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TERRITORIAL KNOWLEDGE FOR DECISION-MAKING AT A LOCAL LEVEL IN LATIN AMERICA: SYSTEM OF LOCAL CLIMATE OBSERVATORIES FOR INFORMATION AND ACTION

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KEY POINTS

✔ In Latin America it is essential to move on to the development of integrated territorial information systems for the management and action of adaptation to climate change. Capacity building, creation of territorial networks, and climate governance are required to respond to the territorial information gaps, integrate local and scientific information and knowledge into decision-making; and implement and replicate good practices that have proven effective in adapting territories to the impacts of climate change.

Executive summary

Resumen ejecutivo

Adaptation to climate change is one of the primary challenges for local development in Latin America, and one of the most significant limitations to local adaptation is the weakness of territorial information systems concerning climate change. Some of the most significant weaknesses include information gaps regarding different territorial scales, the lack of mechanism for effective dissemination of local knowledge and technical/scientific information, in a format that is usable for territorial actors. In addition, there is a lack of adequate methodologies for the integration of information and knowledge on climate change into local decision making processes.

La adaptación al cambio climático es uno de los principales desafíos para el desarrollo local en América Latina, y uno de los principales factores limitantes para la adaptación local es la debilidad de los sistemas de información territorial sobre cambio climático. Algunas de las debilidades más importantes están relacionadas con brechas de información relevante a escalas territoriales, la falta de mecanismos de difusión efectiva de conocimiento local e información técnica/científica, en un formato utilizable por parte de actores territoriales, y la falta de metodologías para la integración de la información y el conocimiento en la toma de decisiones locales.

This policy brief presents a summary of the issue related to the availability, dissemination and integration of territorial information into local climate change adaptation processes. The document considers the three stages of the adaptation cycle (Planning, Implementation, and Monitoring and Evaluation), as well as three crosscutting elements (Capacity Building, Knowledge Transfer, and Governance and Institutionalality) regarding such processes.

El presente *policy brief* muestra un resumen de la problemática relacionada a la disponibilidad, difusión, e integración de información territorial en los procesos de adaptación local, considerando las tres etapas del ciclo de adaptación (Planificación, Implementación, Monitoreo y Evaluación), y tres elementos transversales (Creación de Capacidades, Transferencia de Conocimiento, Gobernanza e Institucionalidad) a dichos procesos.

The development of a System of Local Climate Observatories for Information and Action is proposed for Latin American countries. These observatories should respond to the need for the creation of an effective system of territorial information for climate change action and decision making, including elements such as Structure, Function and Content, and the development of a series of assessments necessary for their design.

Se propone el desarrollo de un Sistema de Observatorios Locales Climáticos para la Información y Acción (SOLCITA) en los países de la región. Dichos observatorios deberían responder a la necesidad de crear un sistema efectivo de información territorial sobre el cambio climático, incluyendo aspectos de Estructura, Función y Contenidos, y el desarrollo de una serie de diagnósticos para su diseño.

Finally, the document provides some initial recommendations regarding concrete activities that would produce the conditions needed for the development of a territorial information system. Such activities would also foment the formation and strengthening of networks and capacities that could set the stage for systems of observatories in local Latin American territories.

Finalmente, se plantean algunas recomendaciones iniciales de actividades concretas, con el fin de generar las condiciones necesarias para el desarrollo de un sistema de información territorial. Asimismo, estas actividades fomentarían la formación y el fortalecimiento de redes de trabajo y capacidades que posibiliten el establecimiento de sistemas de observatorios en los territorios locales de América Latina.

Introduction

The impacts and signs of climate change are accelerating, producing tangible effects on ecosystems, economic activities, critical infrastructure, social welfare, public and private institutions at all levels. However, these impacts directly affect subnational and local territories, which creates the need to adapt to its effects, to manage and reduce the risks and impacts, and to take advantage of opportunities that might present multiple implications of climate change, in each region, territory and/or locality. For climate change adaptation, local scale is crucial for three main reasons (1):

- 1)** Climate change impacts are observed locally, and they are the consequence of geographical, environmental, economic and socio-political factors.
- 2)** Vulnerability and adaptive capacity are essentially local, they result from interactions between multiple socioecological factors (e.g. incomes, infrastructure, human and ecological health, political participation, human behaviour, etc.) that determine ways to reduce exposure, respond and recover from impacts. Therefore, there is a wide variety of vulnerability levels.
- 3)** Adaptation to the climate change is taking place in local territories. Individuals and local organizations (governments, companies, among others) use their knowledge about real or anticipated impacts of climate change to modify behaviours and create new capacities for action. The effectiveness of the adaptation actions towards anticipated or perceived impacts of climate change, will result in replicability processes and an increase in good practices.

Therefore, sub-national actors, including individuals, municipalities, local governments, companies, community-based organizations, among others, need to adapt to climate change. However, since the impacts of climate change and their associated vulnerabilities will depend on the characteristics of each territory, the most appropriate and effective actions will change according to the location. The challenge posed by climate change is being able to incorporate it to local development, since it is

not possible to achieve sustainable development if territories are not prepared for the risks. The current local development processes and instruments in Latin America do not consider climate change as a risk factor for achieving the goals proposed in these plans. In general, climate change is considered an environmental problem and not a development problem.

The three phases for the climate change adaptation process at a national level are the following (2): i) Planning, ii) Implementation; iii) Monitoring and Assessment. This is considered a positive cycle, in which the assessment of results will be integrated to a new cycle of planning, in order to ensure feedback and constant improvement. This process requires vertical integration between national, sub-national, and local/territorial actors. Each of these phases requires information and knowledge. Firstly, to understand the impacts and vulnerabilities at a territorial level, secondly, to determine and implement the best actions according to the capacities, resources and local contexts of development, and finally, to develop indicators that allow monitoring the effectiveness of plans, programs and actions, and making adjustments when needed.

Based on the research carried out under the LatinoAdapta project, the main knowledge and information gaps relevant to climate change adaptation have been identified in six countries of the region: Argentina, Brazil, Chile, Costa Rica, Paraguay and Uruguay (3-8). In all the analyzed countries, one of the most noticeable information gaps was the lack of information related to the impacts and vulnerabilities of climate change, especially, information disaggregated by territorial level.

In a survey conducted in all countries, 77% of the answers expressed that not having information “disaggregated by local level or specific geographical areas” was a Very Important factor (54%) or an Important factor (23%) which affected their use of available information about adaptation for climate change.

Some of the issues highlighted by the national reports were:

- Regional Asymmetry regarding the available knowledge for adaptation, which is usually focused on the most populated areas or of greater economic importance.
- Scattered and disaggregated information, and not appropriate for implementing adaptation measures.
- Limited financial and human resources, and consequently an inappropriate data provision about current and future impacts at a relevant scale.
- Lack of knowledge and information to calculate and measure climate change forecasts related to vulnerability, risks and associated impacts.
- Lack of information and mapping at a community level, related to actions that need to be implemented locally.
- The need to integrate academia and the community, in order to incorporate ancestral knowledge to the learning process of adaptation.

A significant information gap makes it almost impossible to take informed decisions and to use scientific and territorial knowledge in the creation and implementation of local strategies. In most cases the problem is not due to information availability, but due to its limited use within local levels. Either because the format and language used hinders its application on real problems within smaller territories, or because decision-makers lack the abilities to incorporate them effectively to the development and local action.

Having territorial knowledge and information is key for strategic planning and effective implementation. However, these planning and action requirements for the sub-national actors in Latin America, are yet to be fulfilled. As a consequence, aside from the most populated and economically developed cities and territories, there are few cases of strategic planning instruments based on reliable information, at territorial level in the region. In addition, national governments have a low level of knowledge regarding different climate vulnerabilities, as well as about current and forecasted impacts at a local level in their own territories. Finally, the local knowledge integration gap also suggests that countries have no systematization of relevant information on impacts and vulnerabilities, nor on the adaptation actions that are being implemented by governments, communities, civil society organizations, companies and academy. This is crucial to understand the specific challenges the territories face, and to monitor and assess the impacts of actions taken, and thus enable their replication and improvement.

Proposal

a) Challenges

There are multiple challenges that a territorial information system has to face in decision-making and climate actions, such as:

- i)** generate scientific information related to forecasts, impacts and vulnerabilities to climate change, at a territorial scale suitable for decision making;
- ii)** identify, recognize and collect local knowledge and information (from multiple sectors) about impacts, vulnerabilities, and adaptation actions to climate change;
- iii)** translate technical/scientific information into accessible language for non-state and subnational actors;
- iv)** systematize territorial information and knowledge, through accessible platforms, which are designed for non-state and subnational actors from several sectors;
- v)** effectively integrate information and knowledge relevant to the planning cycle of adaptation;
- vi)** ensure a regular update of territorial information, in order to allow constant feedback during the planning cycle of adaptation.

In order for territories to effectively address and respond to climate change, they need to identify their vulnerability; that is, to highlight strengths and weaknesses in relation to the abilities to respond and adapt to climate change, and key intervention points. The territorial actors must understand the critical points or elements that interrupt the delivery of services, must know about the populations and the most vulnerable livelihoods, must have critical infrastructure and be able to identify the places of the territory that can be affected by extreme weather events. Information should also be provided regarding institutional and financial skills to coordinate actions that increase response and recovery capacity, which include actions that increase social cohesion, infrastructure investment, emergency plan generation, protection of local ecosystems, the protection of the population's health and the capacity to generate strategic plans of action

Good Practices Example: Climate Change Risk Map System in Argentina (9-10)

The Ministry of Environment and Sustainable Development (MADS in Spanish) of Argentina, launched the [Climate Change Risk Map System](#) (SIMARCC) in 2017. A publicly accessible digital platform that allows visualization and geo-referencing information at subnational levels (provinces) related to threats and vulnerabilities, in order to produce climate change risk maps under different emissions scenarios (medium and high).

The impact of climate forecasts (temperature, precipitation, heat waves, frost, tropical nights, dry days) can be incorporated to the maps for short and long-term periods (2015-2039; 2050-2100). Consequently, it will determine its influence over different vulnerability aspects (health, environment, infrastructure, socioeconomic conditions, etc.), by using data and information from the Third National Communication of Argentina. Maps can be custom-designed, combining different information layers about climate hazards vulnerabilities, downloaded directly from the site.

This interactive tool allows decision-makers, both from the public and private sector (national government, local and provincial executives, investors, academics, businessmen, etc.) to identify the most vulnerable communities, ecosystems and territories, which are exposed to greater climate change risks. In this way, they can develop public policies and adaptation actions, guide programs and projects, develop territorial planning, risk prevention actions and investment planning for provinces and departments.

b) Proposal: Local Climate Observatories for Territorial Information and Action

In order to integrate information for decision-making at a territorial level, it is necessary to create a System of Local Climate Observatories for Territorial Information and Action (SOLCITA in Spanish). Such observatory system could exist under a national architecture, with territorial subsystems at subnational levels. Therefore, any territory could develop their own observatory. The observatory would create an information system for decision-making with multiple functions that address the challenges; for collecting and generating relevant territorial information and knowledge, and for translating and integrating information in decision-making. As a result, this would provide feedback for the development, implementation and updating of plans and actions. An observatory therefore, has the following objectives: i) to guide policies and actions, through the development and systematization of knowledge, to facilitate cooperation and collaboration between academia, decision-makers and territorial actors from multiple sectors; ii) monitor and assess the impacts of climate change in the territory; iii) facilitate the transmission of knowledge and capacity building between organizations, decision-makers, and territorial actors; iv) serve as a centre for the integration of reliable, quality, available and publicly accessible information and knowledge; v) monitor and assess the implementation and effectivity of adaptation actions.

Good Practices Example: Climate Action Tool in Colombia (11-12)

In Colombia, the Department of Climate Change and Risk Management of the Ministry of Environment has developed an online tool that provides decision-makers and citizens access to information about climate change. [This Climate Change Tool](#) includes: i) climate change scenarios (according to emissions); ii) territorial profile with a general assessment of the territory at a departmental or municipal level; iii) climate situation (precipitation, heat, forests and deforestation); iv) greenhouse gas inventories; v) portfolio of measures for climate change management from adaptation, REDD+ y GHG mitigation; vi) documentary and cartographic support for territorial analysis on climate change; vii) library with relevant documents for climate change management; viii) national indicators system for climate change adaptation.

c) Territorial Information Systems for climate change decision-making

An information system must be able to measure, understand and manage the impact of climate change in local territories. The local impacts of climate change are expressed in different areas (e.g., ecosystems, human health, agricultural activity, disaster safety, economy, etc.) therefore, an information system should include the overall most important impacts for each location. Subsequently, collaboration between a variety of territorial and extraterritorial actors is required, during the management of impacts (adaptation to climate change) in order to build resilience (13-14).

Such actors include local communities, local, provincial, national and international governments, experts and academics, emergency, health and education services, media, among others. Information has to be useful to increase resilience, both in terms of risk prevention, and for response capacity in the event of an emergency or in post-emergency recovery, and also in territorial adaptation to reduce future risks and impacts.

Good Practices Example: Climate Information Systems in Chile (15-18)

Since the beginning of the 20th century, [The Bureau of Meteorology of Chile](#), has been collecting historical data, including climate indices and variables, which have helped the development of different studies and instruments to forecast future climate change information.

The Ministry of the Environment has developed the [Climate Change Digital Platform](#), in order to collect and systematize all climate change information in Chile, including reports and other related materials, by linking the different public information systems in Chile. The most highlighted information includes a baseline of historical data, together with a temperature and precipitation forecast (to 2050), for all the Chilean municipalities. This information was collected from all the existing monitoring stations and other information platforms from the Bureau of Meteorology in Chile.

Moreover, the Ministry of the Environment, together with the Center for Climate and Resilience CR2 (Universidad de Chile), launched the [Climate Simulations Platform](#) in 2018 to provide climate forecasts (precipitation, temperature, humidity, runoff, pressure/sea level, etc.). The platform presents a number of options for generating maps and creating graphs which help in the analysis of climate scenarios for different zones or areas (South America, Chile, and five Chilean macrozones, as well as for dynamically defined polygons or points).

Any information system created for this purposes will be defined according to its Structure, Function and Semiotics. The structure is made up of infrastructure (hardware, software, networks), organization (institutions and people who collaborate), system (platform) policies and procedures which define the information system (or systems). The functions are to acquire, measure, gather, collect, process and distribute. The semiotics have to do with the content of the information system, regarding the different types of data, information and knowledge (19). Infrastructure is necessary to ensure that the system functions are able to fill it with content. For instance, a platform to collect information from different databases: social media to collect academic information, people (investigators, community leaders, etc.) collecting information from local communities. In other words, it crucial to have a procedure that is able to disseminate information and/or knowledge to local users; for example, media that publishes scientific study results about how to protect a neighbourhood from the impacts of extreme rains and floods. In addition, having a system that collects historical data from extreme events, and allows investigators and decision-makers to design plans, programs and effective measures for a specific territory is essential (20).

d) Steps for the development of a territorial information system about climate change

According to Manzano et al. (20), there are a number of steps to follow in order to achieve the development, implementation, and application of an effective system in local decision making:

1) Diagnose and prioritize the local impacts of climate change in each location. This will require analysing available historical data, as well as collecting local knowledge (observations, experiences, actions), to validate the knowledge with the available scientific information.

- 2) Diagnose the current territorial actions and strategies. It is important to be aware of the actions and strategies that the different territorial actors have developed and implemented, to determine their effectiveness, and the territory's level of resilience.
- 3) Perform mapping of territorial and extraterritorial actors who are essential for local climate governance. Local climate management involves a variety of actors: from academia, entrepreneurship, local community managers and civil society, to local, sub-national (provincial, departmental or state) and national governments, both technical and political.
- 4) Diagnose the information system content. Assess the data, information and local knowledge about the impacts and responses to climate change. Identify and collect the existing information, as well as establishing the information gaps on the territory.
- 5) Diagnose the information system functions. It is important to determine the system's capacity in carrying out all its most important functions, according to the needs and context of each territory. Some of the functions are: Acquire / Measure, Gather, Recover, Process (compare, evaluate), and Disseminate. The most important obstacles and facilitating elements for the integration of these functions should be identified.
- 6) Map the information system structure. It is necessary to consider the multiple systems and sources of information, both formal and informal, documented and undocumented, which serve to power this system. Moreover, these sources of information should be mapped: describing the organization, the policies, and the relevant procedures related to them.

Recomendations

In the interest of creating the necessary conditions for the development of a Local Climate Observatory for Information and Action, the following recommendations aim at strengthening the territorial capacities.

a) Strengthening information management and institutional memory capacities of local governments

Strengthening municipal and sub-national governments, by creating and training specialized teams —integrating all municipal organs and areas together with planning instruments and local knowledge— is key for incorporating reliable information in decision-making. Municipal/sub-national teams must receive technical training from academia, State, civil society and other expert institutions.

The lessons learned from past experiences and collective memory (accumulated social knowledge) are fundamental for building resilience abilities. In order to reduce the risk, it is important to be able to internalize past catastrophic experiences to analyse failures and modify actions, and as a result avoid repeating previous mistakes (21).

Municipalities must build institutional memory, which will enable the analysis of municipal actions in the context of current or expected impacts of climate change. The goal is to learn from lessons and improve internal processes. For this, information management is crucial. Having an extensive awareness of the existing human, economic and social capital, existing infrastructure, as well as the social composition and structure, will allow to assess and act more effectively and efficiently.

Local governments must have repositories for collective and institutional memory and records of events and impacts of climate change, so that actions taken before, during, and after the events, can provide lessons beyond political periods. In the event of a disaster, efficient information management is essential for rapid action. This will help to take more appropriate actions in face of future disasters.

Collective and institutional memory, the internalization of learnings from past catastrophic experiences, and adequate information management are essential for building more resilient institutions and communities. Therefore, it is important to have adequate processes, which allow the analysis of municipal internal actions, with processes, channels, and information management systems, to learn and facilitate rapid action in situations of risk and first response, in the event of a disaster.

b) Creation of local knowledge networks and community capacities

Local knowledge and information networks must be created. They should have on the one hand, an internal element which includes work and articulation with other territorial actors from the private sector, citizens and local communities, academia, civil society organizations, and different public services. On the other hand, an external element that allows collaboration, combined efforts and actions together with other territories (at a sub-regional, regional, national and international level). This need arises from the fact that the impacts of climate change are not governed by administrative limits, but rather respond to environments shared between various administrations. Moreover, learning from mistakes, replicating and improving good practices is extremely important. And finally, there are networks at larger scales (national, international) that can provide support with the creation, management and sustainability of information systems, through resources, expertise, technology transfer, or other forms (21).

To achieve the effective development of territorial information systems, it is essential to implement a dynamic working environment with local communities in the context of climate change impacts and challenges. This will result in valuable lessons and learning from experiences, and consequently, strengthening the capacities of both the local government and communities in the event of future impacts. The construction and strengthening of community capacities is key to building resilience and long-term participatory planning that give sustainability to risk management policies of socio-natural disasters, and therefore, mitigate the dangers for the most vulnerable populations in each territory. In addition, these experiences, interaction spaces and communication dynamics, will allow a valuable exchange of information and knowledge. This will be useful for the community to nurture the information system, as well as to share important information that allows communities to increase their resilience and adaptive capacity (21-22).

c) Territorial dialogues about political science to fill information gaps and support local adaptation planning

Facing the impacts of climate change requires local governments to integrate the available scientific information which enables the development of local strategies for climate change. This can only be achieved if there is interaction between the scientific community and local decision-makers. However, enabling this interaction poses a challenge to the current dialogue between the two sectors, and therefore will require methodologies and facilitators in order to ensure an effective interaction. Moreover, it will help to institutionalize interaction processes, and as a consequence achieve a sustainable information system about climate change.

In an attempt to improve integration between science and public policy, requirements and incentives can be developed through academic and/or public service institutions, as a way of encouraging the generation of relevant and useful information for local decision-making. The local management enables the encouragement for creating new structures and integration, communication and union among the municipal and academic actors (23).

It is necessary to establish networking and constant dialogue between local governments and academia, in order to integrate the political science dialogue to the local/municipal context. The aim of this is to identify the main information gaps and respond to the most significant challenges and impacts, providing local concrete solutions. These dialogues will enable collaboration in the design of research projects, which provide territorial information for decision-making, as well as the creation of scientific studies for traditional academic evaluation.

Therefore, it is crucial to summon the local political actors and the academic and scientific actors in working committees for the Local Climate Observatory. This will develop open and constant dialogue about the challenges and solutions of climate change, and by finding common ground between science and politics, they will be able to address each sector's needs with the resources, capacities, and provisions of each other. The results of better communication between science and politics would respond to a great extent, to the demand for information by local decision makers, which would strengthen the implementation of strategic lines of action in the territory (24).

The connection to the academic sector should focus around the information system for decision-making. The possibility of having a system managed jointly should be considered, since it would ensure multiple relevant sources of information, facilitate translation and processing of information in a useful format, and would guarantee an appropriate information management, in terms of planning, action implementation, monitoring and result assessment.

d) Use of the information system for the development of vulnerability diagnosis and local adaptation strategy

Based on the creation of a territorial information system for decision-making and climate action, and in the interaction networks of territorial actors, from academia, civil society, public and private sector and local communities, the territories should be able to generate a vulnerability diagnosis which allows to identify its main issues to face climate change. This diagnosis should be done in collaboration with the local government, members of the community, academia, the private sector and relevant public services. Local governments should lead the process, and they must have municipal technical teams which are trained to use tools that measure vulnerability and the community's adaptive capacity, integrating information and local knowledge. In this way, the process uses the information and knowledge available in the information system, while generating new information and knowledge that feeds back into the system and territorial planning processes.

The process should have a qualitative approach, through which communities and municipal teams define their priorities regarding climate change adaptation and risk reduction. Also, those members who are especially susceptible to the negative effects related to the climate will be identified (neighbours that could be affected by high temperatures, floods, among others; due to preconditions of poverty, health and access to services).

The community and municipal officials should also identify those places within the communal territory which are under higher risk of suffering floods, heat islands, fires, epidemic outbreaks, etc., due to certain physical conditions and the consequences of urban growth. The municipal technical team should also identify pressures associated with climate change which affect or have affected the delivery of services and the operational capacity of municipal departments. For example: floods which stop transport and affect infrastructure, flooded houses and fallen trees, or the increase in the price and demand of water to sustain communal green areas, especially during summer).

The results of this analysis should be summarized very simply using accessible vocabulary, in order to share the key messages to all the municipal and communal actors. In addition, results should be integrated in the decision-making process through the territorial information system, taking into consideration how the local development process may be affected by vulnerability in climate change, and how to integrate information in the different planning instruments.

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