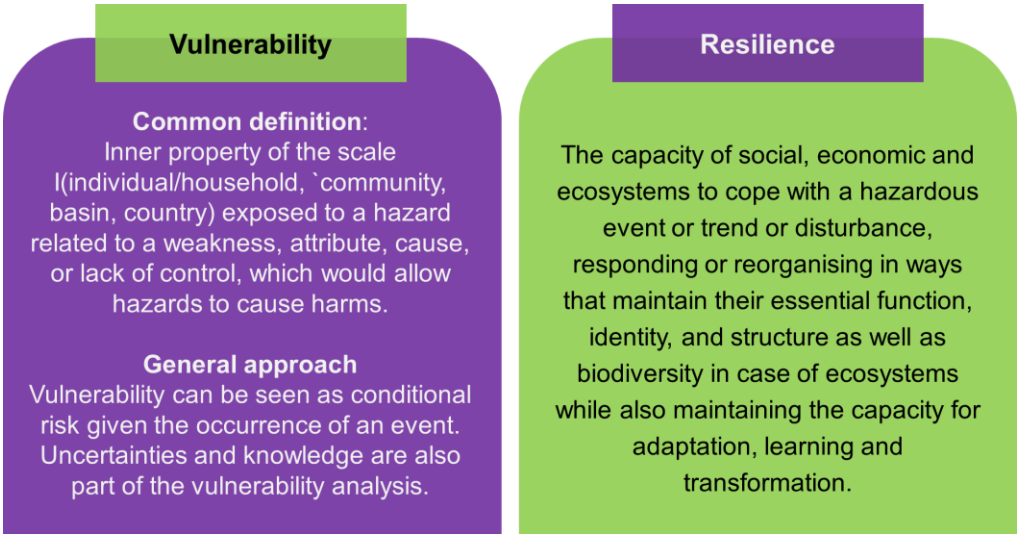

Figure 5-1. Concepts of vulnerability and resilience adopted in the MUISKA approach

5.4 DEVELOPMENT OF STEP 4

5.4.1 Supplies

- Two printed copies of this guide
- Network of hazards and consequences printed in A0 size
- Copies of format 1 and 2 (Table 5-1 y Table 5-2)
- Four copies of the printout of the concepts of vulnerability and resilience in letter size
- Coloured markers
- Masking tape
- Highlighters
- Several rolls of paper
- Camera
- Refreshments
- Lunches

5.4.2 Basic concepts of risk science with a focus on water security

Time allocated: 60 minutes

a) Explain basic concepts of risk science with a focus on water security:

- Diversity of definitions of the term risk.
- Definition adopted in MUISKA: hazard, vulnerability, exposure, uncertainties, and strength of the knowledge.
- Definition of resilience adopted in MUISKA. Use examples from everyday life to explain this concept.
- Space and time considerations in risk analysis.
- Risk communication.

b) Conduct this activity dynamically so that participants can interact with the presenter and the explanation is more effective.

5.4.3 Coffee break

Time allocated: 20 minutes

5.4.4 Preliminary identification of vulnerabilities

Time allocated: 75 minutes

a) Recall the concept of vulnerability adopted in this study.

b) Bring participants together to look at the web of hazards and consequences they constructed in step 1.

c) From this network, identify which hazards and consequences produce other consequences on their own or need another element to have other consequences simultaneously.

d) identify whether this necessary element is a vulnerability in the latter case.

e) Afterwards, ask participants to fill out form 1 (Table 5-1) with the problems identified in items c and d.

Table 5-1. Format 1 for identifying vulnerabilities

No.	Name / Description of the parent consequence	Name / Description of the consequence linked to the parent consequence necessary to generate other consequences	Is the consequence linked to the parent consequence a vulnerability? (Don't know / Yes / No)	What or who or what possesses this vulnerability?	Observations
1					
2					
3					
...					
n					

f) To guide participants in identifying whether a network problem is a vulnerability, consider the following:

- Presence, absence, or deficiency of infrastructure.
- Attitudes, habits, and behaviours of people exposed to risk.
- Time dependency: the speed with which consequences change and the exposed elements' responsiveness.
- Level of understanding of the event by those exposed and those responsible for risk analysis.
- Quality of simulation/prediction models: sensitivity, accuracy, assumptions.
- Availability of open information for exposed persons and risk assessors.

5.4.5 Preliminary identification of resilience

Time allocated: 85 minutes

a) Using the initial hazard network, identify those events that participants are unaware of that have occurred anywhere but could happen in the municipality. Guide participants in thinking of past events, signs, and warnings that such events could occur in the municipality.

b) Ask participants to choose one of these unfamiliar events.

c) Use the guide adapted for this study and originally from Water Aid to identify the state of the constituent element. Table 5-2 presents the constituent elements and their respective questions and aspects to be considered in the analysis.

d) Choose the appropriate aspects of resilience for each group of participants to analyse the constituent elements for the chosen event and fill in format 3 (Table 5-2). For example, citizens can answer questions related to equity and social inclusion.

e) Ask participants to have the concept of resilience on hand and review it for their analysis. Continue to provide real-life examples to promote understanding of the concept of resilience.

Note 1: This preliminary analysis of resilience to water security risks is a collective construction. Therefore, it is okay for participants to answer "I don't know" in format 2 (Table 5-2) as this is also evidence of lack of or no access to information. After developing this step with all participating relevant party groups, it is expected that the system's resilience and how it would act in case of an unknown event in the municipality will be better understood.

Note 2: Depending on the organisations or institutions the participants represent, all or some of the constituent elements of resilience may be analysed.

Table 5-2. Format 2 for analysing resilience in water security by constituent elements and according to the surprise events identified.

Constituent element	Questions to guide the analysis	The current state of the constituent element about resilience to water insecurity risks (Deficient / Emerging / Strengthened / Desired)	Is this element resilient to the occurrence of one or more surprise events? (Yes / No / Don't know)	If the element is not in the "Desired" state, what should be done to achieve this?	Observations
1. Policy, strategy, and planning	• Do environmental and climate change adaptation policies and strategies consider identifying and managing surprise events in the risk analysis? • To what extent are plans related to water security (floods, droughts, extreme rainfall events, drinking water supply, sewerage, urban drainage, various water uses, etc.) based on a risk analysis that includes climate change considerations? • Do water security and climate change policies, strategies and plans include a systemic view and interconnectedness of system elements such as infrastructure?				

Constituent element	Questions to guide the analysis	The current state of the constituent element about resilience to water insecurity risks (Deficient / Emerging / Strengthened / Desired)	Is this element resilient to the occurrence of one or more surprise events? (Yes / No / Don't know)	If the element is not in the "Desired" state, what should be done to achieve this?	Observations
2. Institutional arrangements and capacity	• To what extent are institutional roles and responsibilities for water security clearly defined (e.g., between relevant parties in the water and sanitation, health, planning, disaster risk, citizen coexistence, environment, and climate change sectors)? • To what extent can institutions working on water security address the integration of risk reduction into the dimensions of health and well-being, infrastructure and associated services, economy and productivity, ecosystem services, and culture, justice, and peace?				

Constituent element	Questions to guide the analysis	The current state of the constituent element about resilience to water insecurity risks (Deficient / Emerging / Strengthened / Desired)	Is this element resilient to the occurrence of one or more surprise events? (Yes / No / Don't know)	If the element is not in the "Desired" state, what should be done to achieve this?	Observations
3. Coordination and integration	• What kind of inter-ministerial, inter-departmental and inter-municipal coordination mechanism exists between the departments responsible for climate change, environment, agriculture, energy, transport, health, citizen coexistence, water resources, water supply, and sanitation? • How are water security risk analyses integrated into sectoral dialogues, joint sectoral reviews, information sharing and coordination meetings, thereby strengthening collaboration between departments, municipalities, and agencies and across sectors of society?				
4. Funding	• To what extent are national priorities for risk management and adaptation set and supported with adequate funding mechanisms and sufficient funds? • Is there a specific financing plan to increase the system's resilience to water insecurity and climate change?				

Constituent element	Questions to guide the analysis	The current state of the constituent element about resilience to water insecurity risks (Deficient / Emerging / Strengthened / Desired)	Is this element resilient to the occurrence of one or more surprise events? (Yes / No / Don't know)	If the element is not in the "Desired" state, what should be done to achieve this?	Observations
5. Water and sanitation service provision and behavioural change	• Are water and sanitation service delivery mechanisms based on locally-led risk analysis that addresses surprise events? • Are water and sanitation service providers aware of the interconnections and interdependencies of their infrastructure with other types of infrastructure such as transport, energy, chemicals, etc.? • Do these mechanisms minimise the population's exposure to potential failures arising from surprise events in different contexts? • To what extent are water and sanitation service delivery mechanisms resilient to surprise events and contribute to building community resilience to the impacts of such events? • To what extent do users and communities practice and enforce behaviours that ensure resilience in water security and sustainability of water resources?				

Constituent element	Questions to guide the analysis	The current state of the constituent element about resilience to water insecurity risks (Deficient / Emerging / Strengthened / Desired)	Is this element resilient to the occurrence of one or more surprise events? (Yes / No / Don't know)	If the element is not in the "Desired" state, what should be done to achieve this?	Observations
6. Monitoring	• Have plans been developed to monitor priority hazards to water resources and water and sanitation infrastructure, and to what extent are these plans used? • How effective has data monitoring managed or addressed the hazards detected? • How do you monitor hazards to water security that occur in other territories to learn from them and be prepared in this municipality? • What role do community, local and regional media play in monitoring such hazards? • How do individuals and communities access and consume the information provided by such media?				

Constituent element	Questions to guide the analysis	The current state of the constituent element about resilience to water insecurity risks (Deficient / Emerging / Strengthened / Desired)	Is this element resilient to the occurrence of one or more surprise events? (Yes / No / Don't know)	If the element is not in the "Desired" state, what should be done to achieve this?	Observations
7. Gender and social inclusion	• How well are the different impacts of water insecurity on men and women, sexual and gender minorities, and marginalised and vulnerable people understood? • To what extent are women and men and marginalised and vulnerable groups meaningfully involved in vulnerability assessments and developing and implementing climate change adaptation strategies?				

Constituent element	Questions to guide the analysis	The current state of the constituent element about resilience to water insecurity risks (Deficient / Emerging / Strengthened / Desired)	Is this element resilient to the occurrence of one or more surprise events? (Yes / No / Don't know)	If the element is not in the "Desired" state, what should be done to achieve this?	Observations
8. Environment and water resources	• What level of climate and water resources monitoring data is available at appropriate temporal and spatial scales? • How appropriate are data collection and storage standards for shaping strategic water resources planning at national or basin scale? • What level of reduced future climate projections are available to inform strategic water resources planning at national and basin scales? • How are water allocations effectively determined and regulated in line with sustainable use, social equity, and economic efficiency? • What kind of drought and flood management strategies exist in the country (linked to early warning and contingency planning), and how do they prioritise water use for human consumption over other uses in case of shortages?				

Constituent element	Questions to guide the analysis	The current state of the constituent element about resilience to water insecurity risks (Deficient / Emerging / Strengthened / Desired)	Is this element resilient to the occurrence of one or more surprise events? (Yes / No / Don't know)	If the element is not in the "Desired" state, what should be done to achieve this?	Observations
9. Government leadership	• How is the national, departmental, and municipal government demonstrating active leadership on the water security and climate change adaptation and resilience agenda? • How can future governments continue or enhance such leadership?				
10. Active and empowered people and communities	• To what extent are people and communities adopting local adaptation measures to increase resilience to water security risks? • What mechanism is in place to enable individuals and communities to demand actions related to resilience to water security risks?				

Source: Water Aid, 2021[9]

[9] Australia Aid, Water for Women and Water Aid 2021. Integrating climate resilience with WASH system strengthening [Online]. Available from: https://washmatters.wateraid.org/sites/g/files/jkxoof256/files/2021-11/Integracion integrating-climate-resilience with WASH system strengthening.pdf.

6 GUIDE TO STEP 5: RISK COMMUNICATION

Total duration: 4.5 hours - 270 minutes

6.1 INTRODUCTION

This document is a guide to developing step 5 of the MUISKA approach: risk communication. This session will also be used by Ángela María Bayona, a University of Leeds team member, to present preliminary results related to the sampling and surveys carried out in Cajibío. Ángela will also develop the "Risk Dialogues" activity to identify ways water stored in households could be contaminated. Additionally, in this MUISKA step, participants will create a story to communicate a risk.

6.2 OBJECTIVES

- Identify ways of communicating water security risks to different relevant party groups involved in the municipality's management and use of water resources based on storytelling.
- Implement the "risk dialogues" strategy to identify people's exposure to stored water in households surveyed in the project's framework "Hidden faults: assessing public health risks in intermittent water supply systems".

6.3 DEVELOPMENT OF STEP 5

6.3.1 Supplies

* Two printed copies of this guide
* Coloured markers
* Masking tape
* Highlighters
* Coloured pencils
* Erasers
* Magazines or newsprint to cut out
* Pencils
* Paints
* Brushes
* Scissors
* Several rolls of paper
* Camera
* Refreshments
* Lunches
* AMBV presentations and guides

6.3.2 Presentation of Ángela Bayona's fieldwork results and the "Risk Dialogues" exercise.

Time allocated: 120 minutes

6.3.3 Summary of the previous activity

Time allocated: 5 minutes

a) Briefly mention what was done in step 4 and the results obtained.

b) Introduce what is to be done in step 5.

6.3.4 Basics of risk science with a focus on risk communication

Time allocated: 10 minutes

a) Explain basic concepts of risk communication with a focus on water security, such as:

- Three components of communication (Figure 6-1): a trusted source, a clear message, and a target audience.
- Validity of the risk assessment.
- Recap the explanation of uncertainties and probabilities made during the development of step 4.
- Ways of thinking (Figure 6-2).

Figure 6-1. Three components of communication: source, message, audience

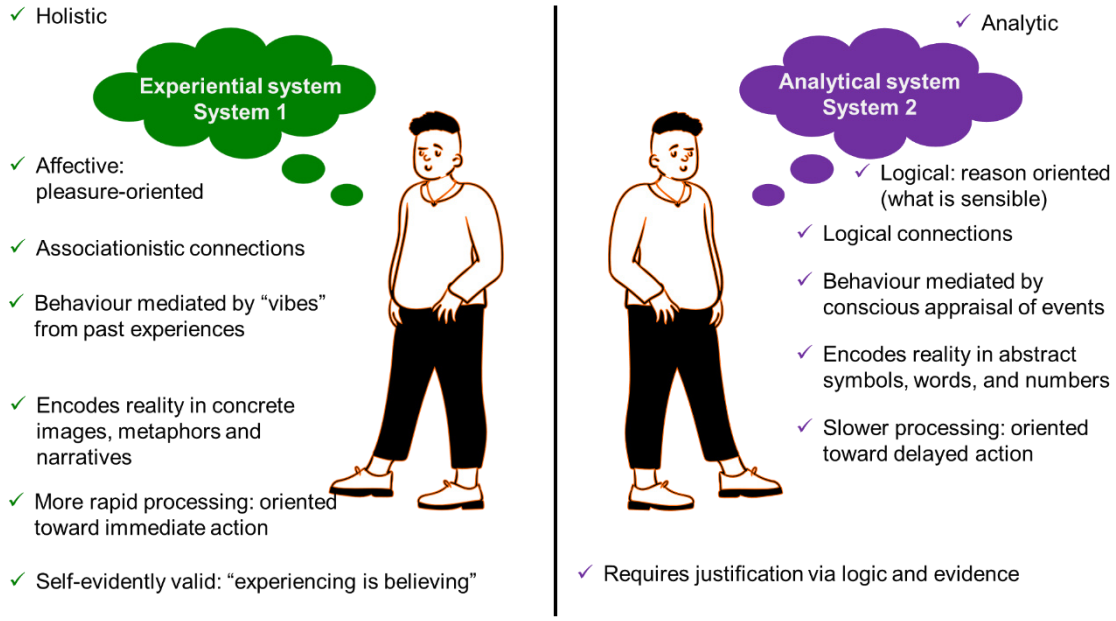

Figure 6-2. Ways of thinking: Systems 1 (experiential) and 2 (analytical)

Source: Adapted from Aven and Shital (2022)[10]

b) Explain the storytelling structure (Figure 6-3) and how it can be used for water security risk communication.

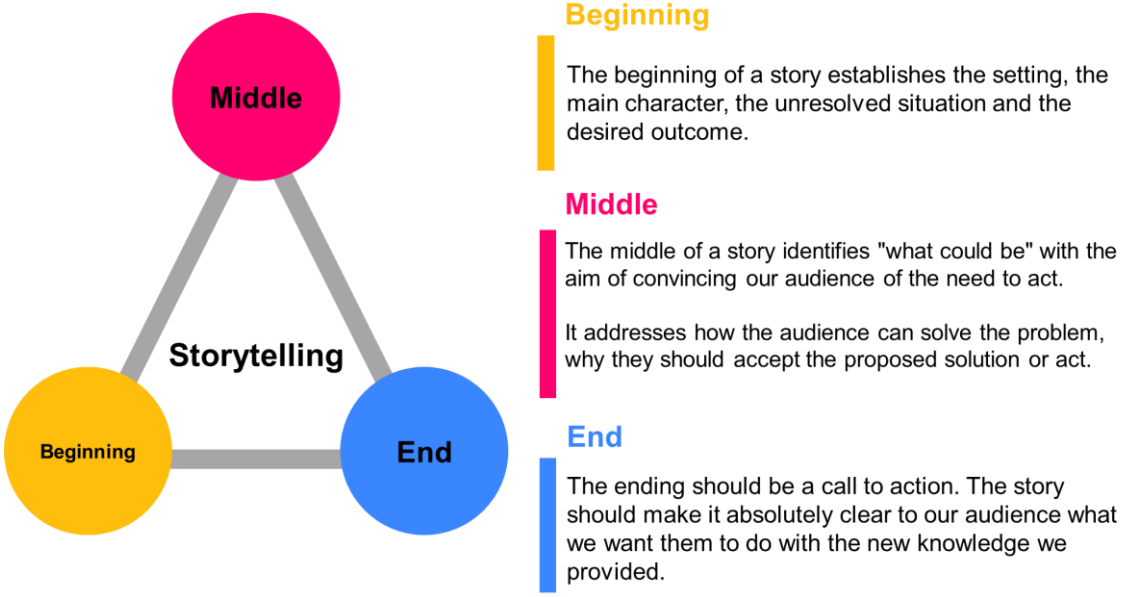

Figure 6-3. The storytelling structure: beginning, middle and end

6.3.5 Design of the message to be communicated

Time allocated: 35 minutes

[10] Aven, T. and Shital, T. 2022. Risk Science. An introduction. New York: Routledge.

a) Each relevant party group or subgroup will carry out this activity.

b) Participants are asked to choose a consequence that will be the basis for communicating a risk.

c) Participants should be oriented to understand the risk associated with that event. Explain on the board very carefully, recapping the concept of risk used in MUISKA and the basics of risk science.

d) Based on these results, the participant structures the message to be communicated through a story (Figure 6-3).

e) For the above, it is necessary for participants to establish the following:

- Risk to be communicated.
- Risk management options.
- Who is the audience? Who cares about this?
- Audience characteristics: their level of knowledge and education; their ways of thinking (Figure 6-2); their values (Figure 6-4); the audience's attitudes and beliefs about the topic in question; their level of receptivity and openness to the ideas being communicated; the audience's concerns about the topic.
- Who is the source of the information?
- Objective of the communication.
- What the source wants the audience to do after receiving the message.
- What message is to be communicated: risk assessment, uncertainties, strength of the knowledge, actions to manage risk, among others.
- Acceptability of the message (trust in the source of the information).
- Design and format the message: oral, written, numbers, text, photos.

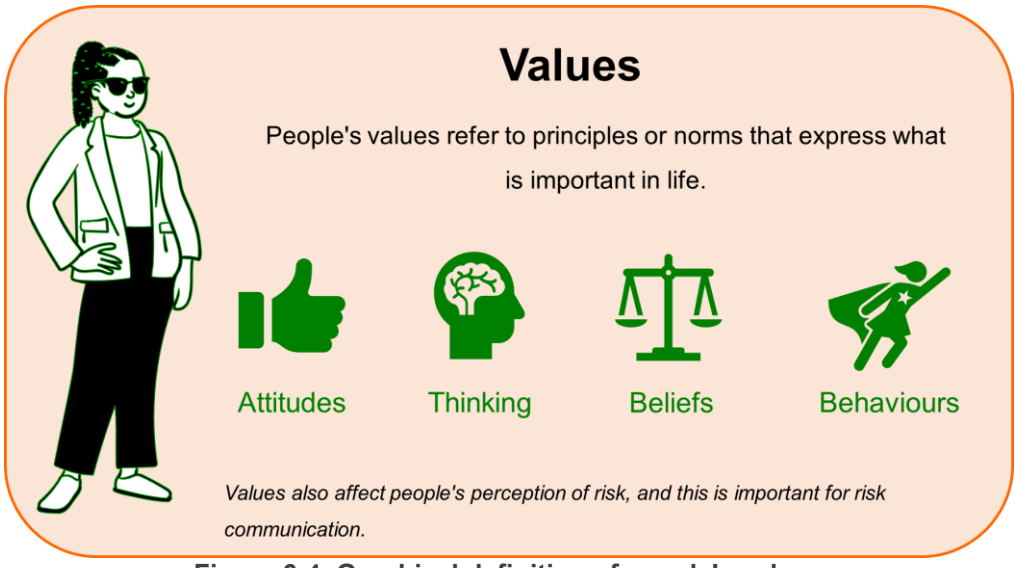

Figure 6-4. Graphical definition of people's values

f) When defining the objective of the communication and what the source wants the audience to do after learning about it, it should be kept in mind that changes in attitude are difficult to achieve and even more so changes in behaviour. This is to avoid setting overly ambitious objectives that cannot be reached, mainly to change the people's behaviours in the municipality.

6.3.6 A story to communicate risk

Time allocated: 50 minutes

a) With the results obtained in the previous workshop on the design of the message to be communicated, all the supplies are made available in the centre of the group so that they are easily accessible to all.

b) Using available supplies, the participant should tell a graphic or oral story to communicate their preferred risk.

c) The moderators of this activity should be open to counterproposals from the group in case they want to tell the story differently. For example, a single oral history in the form of a play, parody, song, *troba*, etc.

6.3.7 Coffee break

Time allocated: 20 minutes

6.3.8 Final reflection

Time allocated: 30 minutes

Ask participants to share their stories and comment on what they liked best after all groups have shared.

Note 3: This workshop was held on the same day (morning session) as in step 6. All three participating groups were present at this workshop.

7 GUIDE TO STEP 6: OUTLINE A PLAN FOR MANAGING WATER SECURITY RISKS

Total duration: 2.5 hours - 150 minutes

7.1 INTRODUCTION

This document is a guide to develop step 6 of the MUISKA approach: outlining a water security risk management plan. This is the last step of this approach, which focuses on risk management.

7.2 OBJECTIVE

Develop a list of possible actions to manage water security risks in Cajibío, including knowledge gaps associated with uncertain risks.

7.3 DEVELOPMENT OF STEP 6

7.3.1 Supplies

- Two printed copies of this guide
- List of the risks assessed in step 4
- Copies of the simple tie-dye diagram
- Copies of the double-tie diagram
- Coloured markers
- Masking tape
- Erasers
- Pencils
- Several rolls of paper
- Camera
- Refreshments
- Lunches

7.3.2 Summary of the previous activity

Time allocated: 5 minutes

a) Briefly mention what was done in steps 3, 4 and 5 and the results obtained.
b) Introduce what is to be done in step 6.

7.3.3 Basic concepts considered in step 6

Time allocated: 10 minutes

Explaining basic concepts of risk management (Figure 7-1).

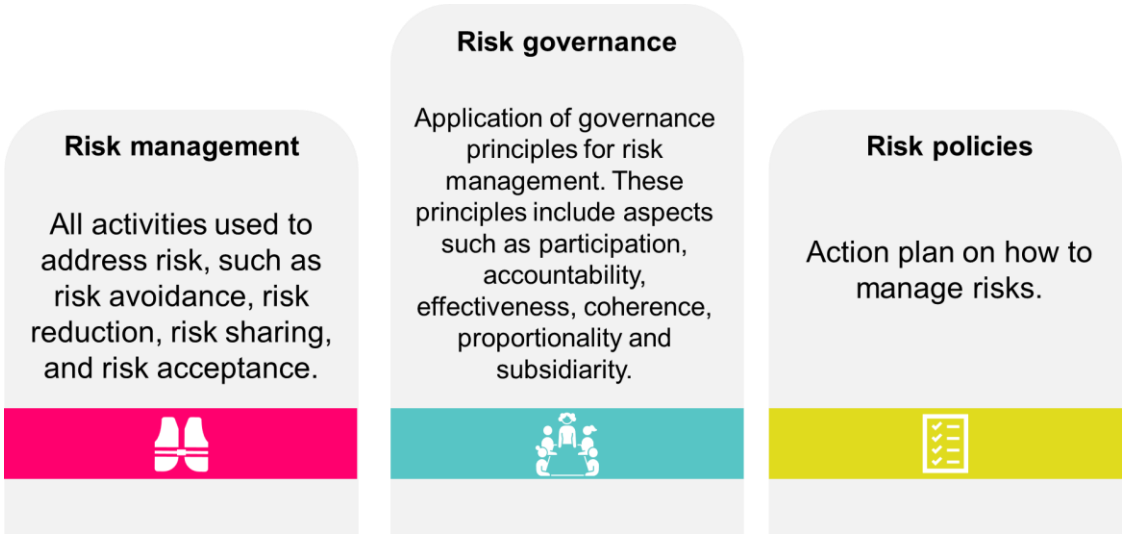

Figure 7-1. Key concepts in risk management

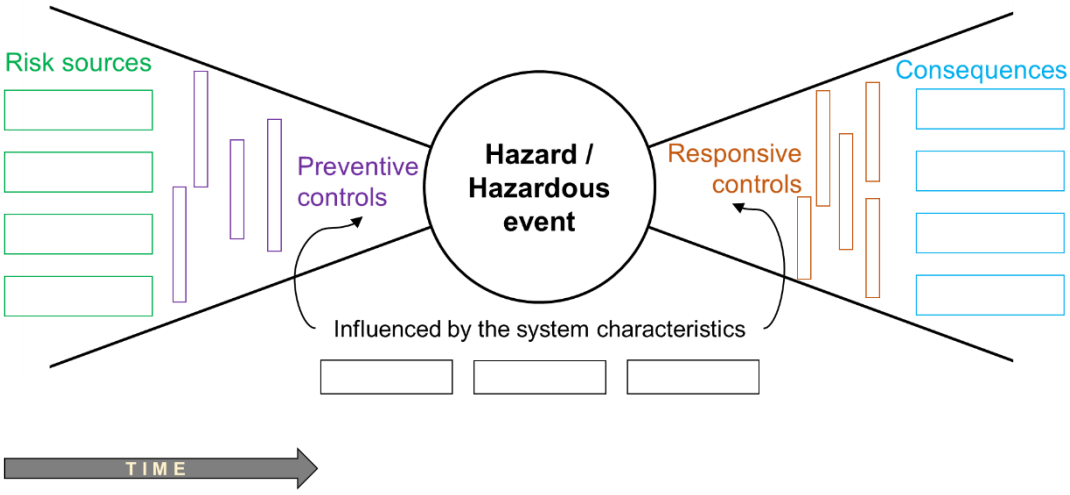

Figure 7-2. Simple bow-tie diagram for risk analysis

Source: Adapted from Logan et al., 2022.[11]

7.3.4 Identification of Risk Management Interventions

Time allocated: 90 minutes

a) Each group of participants chooses a consequence for this activity.

b) Based on the simple bow-tie diagram (Figure 7-2), groups link one risk to others in cases where there is an interdependent relationship (Figure 7-3). For this, they should rely on the network of hazards and consequences that they built in Step 0.

c) First, the groups choose a consequence and analyse it as a simple problem with the simple bow-tie diagram (Figure 7-2). Orient the participants with this procedure:

   a. Identify barriers to prevent the risk (tie knot) from occurring (left side of the tie).

[11] Logan, T.M., Aven, T., Guikema, S.D. and Flage, R. 2022. Risk science offers an integrated approach to resilience. *Nature Sustainability*. **5**(9), pp.741-748.

   b. Identify all the consequences of that risk (right side of the tie) and check whether these barriers change the consequences (disappear, decrease, new consequences appear, etc.).
   c. In case consequences continue to exist despite the implementation of barriers, identify interventions to control the risks associated with these consequences.

d) Analyse a simple problem helps participants become familiar with bow-tie diagrams.

e) Then, the same consequence is analysed and linked to another, using the double bow-tie diagram (Figure 7-3) as follows:
   a. Identify barriers to prevent the initial risk (tie knot) from occurring (left side of the tie).
   b. Identify all the consequences of that risk (right side of the tie) and check whether these barriers change the consequences (disappear, decrease, new consequences appear, etc.).
   c. In case consequences continue to exist despite the implementation of barriers, identify interventions to control the risks associated with these consequences.
   d. Highlight the risk nested to the initial risk in a different colour.
   e. Identify barriers to prevent the second risk (nested to the initial risk) from occurring (left-hand side of the tie).
   f. Identify whether these barriers are also somewhat effective in managing the risk associated with other consequences.

f) Barriers may include infrastructure, codes, standards, protocols, procedures, training, supply of consumables, policies, education, new or increased knowledge, uncertainty reduction, early warning, monitoring, vaccination, nutrition, redundant systems, diverse systems, adaptive systems, preventive measures, insurance.

Note 4: This workshop was held on the same day (afternoon session) as the Step 5 workshop. Two of the three groups participating in the study attended this workshop.

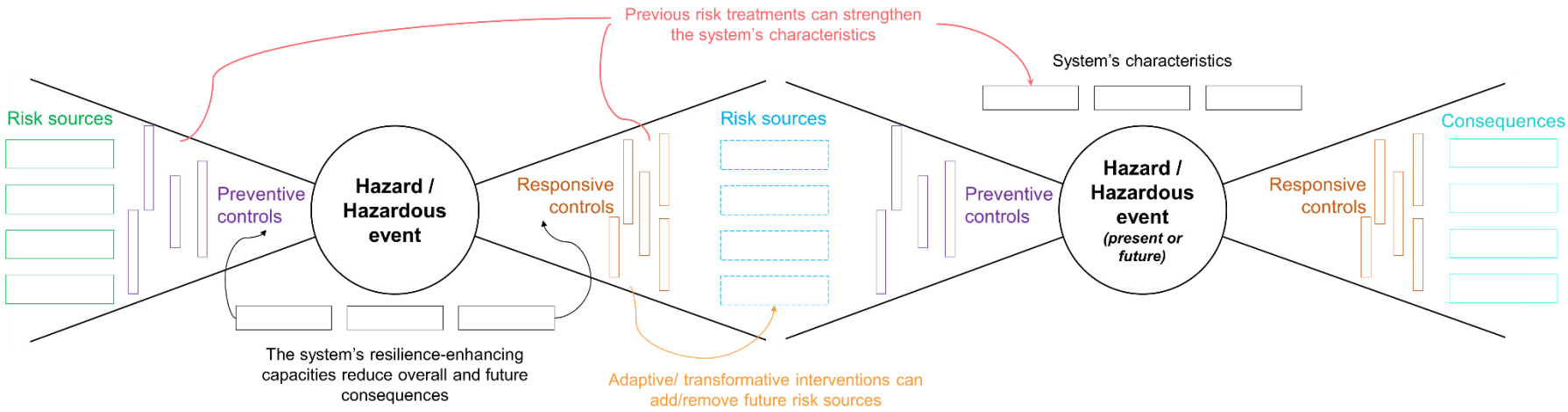

Figure 7-3. Double bow-tie diagram for risk analysis

Source: Adapted from Logan et al., 2022.[12]

[12] Logan, T.M., Aven, T., Guikema, S.D. and Flage, R. 2022. Risk science offers an integrated approach to resilience. *Nature Sustainability*. **5**(9), pp.741-748.

7.3.5 Coffee break

Time allocated: 15 minutes

7.3.6 Individual Barrier Analysis

Time allocated: 30 minutes

a) Based on format 1 (Table 7-1) and the risks analysed with the double bow-tie diagram, participants are asked to explore each barrier.

b) If there are too many barriers for the time allotted, consider splitting the group into subgroups to discuss subgroups of barriers.

7.3.7 Closing of the field phase in Cajibío

At the end of the step 6 workshop and taking advantage of the presence of most of the participants in this workshop (two out of three relevant party groups), the field phase in Cajibío was closed, expressing gratitude for the time spent and all the knowledge and experiences shared. The research team also explained the future work and how to stay in touch. The participants spontaneously expressed their perceptions of the work carried out in the framework of the co-development of the MUISKA approach.

Table 7-1. Format 3 for individual analysis of barriers

Barrier	FUNCTIONALITY	INTEGRITY / RELIABILITY	ROBUSTNESS / RESILIENCE	EQUITY	IMPLEMENTATION		
	The barrier will work now and in the future. (Yes / No / Don't know)	The barrier will be in place and intact when needed. (Yes / No / Don't know)	The barrier can withstand disturbances and situations different from the normal state. (Yes / No / Don't know)	Does the barrier impose a fair and equitable burden on those affected by its implementation? (Yes / No / Don't know)	Which organisations are responsible for implementing this barrier?	How can these organisations be articulated with other relevant parties in the sub-basins for the successful implementation of the barrier?	Is the barrier compatible with legal requirements and political agendas? (Yes / No / Don't know)
1							
2							
3							
...							
n							

Continued Table 7-1. Format 3 for individual analysis of barriers

Barrier	ACCEPTABILITY		SUSTAINABILITY	Observations
	Is the barrier morally acceptable? (Yes / No / Don't know)	Would the barrier be accepted by the people affected by the respective risk? (Yes / No / Don't know)	Does the barrier help maintain or enhance vital ecological functions, economic prosperity, and social cohesion? (Yes / No / Don't know)	
1				
2				
3				
...				
n				

Note 5: The formats that are not included in these guides can be requested by email to Carolina Montoya Pachongo.

Note 6: These guides were produced initially in Spanish, as this is the official language in Colombia. All activities and interactions with research participants were in Spanish, and interpreters were unnecessary since the research team could communicate in this language.

Funders:

This work was supported by the Water Security and Sustainable Development Hub funded by the UK Research and Innovation's Global Challenges Research Fund (GCRF) [grant number: ES/S008179/1].

MUISKA

MUltidimensional rISK Analysis
for water security