Co-designing climate services for water planning

A case study from the Campoalegre River Basin in Colombia

SEI discussion brief
September 2020

Tania Fernanda Santos Santos

Åsa Gerger Swartling

IMAGE (ABOVE): Café de Colombia

Key Messages

- **The Tandem framework was created to guide the co-design of climate services to enhance climate change adaptation; such co-design processes contributed to improving the relevance and understanding of climate-related information and plans in the Campoalegre River Basin of Colombia.**
- **An important aspect of the process is the emphasis placed on embracing the perspectives, needs and preferences of a wide variety of relevant participants and stakeholders. The experiences in the Colombia case study underscore that power dynamics require careful consideration. Great care must be taken to ensure that those who represent less powerful groups have an opportunity to speak, and that others listen to what they have to say.**
- **Trust, credibility and commitment are essential values in such processes. An initial discussion among providers, intermediaries, and information users helps the design and implementation of effective co-production processes.**
- **Climate services are likely to progress more quickly in situations in which relationships have previously been established. Thus, it would be beneficial to conduct preliminary work focused exclusively on establishing such relationships and generating trust – not only in institutions, but also in tools that can engage stakeholders in related processes. Such efforts would help both climate services in general, and, specifically, the Tandem framework.**

Introduction

Despite a strong increase in climate change adaptation research over the past decade, climate information is seldom used to its full potential in adaptation planning and decision-making. This gap between research and action (Klein and Juhola 2014; Palutikof et al. 2019a) signals that there is a lack of actionable knowledge to support adaptation decision-making (Ernst et al. 2019; Mach et al. 2020) One of the ways forward is the use of more bottom-up and inclusive approaches that challenge providers to tailor information to users' specific institutional and decision contexts (Hewitt et al. 2017; Palutikof et al. 2019b).

Tailored information meets the ambition to bridge the gap between providers and users of climate information. It has been shown to assist and improve adaptation decision-making. Such climate information outputs have come to be widely known as climate services (Vincent et al. 2018; WMO 2018) Climate services may be in different formats such as models, assessments or participatory processes or "tools, products, websites" (Vaughan and Dessai 2014, p.588).

The Tandem framework (Daniels, E. et al. 2020; Daniels et al. 2019) was developed in the SEI Climate Services Initiative to inform processes for co-designing climate services.

This brief is part of a series designed to test and refine the Tandem framework using completed and ongoing projects related to climate services and adaptation decision-making. The case study presented here summarizes the results of the 2019 application of the framework in the Campoalegre River Basin in the coffee-producing region of Colombia, and draws on SEI's previous work with the water sector and water-management planning efforts in the region. The brief presents the Tandem framework methodology and its application, discusses insights, and, based on the experiences from the processes, makes recommendations about the utility of the framework, and measures that could improve the framework and provide more effective climate services.

The Tandem framework[1]

The framework was developed to guide **providers** and **intermediaries** of climate information through seven iterative steps that are intended to produce relevant, actionable and sustainable climate services that meet the needs of its **users** (Daniels, E. et al. 2020; Daniels et al. 2019):

- **Step 1** consists of identifying and defining an adaptation challenge that would benefit from the use of a climate service.
- **Step 2** focuses on identifying and engaging with potential users of a climate service.
- **Step 3** involves co-defining the desired objectives of a climate service, and reviewing advantages and shortcomings of existing services.
- **Step 4** entails gaining an understanding of the institutional and decision contexts in which the climate service will be embedded.
- **Step 5** guides providers and users of the climate service in co-exploring data and information needs, including their sources, formats and modes of dissemination.
- **Step 6** consists of appraising adaptation measures, in which decision-support methods may be used to identify, evaluate, prioritize and sequence interventions.
- Step 7 ensures that the climate service is used in practice by embedding it in existing institutions, and ensuring that mechanisms are in place for maintaining, evaluating and upgrading the service as appropriate .

Case Study

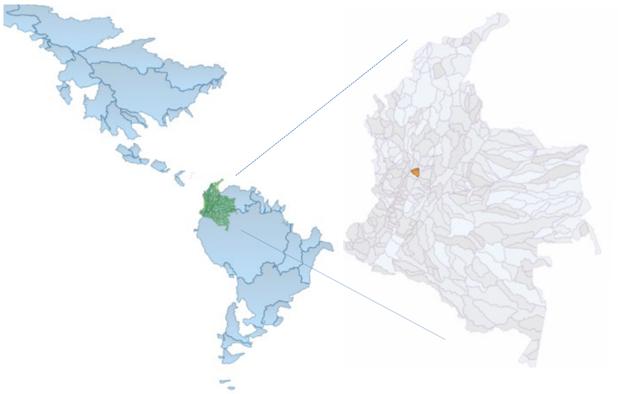
SEI has previous experience in working to increase the robustness of decision-making in the context of water resources (Purkey, David et al. 2018), and to investigate the roles of poverty and equality in water resource planning in the coffee region of Colombia (Forni, L et al. 2018). As a result of these previous SEI engagements, the Water Evaluation and Planning (WEAP) tool (Yates and Galbraith 2005) had been deployed and adopted by the relevant environmental agencies (the *Corporación Autónoma Regional de Risaralda* (CARDER) and the *Corporación Autónoma Regional de Calda*s (CORPOCALDAS)) and other stakeholders to integrate climate information into water resource analysis and planning processes. This tool provides an analytical engine to support the decision-making process for planning purposes as part of the *Plan de Ordenación y Manejo de Cuencas Hidrográficas* (POMCA).

The POMCA is the instrument through which the coordinated planning of land use, water, flora, fauna and basin management takes place in Colombia. The plan is defined by the hydrological sub-zones in the country (extending from 12 km2 to 25.000 km2, and spatial scales from 1:25.000 to 1:100.000, according to the bioregion). The POMCA is intended to

1 Note: The Tandem framework is designed to evolve as experiences and applications in the field generate new insights. This case study is based on an early version, updated in Daniels, et al. 2020. The most up-to-date information is available through online guidance at https://www.weadapt.org/tandem.

Figure 1. Campoalegre River Basin.

Area	640 km²
Location	Center-west area of Colombia. Los Andes Mountains.
Water Use	Energy generation, human consumption, agriculture and livestock
Land use	26.9% forest, 23.7% coffee, 16.6% other crops, 16.5% grass, 1.9% urbanization, 0.8% water bodies
Economic sectors	Traditional: coffee, fashion. Priority: tourism, agriculture, industry
Altitude	800 to 3500 miles above sea level



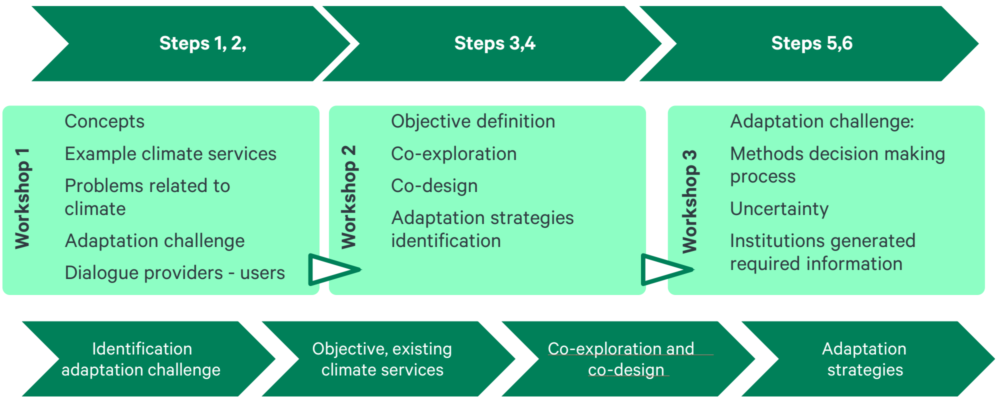
Source: (Minambiente, 2014)

be a continuous process conducted in 10-year cycles and five specific phases: readiness, diagnosis, formulation, execution, and evaluation (Minambiente 2014). Currently the POMCA for the Campoalegre River Basin is in the formulation phase.

Local and regional communities participate in this process, which is intended to lead to the improved use and management of the region's shared natural resources (Minambiente 2014). This participation takes place via a democratic process, in which each basin group – including farmers, municipalities, NGOs, indigenous populations, and the private sector – appoint two representatives to serve as members of the Basin Council.

To meet the current and future climate change-related challenges in the region the Basin Council needs climate information for council members and for the many, diverse inhabitants of the basin as part of the planning process. The Tandem framework was applied in 2019 to co-produce climate services in the POMCA formulation of the water resources planning process, which is currently under construction. The Tandem application took place over an eight-month period in 2019. The process relied on interviews with stakeholders, and three workshops with the Basin Council. The workshops were designed and conducted following the steps of Tandem (as illustrated in Figure 2). Participants answered questions designed to address each step in the process, and their responses were analyzed to shed light on aspects that worked, and to offer ideas for how to improve both the Tandem framework, specifically, and climate services, broadly.

Figure 2. Tandem application



The Tandem framework application

All steps of the Tandem framework were applied in the workshops. Different stakeholders provided information both in terms of their respective roles as Basin Council representatives, and in terms of their specific needs as inhabitants of the basin region. As shown in Figure 3, each workshop was designed to provide insights and contextualized knowledge on steps described in the framework. Where appropriate, iterations were carried out, underscoring the non-linear character of this methodology.

Prior to the workshops, interviews were conducted with regional experts to explore a number of issues (corresponding to Tandem Step 2). This included giving an overview of information that providers have or are aware of; outlining existing climate information needs of users; gaining an understanding of information-provider institutions, and how they interact with communities, sectors, groups, and among one another; examining power relationships for decision-making in the region; and establishing a greater understanding of non-climate-related information required for making climate adaptation decisions.

The first workshop initiated a dialogue between climate information providers and users. Representatives from the *Instituto de Hidrología, Meteorología y Estudios Ambientales* (IDEAM), regional environmental agencies, universities, and other information providers gave an overview about the climate information they generate and the communication channels they use. They also explained how the generated information can be used, and how climate information needs had been established (corresponding Tandem Step 3). Providers offered information about available meteorological data, forecasts, time series, climate change vulnerability, and adaptation strategies. In addition, various user groups, provided an overview about their needs and existing gaps in available climate and other information (e.g. related to scale, accuracy, and credibility on climate and other issues). This workshop revealed that users struggle both to find needed information, and to use information that they do find.

The central theme in this workshop was to explore the adaptation challenge (Tandem Step 1). Defining the challenge proved difficult due to the diversity of stakeholders and sectors involved, the many complex issues to be addressed, and the divergence of stakeholder needs. Thinking in a holistic way and establishing priorities among various adaptation challenges and options required a process to understand both the wider decision context and the relationships between many factors that affect the basin environment. Nevertheless, in this meeting, stakeholders identified the following adaptation challenges:

1. Better use of land in the face of vulnerabilities and threats (for example flood and drought) related to current and future impacts of climate change .
2. Improving climate education, and fostering behavioral change.

In the second workshop, participating actors used maps to identify which climate-related factors affect conditions in the basin. They were asked which impacts they considered to be the most significant, which groups they perceived as most affected, and whether different groups experience different effects. For example, the participants identified groups by economic sectors, such as the coffee-growing sector, in which farmers face the risk of crop loss from soil erosion and landslides. Within this group, women represent a subgroup that experiences different effects because of female roles, which usually involve taking care of households . Their household work relies on aqueducts and infrastructure as sources of fresh water. If landslides or droughts affect this infrastructure, women will need to spend more time transporting water from other sources to meet their household needs.

BOX 2. WHY DO BASIN COUNCILLORS NEED CLIMATE SERVICES?

The *Plan de Ordenación y Manejo de Cuencas Hidrográficas* (POMCA) establishes participatory processes to define how the resources in a river basin in Colombia will be used to achieve "sustainable development". Sustainable land use to guarantee ecosystem services and disaster risk reduction are part of the scope of the decision-making processes that consider adaptation strategies for current and future climate conditions.

In the Campoalegre River Basin, 21 basin councillors are in charge of defining land use management and programs under POMCA. These councillors are representatives of indigenous groups, coffee farmers, community organizations, municipal governments, supply companies, universities and hydro-energy endeavours. They have very different profiles and backgrounds.

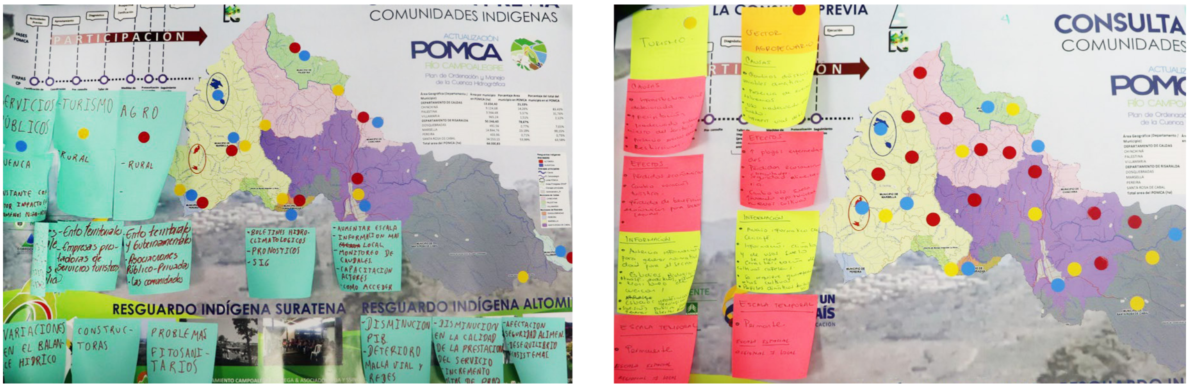
Currently, POMCA is in the "formulation" phase, where the programs and projects are defined. Objective tools will be used to evaluate management alternatives by simulating various possible scenarios.

Access to information about climate change and variability in easy-to-use formats is a fundamental requisite for councillors, who must make informed decisions, and for basin inhabitants, who need greater understanding of issues and adaptation options.

Other climate-related concerns raised in the workshop include the effect of droughts on hydropower facilities; the effects of water availability, floods, and human health risks on municipalities; and the impact of changes in temperature and precipitation patterns on farmers and agricultural communities. Participants identified strategic ecosystems that warrant careful consideration, including Páramo ecosystems (alpine tundra regions), which were identified as vulnerable because climate change may alter their lower boundaries. Such Páramo ecosystems are known in the Andes as “water factories” because they retain about 50% of the rainwater – and thus play a pivotal role in regulation of water flows (Torres et al. 2014)

The physical location of the perceived threats allows identification of vulnerabilities as well. In this river catchment, risks are primarily related to landslides, mainly in coffee areas during high precipitation periods. Supply systems are vulnerable because landslides may affect infrastructure, and sediment resuspension may affect water quality. Energy generation could be affected in drought periods. Figure 1 maps results (incorporating Tandem steps 1-4) of this workshop.

Figure 3. Social mapping exercise aimed at identifying information needs and other relevant information to define the adaptation challenge



In this co-exploration process the stakeholders framed the objective of the climate services as: “To manage climate information to maintain the provision of ecosystem services in the Campoalegre River Basin”. Strategies to reach this objective (Tandem Step 5) were:

- Ecosystem restoration
- Better land use practices
- Efficient water use
- Diversification of energy sources
- Cultivation of alternative crops
- Knowledge acquisition about climate, threats, vulnerabilities and adaptation strategies

Members of the Basin Council were asked to make drawings describing what climate information would be useful/usable as decision support to reach the objectives defined collectively (see Figure 4 for examples). During this exercise users had an opportunity to co-design the graphical interface and information they need to take their own decisions as council members, or as inhabitants developing activities there. As Basin Council members, they are expected to understand how climate variability and climate change affect future scenarios in the river basin, and to address ways to make better related decisions (e.g. by running a decision-support system, such as WEAP (see Box 2)).

The third workshop followed up on the previous workshops . Participants completed individual questionnaires, which posed five questions aimed at validating the proposed adaptation strategies (proposed in the second workshop), and tailoring these to individual roles in the river basin. During the second part of the workshop, participants split into six groups to respond to another questionnaire examining their roles as council members.

Both exercises were developed to obtain information (Tandem steps 5 and 6) related to scales, dissemination methods, institutional agreements, time series, and visualization tools. For the Council, the Internet was perceived to be an excellent option as a communications medium for climate information for stakeholders and technicians. Text messaging and WhatsApp were considered to be potentially relevant dissemination alternatives for users in general. However, because Internet access is poor in some rural areas, and because some technical forms of communication are not used by all, participants felt that some form of print publication would be needed to reach some climate information users. This information set the stage for the implementation of the climate service, and for subsequent monitoring, evaluation and learning processes that should follow to address any needed "re-think" of climate services (Tandem Step 7) as plans are implemented and circumstances change.

BOX 2. WHY USE WEAP AS A CLIMATE INFORMATION TOOL IN RIVER CATCHMENTS?

The Water Evaluation and Planning (WEAP) tool is a decision support system for integrate water management, allowing the full integration of supply, demand, water quality and ecological considerations.

Climate information is included in WEAP to characterize variables such as precipitation, temperature, humidity, solar radiation, etc, and to model the interaction between these variables and flow, water quality, vegetation. These interactions are affected also by human activities such as land use, water demand, sanitation strategies. Any change about climate affects the interactions between those elements and consequently the availability of resources for inhabitants and ecosystems.

WEAP aids the analysis of scenarios in which changes in climate, human activities and the effects on resources can be evaluated to make robust decisions with planning purposes.

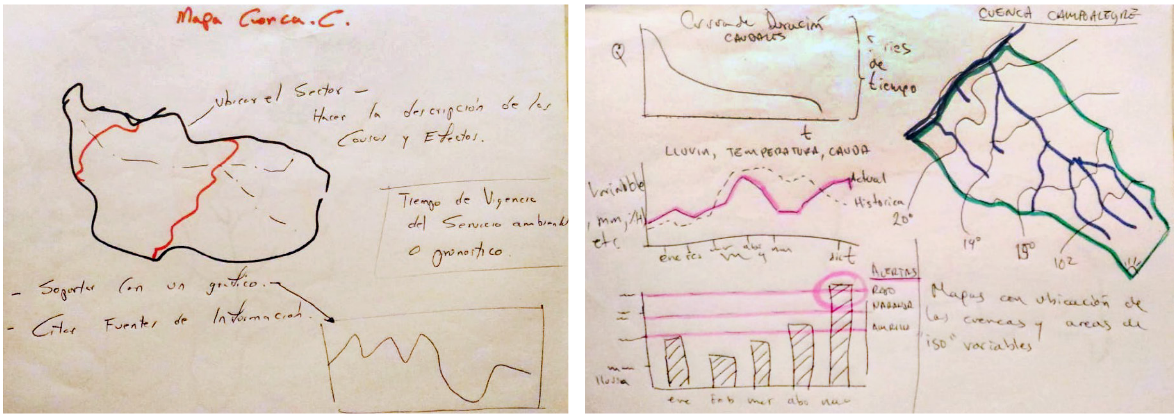
The use of WEAP as a platform to manage climate information and support decision-making processes about adaptation strategies is possible if the users can understand the database of river basin, and the uncertainties, strategies and metrics that are fundamental to making comparisons among management options. In the Campoalegre River Basin, this process has taken years of an integrated work between stakeholders and SEI. The work has included activities for learning and capacity building, creating information dissemination channels, and establishing mechanism to upload information for the model and the tool's application in POMCA planning processes.

WEAP was developed by the SEI U.S. Center. (https://www.weap21.org)

What new questions and methods could improve climate services and the Tandem framework?

The iterative questions that underlie the Tandem framework provide initial guidance as a first approach to stakeholder engagement. However, in this study, the questions, while flexible, did not support the fundamental issues that had to be addressed prior to the identification of the adaptation challenge. Among the participants in this setting, it appeared to be important to first describe and specifically identify the climate change-related facts and problems, and then, from there, to define the adaptation challenge. Once participants identify the adaptation challenge to be addressed, proposing adaptation

Figure 4. Co-production process.



Exploring information needs, visualization and languages according to type of user. Participants created drawings to illustrate both the information they need, and how information could be presented to give them a better understanding of related issues.   One participant (shown at left) suggested a map with time-series information explaining s the cause and effects of some threats related to water sector. Another participant (shown at right) suggested a visualization using maps with climate information such as mean temperature and precipitation, and graphs of flow duration curves, alerts about high precipitation levels, and historical, current and future time-series analysis of variables such as temperature, precipitation and water flow.

strategies that respond to challenges requires a greater understanding of another set of variables. These can be highly complex, and evaluating them and implementing related measures require hard work and even deeper understanding. For climate service providers, creating a set of methods to develop workshops to follow the steps defined in Tandem could offer a beneficial approach for more effective application in various contexts.

In this case study two methods developed appeared to be particularly useful to reach targeted goals of each step.

1. Social mapping (Step 1) helped participants to understand the many factors affected by climate change. This exercise helped participants reach a consensus both about the nature of the regional adaptation challenges, and the climate service goals that users wanted to pursue and reach.
2. Individual questionnaires addressing knowledge of climate information needed to implement adaptation strategies (Steps 5 and 6) allowed participants to hear from those members of groups that are often overlooked, and whose points of view seldom receive attention. To build a differentiated climate service that best suits needs of diverse users, incorporating such a diversity of viewpoints is essential. The Basin Council, which serves as a structure to ensure participation of the different groups, provides a communications space between actors and institutions to discuss different needs and thoughts about how to create a common future. However, the meetings and workshops generate a dynamic in which prevailing power relationships predominate. This appears to be based on the differences in technical knowledge, about which some participants gain the attention of the audience and other participants' opinions lose attention. Training in specific topics related to climate, assessing and understanding risks, vulnerabilities and adaptation strategies would improve the informed participation of all stakeholders.

Previous experiences in this region (Forni, L et al. 2018; Moncada et al. 2020), and already established relationships with relevant organizations made possible the design and implementation of this case study within a relatively short period of eight months. Based on this experience , we believe that climate service providers and the Tandem framework could benefit from including a preliminary stage to foster relationship building, and to establish trust, not only in institutions, but also in tools that can support and engage stakeholders in the process.

References

Daniels, E., Bharwani, S. and Butterfield, R. (2019). *The Tandem framework: a holistic approach to co-designing climate services.*

Daniels, E., Bharwani, S., Gerger Swartling, Å., Volturius, G. and Brandon, K. (2020). Refocusing the climate services lens: introducing a framework for co-designing “transdisciplinary knowledge integration processes” to build climate resilience. *Climate Services*. DOI: 10.1016/j.cliser.2020.100181

Ernst, K. M., Gerger Swartling, Å., André, K., Preston, B. L. and Klein, R. J. T. (2019). Identifying climate service production constraints to adaptation decision-making in Sweden. *Environmental Science & Policy*, 93. 83–91. DOI: 10.1016/j.envsci.2018.11.023

Forni, L, Moncada, A. and Escobar, Marisa (2018). *Examining poverty and equality in water resources planning*. https://www.sei.org/wp-content/uploads/2018/08/examining-poverty-and-equality-in-water-resources-planning.pdf

Hewitt, C. D., Stone, R. C. and Tait, A. B. (2017). Improving the use of climate information in decision-making. *Nature Climate Change*, 7. 614–16. DOI: 10.1038/nclimate3378

Klein, R. J. T. and Juhola, S. (2014). A framework for Nordic actor-oriented climate adaptation research. *Environmental Science & Policy*, 40. 101–15. DOI: 10.1016/j.envsci.2014.01.011

Mach, K. J., Lemos, M. C., Meadow, A. M., Wyborn, C., Klenk, N., et al. (2020). Actionable knowledge and the art of engagement. *Current Opinion in Environmental Sustainability*, 42. 30–37. DOI: 10.1016/j.cosust.2020.01.002

Minambiente (2014). *Guía Técnica para la formulación de Planes de Ordenación y Manejo de Cuencas Hidrográficas*, POMCAS. 104.

Moncada, A. M., Escobar, M., Betancourth, A., Vélez Upegui, J. J., Zambrano, J. and Alzate, L. M. (2020). Modelling water stress vulnerability in small Andean basins: case study of Campoalegre River basin, Colombia. *International Journal of Water Resources Development*. 1–18. DOI: 10.1080/07900627.2019.1699780

Palutikof, J. P., Street, R. B. and Gardiner, E. P. (2019a). Decision support platforms for climate change adaptation: an overview and introduction. *Climatic Change*, 153(4). 459–76. DOI: 10.1007/s10584-019-02445-2

Palutikof, J. P., Street, R. B. and Gardiner, E. P. (2019b). Decision support platforms for climate change adaptation: an overview and introduction. *Climatic Change*, 153(4). 459–76. DOI: 10.1007/s10584-019-02445-2

Purkey, David, Escobar, Marisa, Mehta, Vishal, Forni, Laura, Depsky, Nicolas, Yates, David and Stevenson, Walter (2018). A Philosophical Justification for a Novel Analysis-Supported, Stakeholder-Driven Participatory Process for Water Resources Planning and Decision Making. *Water*, 10(1009). www.mdpi.com/journal/water

Torres, M. C. D., Flórez, F. H. and Triana, F. A. (2014). Efecto del Uso del Suelo en la Capacidad de Almacenamiento Hídrico en el Páramo de Sumapaz - Colombia. *Revista Facultad Nacional de Agronomía Medellín*, 67(1). 7189–7200. DOI: 10.15446/rfnam.v67n1.42642

Vaughan, C. and Dessai, S. (2014). Climate services for society: origins, institutional arrangements, and design elements for an evaluation framework. *Wiley Interdisciplinary Reviews: Climate Change*, 5(5). 587–603. DOI: 10.1002/wcc.290

Vincent, K., Daly, M., Scannell, C. and Leathes, B. (2018). What can climate services learn from theory and practice of co-production? *Climate Services*, 12. 48–58. DOI: 10.1016/j.cliser.2018.11.001

WMO (2018). *Guidance on Good Practices for Climate Services User Engagement : Expert Team on User Interface for Climate Services*. World Meteorological Organization, Geneva, Switzerland. https://library.wmo.int/doc_num.php?explnum_id=4550

Yates, D. and Galbraith, H. (2005). WEAP21 – A Demand-, Priority-, and Preference-Driven Water Planning Model. *Water International*, 30(4). 12.

SEI Stockholm Environment Institute

Published by
Stockholm Environment Institute
Linnégatan 87D, Box 24218
104 51 Stockholm, Sweden
Tel: +46 8 30 80 44

Author contacts
tania.santos@sei.org
asa.swartling@sei.org

Media contact
karen.brandon@sei.org