

WATER



on the Eastern Cape, Baja California Sur, Mexico

Watersheds of Los Planes, San Bartolo, Santiago and Cabo Pulmo

A report based on the research of Dr. Arturo Cruz Falcón,
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WATER

on the Eastern Cape, Baja California Sur, México.
Watersheds of Los Planes, San Bartolo, Santiago y Cabo Pulmo
Baja California Sur, 2021

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This report summarizes three years of research and presents the latest data on one of the most essential resources in the world, especially for the Eastern Cape region of Baja California Sur, Mexico: water.

We put this information in your hands so you have the facts to inform your decisions about the future of this region.

These are the main findings of this research by specialists on the subject:

1. Currently water use rights have granted more water than we have available.
2. In 20 years we will need at least 46% more water than we have.
3. We have limited information about the water quality of the wells in the region.
4. Accelerated growth has been observed on the Eastern Cape, so more studies and information are needed to plan for the future and prevent a water crisis.
5. There are different ways to get more water. We must evaluate their economic, social and environmental advantages and disadvantages.

The good news is that with this information we can make a difference for our homes and in the community!

How? By using the information to plan today for a bright future for the Eastern Cape.



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Why the Eastern Cape?

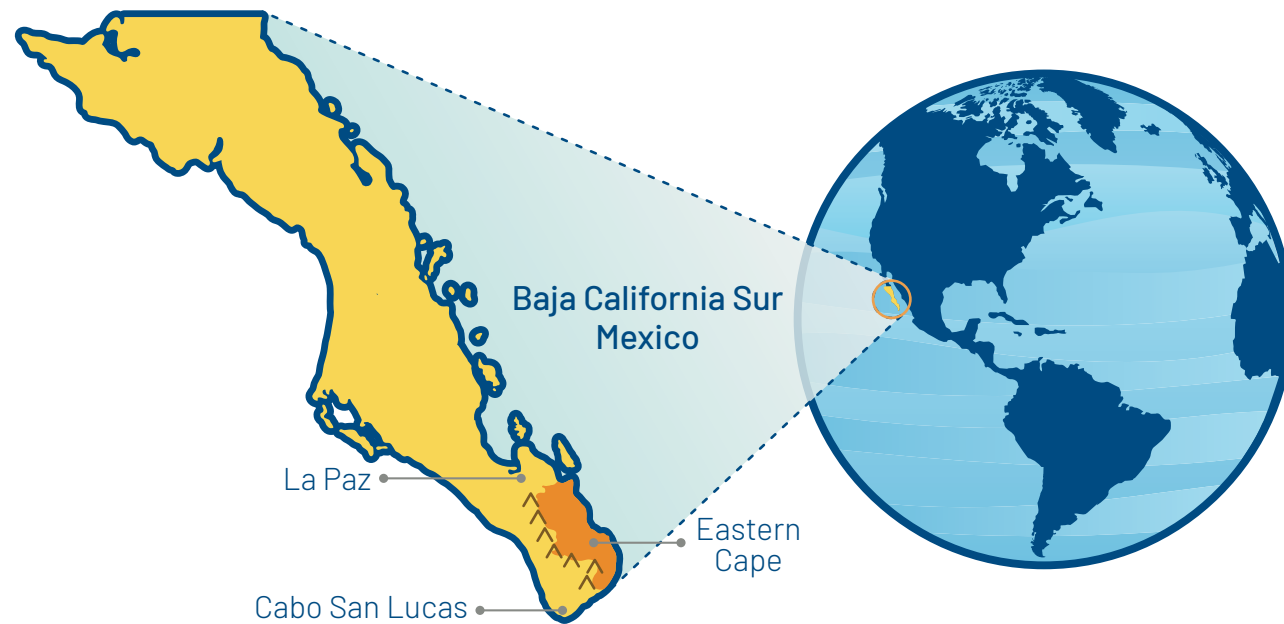
This region of magnificent beauty has important natural reserves such as the Cabo Pulmo National Park and the Sierra la Laguna mountains which are both World Heritage Sites. Currently, the accelerated growth in real estate increases the demand for the Eastern Cape's most precious resource: water.

For centuries this region has been inhabited by small traditional fishing and agricultural populations.

But currently, its natural attributes and its proximity to La Paz and Los Cabos attract investors with large construction projects.

The fate of this region and the life of its small communities may be uncertain.

In this report we define **the Eastern Cape** as the region located in the midst of La Paz and San José del Cabo, the Sierra La Laguna and the Gulf of California.



Ask yourself, what we can do to create the region and communities that we want?



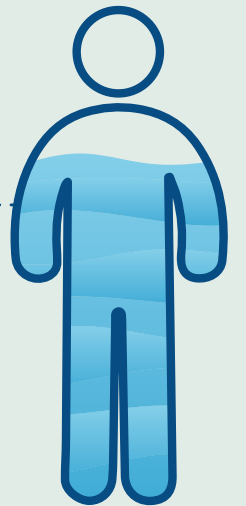
Why is water important?

Ask yourself, what we can do to create the region and communities that we want?



The surface of the planet and our bodies

are **70%** water



However, of all the water that covers the world, only 2.5% is fresh water, and most of it is trapped in ice or underground.



Fresh water

is a small part of the water on the planet

only 1% is available for human use

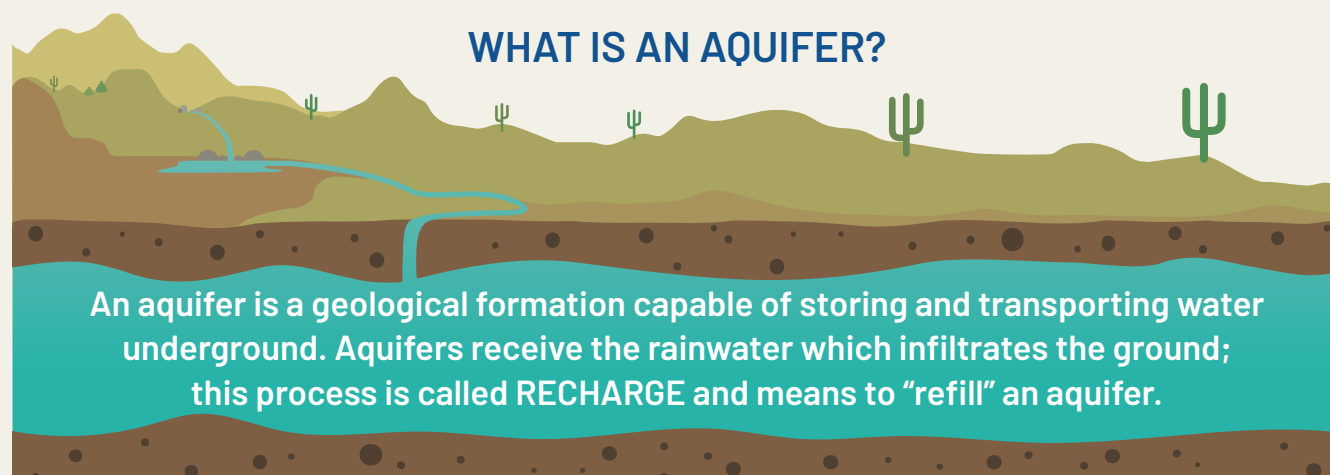
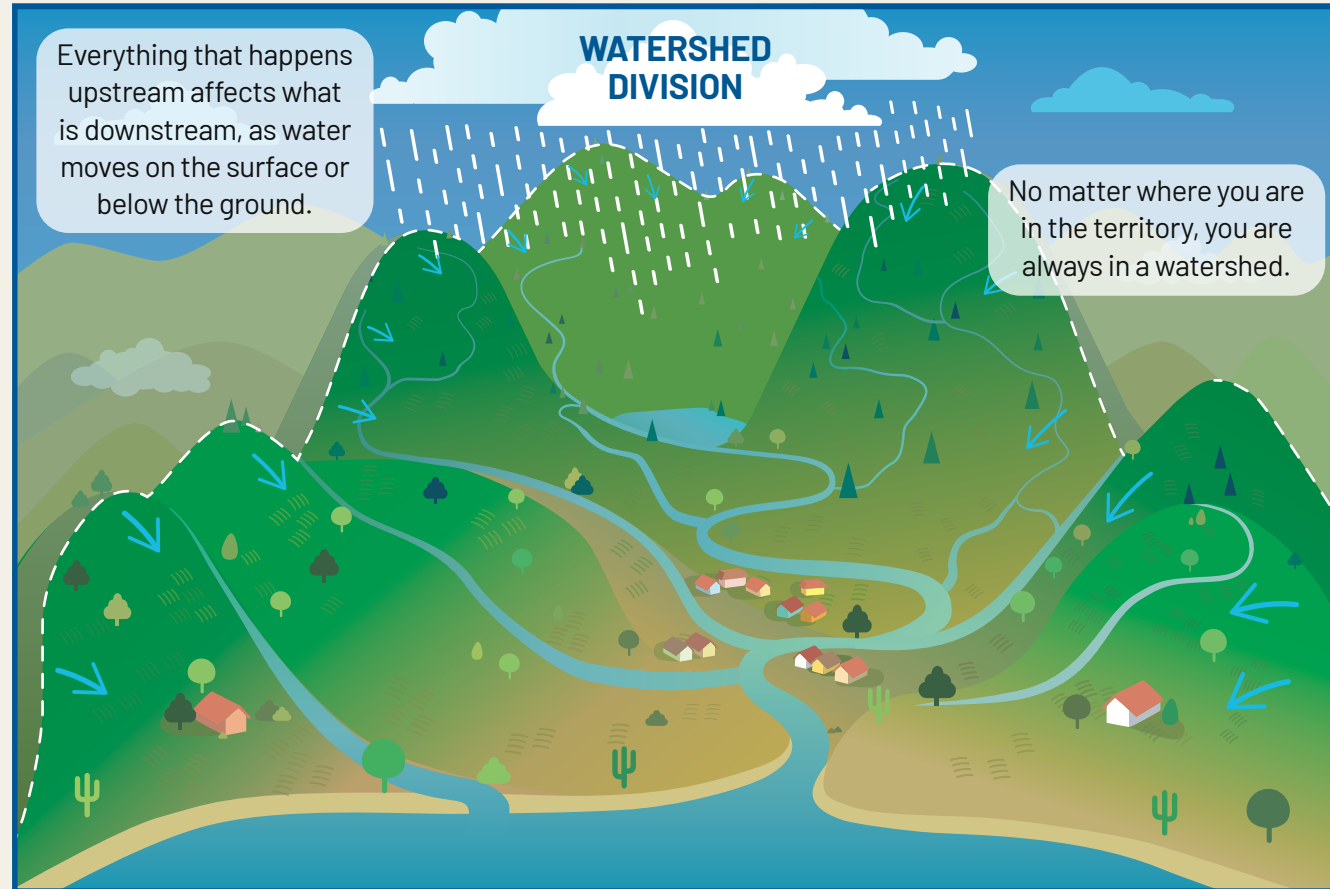


But if water is so important, how much do we know about it?



What is a watershed basin?

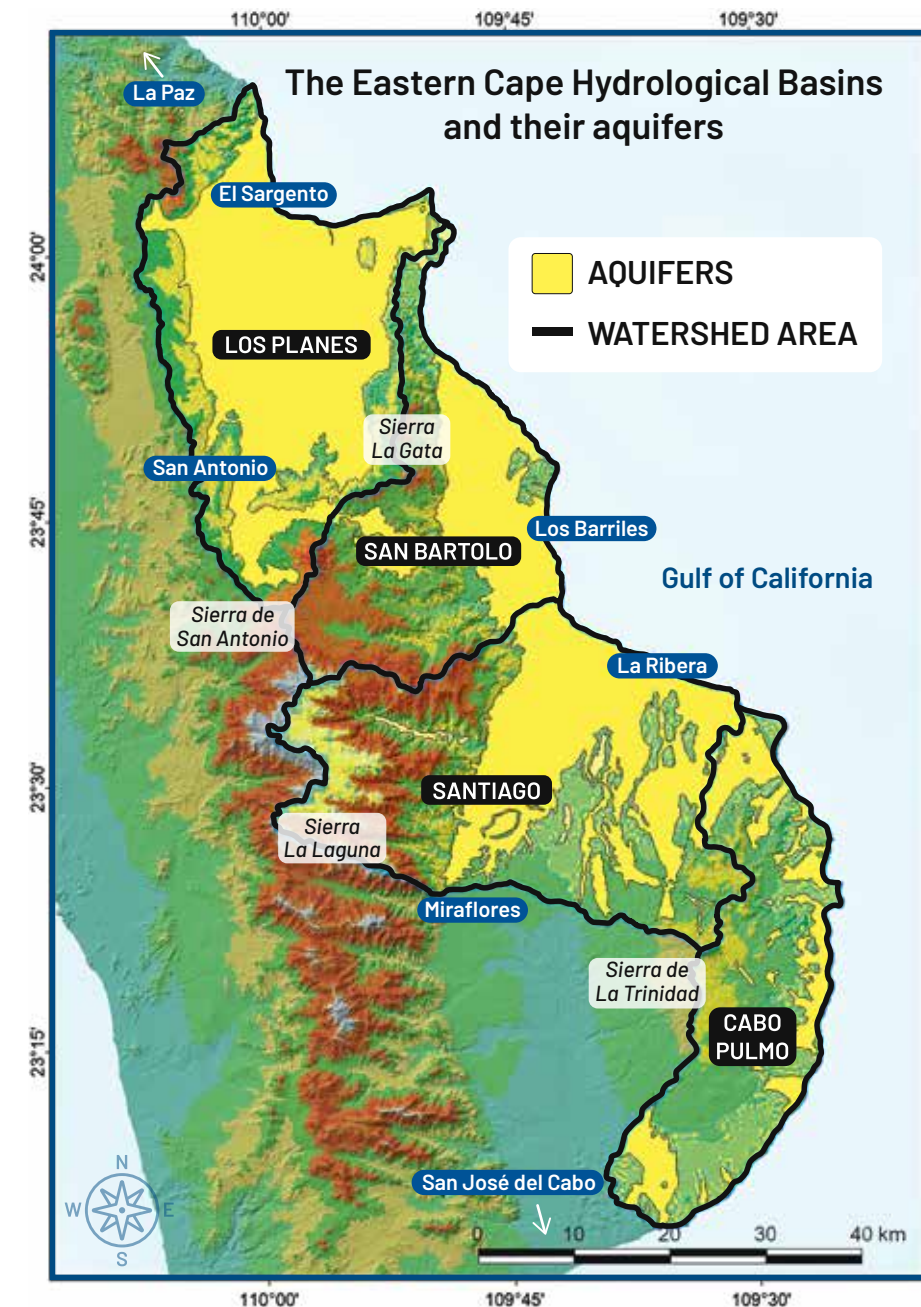
It is an area where water flows from higher land (like mountains) to a lower level where it runs into a river, lake, sea, or another body of water (dam or reservoir). It works like a funnel that delivers the rainwater and recharges (refills) the aquifers.



More information on page 26

Watersheds and Aquifers of the Eastern Cape

In Baja California Sur 42 hydrological basins are defined, of which 4 comprise the Eastern Cape region: Los Planes, San Bartolo, Santiago and Cabo Pulmo.



The water in this region comes mainly from the rain that falls on the high areas of the mountains.

It is estimated that a total of **47.1 Mm³** (million cubic meters) of water is recharged each year in the aquifers of the Eastern Cape.

98% of the water used by the communities of the Eastern Cape region is obtained from groundwater.



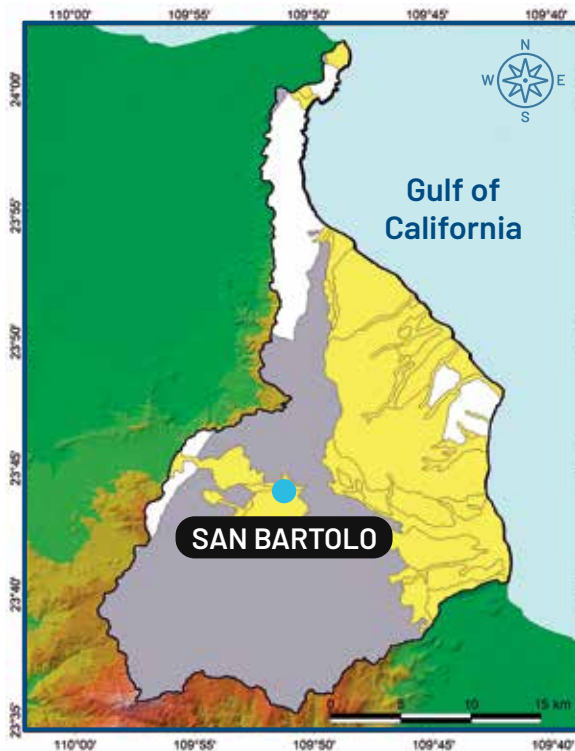
Watersheds and aquifers of Eastern Cape



LOS PLANES WATERSHED

Size: **1,083.4 km²**
 Population: **8,344**
 Area of aquifer: **715.64 km²**
Water contribution to the region: 20.0%

WATER RECHARGE (REFILL) 9.4 Mm³
VOLUME OF WATER CONCESSIONED: 13.09 Mm³
COMMITTED NATURAL DISCHARGE: 1.0 Mm³



SAN BARTOLO WATERSHED

Size: **677.7 km²**
 Population: **4,419**
 Area of aquifer: **247.44 km²**
Water contribution to the region: 23.1%

WATER RECHARGE (REFILL): 10.9 Mm³
VOLUME OF WATER CONCESSIONED: 2.17 Mm³
COMMITTED NATURAL DISCHARGE: 6.9 Mm³

AREAS WITH POSSIBILITIES OF RECHARGE AND/OR HIGH POSSIBILITY OF RECHARGING
 High possibility Medium possibility Low possibility No chance Reference community

Concessioned water: Title to water granted by CONAGUA for the use, and exploitation of national waters.

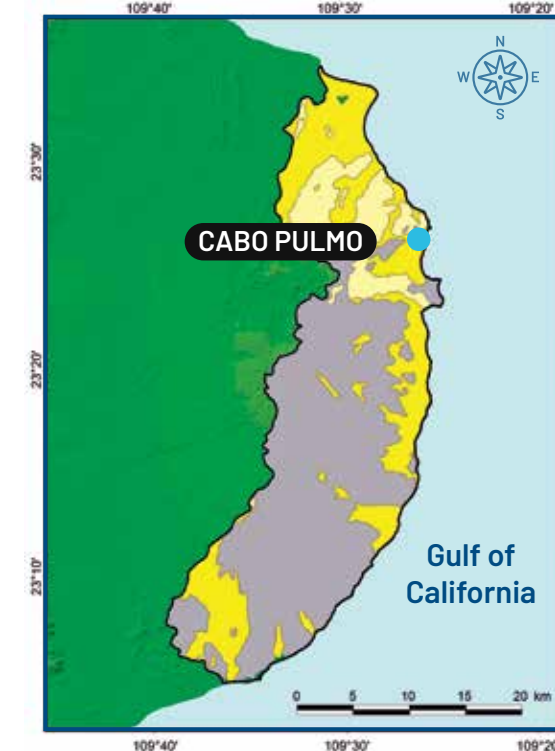
Committed natural discharge: water that must be conserved to prevent negative environmental impact.



SANTIAGO WATERSHED

Size: **1,039.8 km²**
 Population: **8,038**
 Area of the aquifer: **684.48 km²**
Water contribution to the region: 52.0%

WATER RECHARGE (REFILL) 24.5 Mm³
VOLUME OF WATER CONCESSIONED: 19.55 Mm³
COMMITTED NATURAL DISCHARGE: 4.6 Mm³



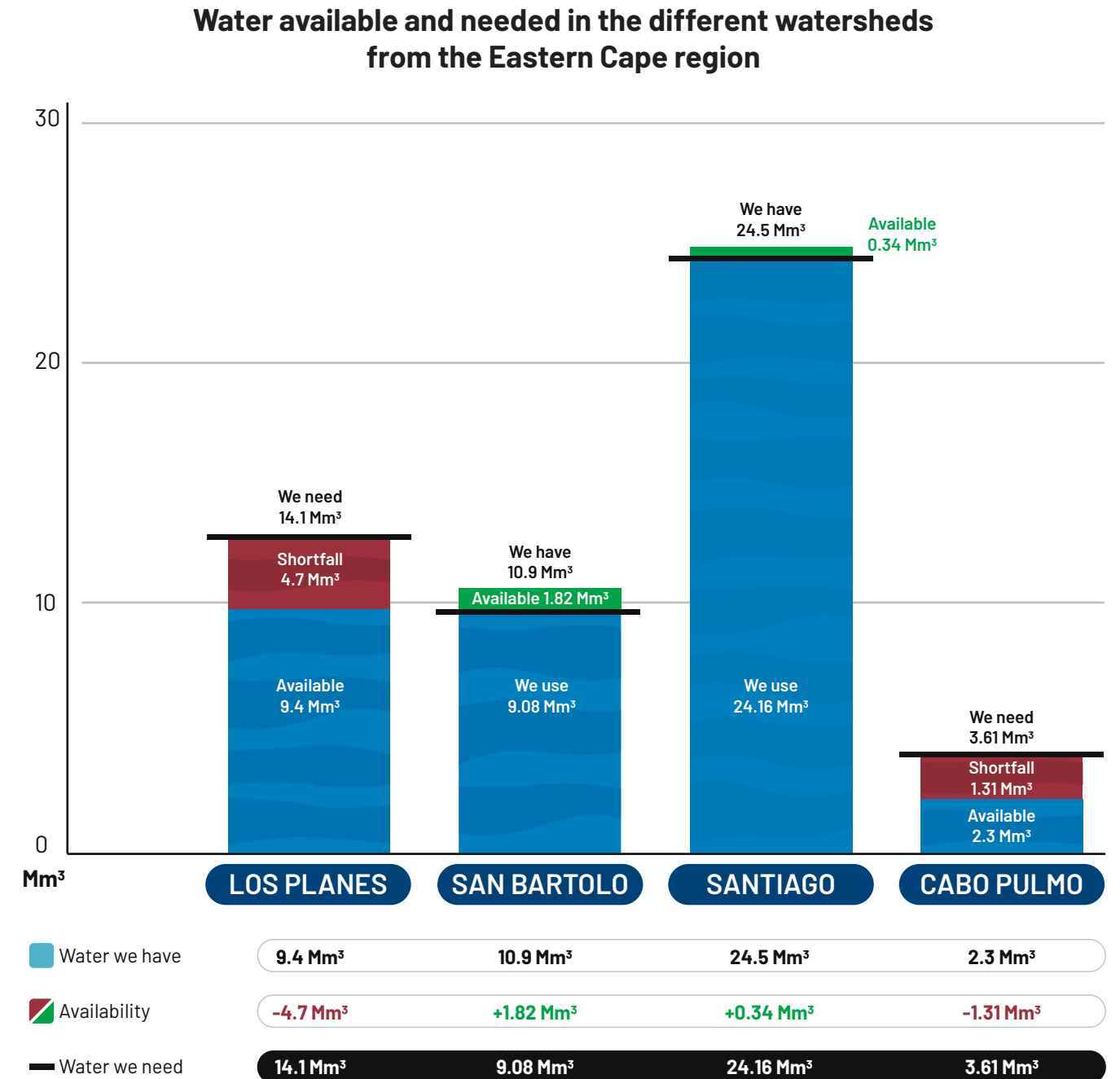
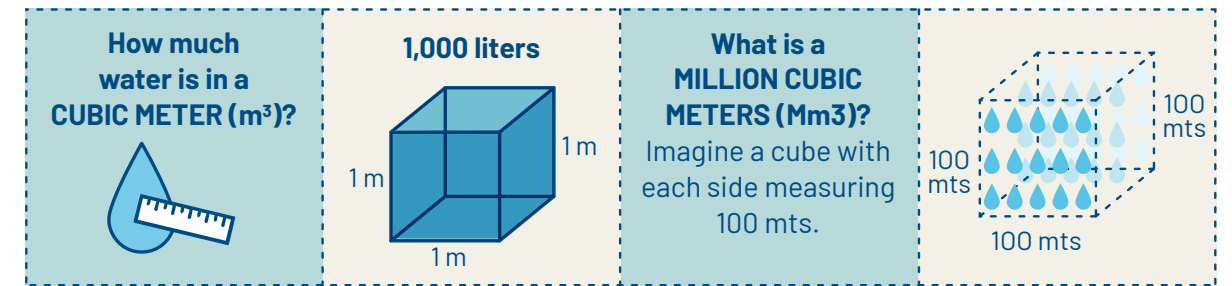
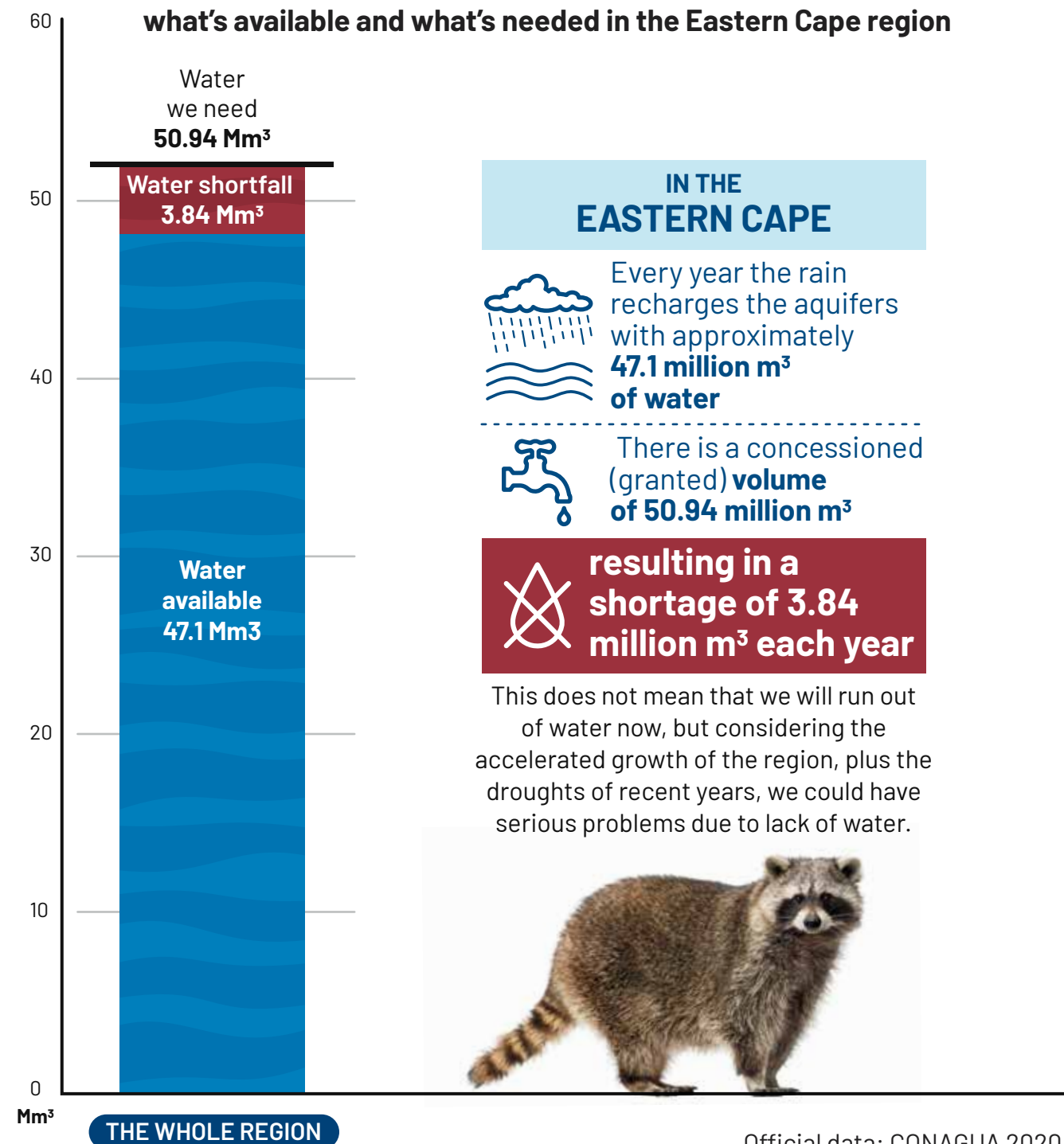
CABO PULMO WATERSHED

Size: **573.5 km²**
 Population: **500**
 Area of the aquifer: **249.8 km²**
Water contribution to the region: 4.9%

WATER RECHARGE (REFILL) 2.3 Mm³
VOLUME OF WATER CONCESSIONED: 1.61 Mm³
COMMITTED NATURAL DISCHARGE: 2.0 Mm³

Do we have enough water?

The amount of water that is recharged in 2 of our 4 basins is not enough to supply the concessions (water grants) and protect the ecosystems of the Eastern Cape.

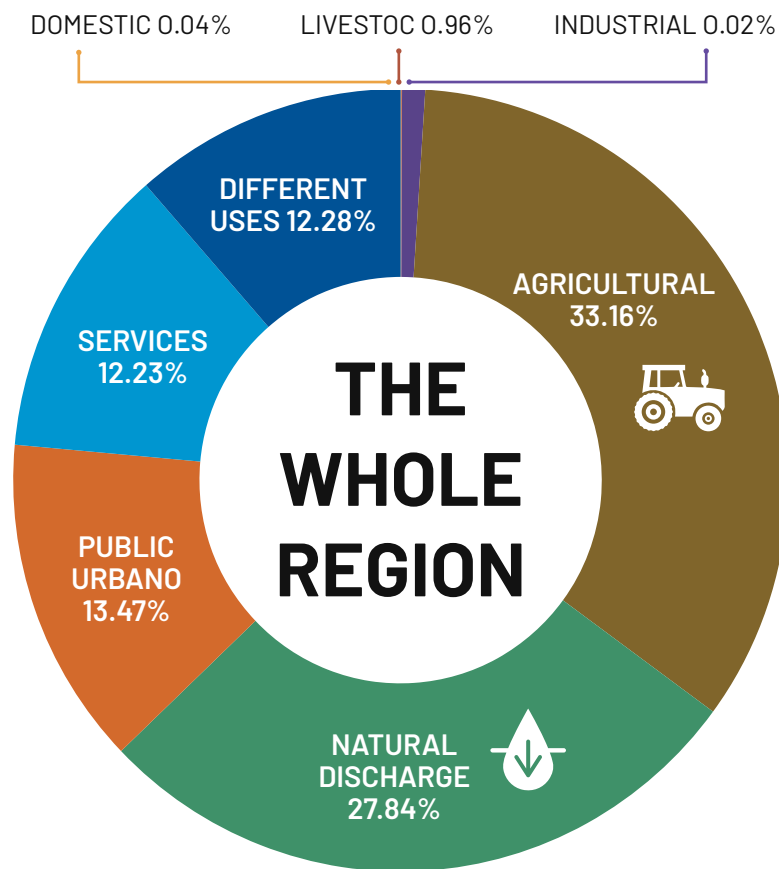


How do we use the water?

On the Eastern Cape, most of the water is concessioned (granted) for Agriculture (33.16%) and Natural Discharge (27.84%).

We cannot quantify what is used for tourism, since parts of it appears in several areas including: Services, Different uses and Urban public.

Percentage of groundwater concessioned for each use in the Eastern Cape

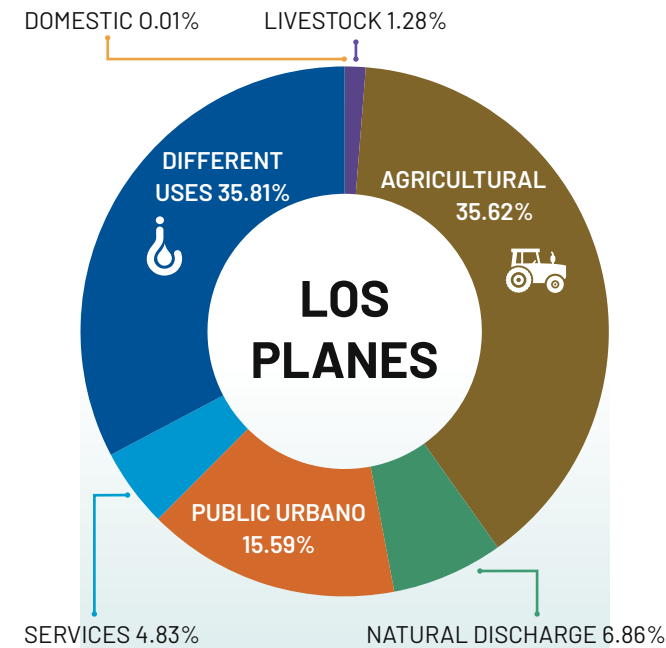


According to data from the Public Registry of Water Rights (REPDA) 02-17-2021.

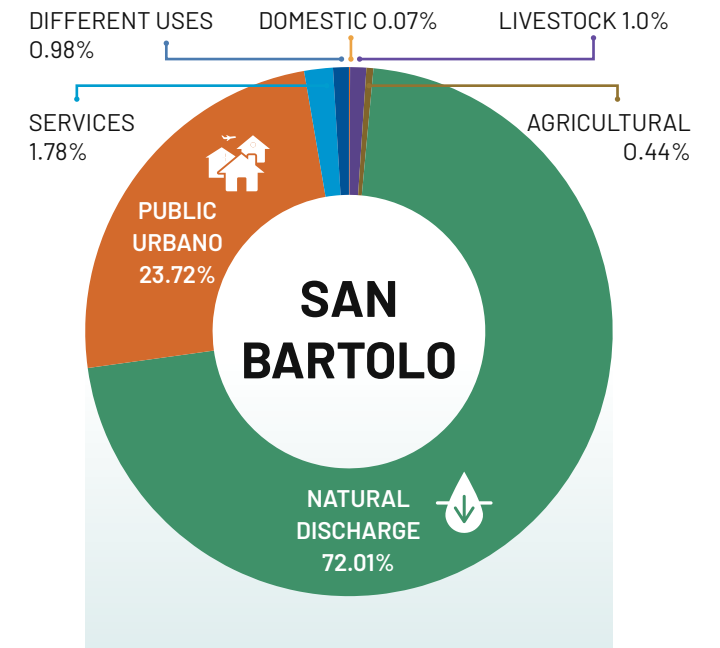
We are all involved in taking care of our water. In order to measure it and plan for its best use and administration, greater precision in the categories of use is necessary.



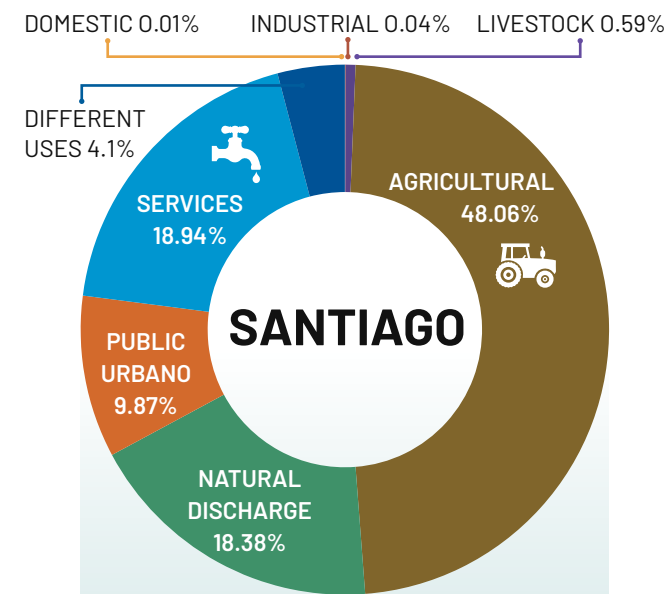
Each region is assigned water in different ways depending on the productive activities that are carried out there.



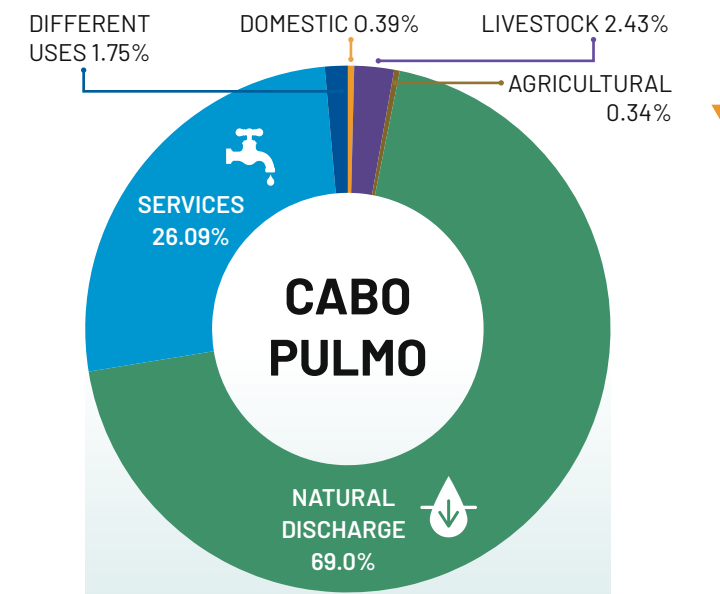
Of the 9.4 Mm³ of water that is recharged per year: in Los Planes, a third of the water is allocated for Agriculture.



Of the 10.9 Mm³ of water that is recharged per year: in San Bartolo most of it is allocated for natural discharge and urban public.



Of the 24.5 Mm³ of water that is recharged per year: in Santiago most of the water is assigned to Agriculture, Services and Natural Discharge.



Of the 2.3 Mm³ of water that is recharged per year: in Cabo Pulmo most of the water is assigned to Natural Discharge and Services.

Without accurate information on current water consumption, how can we manage it efficiently and plan for the future?

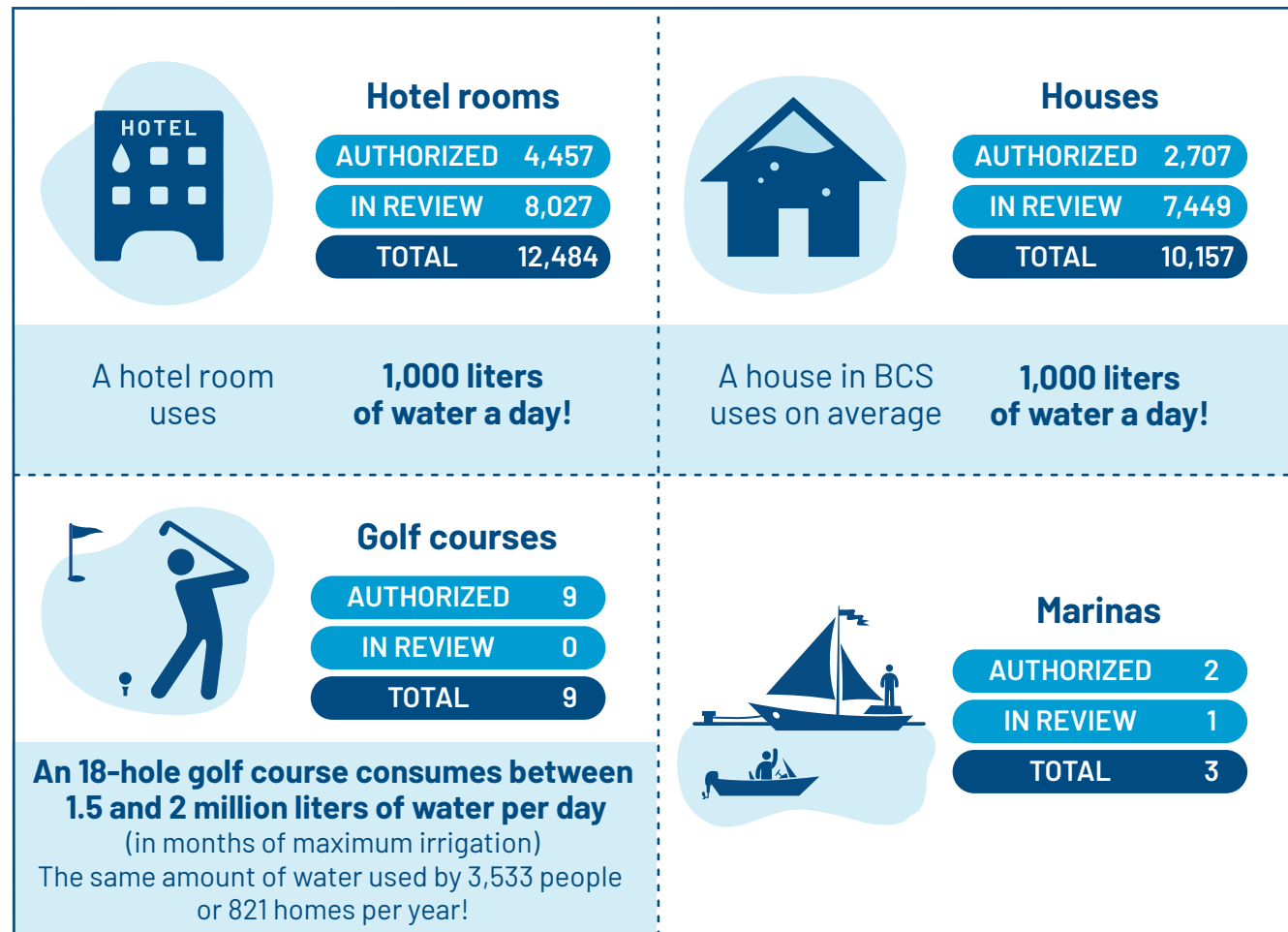


What will the use of water be like in the future?

At the rate we are going, much of the water will be used by areas with population growth and those areas where tourism will increase significantly.

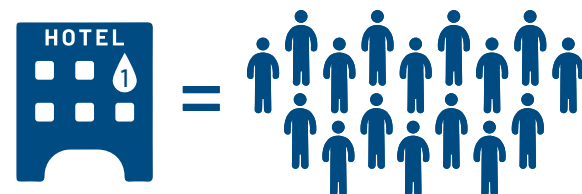
A review of the authorized and proposed projects for this region has been compiled.

Coastal projects authorized and proposed in the Eastern Cape by 2020



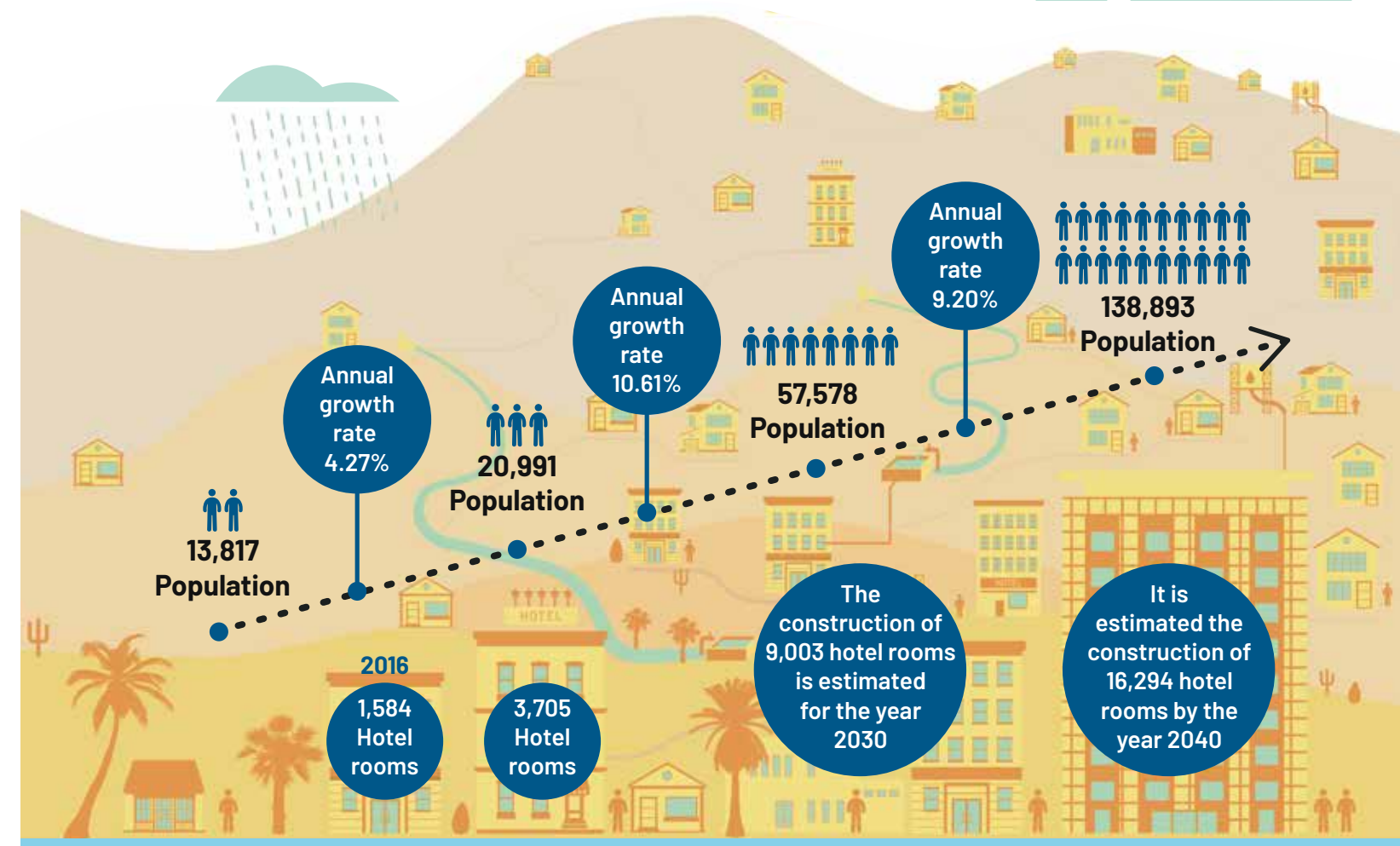
(Cabo Pulmo Vivo coalition, 2020)

Building a hotel creates jobs and people migrate to work in them.
In Los Cabos for every new hotel room 16 people will move into the area.



The following graph shows past, present and future water consumption based on population growth trends and the number of hotel rooms in our region (*without considering the concessions granted for use of water).

Projection of the water we will need due to growth of tourism alone



2010

We needed **1.17 Mm³** of water per year*

2020

We needed **3.13 Mm³** of water per year*

2030

We will need **8.18 Mm³** more water per year*

2040

We will need **17.74 Mm³** more water per year*

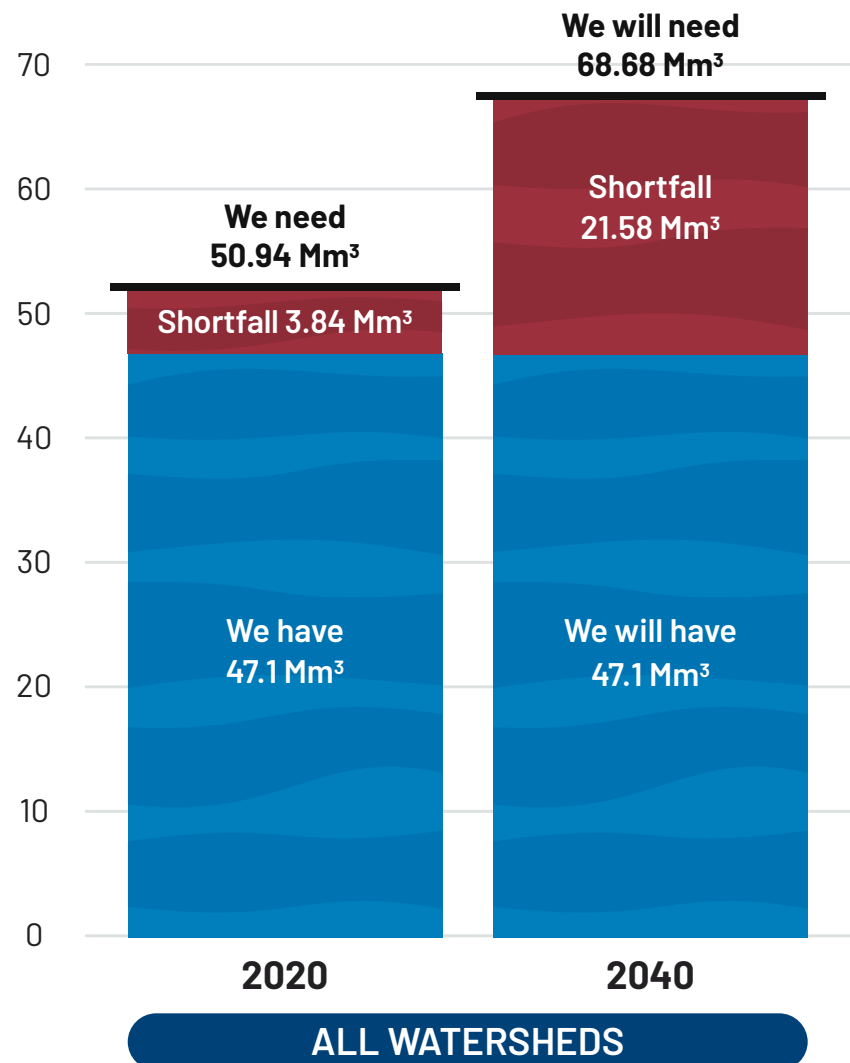
Today some projects are conditioned to supply the water they will need with desalination plants, however, we must think... Who will supply the growing population that results from these projects?



How much water will we need in the future?

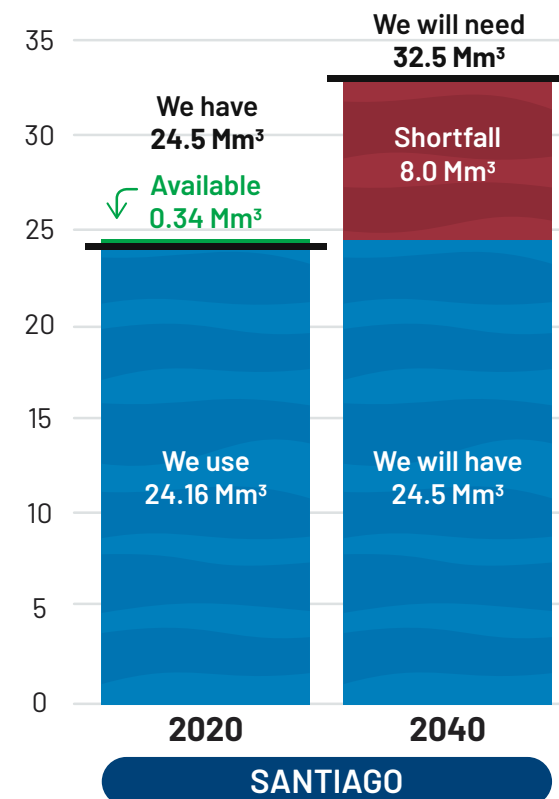
Based on the concessions granted and projections, in 20 years we will need at least 46% more water than is recharged annually by rain in the Eastern Cape region.

Water recharge and future demand in the Eastern Cape region

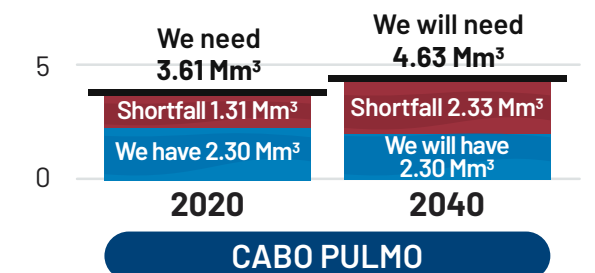


2020: Information based on official CONAGUA data from 2020.
 2040: Information based on official CONAGUA data from 2020 and growth projections for hotel rooms and population based on the history of Los Cabos 1990-2010. It does not include growth projections for agriculture or businesses.

Water recharge and future demand in the Eastern Cape region



Why is it important to raise awareness? Because there is the possibility of a shortage and this a very good time to prevent it and not face a situation like the one that Cabo San Lucas has been experiencing for 30 years.



Do you know the quality of the water that we currently have available?



Is our water safe to drink?

In general, the water quality in the region is thought to be safe, but this research has shown that this is not always the case.

The conditions of a body of water are dynamic and can change at any time. Therefore, constant and punctual data is required from each well to make an accurate diagnosis of the current state of our water.



This map is constantly updated. Visit the map at: <https://bit.ly/2J2i4Ks>



The map indicates the points where water quality samples have been taken in the four watershed basins:

- Safe water for different uses.
- Water with polluting elements that do not exceed the permissible limits by the Official Mexican Standard (NOM).
- At least one element passes the permissible limits by the NOM (Arsenic, Salinity and pH).

LOS PLANES WATERSHED BASIN

In 42 of the 118 wells that exist:

- 17% is safe water for different uses.
- 2% is water in average conditions due to the presence of arsenic.
- 81% in conditions not suitable for use because of elements such as arsenic, salinity and pH above the NOM.

SAN BARTOLO WATERSHED BASIN

In 30 wells studied of the 83 that exist:

- 67% is safe water for different uses.
- 10% in medium conditions due to the presence of slightly brackish water or fecal coliforms.
- 23% not suitable for use due to the presence of salts and arsenic above the NOM.

SANTIAGO WATERSHED BASIN

In 11 wells studied of the 110 that exist:

- 73% is safe water for different uses.
- 18% in medium conditions due to the presence of salinity.
- 9% is a site with salinity and pH above NOM.

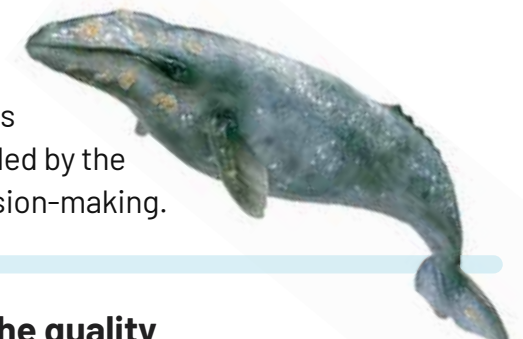
CABO PULMO WATERSHED BASIN

In 14 wells studied of the 62 that exist:

- 50% is safe water for different uses.
- 21% have medium conditions due to the presence of arsenic and salts.
- 29% have salinity problems above NOM or presence of arsenic.

In order to ensure everyone's participation and compliance with the Official Mexican Standard, for the benefit of the community, it is necessary to be aware of the information provided by the competent authorities and to participate in decision-making.

What other actions can we take to be sure of the quality of the water for our consumption and use?



How can we get more water?

There are many ways to obtain water on a small and large scale. Some actions can be carried out by us and for others we require the participation of the community, the government and all those involved.

There are various costs, benefits, and impacts of each method to be evaluated.

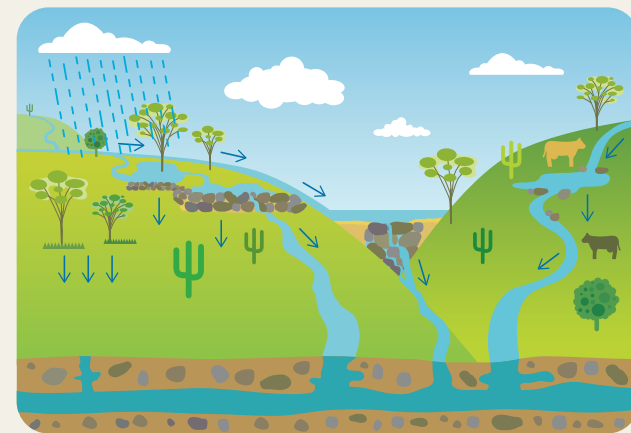
INCREASE WATER CAPTURE / RETENTION TO INCREASE INFILTRATION AND AVAILABILITY

WHAT I CAN DO:

- In our watersheds, houses and schools we can capture rainwater (and even mist) through small capture and storage works for our use.
- We can also recreate simple catchment works in our patios and sidewalks similar to geographic watersheds and plant native plants for their retention.

WHAT WE ALL CAN DO:

- Reforest and increase vegetation cover so that soils retain as much water as possible.
- Large dam works in streams, creating reservoirs to store and distribute water. This requires a large investment and can affect ecosystems.
- Small works from 15 cm high banks and stone and branch dams in ravines, which, applied extensively, can increase the capture of water (for orchards, livestock and our houses) and the recharge of the aquifers through infiltration to the subsoil.



EFFICIENCIES AND SAVINGS

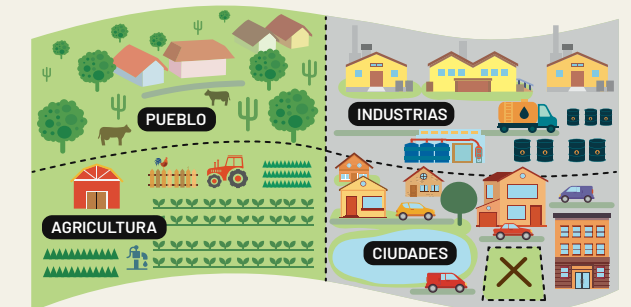
WHAT I CAN DO:

- Talk to your family and friends about the importance of taking care of the water we already have.
- Repair any leaks.
- Take short showers.
- Put a full glass bottle in the toilet tank. This alone will save almost a liter of water each time the lever is pulled.
- If you have a garden, install a drip irrigation system and take care of the composition of the soil by mulching to avoid rapid evaporation.



WHAT WE ALL CAN DO:

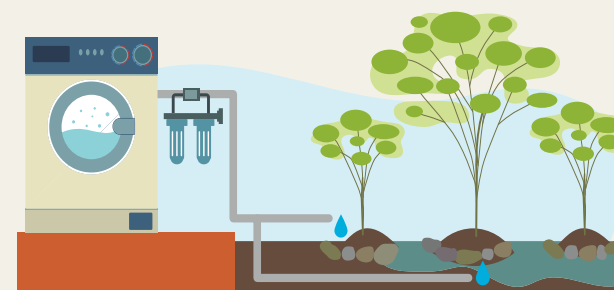
- Encourage that the gardens of all public spaces, offices, schools and homes, grass and tropical plants are changed for those that are tolerant to drought and are irrigated with drip systems. This can save up to 75% of the water we use for that each day.
- Plan the orderly growth of communities and land use.
- Promote a culture of saving, not wasting for industry, agriculture and domestic use.
- Concessions must prioritize use for current and future populations.



WATER TREATMENT

WHAT I CAN DO:

- At home, we can create simple filters with sand and gravel to treat gray water from the shower, kitchen, washing machine and/or laundry room to irrigate orchards and gardens.
- Recover the water from the shower and wash the car with it.



WHAT WE ALL CAN DO:

- More treatment plants and dumps are required. Currently the reuse of gray water help us to reduce the use of drinking water by 16%, but depending on the site and the design of the system we could reduce up to 40%.



How can we get more water?

DESALINATION

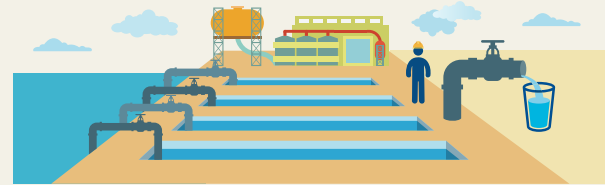
WHAT I CAN DO:

- You can create small systems to use seawater through evaporation-condensation of water. This can be used to irrigate our plants and vegetables or even to drink!



WHAT WE ALL CAN DO:

- Desalination plants can produce a lot of water, but their economic and environmental costs must be considered. It requires a large investment and continuous and intensive use of electricity. In addition, management of brine waste must be carefully monitored to avoid environmental damage. Currently, the generation of electricity in the south of the state causes pollution in the quality of the air we breathe.



MEASUREMENT FOR MANAGEMENT AND DECISION MAKING

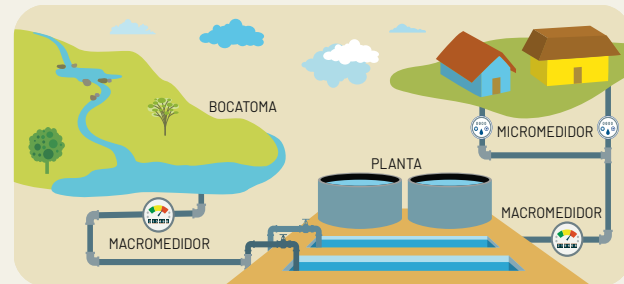
WHAT I CAN DO:

- Participate in watershed water research and conservation programs in your region.
- Inform your families and communities.
- Participate in the appropriate decision-making regarding the water of your community and the region.



WHAT WE ALL CAN DO:

- Provide more information on the status of water quality in a timely manner.
- Have meters on all supply sources and household intakes to quantify the volume of water that is extracted from the wells and delivered to the user. This will provide current and reliable information, that allows us to manage our water efficiently.



We need more research

Much of our research findings are based on models, estimates, and public/official data. The findings are limited in the absence of information or more in-depth research. The lack of water is an important factor that will generate problems for future generations in this region.

➔ Based on studies, measurement, monitoring and transparency we need to know:

MEASUREMENT



- Can we refine our knowledge of the volume of groundwater, and how much could be accessible?
- How much water are the different concessions using?

STUDIES AND EVALUATION OF ALTERNATIVES



- Where are the greatest opportunities to make water more efficient and not waste?
- What are the lowest cost and most beneficial options that can provide us with the greatest amount of water?

MONITORING



- What is the quality of the water in most of our wells?
- How much water does it rain each year and how much is available in aquifers?

BASED ON THE ABOVE:
What alternatives should we apply so that the growth of the region is orderly and possible within the limits of water, ecology and finances that we have in the region?



Conclusions

AVAILABILITY

According to the present research, today we do not have enough groundwater to supply all the currently assigned concessions, if they are fully used, and to sustain natural processes in 2 of the 4 basins of the region.



FUTURE

We estimate that in 20 years we will need at least 21.58 Mm³ more water, that is, 46% more water than is recharged (refilled) in our aquifers. We need to accurately categorize and measure concessions and uses, in order to understand the actual needs of tourism, residents and economic activities in the future.



QUALITY

As we were able to observe, not all the water in the region is safe. The conditions of a body of water are dynamic and can change at any time. We need constant and timely data from each well to make an accurate diagnosis of the current state of our water.



The challenge belongs to everyone, federal and state authorities, companies, community members and each of the residents of the Eastern Cape region, since it has been shown that only by collaborating for a common good can we create awareness about the proper use of the Water.

EVALUATION

In general, we require more studies to have accurate information and to be able to evaluate alternatives so that our communities, families and the environment have the water they need.



OPPORTUNITY

We only capture 6% of the rain for our use. There are methods to retain and reuse water on a large scale. We must methodically evaluate the costs and benefits of alternatives to increase water availability. Taking care of water begins in our homes.



Let's encourage others to raise awareness of water and do something to take care of it.



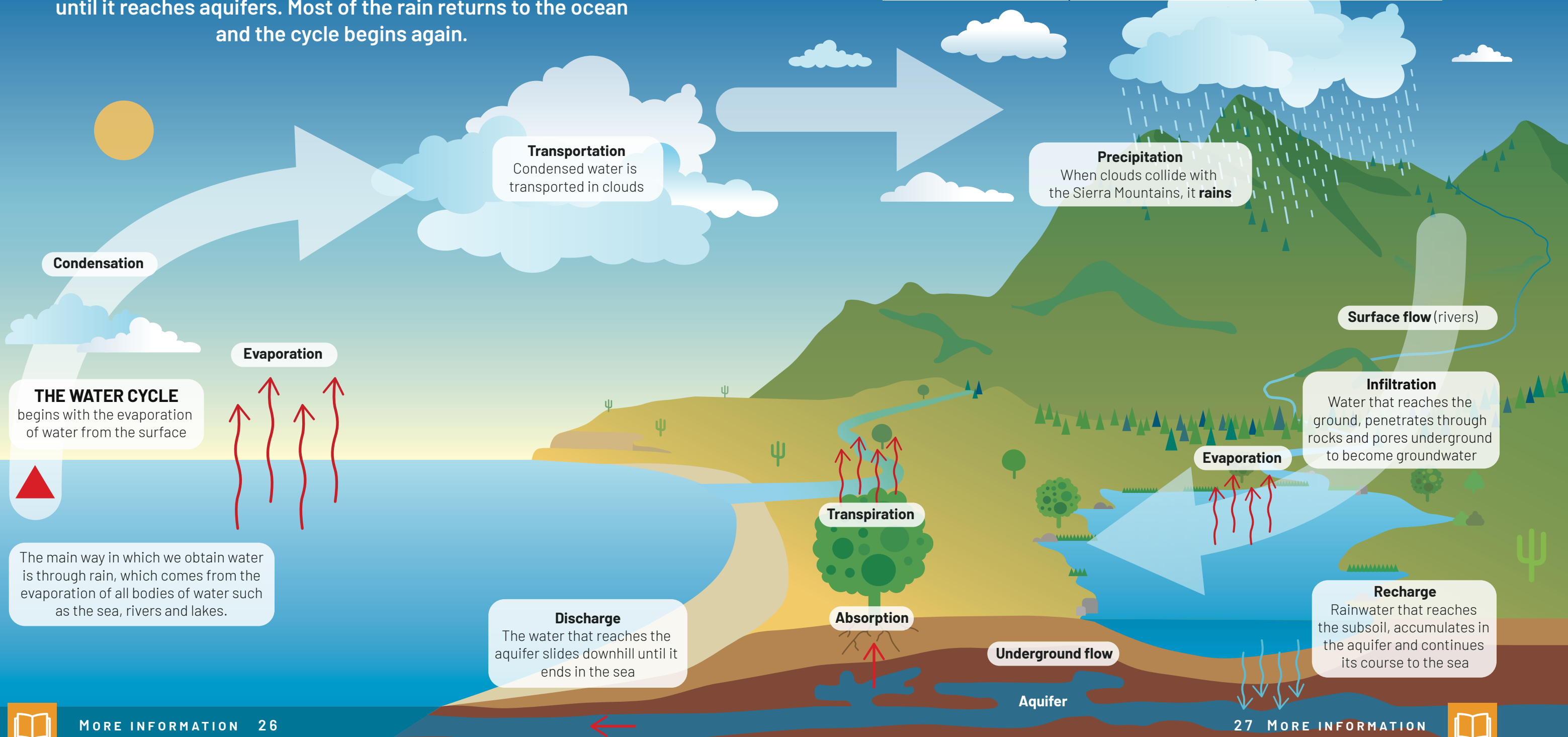
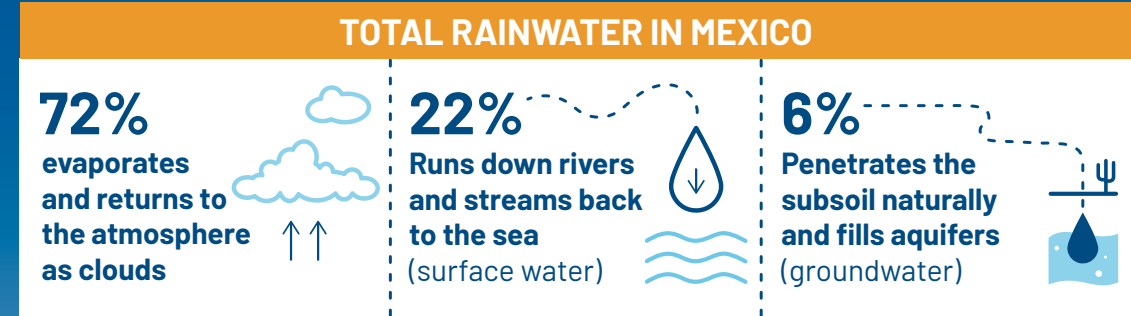
MORE INFORMATION

Here we will delve into the findings presented above

Continued from page 6

What is a watershed?

In our region, the water evaporates mainly from the Gulf of California and is captured in the mountains in the form of clouds. When the clouds cool down or hit the mountain ranges, it rains. Rain falls on the surface, runs down streams, and seeps into the ground until it reaches aquifers. Most of the rain returns to the ocean and the cycle begins again.



MORE INFORMATION

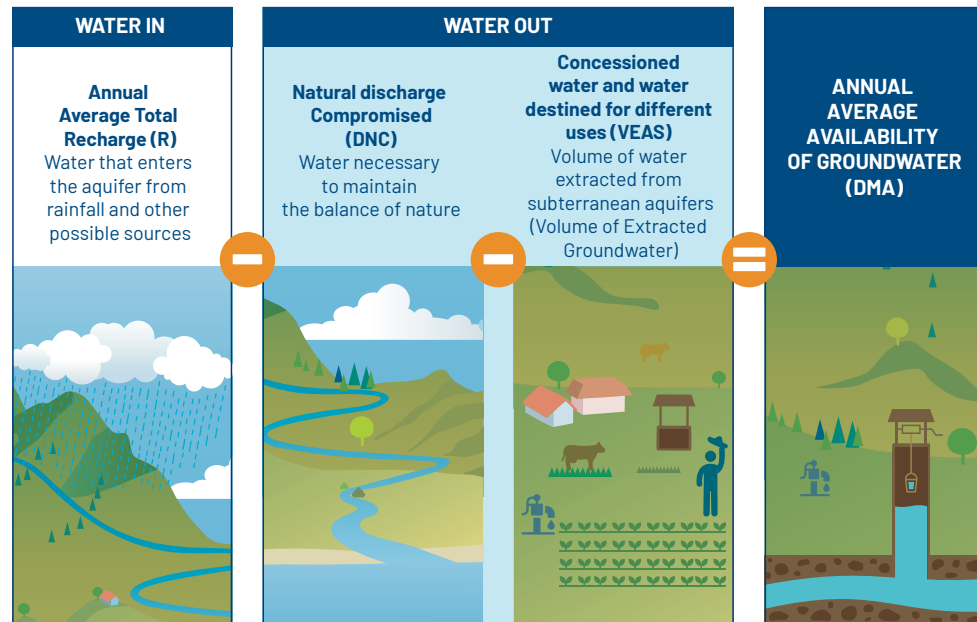
Here we will delve into the findings presented above

Continued from page 11

Do we have enough water?

The National Water Commission (CONAGUA) answers this question using the following formula to inform grant concessions and authorize the use of water.

$$R - DNC - VEAS = DMA \quad (\text{For the acronym in Spanish})$$



The amount of available water (DMA) results from:

The amount of rainwater that enters our aquifers each year, less that required to maintain nature, and the water already allocated for various uses such as Services, Agriculture and municipal networks, etc.

Continued from page 15

What will the use of water be like in the future?

One way to project our need for water into the future is by analyzing what has happened in nearby cities.

- For example, Cabo San Lucas went from 1,243 hotel rooms in 1986 to 18,898 in 2019; and from 34,357 inhabitants in 1990 to a projection of 352,619 inhabitants by 2020.
- If in the next 20 years the Eastern Cape experiences the same growth rate, by 2040 we would need 17.74 Mm³ more water than the 47.1 Mm³ that is recharged with the rains.
- Our way of estimating yields "intermediate" results, since data from the Municipal Planning Institute (IMPLAN) of Los Cabos indicate that in the Eastern Cape region we could have more accelerated growth.



It is essential to know how much additional water we will need and to define where we will get it from.

Continued from page 19

Is our water safe to drink?

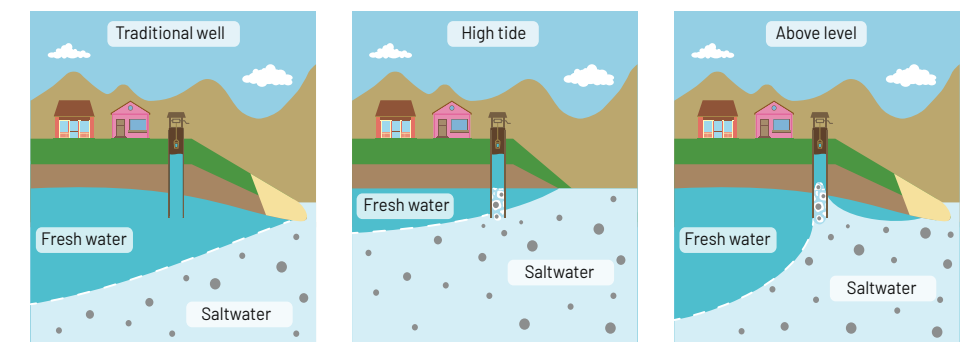
Our drinking water must comply with the standards of the Official Mexican Standards (NOM) for safe consumption, with special attention to the levels of the most harmful substances for health such as: arsenic, chlorine, lead, boron, salt and coliform bacteria.

MAIN SOURCES OF POLLUTION:

- Solid urban waste
- Municipal discharges
- Natural pollution
- Agricultural activities
- Industrial waste
- Mining
- Saline intrusion

NOM-127-SSA1-1994
Mexican regulations that establish the permissible limits for the quality and treatment of water purification for human consumption that must be complied with.

SALT INTRUSION



Saline intrusion occurs if the sea level rises or if the volume of water within the aquifer decreases due to overexploitation or drought. The water that is destined for natural discharge indirectly helps to combat this phenomenon by not extracting that volume from the aquifer.

Continued from page 13

How do we use the water?

According to the National Water Law, the different uses or concessions of groundwater are:

- Natural discharge:** Water that must be conserved to prevent a negative environmental impact to ecosystems or the migration of poor quality water to an aquifer.
- Industrial:** Factories, companies and electric power generation.
- Domestic:** Use of people and the home.
- Livestock:** For raising and fattening cattle and poultry.
- Urban Public*:** For people or human settlements, through the drinking water network.
- Agriculture:** Orchards and farms.
- Different Uses*:** All those that are not are defined.
- Services*:** Services other than the above; as well as for remote communities not connected to the drinking water network.

*The concessions for tourism are found among these categories.



MORE INFORMATION

Here we will delve into the findings presented above

Continued from page 22

How can we get more water?

For each option for getting more water, we must analyze the cost and benefit: how much water will it produce? How much will it cost? Who will pay? And how will it affect our natural environment?

Here are some resources where you can find more information on these topics:

CAPTURE SURFACE WATER

It is estimated that there is 45.5 Mm³ of water that runs into the sea and does not infiltrate the subsoil. Cementing streams will increase the amount of water that is wasted. Learn more about green infrastructure for Sonoran Desert Communities by Watershed Management Group. <https://bit.ly/2MdA7iy>

EFFICIENCY AND SAVINGS

The Basin Councils are the mechanism established in the National Water Law to incorporate citizen participation in decision-making on water. www.gob.mx/conagua/documentos/consejos-de-cuenca

WASTE WATER TREATMENT

Has a double benefit since it is recycled and a greater exploitation of surface or underground water can be avoided. Management (step by step) of greywater by Greywater Action. <https://bit.ly/2LkC7V6>

DESALINATION

Producing 1 m³ of desalinated water costs \$ 26.61 pesos, versus \$ 4.88 pesos for the aquifer water (OOMSAPAS Los Cabos). Building a 7.88 Mm³ / year desalination plant costs \$ 986 million pesos. www.proyectosmexico.gob.mx

MACRO AND MICRO MEASUREMENT

Studies carried out found that with installed meters, users regulate their consumption more. Volumes measured for concessionaires indicate how much water is used and how much is available. www.imta.gob.mx

Wetlands are natural water reserves

They are zones of the terrestrial surface temporarily or permanently flooded by fresh or salty water and in flow or static; regulated by climatic factors and that are in constant relationship with the living beings that inhabit them.

Wetlands are indispensable for humanity because:

- They recharge groundwater.
- Prevent saline intrusion.
- Protect us from hurricanes and floods.
- Supply fresh water, food and building materials.
- Support biodiversity.
- Help mitigate climate change.

However, more and more studies show that the area and quality of wetlands continue to decline in most regions of the world. To protect them, Mexico is part of RAMSAR, a convention that recognizes wetlands of international importance for their conservation.

Some wetlands in our region are:

- La Zorra Canyon
- San Bartolo Canyon
- Los Frailes Lagoon
- Santiago Oasis
- La Ribera estuaries
- El Rincón lagoon

It is everyone's responsibility to inform themselves and protect these irreplaceable ecosystems.



The conclusions presented here are only the first step in understanding the Eastern Cape's needs and opportunities in relation to water.

The Eastern Cape has a bright future from an ecological and economic point of view. If companies together with federal and state authorities and communities in the region use scientific information to plan responsibly the care and use of water as well as all our natural resources, we will be able to leave future generations a healthy planet.



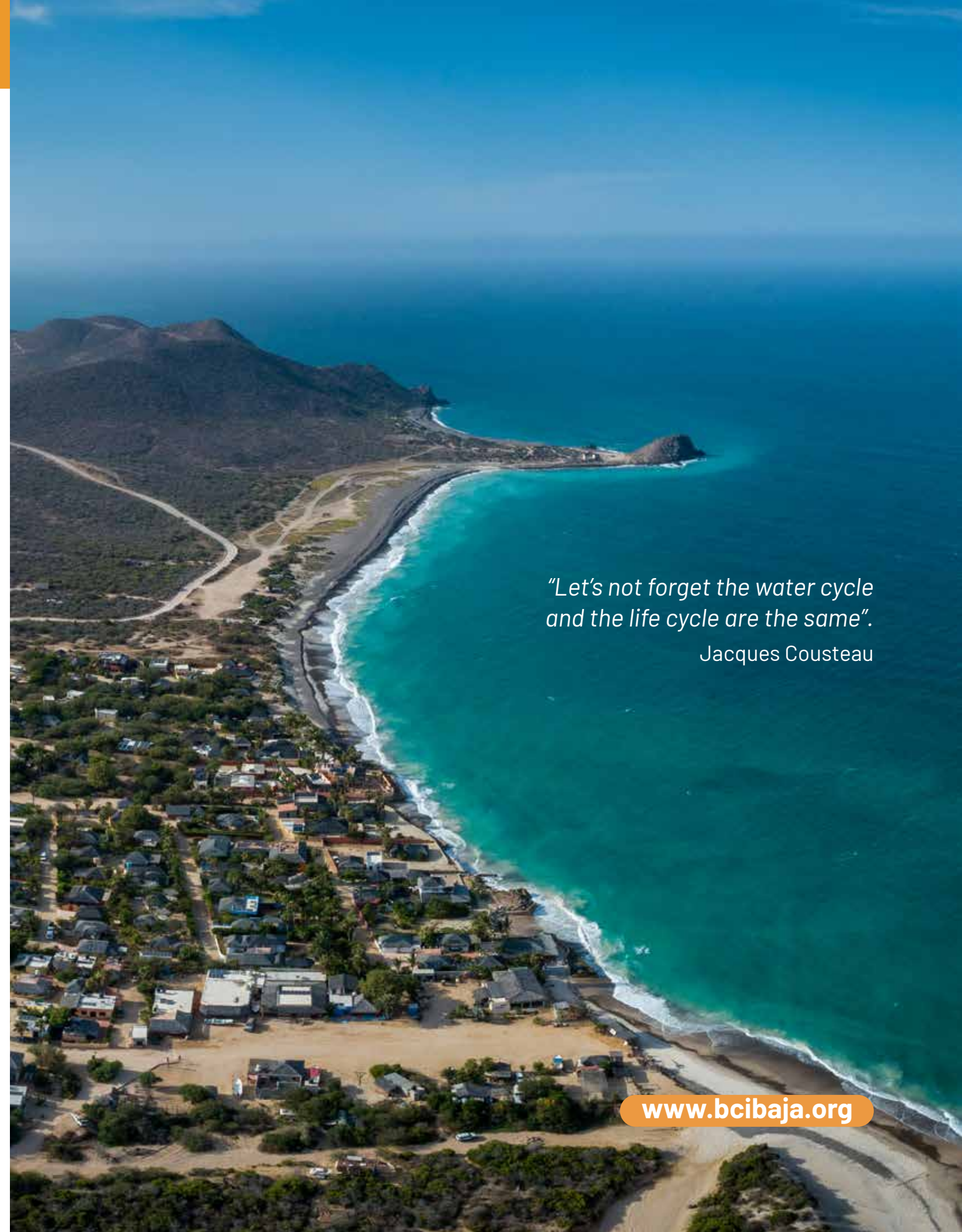
Dr. Arturo Cruz Falcón / Oceanographer, Master in Exploration Geophysics and PhD in Marine Sciences, with experience in studies of coastal processes, geophysics and geohydrology of the coastal zone, basins and aquifers. He is currently working at CIBNOR, in studies on water availability and quality.



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M.C. Pablo Noé Castro Moreno / Marine Biologist with a Master's Degree in Marine and Coastal Sciences, with more than 20 years of experience in topics related to the management and administration of fisheries and natural resources. He currently collaborates with Legacy Works Group as a program officer in training for restoration and management of natural resources at BCS.



"Let's not forget the water cycle and the life cycle are the same".

Jacques Cousteau

www.bcibaja.org





Access to the full study
and the sources on which
this report is based here.
Scan the code or go to
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