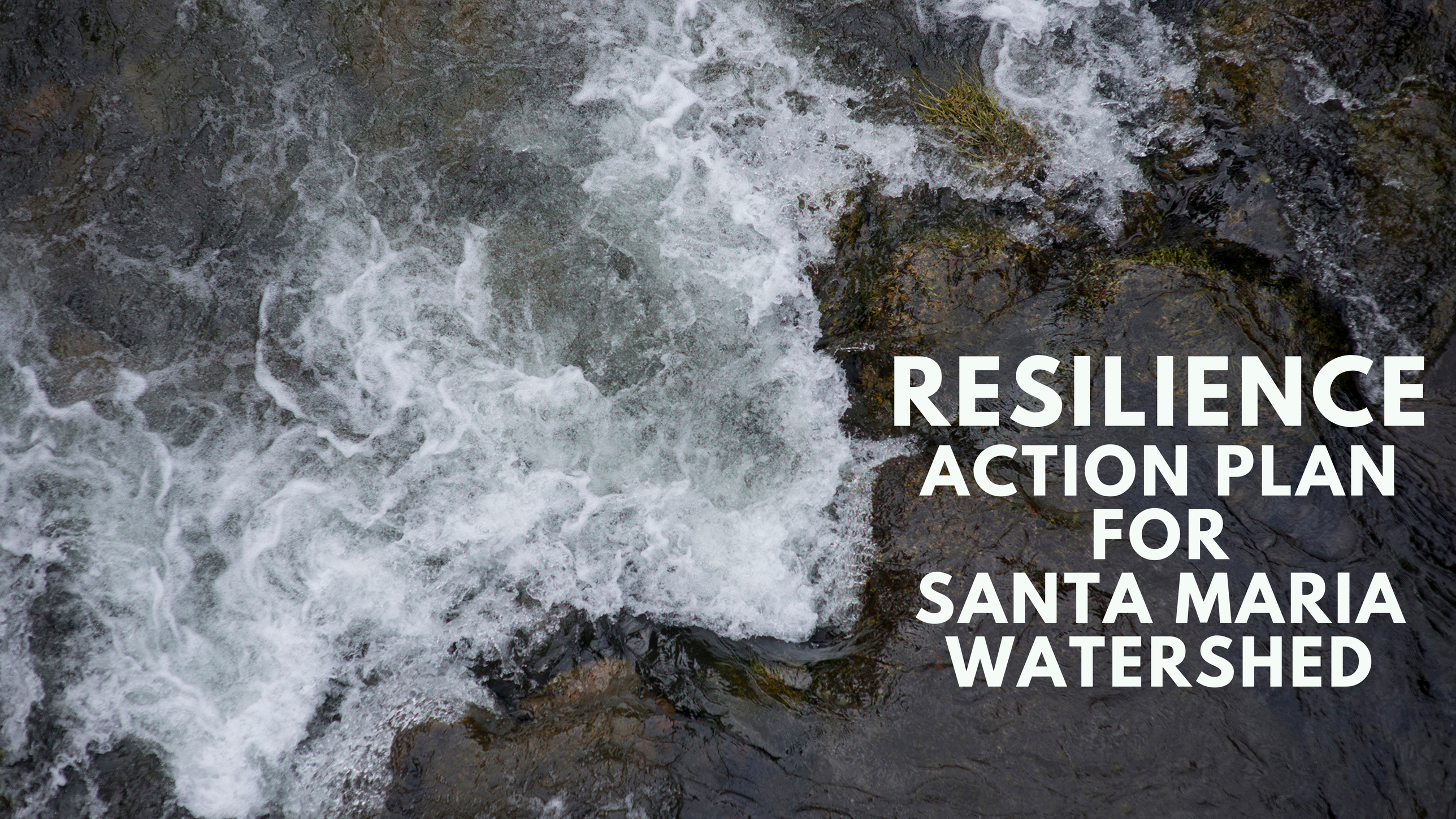

RESILIENCE
ACTION PLAN FOR SANTA MARIA WATERSHED


Adaptation Research Alliance


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INDEX

STATE OF THE CLIMATE IN SANTA MARIA WATERSHED

The climate in Panama is determined by three factors: geography, oceanography and meteorology. Geography refers to latitude, longitude, altitude, relief and continentality, linked to the influence that the sea has on any point on the earth's surface. The Intertropical Convergence Zone (ITCZ) contributes greatly to the definition of climate. Its north-south and south-north displacement define two periods, the dry and the rainy.

The hydrographic Watershed of the Santa María River presents the following types of climate:

Type of Climate	Area (Km2)	%
Oceanic Tropical Climate	411,18	12
Medium and High Mountain Tropical Climate	222,55	7
Low Mountain Oceanic Climate	37,17	1
Sub-equatorial climate with dry season	1659,94	50
Tropical Climate with a Long Dry Season	1033,56	30
TOTAL	3,3363.45	100

Oceanic Tropical Climate

It is recorded to the north of the basin, and is characterized by annual average temperatures that range between 25 ºC and 27 ºC. The influence of the trade winds (north) determines rainfall throughout the year with maximums of up to 4000mm.

Medium and High Mountain Tropical Climate

This strip extends above 1,600 meters above sea level and stands out for having low temperatures at night. At 3,000 meters above sea level, it is estimated that the average temperature is between 10 °C and 11 °C and in the early morning it can approach 0 °C. Mountain rains are heavy.

Low Mountain Oceanic Climate

Towards the northwest, it has a cold high altitude climate and is influenced by the trade winds and its precipitation is significant. A very short dry season stands out (a few weeks in February), its average annual temperature is estimated at 18 °C and rainfall totals are approximately 3,710 mm per year. Rains of fine drops called "bajareques" are frequent, as well as the formation of rainbows.

Sub-equatorial climate with dry season

It is presented as the climate with the greatest extension in Panama and is the most representative in the hydrographic basin of the Santa María River (49.35%), especially in its middle part. Annual precipitation is below 2,500 mm to 1,122 mm. Average temperatures range from 26°C to 27°C. In this climate, the dry season is short and pronounced, lasting 3 to 4 months.

Tropical Climate with a Long Dry Season

Towards the mouth of the basin, the lower part, there is a tropical climate with a prolonged dry season, typical of the Panamanian central Pacific (area of the Dry Arch). It is characterized by being warm with average temperatures ranging between 27ºC and 28ºC, and low rainfall (below 1500mm per year). The dry season is marked, with strong winds, low relative humidity, and high evaporation

Precipitation

According to the water balance, the basin registers an average annual rainfall of 2,091 mm. The spatial distribution of rainfall is heterogeneous and there are two nuclei of high rainfall, especially to the northeast in the area of La Yeguada, with rainfall between 2,500 and 4,000 mm. From the center of the basin towards the coast, rainfall drops to values of 1,400 mm per year. 90% of the rain occurs during the months of May to November, and the remaining 10% from December to April, approximately.

Temperature

The annual mean for the Santa María river basin varies with a range between 17.21 and 27.74 degrees centigrade (°C), with a mean of 26.30 °C and a standard deviation of 1.68. The maximum temperatures occur in the middle part of the basin, downwards, with a range between 27.21°C and 27.74°C. The lowest values occur in the upper part to the north of the basin with minimums between 17.2°C and 20.64°C.

Climate Change Scenarios

Changes in average precipitation

Based on the period 1985-2018 of the data collected by meteorological stations in the basin, it can be compared with the scenario precipitation. The behavior of precipitation in the Santa María river basin in this period of time is shown as a percentage. An average decrease of 18.7% is expected, with a maximum decrease of 36.6% towards the northeast of the basin, with a minimum rise of 0.47%.

Changes in temperature

Based on the temperature of the period 1985-2018, it can be compared with the average temperature of the scenario. A percentage that shows the behavior of precipitation in the Santa María river basin is compared. An average increase of 4.0% is expected, with a maximum increase of 14.5% in the upper part and a decrease of -1, in the central part


COLLECTIVE KNOWLEDGE
FOR ADAPTATION FOR
CLIMATE CHANGE
FAMILY FARMING


Adaptation Research Alliance
FASHION

Co-Creation Workshop for the Construction of Collective Knowledge for Adaptation to Climate Change focused on Family Farming in the Upper Part of the Santa María Basin

Outcomes

Participated 40 Family Farmers that within their crops they produce: coffee, citrus and vegetables from the Corregimiento of El Alto, Municipality of Santa Fe, Veraguas

- Agroforestry Systems, with native tree species such as Cedar and Mahogany

- Living and Dead Barrier, to conserve the soil, within some of the species that are used are plantain, pineapple and lemongrass.

- Organic fertilizers such as Crece Verde, Bocachi, Compost and Wormcompost

- Pest Control through Local Plants, in which they use, for example, some crops such as onions as an ingredient to combat insects

- Use seeds and species that can adapt to climate change, for example some varieties of coffee, that are more resistant to high temperatures and pests

- Eliminating ground burning

- Diversification with native, fruit and timber species


DISASTER RESILIENCE TOOL

Co-creation Workshop with the Santa Maria Watershed Committee for implement the Disaster Resilience Tool, Risk Estimation and Fomulation of Action Plan

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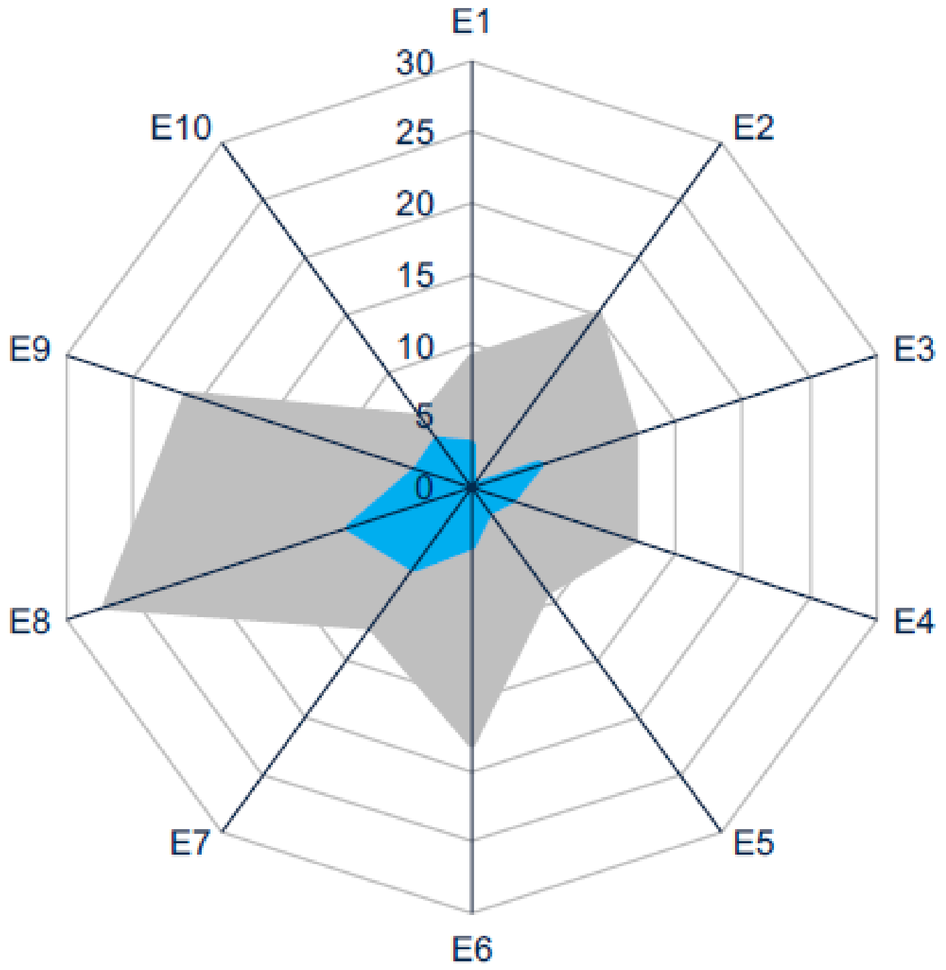
CONTEXT

This Tool provides a set of assessments that will allow territory to monitor and review progress and challenges in the implementation of the Sendai Framework for Disaster Risk Reduction: 2015-2030, and assess their disaster resilience. It is structured around UNDRR's Ten Essentials for Making Cities Resilient.

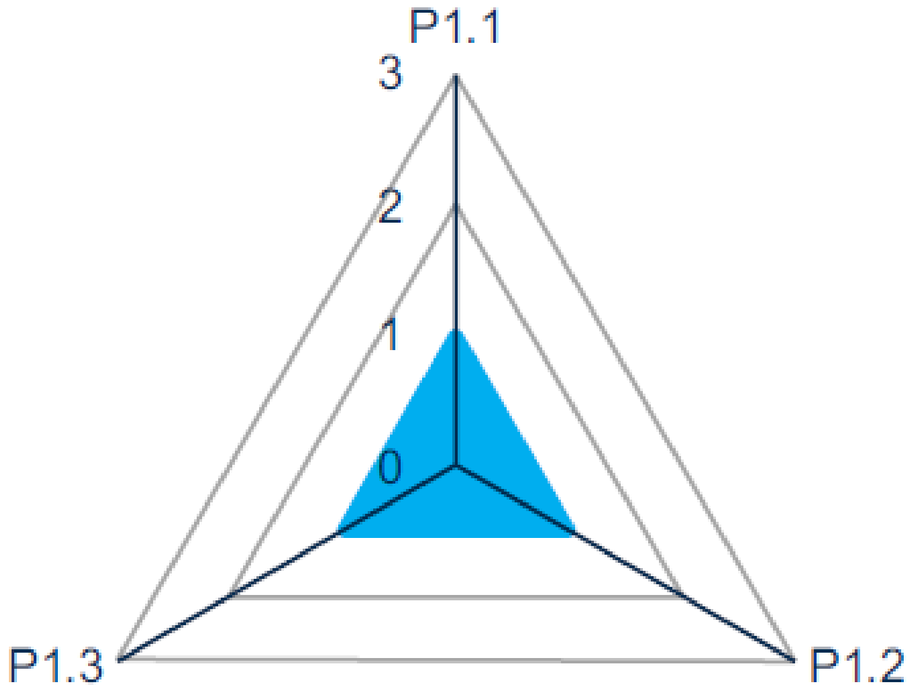
Responding to key Sendai Framework targets and indicators, and with some critical sub-questions. This approach is suggested for use in a 1 to 2 day, multi-stakeholder workshop. In total there are 47 questions / indicators, each with a 0 – 3 score.

OUTCOMES

THE OVERALL SCORE FOR THIS ASSESSMENT IS 41 / 141



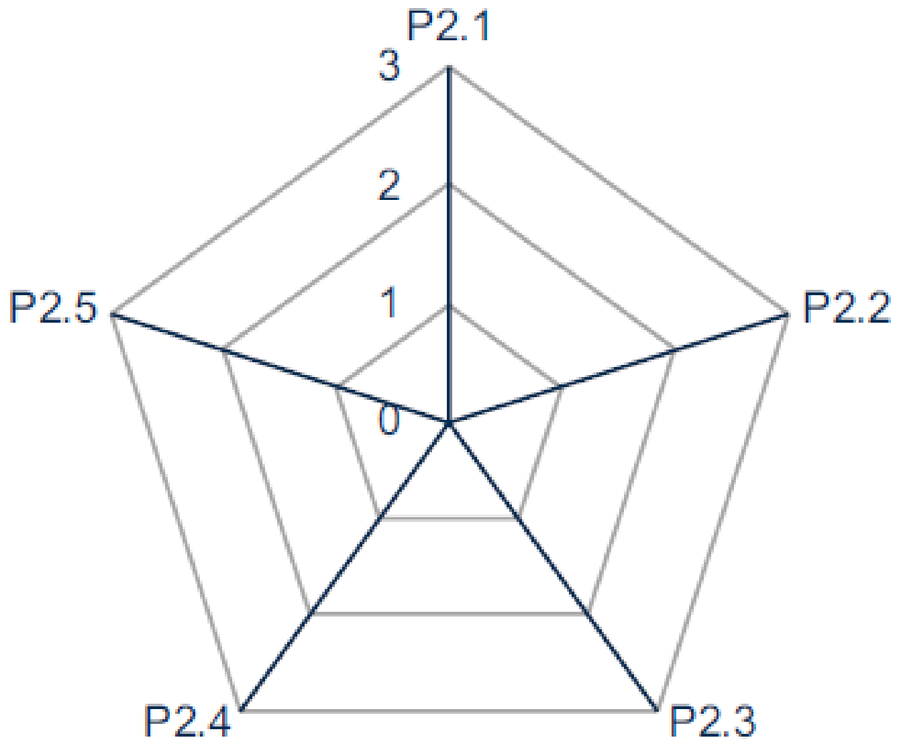
Essential 01: Organize for Resilience



P1.1 – Plans offering partial compliance with Sendai Framework and covering some of the Ten Essentials
1

P1.2- Is there a multi-agency/sectoral mechanism with appropriate authority and resources to address disaster risk reduction
1

P1.3 - Is resilience properly integrated with other key basin functions / portfolios?
1



Essential 02: Identify, Understand and Use Current and Future Risk Scenarios

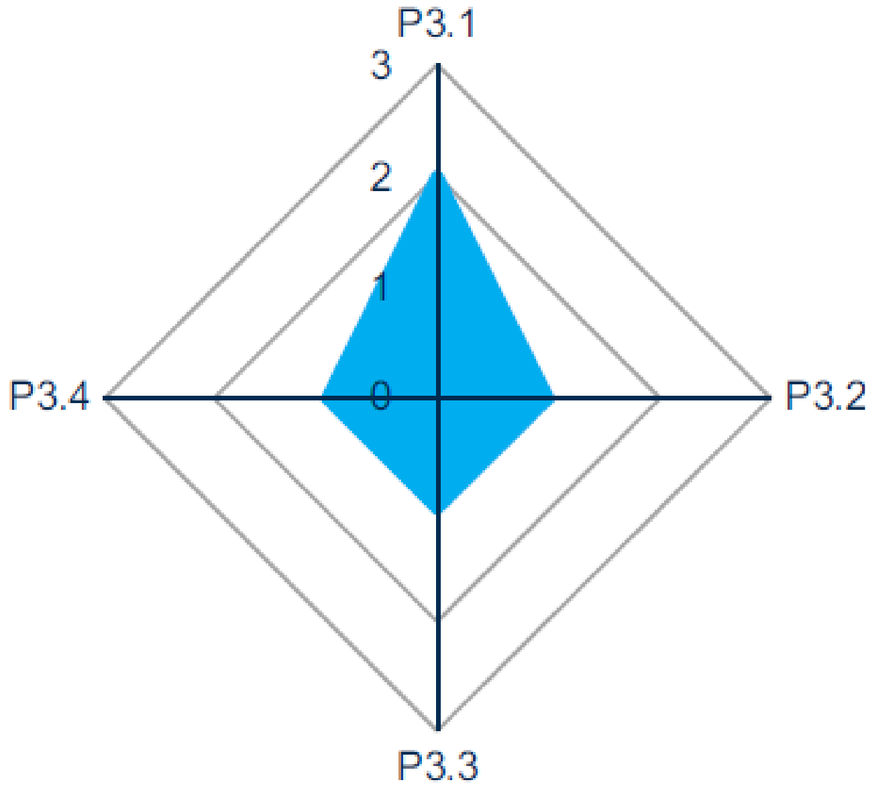
P2. 1- Does the basin have knowledge of the key hazards that the basin faces, and their likelihood of occurrence? 0

P2. 2 - Is there a shared understanding of risks between the basin and various utility providers and other regional and national agencies that have a role in managing infrastructure such as power, water, roads and trains, of the points of stress on the system and city scale risks? 0

P2.3 -Are their agreed scenarios setting out basin-wide exposure and vulnerability from each hazard, or groups of hazards ? 0

P2.4 -Is there a collective understanding of potentially cascading failures between different basin and infrastructure systems, under different scenarios? 0

P2.5- Do clear hazard maps and data on risk exist? Are these regularly updated? 0



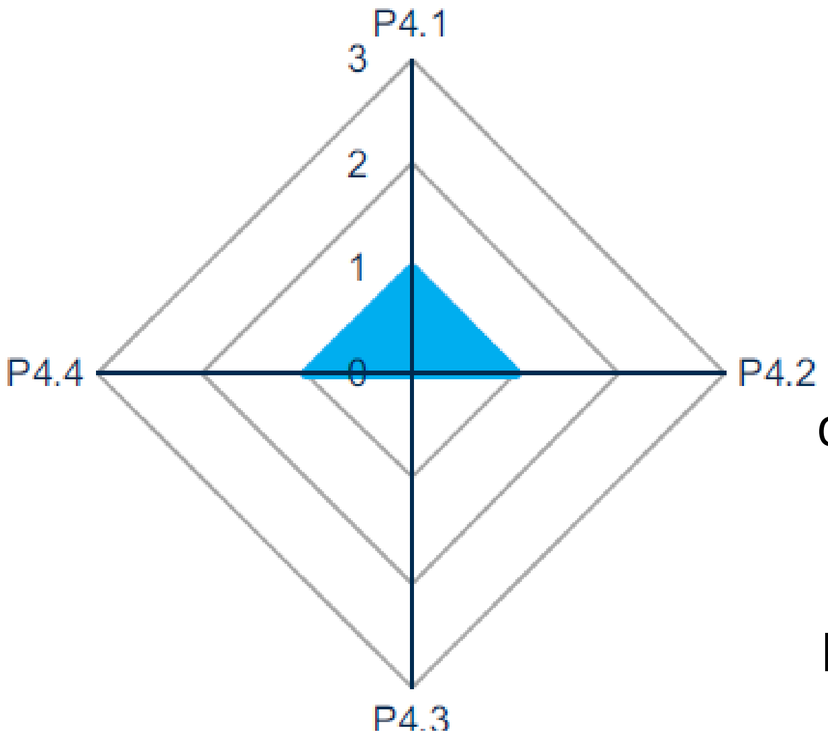
Essential 03: Strengthen Financial Capacity for Resilience

P3.1- The basin / lead agencies understand all sources of funding, and the “resilience dividends”, are well connected,understand all available routes to attract external funding and are actively pursuing funds for majors resilience investments. 2

P3.2- Does the basin have in place a specific ‘ring fenced’ (protected) budget, the necessary resources and contingency fund arrangements for local disaster risk reduction (mitigation, prevention, response and recovery)? 1

P3.3 -What level of insurance cover exists in the basin, across all sectors – business and community? 1

P3.4- What incentives exist for different sectors and segments of business and society to support resilience building? 1



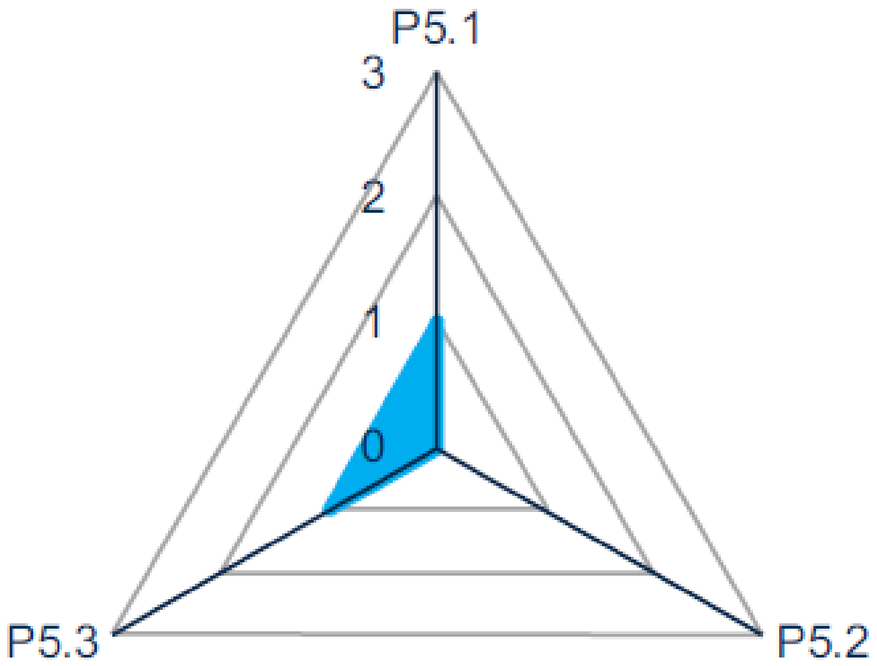
Essential 04: Pursue Resilient Urban Development

P4.1-Is the basin appropriately zoned considering, for example, the impact from key risk scenarios on economic activity, agricultural production, and population centres? 1

P4.2 - Are approaches promoted through the design and development of new urban development to promote resilience? 1

P4.3 -Do building codes or standards exist, and do they address specific known hazards and risks for the basin? Are these standards regularly updated? 0

P4.4- Are zoning rules, building codes and standards widely applied, properly enforced and verified? 1

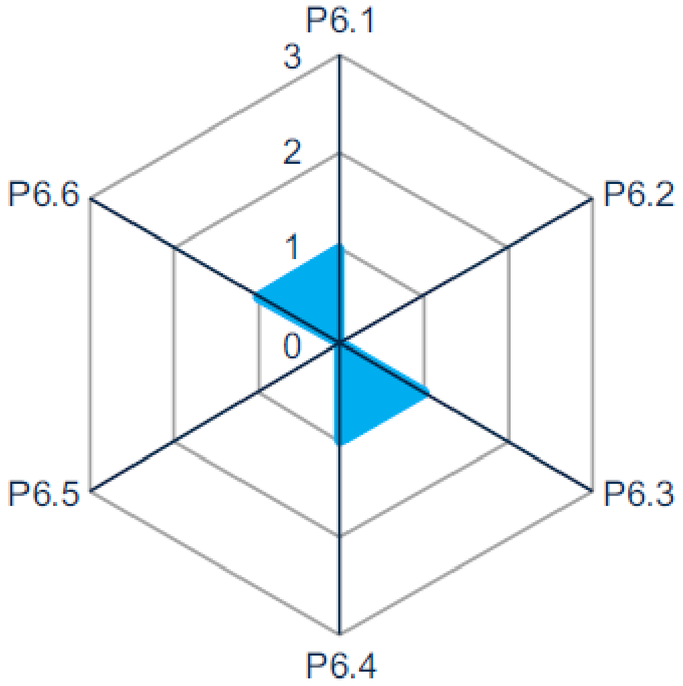


Essential 05: Safeguard Natural Buffers to Enhance the Protective Functions Offered by Natural Ecosystems

P5.1- Beyond just an awareness of the natural assets, does the basin understand the functions (or services) that this natural capital provides for the basin? 1

P5.2-Is green and blue infrastructure being promoted on major urban development and infrastructure projects through policy? 0

P5.3- Is the basin aware of ecosystem services being provided to the citys from natural capital beyond its administrative borders? Are agreements in place with neighbouring administrations to support the protection and management of these assets? 1



Essential 06: Strengthen Institutional Capacity for Resilience

P6.1 - Does the city have clear access to all the skills and experience it believes it would need to respond to reduce risks and respond to identified disaster scenarios? 1

P6.2-Does a co-ordinated public relations and education campaign exist, with structured messaging and channels to ensure hazard, risk and disaster information (that can be understood and used) are properly disseminated to the public? 0

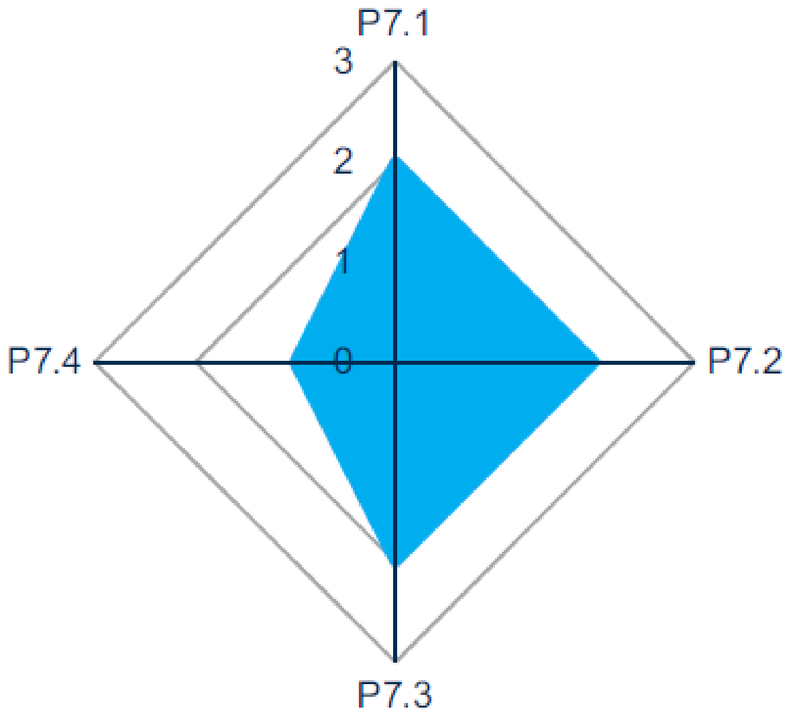
P6.3- Extent to which data on the basin resilience context is shared with other organizations involved with the basin resilience. 1

P6.4- Are there training courses covering risk and resilience issues offered to all sectors of the basin including government, business, NGOs and community? 1

P6.5- Are training materials available in the majority of languages in common use in the city? 0

P6.6- Is the basin proactively seeking to exchange knowledge and learn from other cities facing similar challenges? 1

Essential 07: Understand and Strengthen Societal Capacity for Resilience

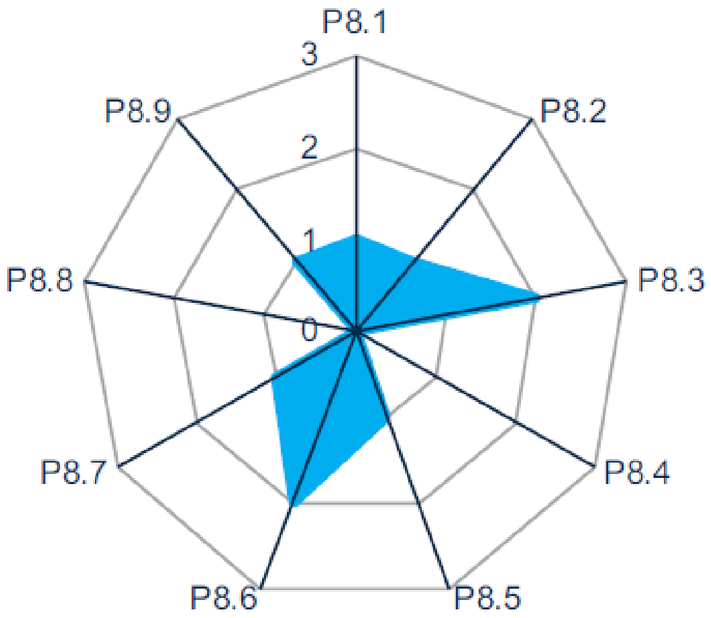


P7.1- Are “grassroots” or community organizations participating in risk reduction and post-event response for each neighbourhood in the basin ? 2

P7.2- Are there regular training programmes provided to the most vulnerable populations in the basin ? 2

P7.3- What proportion of businesses have a documented business continuity plan that has been reviewed within the last 18 months? 2

P7.4- How effective is the basin at citizen engagement and communications in relation to DRR? 1



Essential 08: Increase Infrastructure Resilience

P8.1-Is critical infrastructure resilience a basin priority, does the basin own and implement a critical infrastructure plan or strategy? 1

P8.2-Is existing protective infrastructure well-designed and well-built based on risk information? 1

P8.3- Would a significant loss of service for these two essential services be expected for a significant proportion of the basin under the agreed disaster scenarios? 2

P8.4-Would a significant loss of service be expected for a significant proportion of the basin in the ‘worst case’ scenario event? In the event of failure would energy infrastructure corridors remain safe (i.e. free from risk of leaks, electrocution hazards etc.)? 0

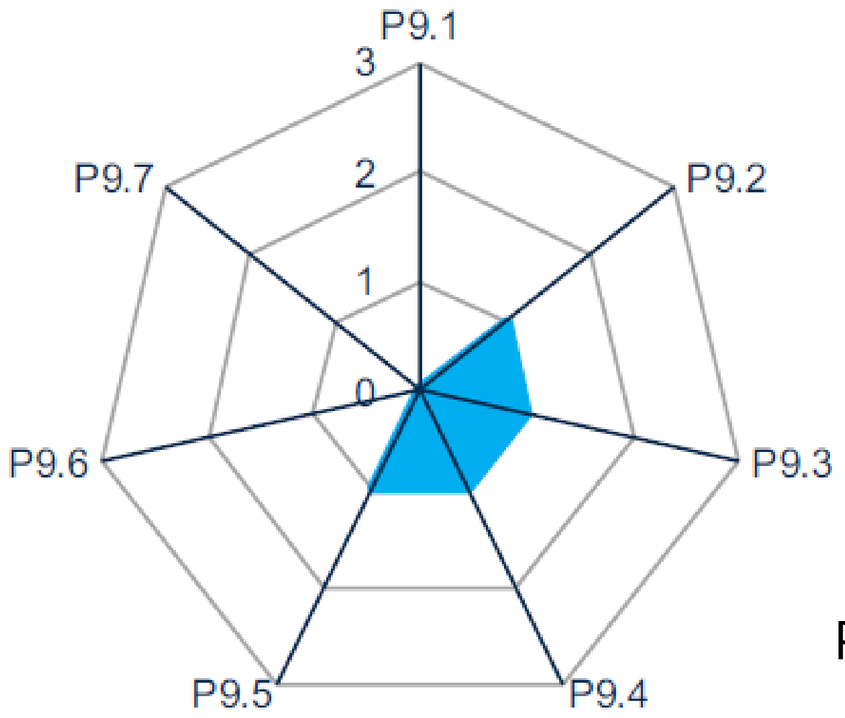
P8.5- Would a significant loss of service be expected for a significant proportion of the basin in the ‘worst case’ scenario event? In the event of failure would transport infrastructure corridors remain safe (i.e. free from risk of flood, shocks etc) and passable? 1

P8.6-Would a significant loss of service be expected for a significant proportion of the basin in the ‘worst case’ scenario event? 2

P8.7-Would there be sufficient acute healthcare capabilities to deal with expected major injuries in ‘worst case’ scenario? 1

P8.8- % of education structures at risk of damage from “most probable” and “most severe” scenarios 0

P8.9-Will there be sufficient first responder equipment, with military or civilian back up as required? 1



Essential 09: Ensure Effective Disaster Response

P9.1-Does the basin have a plan or standard operating procedure to act on early warnings and forecasts? What proportion of the population is reachable by early warning system? 0

P9.2-Is there a disaster management / preparedness / emergency response plan outlining city mitigation, preparedness and response to local emergencies? 1

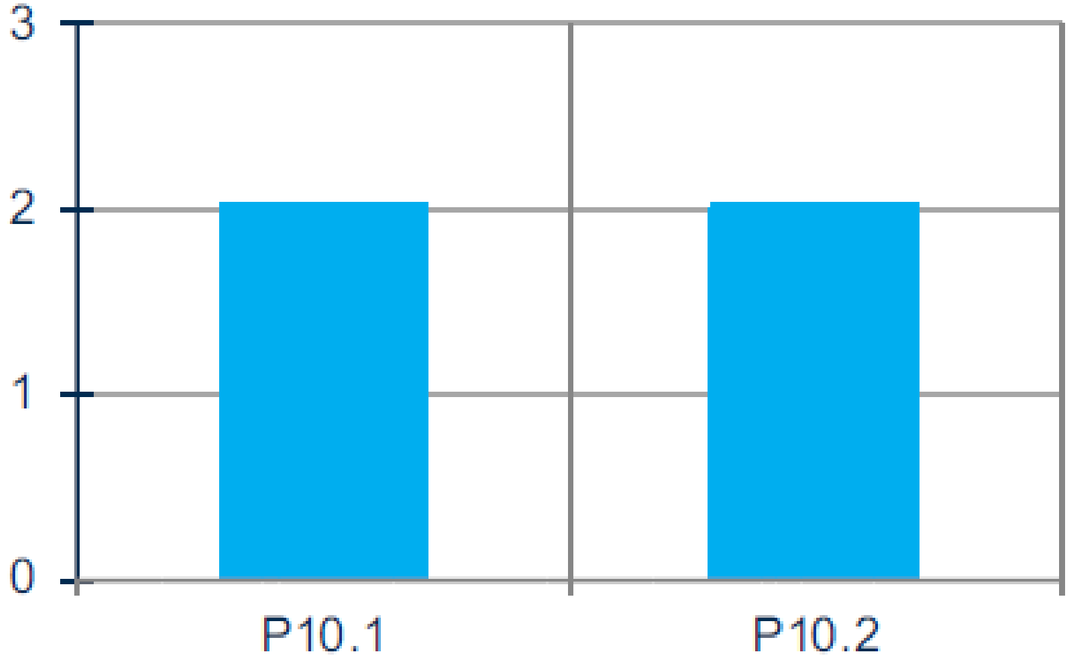
P9.3-Does the responsible disaster management authority have sufficient staffing capacity to support first responder duties in surge event scenario?1

P9.4-Are equipment and supply needs, as well as the availability of equipment, clearly defined? 1

P9.5- Would the basin be able to continue to feed and shelter its population post-event? 1

P9.6-Is there an emergency operations centre, with participation from all agencies, automating standard operating procedures specifically designed to deal with “most probable” and “most severe” scenarios? 0

P9.7-Do practices and drills involve both the public and professionals? 0



Essential 10: Expedite Recovery and Build Back Better

P10.1-Is there a strategy or process in place for post-event recovery and reconstruction, including economic reboot, societal aspects etc.? 2

P10.2- Do post-event assessment processes incorporate failure analyses and the ability to capture lessons learned that then feed into design and delivery of rebuilding projects? 2

RISK ESTIMATION

AREA	THREAT	VULNEARABLE SECTOR
Upper Part Santa Fe	Floods Landslides Winds Droughts Pollution	Agricultural Water Public Infrastructure
La Yeguada	Floods Forest Fires Landslides	Agricultural Forest
Los Valles	Forest Fires Wind Pest Landslides	Water Agricultural Households Biodiversity Forest

AREA	THREAT	VULNEARABLE SECTOR
Middle Part	Fires Floods Winds Pollution Landslides	Agricultural Households Public Infrastructure
Low Part	Floods Fires Pest Droughts Winds Pollution	Agricultural Health Households Environmental Biodiversity


ACTION PLAN

Action 1

Protection of water recharge areas

Justification

In the hydrographic basin of the Santa María River, the hydric recharge zones are not adequately protected or conserved, and in the cases where agricultural activities take place, the necessary measures are not taken so that they develop their process of capturing and infiltration of water in the ground. The protection will ensure the availability of water in sources that depend on recharge

Coverage:

Upper and middle part of the hydrographic basin of the Santa María River

Objective of the Action:

Maintain or increase the water supply, through the protection and conservation of water recharge areas to contribute to climate change adaptation measures

Activity:

-Identification and spatial delimitation of water recharge zones

- Definition of protection measures based on the application of conservation practices, forest recovery and others.

- Design of a protection strategy based on the establishment of good practices and financial incentives.

Action 2

Diversification of crops adapted to climate change

Justification:

Agricultural production in the hydrographic basin of the Santa María River is based on traditional types of crops, some of which have lowered their yields due to the effects of climate change, consequently it is important to value new species that adapt to the new climatic conditions.

Coverage:

The entire hydrographic basin of the Santa María River

Objective of the Action:

Promote the adoption of new crops that are more resistant to climate change or that adapt to prevailing climate conditions

Activity:

-Diagnosis of diversification needs and their receptivity.

- Inventory of alternatives for crop diversification

- Training in the management of new crops.

- Implementation of demonstration farms

Action 3

Agroforestry and silvopastoral systems

Justification:

Degradation and loss of soil fertility, as well as loss of biodiversity, due to intensive agricultural production and the use of land not according to its capacity.

Coverage:

Upper and middle part of the hydrographic basin of the Santa María River

Objective of the Action:

Contribute to the recovery of degraded soils or in the process of degradation due to poor land use, increasing the ecosystem benefits resulting from the implementation of these systems.

Activity:

-Identification and selection of sites and species most favorable to the conditions of the basin

-Establishment and management of silvopastoral and agroforestry systems with species adapted to climate change.

-Recovery of degraded pastures and improvement of associated crops in agroforestry systems

Action 4

Fire control in dry season

Justification:

In the hydrographic basin of the Santa María River, among the agricultural practices for preparing the land for sowing, the use of fire is used, which coincides with dry periods, prior to sowing and the presence of rains. This practice helps to clean weeds, but eliminates biodiversity in the soil, makes the soil vulnerable to erosion, in addition to the generation of gases (carbon monoxide).

Coverage:

The whole basin

Objective of the Action:

Train and provide alternatives to farmers to carry out alternative practices to the use of fire.

Activity:

- Make a diagnosis to find out the reasons or factors why farmers carry out this practice.
- Demonstrate to farmers and local authorities the negative elements of using this practice
- Identify the alternatives and define with the farmers those that can be put into practice, and train the farmers in the application of the practices, emphasizing the benefits

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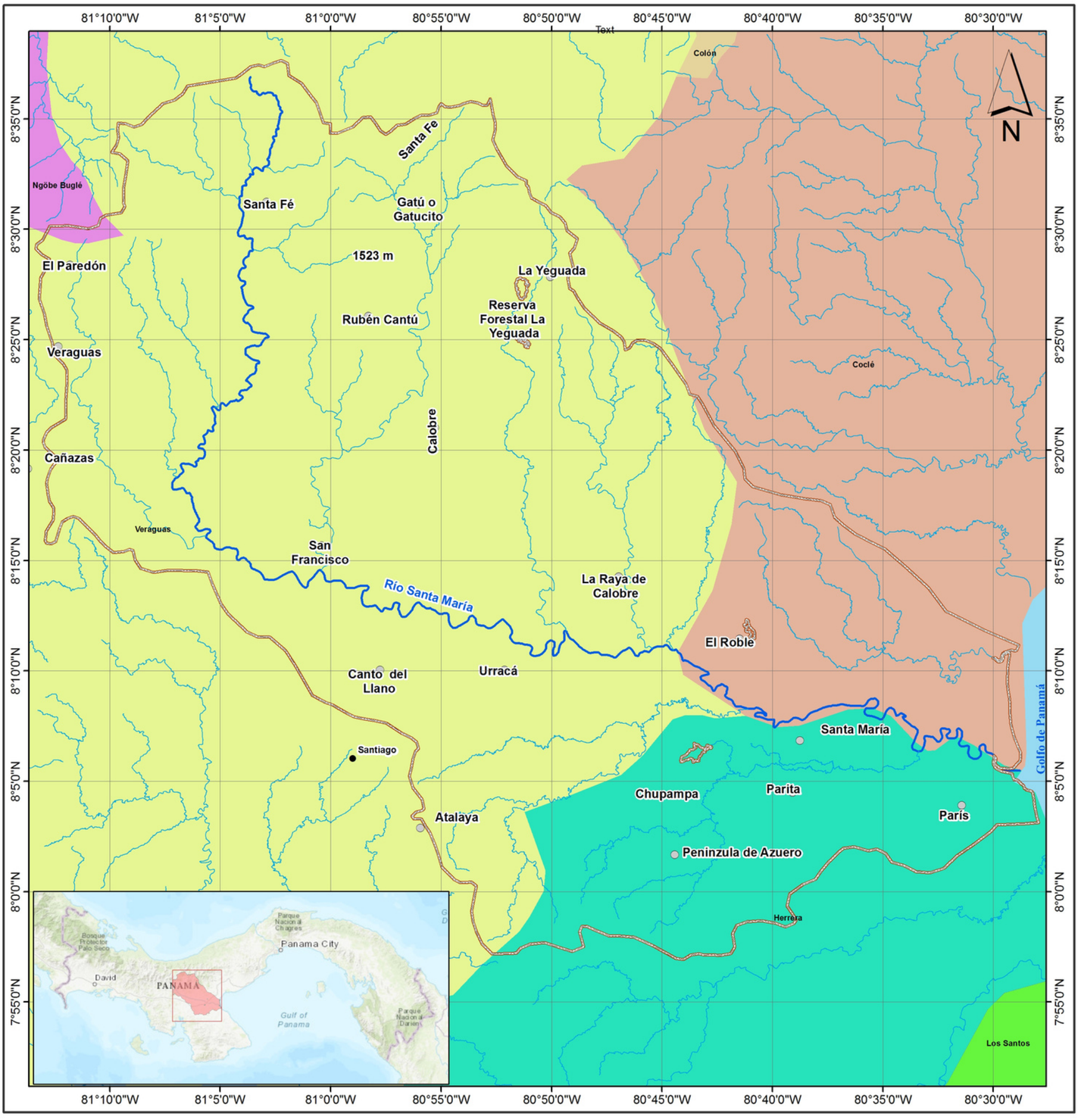
Mapa de Cuenca Río Santa María



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Erina Libertad
Macarena Urchipia Giúdice
Arcadio Camaño Duartes
Wilmer Alberto Rodríguez

0 4,6 9,2 18,4 km

Leyenda

- Cuenca Río Santa María
  Área total: 3,367.98 km2
- Río Santa María
  Longitud: 174.84 km
- Otros Afluentes

Provincias

- Coclé
- Colón
- Herrera
- Los Santos
- Ngöbe Buglé
- Veraguas