ARC61704 | SUSTAINABLE LIVING

Sustainable System In A City

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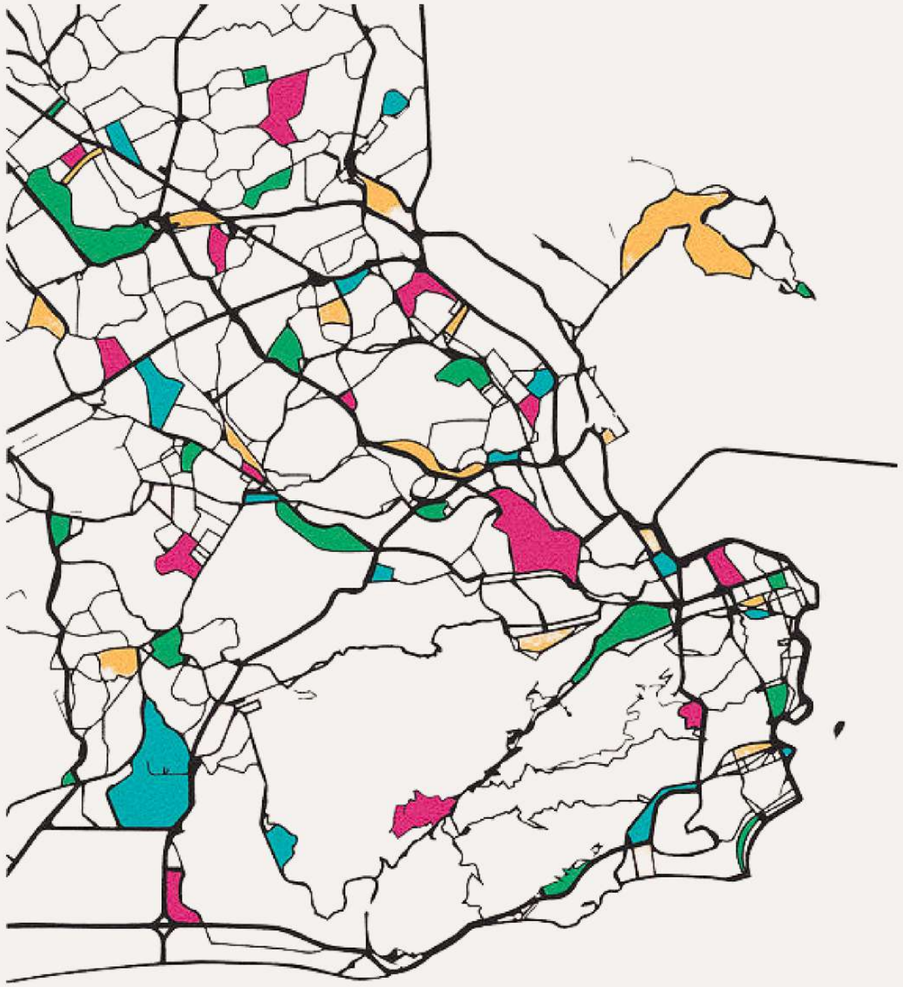


RIO DE JANEIRO, BRAZIL

Rio de Janeiro is a vibrant and diverse city located in the southeastern region of Brazil. It is known for its stunning natural beauty, iconic landmarks, and rich cultural heritage.

LOCATION
RIO DE JANEIRO, BRAZIL

METRO POPULATION
13,728,000

URBAN POPULATION
6,210,000

CLIMATE
TROPICAL SAVANNA

TOTAL AREA
1220 KM2

AVERAGE TEMPERATURE
27°C

URBAN DESIGN PATTERN

SUBURBANISED CORE CITY

MIX OF WELL-PLANNED NEIGHBOURHOODS & FAVELAS

GRID-LIKE STREET PATTERN INFLUENCED BY THE CITY'S TOPOGRAPHY

IRREGULAR & DENSELY POPULATED FAVELAS

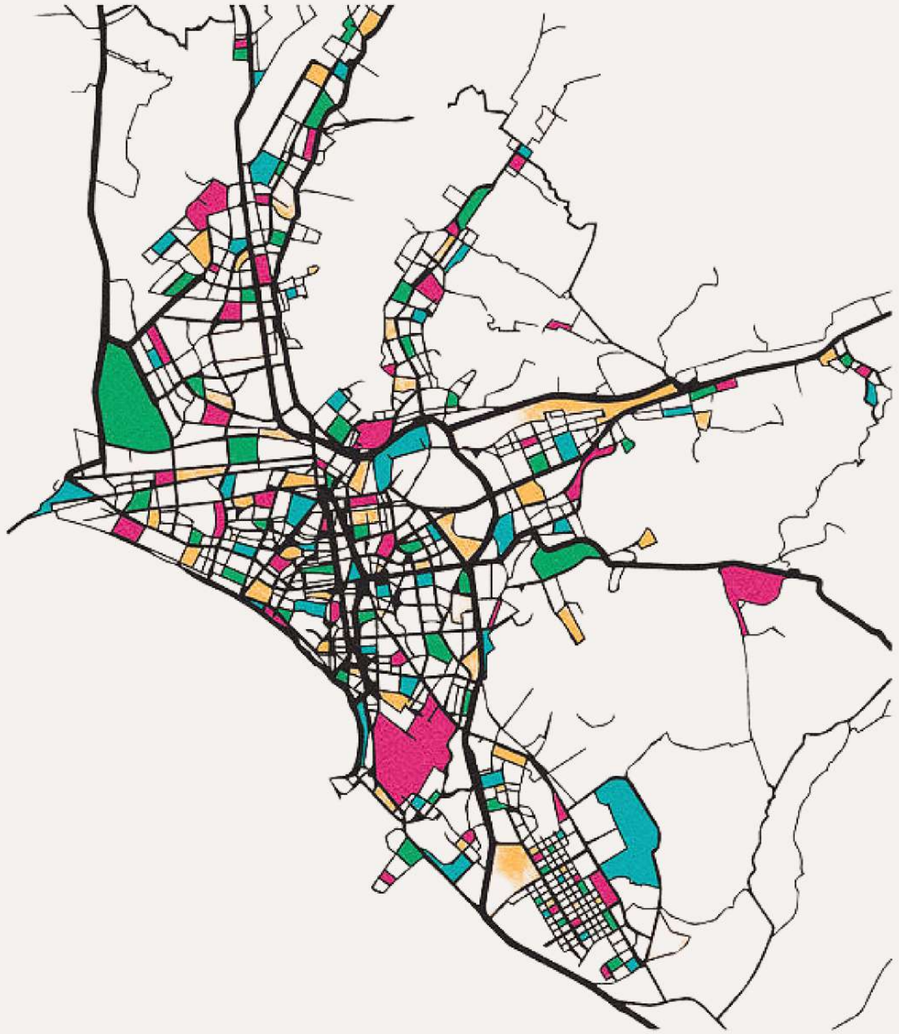
URBAN DENSITY

Rio de Janeiro has a mix of urban densities depending on its location:

FAVELAS, DOWNTOWN & CENTRAL AREAS ARE OFTEN WHERE THE URBAN DENSITY IS HIGH

THE SUBURBS & NATURAL AREAS ARE WHERE THE URBAN DENSITY IS LOW

BACKGROUND OF LIMA



LIMA, PERU

Lima, the capital & largest city of Peru, is a vibrant metropolis located on the country's central western coast. It is a dynamic & culturally rich city that invites travellers to explore its history, cuisine, & natural beauty.

LOCATION
LIMA, PERU

CLIMATE
SUBTROPICAL DESERT

TOTAL LAND AREA
2,700 KM2

METRO POPULATION
11,204,000

URBAN POPULATION
8,852,000

AVERAGE TEMPERATURE
23.5°C

URBAN DESIGN PATTERN

HISTORIC COLONIAL CORE

GRID-BASED STREET LAYOUTS

MODERN SUBURBAN DEVELOPMENT

INFORMAL SETTLEMENTS - BARRIADAS

URBAN DENSITY

Lima has a high population density:

LIMA'S POPULATION LIVES IN A PLOT OF LAND NO BIGGER THAN 2,672 KM2

SIGNIFICANT FLOOD EVENTS OF RIO DE JANEIRO

6 APRIL 2010

CAUSE

Nearly **9 INCHES** of rain in **< 24 HOURS**

< 0 preparation for heavy rainfall

DAMAGES

> 249 casualties

15,000 homeless

13.5 billion USD of property damages

11 JANUARY 2011

CAUSE

Torrential rainstorm

10 INCHES of rain in **< 24 HOURS**

DAMAGES

916 casualties

2960 homes destroyed

1.2 billion USD of property damages

FEBRUARY 2023

CAUSE

Heavy rainfall

26 INCHES of rain in 48 hours

DAMAGES

> 233 casualties

850 homes destroyed

SIGNIFICANT FLOOD EVENTS OF LIMA

1982-1983

CAUSE

"El Nino"

Heavy rainfall

Deluged by more than 3m of rainfall

DAMAGES

> 100 casualties

>1000 homes destroyed

400 **million USD** of crop & property damages

1997-1998

CAUSE

"El Nino"

Global warming

Heavy rainfall

Warming of sea temperatures

DAMAGES

> 137 casualties

>1000 homes destroyed

1.8 billion USD of & property damages

2017

CAUSE

Abnormal warming of Pacific waters

Heavy rainfall

DAMAGES

> 100,000 victims

>157,000 homes destroyed

1.2 billion USD of & property damages

BLUE INFRASTRUCTURE

RIO DE JANEIRO

FLOODING

HEAVY RAINFALL

- More than **200mm/ 7 inches** of rain in a 72 hour period
- over **350 people** had evacuated their homes and **200 homes** damaged

POOR/ CLOGGED DRAINAGE

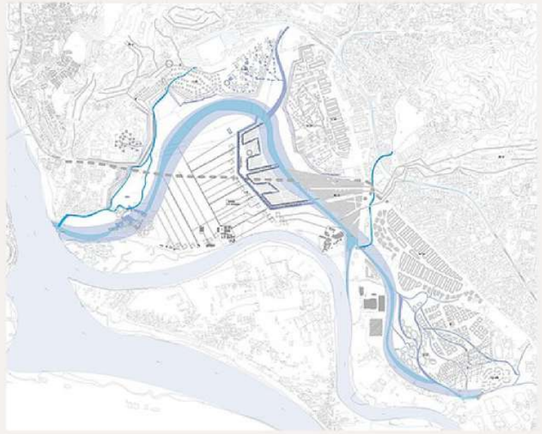
- Due to increasing urbanization which removes forms of open space that absorb rainwater

WATER POLLUTION

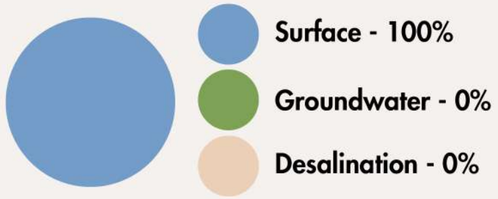
SEWAGE

The dumping of liters of sewage into the Guandu river

Caused by the Amazon Basin's rapidly growing population along with the government's failure to provide adequate sanitation infrastructure



The Guandu River = The **main water supply** for Rio de Janeiro.



THE GUANDU TREATMENT PLANT

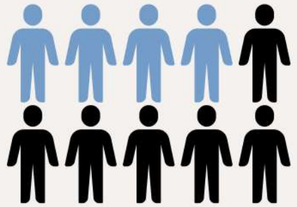
- Largest water treatment plant in the world
- Provides 92 per cent of drinking water for Rio

LIMA

ACCESSIBLE WATER

48% / 16 million people of the population lack access to a reliable, safely managed source of water due to ...

Climate change **Overpopulation**

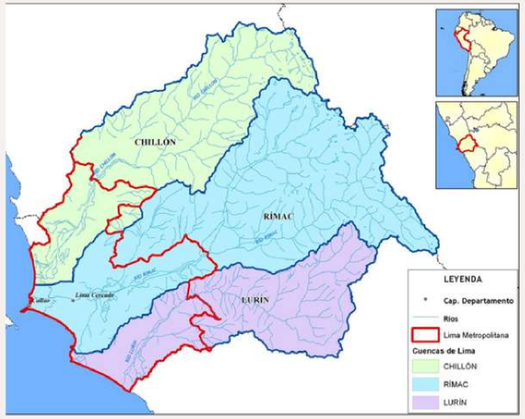


Only 4 out of 10 people have safely managed water sanitation.

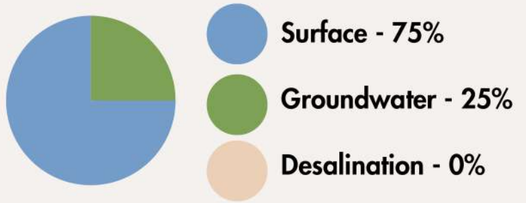
FLOODING

Since January 2023, floods, landslides and mudslides have become part of the daily life of the residents of Peru.

CAUSES	INTENSITY
• Climate change • Heavy rainfall • Overflowing of rivers	• Rains caused $3bn worth of damage • 10 times more rainfall than normal.



The Rímac, Chillón, and Lurín Rivers are Lima's 3 main sources of water



10km **Average distance to water sources from Lima**

100% **Of water from inter-basin transfer**

BLUE INFRASTRUCTURE

RIO DE JANEIRO

FLOODING

States	Estimated population	Population at risk
São Paulo state	44,222,320	5,456,570
Rio de Janeiro state	17,128,208	3,345,481
Minas Gerais state	21,313,029	3,944,170
Espírito Santo state	3,656,100	886,046
São Paulo municipality	12,507,966	2,641,855
Rio de Janeiro municipality	6,906,512	895,267
Brazil total	**202,347,402**	**33,318,370**

DAMAGES

Floods in Brazil are estimated to have caused

- **USD $2.8 billion in economic losses** between 2000 and 2010
- **1,000 lives lost** in seven municipalities

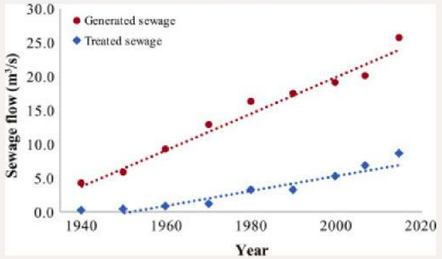
SOLUTIONS

In 2012, Rio de Janeiro started construction on four underground reservoirs as well as a diversion tunnel for the Joana River in order to improve the city's flood resilience.

- Able to accommodate a **25-year rainfall event**
- Receives water from **five different rivers**

WATER POLLUTION

Approximately **90 tonnes** of waste is dumped into the Bay every day



SOLUTIONS

- **Eco barriers**

Consisting of buoys, some with nets, that are strung across rivers to trap trash

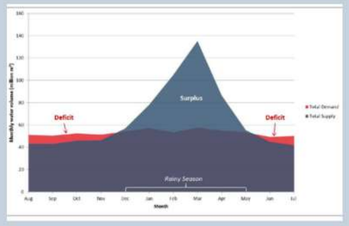
- **Eco boats**

So workers could skim the garbage out with nets.

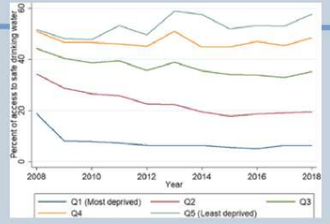
LIMA

ACCESSIBLE WATER

Lima receives just **13mm** of annual rainfall which puts them in a yearly water deficit



Overpopulation the leading cause to urban slums which have limited or no access to safe piped water.



SOLUTIONS

Water.org's programs in Peru prioritises regions that have a high demand for water and sanitation.

7 financial institutions

1.1 million water & sanitation loans

Access to clean water to **4.3** million people

FLOODING

Coastal El Niño - A climate phenomenon which triggers a rise in water temperatures near the coast, causing a raise in sea levels leading to floods.

2017's rainy season caused **150,000 people** to be displaced from their homes.

SOLUTIONS

THE AMUNAS SYSTEM

It works by funnelling water from highland streams into the mountain, where it'll take months to emerge in springs and natural reservoirs.

Lowering the chances of raised sea levels and the water going towards flooding.

GREEN INFRASTRUCTURE

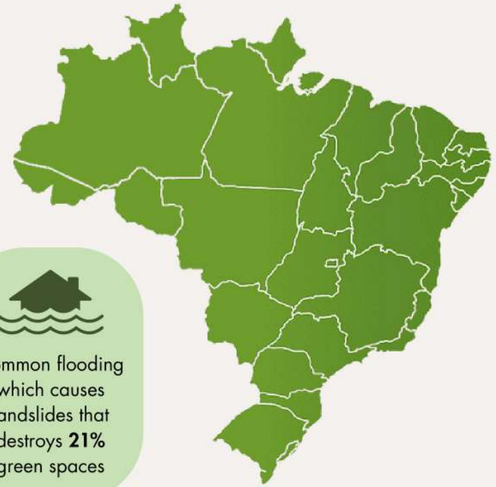
RIO DE JANEIRO

GREEN SPACES

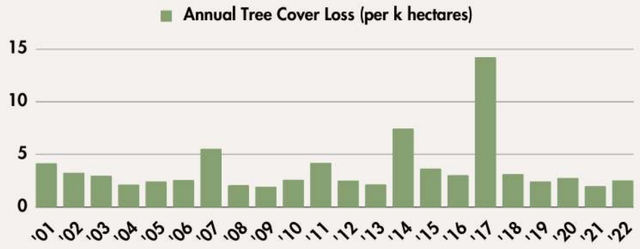
12%
Rio de Janeiro's total land area preserved as natural open space.

40%
of forest coverage throughout Rio De Janeiro.

15%
land area designated as park green space or urban parks.



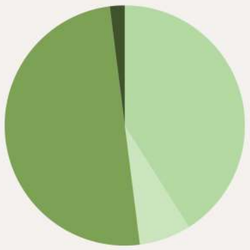
Common flooding which causes landslides that destroys **21%** green spaces

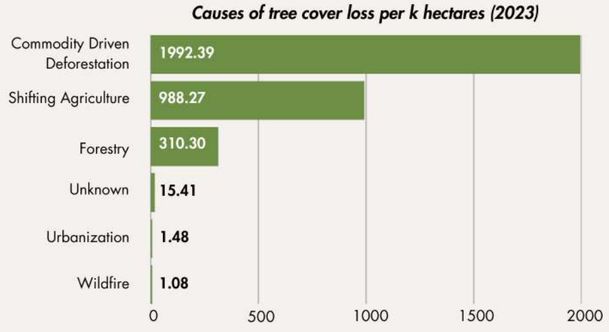


Fires were responsible for **20%** of tree cover loss in Rio de Janeiro between 2001 and 2022.

From 2001 to 2022, Rio de Janeiro lost **80.6 kha** of tree cover, equivalent to a 4.5% decrease in tree cover since 2000, and **37.6 Mt** of CO_2e emissions.

LAND USE





LIMA

GREEN SPACES

6-7%
of its land area designated as preserved natural open space.

Less than
1%
of forest coverage.

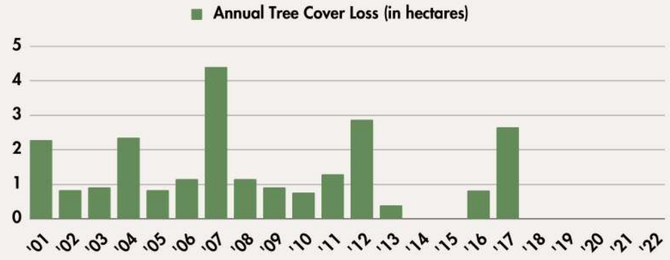
2% to 4%
land area designated as park green space or urban parks.

An estimation of **1000** trees cut down every year, **80%** of the time illegally.

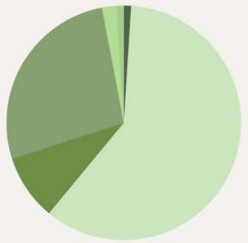
From **2002 to 2022**, Lima lost **0.00 ha** of humid primary forest.

TREE COVER LOSS

From 2001 to 2022, Lima lost **23 hectares** of tree cover, equivalent to a 0.14% decrease in tree cover since 2000, and **8.97 kt** of CO_2e emissions.



LAND USE



From 2001 to 2022, Lima lost **9 hectares** of tree cover from fires and **15 hectares** from all other drivers of loss.

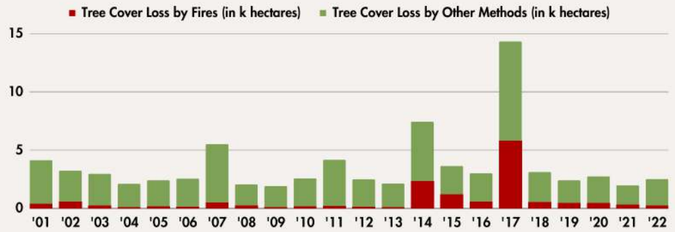
Total Tree Cover Extent (2001)	16515 Hectares
Tree Cover Loss (2001 - 2020)	23 Hectares
Total Tree Cover Extent (2020)	16492 Hectares
Total Tree Cover Loss in % (2001 - 2020)	0.1% Loss

GREEN INFRASTRUCTURE

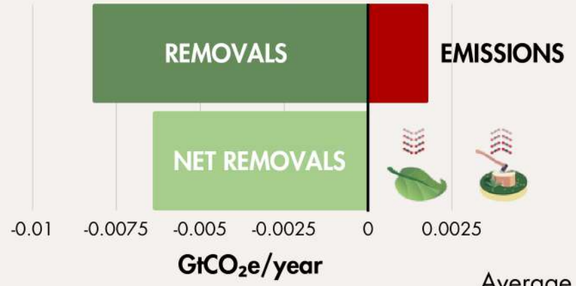
RIO DE JANEIRO

DEFORESTATION

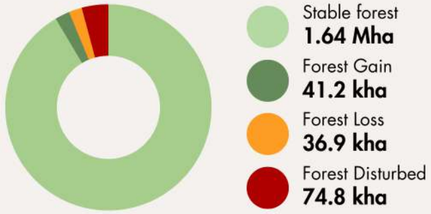
In 2010, Rio de Janeiro had **1.77 Mha** of natural forest, extending over **41%** of its land area. In 2022, it lost **2.49 kha** of natural forest, equivalent to **1.48 Mt of CO_2 emissions**.



Between **2001 and 2022,** forests in Rio de Janeiro emitted **1.71 $MtCO_2e$/year,** and removed **-8.20 $MtCO_2e$/year**. This represents a net carbon sink of **-6.49 $MtCO_2e$/year**.



From 2000 to 2020, Rio de Janeiro gained **41.2 kha** of tree cover region-wide equal to **0.51%** of all tree cover gain in Brazil.



Industrial agriculture is the biggest driver of deforestation setting fire to illegally clear land endangering **198 species of animals**.

Average air temperatures in Rio have increased by about **0.05 degrees** Celsius per year in recent decades. This is partly due to the **rapid urban expansion.**

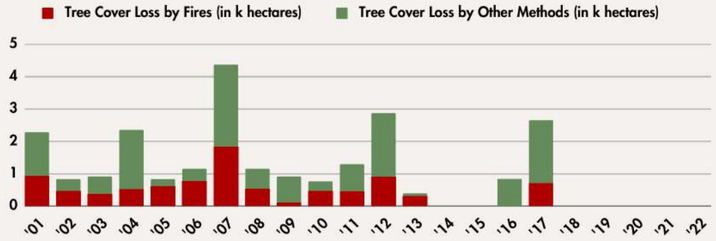
SOLUTIONS

The **Rio reforestation program** planted more than **10 million seedlings** of native species of the Atlantic Forest and increased the city's green coverage by **3.4 thousand hectares.** The building of a natural barrier contributes to the reduction of landslides.

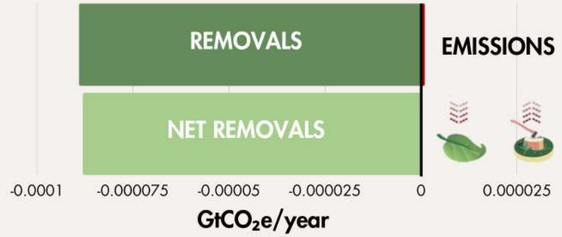
LIMA

DEFORESTATION

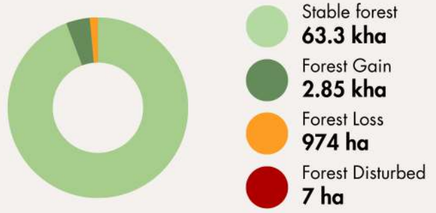
From 2001 to 2022, Lima lost **9 kha** of tree cover from fires and **15 kha** from all other drivers of loss. The year with the most tree cover loss due to fires during this period was 2007 with **2 kha** lost to fires — **43% of all tree cover loss** for that year.



Between 2001 and 2022, forests in Lima emitted **408 tCO_2e/year**, and removed **-89.5 $ktCO_2e$/year**. This represents a net carbon sink of **-89.1 $ktCO_2e$/year.**



From 2000 to 2020, Lima experienced a net change of **1.87 kha** (2.9%) in tree cover.



As of 2000, 0.51% of Lima land cover was **>30% tree cover**.

The majority of the land cover in Lima is **mostly sand** as Lima is considered the second largest desert city in the world

The main drivers of deforestation in Peru are **illegal logging** (accounting for **66% of lumber exports**) endangering over **12** species of animals.

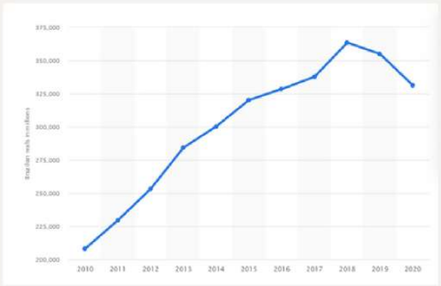
SOLUTIONS

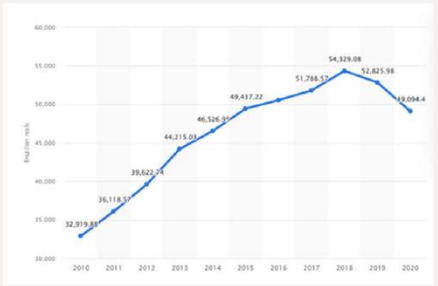
Lima **expanded several large national parks** by firstly, **granting indigenous peoples rights to significant forest areas** in the Amazon; **developed an innovative program** where the government gives indigenous communities support to take care of the forests; **created indigenous territories** that protect several isolated indigenous groups; **strengthened regulations** to prevent the conversion of forests to farmland and finally **created a national alliance for sustainable and deforestation-free production**.

RED INFRASTRUCTURE

RIO DE JANEIRO

ECONOMY





2023

GDP

144.1 billion USD

GDP per capita

21,200 USD

Primary Sector:
Sugarcane Production
Orange Production

Industrial Sector:
Oil Production — Information Technology
Pharmaceutical — Construction

Tertiary Sector:
Banking
Tourism

GREEN INITIATIVE

By 2050

Neutralise its greenhouse gas (GHG) emissions & achieve **carbon neutrality**, in line with the **Paris Agreement.**

Vision 2050

Based on **Sustainable Development Goals**, **5 themes** have been established and targeted to achieve by 2050. Which are: **Cooperation and Peace**, **Equality and Equity**, **Longevity and Well-Being**, **Climate Change and Resilience**, & finally **Governance**.

LIMA

ECONOMY

Primary Sector:
Mining
Fishing

Industrial Sector:
Oil Derivatives — Textiles/ Clothing
Chemicals Production — Food

Tertiary Sector:
Cargo
Tourism

2023

GDP

222.1 billion USD

GDP per capita

22,210 USD

>60%
of Peru's **industrial production** from **~7000 factories**

>70%
of Peru's **tertiary sector** from **hotels** and shipping
>21 million tons of **cargo** per year

Main export commodities: **oil, steel, silver, zinc, cotton, sugar** and **coffee**

GREEN INITIATIVE

Climate Action Plan

To **increase urban green areas** and ensure they are **safe and inclusive** and promote their active use.

established a **minimum requirement for green areas** at district level and in new developments

9 m2 per inhabitant

1 tree for every **3** inhabitants

SDG Index Rank

65/166

SDG Index Score

Spillover Score

RED INFRASTRUCTURE

RIO DE JANEIRO

HERITAGE

1 July 2012

Part of the city designated a World Heritage Site by UNESCO, named "**Rio de Janeiro: Carioca Landscapes between the Mountain and the Sea**",

POLICIES

MORAR CARIOCA — Plano Municipal de Integração de Assentamentos Precários Informais

Integrating Informal Settlements

Aims to provide **integrated development and services** through the Municipal Secretary of Housing to incorporate these areas into the bordering more formal communities

bikeRio

Bicycle Capital City

Creating a cycling culture around **cleaner and more accessible transport**

Contingency Plan

Guides **preparedness and response actions** in the event of a **disaster caused by heavy rains** and to **execute mitigation, response and recovery actions** in support of the local government

Sub-National Climate Change Policies

Climate change laws and instituted policies to **decrease emissions and improve sustainability** in the region.

LIMA

HERITAGE

1988

The **city's historic center** was declared a UNESCO World Heritage Site, due to its **large number of historical buildings** dating from the **Spanish colonial era.**

HUMAN RESOURCES

52% attended primary school

33% attended secondary school

Most children attend school in Lima, but **illiteracy rates have remained high**.

119 hospitals

2.7 physicians per **1000** residents

Healthcare in Lima is a **matter of class**. Poorer Limeños have **little access** to health care. **Unhealthy conditions** have led to **cholera and tuberculosis outbreaks**.

POLICIES

32.5m affected by floods, droughts, forest fires, earthquakes, landslides, or volcanic eruptions

>511,000 lost their homes to natural disasters between 1990 and 2020.

Policy Reform from **2010 - 2020**

To **improve** its **disaster risk management readiness and practices**.

Established stronger financial protections

Increased public investment in **disaster prevention**, and targeted interventions for resilient health and water infrastructure, reducing the population's vulnerability.

GREY INFRASTRUCTURE

SDGS RELATED TO GREY INFRASTRUCTURE

6 CLEAN WATER AND SANITATION
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION

RIO DE JANEIRO

EXISITNG GREY INFRASTRUCTURE

Water Supply & Wastewater Infrastructure - Treatment plants & network of pipes

Stormwater Management - Storm drains & retention ponds

Transportation Infrastructure - Network of roads, highways & bridges

Waste Management - Landfills & recycling programs

PROBLEMS

Water & sewerage system - Water shortages, pollution of water bodies, & inadequate wastewater

Flood control - Heavy rainfall, flooding, insufficient drainage & flood control system

Transportation - Traffic congestion, overly-exhausted transport system & increased pollution

Solid waste management - Insufficient waste collection services, illegal dumping& inadequate recycling infrastructure

TRANSPORTATION

MODES OF TRANSPORT

METRO BRT TRAM / VLT FERRY BICYCLE TAXIS / UBER

Road transport sector accounts for
35.9% OF RIO'S TOTAL GHG EMISSIONS

Citizens are exposed to an annual average of
BETWEEN 11 TO 17 MG/M3
of harmful air pollution

The transport sector contributes yearly
NEARLY 36% / 7,371 Gg OF CO2e
released into the atmosphere

LIMA

EXISITNG GREY INFRASTRUCTURE

Sewerage & Wastewater Treatment - Extensive sewerage system & wastewater treatment facilities

Water Supply & Distribution - Reservoirs, pipelines, & water treatment plants

Transportation Infrastructure - Network of roads, highways, bridges & tunnels

Waste Management - Waste collection, disposal, & recycling systems, with landfills & waste treatment facilities

PROBLEMS

Sanitation & Wastewater Management - Inadequate sanitation infrastructure & improper sewage disposal

Flood Risk - Inadequate stormwater drainage system during heavy rainfall

Transportation - Traffic congestion, air pollution & increased fuel consumption

Waste Management - Overwhelmed city landfill sites

TRANSPORTATION

Public transport in Lima is handled by buses, metros & taxicabs.

MODES OF TRANSPORT

METRO BUS TAXIS

Transport sector Is responsible for
40% OF LIMA'S GHG EMISSIONS

PM2.5 concentration in Lima is currently
5.7 TIMES
the WHO annual air quality guideline value

Greenhouse gas emissions may
INCREASE BY 200% BY 2050
if actions are not taken to reduce it

GREY INFRASTRUCTURE

RIO DE JANEIRO

WASTE MANAGEMENT

10,000 tons of waste is collected every day in Rio de Janeiro.

Formal recycling system
Municipal Waste Management Company (COMLURB)

Handles a very small percentage of the waste collected every day

70 - 80% of waste collected is sold as recyclable material

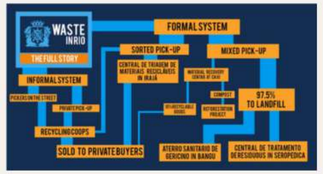
Accounts for only 3.7% OF THE CITY'S TOTAL WASTE

Informal recycling system
- Catadores
- Private pick-up services

Vast majority of recycling happens through the informal recycling system
Fills a vital gap in Rio's recycling system

SOLUTION

Refining economic feasibility model -
The waste management plant currently serves 70,000 people and can divert up to 35 tons of organic garbage from landfills each day.



Rio de Janeiro's waste management diagram

FLOOD CONTROL SYSTEM

ISSUES

Heavy rain - Cause flooding due to poor drainage, traffic congestion, damage to buildings & infrastructure & landslides.

Low lying geography - Prone to landslides & flooding.

SOLUTION

Construction of 4 underground reservoirs & a diversion tunnel - Extra water will now build up in the tanks & be pumped to the surrounding bay.

BENEFITS

Avert flooding, protect the infrastructure, & enhance traffic flow.

LIMA

WASTE MANAGEMENT

The city with the largest ecological footprint, surpassing acceptable limits, is Lima.

About 8,468 tons of garbage is generated daily,
WHEREOF, ONLY 4% IS RECYCLED.

There are only four sanitary landfills in Lima,
46.2% OF WASTE IS DISPOSED ILLEGALLY

The average Lima resident's current lifestyle would
REQUIRE 1.27 PLANETS FOR US TO EXIST

SOLUTION

Finding the illegal dump -
Help from vultures have been enlisted to sniff out garbage to find the various illegal dumps in Lima and note their locations on a live map to call attention to the massive trash issue plaguing the megacity.

FLOOD CONTROL SYSTEM

The risk of an urban flood in Lima is considered to be high. This means that at least once in the following ten years, potentially dangerous and life-threatening urban floods are anticipated.

ISSUES

Urbanization - Resulted in a decrease in the permeability of the land, leading to flooding & catastrophic damages when heavy rain occurs in the area.

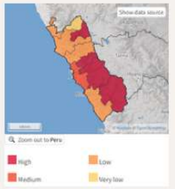


Diagram of the flood risk in different parts of Lima

BENEFITS

The collected water from the green ditches will be distributed to increase the green spaces of the district.

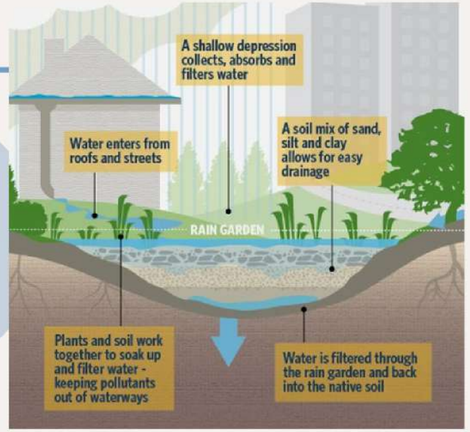
SOLUTION

Retention tank & green ditches - To reduce the risk of flooding due to urbanization.

BLUE INFRASTRUCTURE

RIO DE JANEIRO

PROPOSAL



Urban Planning and Land Use Regulation

- Encourage **sustainable urban planning** and **green infrastructure** to **absorb excess rainwater**.
- Restore or create natural wetlands, which can act as **natural buffers against floods** by absorbing and storing excess water.

Government Initiatives

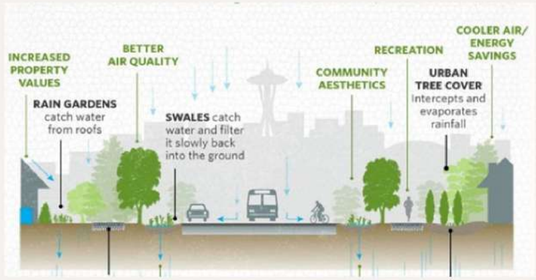
- Implement and enforce strict land use regulations to **prevent construction in flood-prone zones**.
- **Educate the public** about flood risks, safety measures and proper solid waste disposal.
- Promote flood insurance to encourage homeowners to protect themselves financially.

Improved Drainage Systems and Introduce Flood Forecasting Technology

- **Upgrade and expand the city's drainage infrastructure** to accommodate heavy rainfall.
- Regularly **clean and maintain** existing stormwater drains and channels to **prevent blockages**.
- Invest in modern technology for **flood forecasting** and **warning systems** that provide real-time information to residents and authorities.

LIMA

PROPOSAL



Stormwater Management and Green Spaces

- Implement green and sustainable **stormwater management** practices, such as **permeable pavements** and **rain gardens**, to reduce surface runoff.
- Increase **urban green spaces and afforestation** to absorb rainwater, reduce runoff, and improve overall urban resilience.

Government Cooperation with Third Parties

- **Ensure coordination** between municipal, state, and federal government agencies to create a **cohesive flood management strategy**.
- Government should work with NGOs to **continuously collect and analyze data** related to rainfall, river levels, and historical flood events to **improve flood prediction** and management.

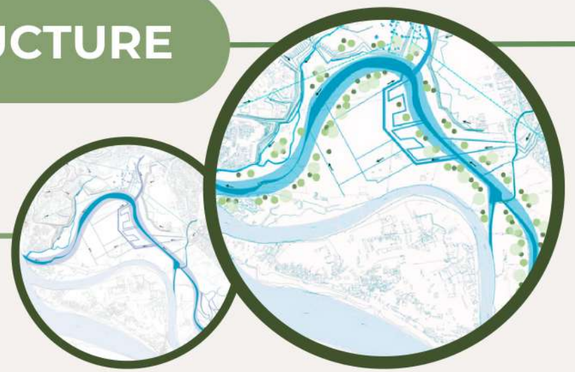
Sustainable Infrastructure

- Invest in **sustainable and resilient infrastructure** that can withstand flooding, such as **elevated roads** and **flood-resistant buildings**.
- Introduce **modern floating houses and buildings** in flood-prone zones.
- **Clean and maintain** stormwater channels and drains on a regular basis to **avoid obstructions**.

GREEN INFRASTRUCTURE

RIO DE JANEIRO

PROPOSAL



Tree Planting

- Launch **city-wide tree planting initiatives** to increase urban canopy cover, which can help mitigate heat, reduce air pollution, and enhance aesthetics.

Green Roofs and Walls

- Promote and incentivize the installation of green roofs and walls on buildings, which can help **reduce the urban heat island effect**, **improve air quality**, and **manage stormwater runoff**.

Community Gardens and Urban Agriculture: (Ongoing Operation)

Promote community gardens and urban agriculture to provide residents with access to fresh produce, strengthen community bonds, and reduce the need for long-distance food transportation.

Rio de Janeiro is currently collaborating with local favelas to possibly create the world's largest urban garden, as part of a government-funded initiative known as **"Hortas Cariocas"**

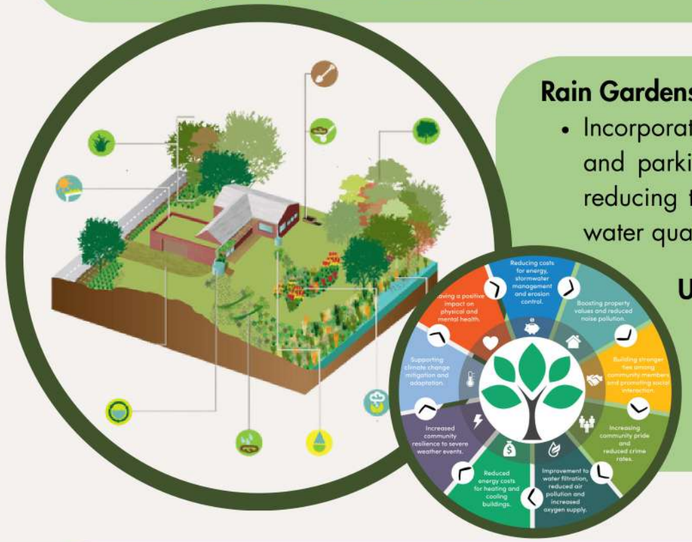
This initiative aims to popularise the consumption of organic produce while also providing a source of income for disadvantaged families. This can also help indirectly improve the green infrastructure of Rio De Janeiro.

LIMA

PROPOSAL

Urban Parks and Green Spaces
(example taken from Boise River, USA)

- Create more urban parks, greenbelts, and recreational areas in densely populated neighborhoods to **provide residents with access to nature and reduce heat stress.**
- Establish pocket parks and community gardens to **increase green spaces in urban areas.**



Rain Gardens and Bioswales

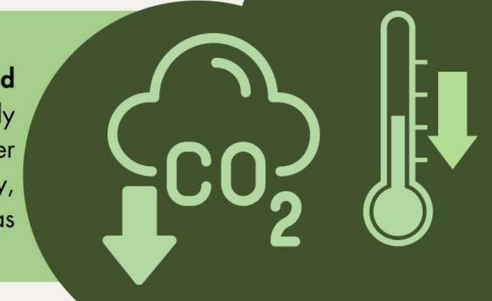
- Incorporate rain gardens and bioswales into streetscapes and parking lots to **capture and filter stormwater runoff**, reducing the burden on grey infrastructure and improving water quality.

Urban Forestry Management

- Establish a comprehensive urban forestry **management plan** to monitor and care for existing trees and ensure their long-term health and vitality.

Goals to Achieve

Increase Urban Trees Canopy Cover by **15% which is around 9,000 hectares** to achieve temperature **reduction of 2°C** mainly for the poorer areas of Lima, where electricity and clean water is harder to obtain by the locals. With Lima being a desert city, **a sustainable approach to reduce CO2 levels** in the urban areas would be to **plant more trees**.



RED INFRASTRUCTURE

RIO DE JANEIRO

PROPOSAL

Public-Private Partnerships (PPPs)

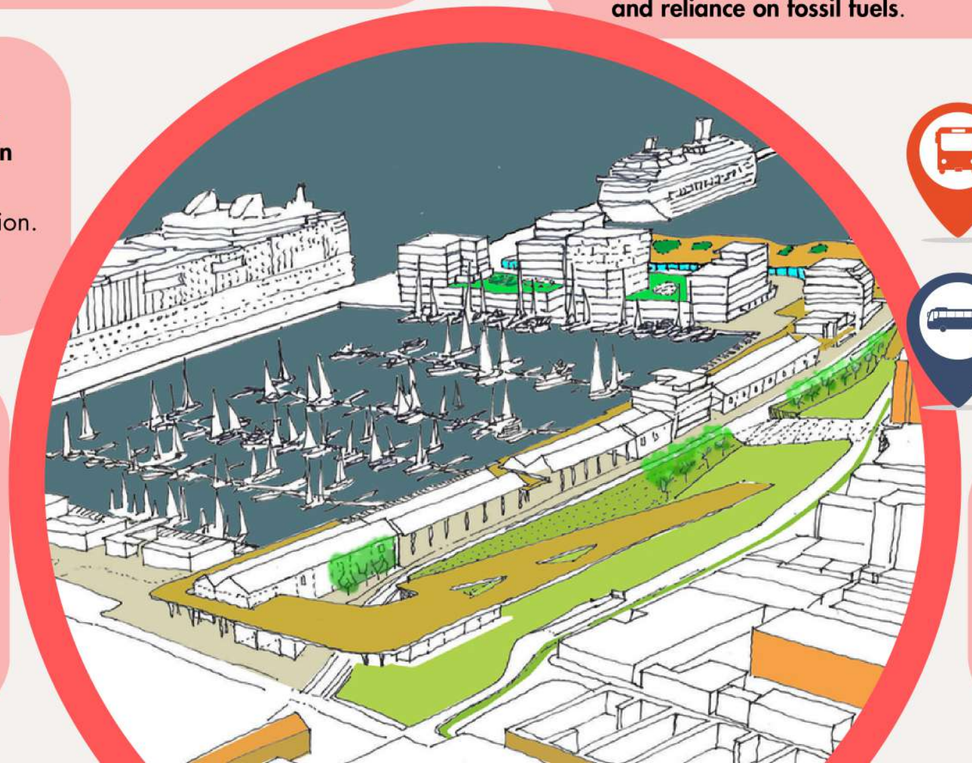
- The government should help **compensate private institutions** that **focus on environmental and eco-friendly efforts** that **promote sustainable living** among the locals.
- Explore PPPs **to fund and manage infrastructure projects**, leveraging private sector expertise and investment.
- Ensure **transparency**, **accountability**, and a **fair balance of risks and rewards** in PPP agreements.

Mobility Policies

- Implement **pedestrian-friendly streets** and **pedestrian zones in the city center** to encourage walking and reduce air pollution.
- Walking can also **promote a healthy lifestyle** for the locals.

Urban Regeneration

- Promote the **revitalization of neglected urban areas** through mixed-use development, green spaces, and cultural amenities.
- Encourage **public-private partnerships (PPPs)** to **drive investment in urban regeneration projects**.
- Introduce a **"sustainable building plans only"** or similar policy to any **future constructions in the urban areas**, especially in poorer areas such as the favelas.



LIMA

PROPOSAL

Clean Energy Transition

- Establish **renewable energy targets and incentives** to promote the use of clean energy sources like wind and solar power for electricity generation.
- Introduce **energy efficiency standards for buildings, appliances, and industries** to reduce energy consumption and greenhouse gas emissions.
- Encourage the installation of **solar water heaters** in residential and commercial buildings to **reduce energy costs and reliance on fossil fuels**.

Public Transportation Policies

- **Develop** and **expand the city's public transportation system**, including buses, trams, and the metro, **to reduce traffic congestion** and **encourage the use of public transit**.
- **Create bike lanes**, **bike-sharing programs**, and **secure bike parking facilities** to promote cycling as a sustainable mode of transportation.

Urban Resilience Planning

- Integrate **climate resilience** into **urban planning** to prepare for extreme weather events and rising sea levels.
- **Develop and implement strategies** to mitigate urban heat islands and enhance urban green spaces.

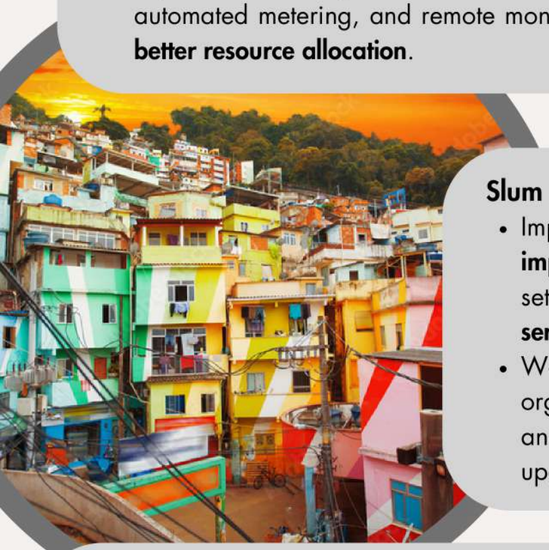
GREY INFRASTRUCTURE

RIO DE JANEIRO

PROPOSAL

Smart Infrastructure

- Invest in smart city technologies to **enhance the efficiency** and management of infrastructure systems.
- Implement intelligent traffic management systems, automated metering, and remote monitoring of utilities for **better resource allocation**.

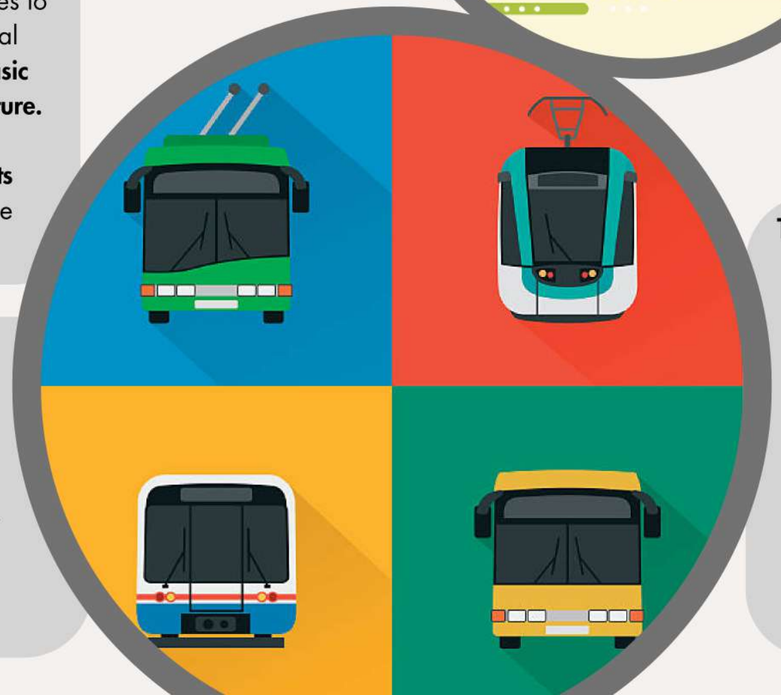


Slum Upgrading

- Implement slum upgrading initiatives to **improve living conditions** in informal settlements, providing access to **basic services, sanitation, and infrastructure.**
- Work with NGOs and community organizations to **empower residents** and **ensure their participation** in the upgrading process.

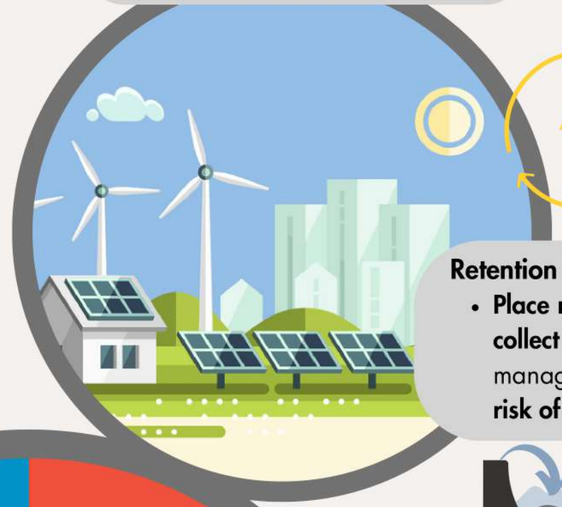
Transportation Network

- Upgrade and expand the road network to **alleviate traffic congestion** and **improve road safety**.
- Introduce **pedestrian-friendly streets** and **appropriate pedestrian zones** to **allow walking as a mode of transportation**.
- **Modernize bridges and tunnels** to ensure they meet **safety and capacity standards**.
- Invest in **efficient public transportation systems**, including buses, trams, and metro lines, to **reduce reliance on personal vehicles**.



LIMA

PROPOSAL



Renewable Energy and Sustainable Practices

- Encourage the **adoption of renewable energy sources**, such as solar and wind power, for public and private buildings.
- Promote **sustainable construction practices**, including green roofs and energy-efficient designs.

Retention Tanks & Green Ditches

- **Place retention tanks** and **green ditches** to **collect rain water** and act as a stormwater management system. This is to **reduce the risk of flooding** in urban areas.

Transportation Infrastructure

- **Develop and expand the metro and bus rapid transit (BRT) systems** to provide efficient, affordable, and accessible public transportation options for all residents.
- **Introduce modern, eco-friendly buses and trams** to reduce emissions and congestion.
- Implement **road widening** and improvement projects to **alleviate traffic congestion.**
- Create an **adequate drainage system** to **capture** and **direct rainwater away** from the roads and pavements.
- Develop **pedestrian-friendly sidewalks**, **bike lanes**, and **pedestrian zones** to promote active transportation and **reduce dependence on cars**.

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THANK YOU