

Final Report

Mitigation Policy for the
Dominican Republic

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An aerial photograph of a tropical beach. The foreground shows a white sandy beach with several palm trees and blue lounge chairs. The water is a vibrant turquoise color, transitioning to a deeper blue further out. The sky is clear and bright.

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Executive Summary

Target: The Dominican Republic's Nationally Determined Contribution (NDC) has set targets for reducing waste management, improving human settlements and conservation, and adhering to the UNFCCC's regulations through the agriculture and tourism sectors. Rising sea levels and increased frequency of natural disasters threaten the country's infrastructure and economic development. To prioritize mitigation strategies, cross-sectional approaches and public-private partnerships should be utilized to ensure the proposed mitigation policy is integrated into all sectors of the Territorial Management and Land Use Framework including relief land, soil, water, and others.

Agriculture: There has been a sharp decrease in the number of farmers and agricultural revenue in recent years due to the increasing effects of climate change and natural disasters. The country has set a goal of GHG reduction by 27.7% (20% conditional, 7% unconditional) by 2030, compared to business as usual. Agriculture is one of the economic sectors most vulnerable to climate change due to its intrinsic connection and dependence on the current climate viability. Furthermore, droughts and flooding in different parts of the country have made it difficult for people to continue living life as normal. Recommendations include promoting aid for farming families to build their own businesses and entrepreneurship capabilities, rerouting flood water to drought-prone areas and building aquifers, and focusing on climate-smart agriculture and best management practices in agriculture such as the use of drip irrigation and cover crops.

Conservation: Conservation in the Dominican Republic can be achieved in multiple sectors but especially in urban heat and industrial zones. Over 80% of the population lives in urban areas, leading to a rise in urban heat through the vastness of urban areas. Through some conservation methods, the heat in these areas can be maintained and lowered. More than 30% of the GDP of the Dominican Republic is achieved through the industrial sector. Through some conservation methods, the economy of the nation will remain unchanged despite a focus on environmental sustainability.

Human settlements: The Dominican Republic faces challenges related to human settlements, working opportunities, renewable energy, and tourism. To address these issues, recommendations include leveraging renewable energy development for job creation, learning from Brazil's success in biofuels and renewable energy, promoting eco-tourism and community-based tourism while enforcing regulations, and addressing transportation-related emissions in the tourism industry. These measures aim to enhance working opportunities, reduce greenhouse gas emissions, promote sustainable energy practices, and drive tourism while preserving natural resources and benefiting local communities. Implementing these recommendations will contribute to a sustainable and prosperous future for the Dominican Republic.

Tourism: The Dominican Republic faces several challenges related to tourism, particularly regarding the negative impacts of all-inclusive accommodation models on service quality, carrying capacity, and the neglect of local culture and traditions. The country has a diverse coastal and marine ecosystem that is vulnerable to climate change impacts so sustainable tourism practices should be prioritized to reduce the man-made carbon footprint of greenhouse gasses primarily caused by tourism activities such as transportation, accommodations, and recreational activities, protect marine biodiversity, and benefit the local community's livelihoods. Potential marine tourism practices and regulations should prioritize education and awareness, local citizen engagement, hotel waste regulations, and a series of sustainable marine management practices such as coral reef conservation and blue carbon coastal wetlands protection. Urbanization is another challenge that is posed in the DR, which might lead to environmental degradation, pollution, deforestation, and habitat loss. Potential strategies should promote regional tourism and reduce the concentration of tourism activities through Destination Management Organizations, green tourism infrastructures and public transportation in rural areas, and sustainable urban planning and design. The importance of ecotourism addressing sustainable forest management tours, biodiversity conservation efforts, and community-based ecotourism initiatives are emphasized to ensure the long-term viability of eco-tourism in the DR.

Waste management: Waste management is a rapidly increasing problem in the Dominican Republic due to a lack of space for landfills, lack of awareness about recycling, and weak legal instruments to protect the environment. Unfortunately, waste continues to negatively impact the environment, air quality, soil, and water quality. Nonetheless, a few policy implementations can be put in place to combat this issue. First, the DR should invest in campaigns to raise awareness about waste management practices such as waste classification. Second, the DR should invest in building biodigesters across the nation because biodigesters allow the DR to use solid waste to produce energy that can be used to operate farms and businesses. Third, public-private partnerships should be utilized because they foster a shared vision between the public and private sectors. In that regard, both sectors can divide work so that the private sector is responsible for funding delivery practices while the public sector is responsible for advisory regulations.

Road Map

Brief summary of the Draft Law and the Research Questions the Consulting Team will address in this report

Four guiding pillars exist for the Policy of Territorial Management and Land Use:

1. **Human Settlement**
2. **Environmental Protection and Management**
3. **Competition**
4. **Cohesion of Land Use**

Additionally, there are guiding principles for the current draft law that should be consulted in proposing policies that help the DR meet its Nationally Determined Contributions under the UNFCCC. These principles are:

1. **Belonging:** Representativeness of territory with natural resources and urban complexes that define it as typical of a specific cultural area.
2. **Habitability:** Security in the use of the territory and the construction of infrastructures capable of generating harmony between the natural and built environment.
3. **Co-responsibility:** The contribution of all governmental and non-governmental entities to organize the territory.
4. **Participation:** Actors and social groups participate in the planning, decision-making, execution, monitoring, and evaluation processes of the interventions of this plan and in pursuit of territorial ordering.
5. **Equity:** Universal access of communities to basic services and equal opportunities for all populations in the territory.
6. **Governance:** Agreements entered into at the coordination levels as a guarantee that the goals and activities proposed for territorial planning are carried out in a transparent and participatory manner.
7. **Sustainability:** All interventions carried out in the territory must guarantee a balance between economic growth, environmental protection, and social welfare.

To help the DR adhere to the guiding pillars and principles and meet its commitments to the UNFCCC, the consulting team will address the following:

1. How can mitigation policy be included in all sectors described in the Territorial Management and Land Use? (sectors: relief land, soil, water, waste, tourism, etc)
 - a. Cross-sectoral approaches
 - b. Public-private partnerships
2. Which mitigation activities should be prioritized in the draft law on Territorial Management and Land Use?
3. What policies could be drafted to help meet national and international commitments to reducing GHGs.

Greenhouse Gases & Short-Lived Climate Pollutants

Definitions, impact, and mitigations measures

According to the Assessment of Short-Lived Climate Pollutant Mitigation in the Dominican Republic report (2021), climate change and air pollution are connected phenomena because greenhouse gasses and air pollutants are produced by the same sources (Priddle 2016). Therefore, implementing mitigation measures that address greenhouse gas sources will also mitigate air pollutant emissions and vice versa.

Black carbon (CB), Tropospheric Ozone, Methane, and hydrofluorocarbons fall under the following categories at the same time: air pollutants, short-lived climate pollutants, and greenhouse gasses. Also, these pollutants are often produced by the same sources. Thus, the implementation of mitigation measures that address these sources will lead to a positive change in reducing the negative impacts of climate change. In the context of the Dominican Republic, there are two important short-lived climate pollutants:

- Black carbon: emissions of black carbon contribute to air pollution, human health, and average global temperature.
- Methane: short-lived pollutant and greenhouse gas that is responsible for the second largest contribution to increasing the average global temperature.

Main sectors responsible for black carbon emissions:

1. Residential combustion: use of wood in rural areas (using wood for cooking).
2. Industry: use of bagasse as fuel.
3. Transportation: diesel buses were responsible for large emissions of black carbon.

Main sectors responsible for methane emissions:

1. Agriculture: livestock is responsible for the largest methane emissions.
2. Waste: management of solid waste is a leading contributor to methane emissions.

In conclusion, short-lived pollutants and greenhouse gasses share the same sources. Targeting the sources of short-lived pollutants and greenhouse gasses in sectors such as agriculture, residential, and transportation will mitigate the negative impact of these pollutants on the environment.

Mitigation Practices & Benefits of Mitigation

Explanation of mitigation practices that the DR can implement to address the Short-Lived Climate Pollutants mentioned above and the long-term effects of climate change.

The Assessment of Short-Lived Climate Pollutant Mitigation in the Dominican Republic report (2021) highlights the lack of existing laws addressing Short-Lived Climate Pollutants (SLCPs) in the country. However, since SLCPs and greenhouse gasses are often produced from the same sources, the country can build on existing laws addressing greenhouse gasses to also address SLCPs.

Black carbon emission reduction (Assessment of Short-lived Climate Pollutants, 2021):

1. Reducing the average age of vehicle fleet from 15 years to 10 years. To achieve this, annual, regular, and technical reviews of cars to ascertain that they keep achieving the emission requirements.
2. The report also suggests faster implementation of the National Electric Mobility Strategic Plan to further reduce emissions from the transportation sector.
3. To reduce emissions from burning wood in the residential sector, raising awareness of artisan stoves.
4. Increasing the proportion of vehicles using compressed natural gas fuel.
5. Encouraging the use of biofuels in the transportation sector.
6. Increase the percentage of electricity produced from renewable sources.

Land Use In Forestry

The forest cover in the Dominican Republic spans an area of **18900 km²**, which accounts for **39.24%** of the country's total area. In an effort to combat deforestation, reforestation efforts have been implemented, resulting in the planting of **137 million** trees between 1997 and 2014. However, deforestation remains a pressing issue, with **55%** of it being caused by the expansion of agricultural and livestock frontiers. These trends demonstrate the importance of ongoing efforts to address deforestation in the country, which include the promotion of sustainable land use practices and conservation efforts to preserve the country's natural resources and biodiversity.

The Ministry of the Environment and UNFCCC have put strategies (see Table 1) in place to preserve the forests that already exist outside the National System of Protected Areas. However, concerns have been raised regarding the legal certainty of these strategies, as well as the potential for undesirable changes to land use practices. Specifically, the legal framework governing the country's forest management plans is unclear, and some forested areas are converted to other uses such as agricultural or urban development without proper planning or consultation (Topodata, 2019).

Table 1. Set of objectives and strategies for mitigation in forestry in the DR (UNFCCC, 2022).

Sector	Policy Objective	Prioritized Strategies
Forestry	Forest cover	<ul style="list-style-type: none"> Assisted afforestation and natural regeneration National Reforestation Program National Forestry Law
	Protected areas	<ul style="list-style-type: none"> Designate National parks, forest reserves, and wildlife sanctuaries. Protected forests: protection of soil and bodies of water Conservation forests: conservation of tree species, soil, and water bodies Production forests: commercial plantations for timber, energy, industrial, food, and ornamental use
	Deforestation & degradation	<ul style="list-style-type: none"> Forest fire management Planning, optimization of soils conservation and management Urban land use planning and green infrastructure
	Technological R&D - AFOLU	<ul style="list-style-type: none"> Portfolio of technology options for AFOLU

Based on the existing framework and potential concerns, it is important to address different forest types, areas, and characteristics when prioritizing mitigation activities (see Table 2) because each forest type has unique ecosystem functions, biodiversity values, and carbon sequestration potential. For example, Coniferous Forests have different carbon storage and biodiversity values compared to Broadleaf Forests, Dry Forests, or Wetland Forests. Therefore, differentiated mitigation policies need to be applied to ensure that mitigation efforts are effective, efficient, and socially equitable, while also enhancing the resilience of forest ecosystems to climate change.

Table 2. Main forest type, area, characteristics, and prioritized mitigation activities in the DR:

Type	Area	Characteristics	Prioritized Activities
Coniferous Forest	17.52%	Pine and mixed forest	<ul style="list-style-type: none"> • Reduce the rate of deforestation and forest degradation • Promote reforestation and afforestation
Broadleaf Forest	21.69%	Cloudy, humid, and half damp forest in mountainous and coastal areas	<ul style="list-style-type: none"> • Forest restoration and landscape conservation • Enhance forest carbon stocks, e.g., sustainable forest management practices, reduced impact logging and conservation programs • Biodiversity conservation to ensure continued functioning and resilience
Dry Forest	10.03%	Semi-deciduous trees	<ul style="list-style-type: none"> • Reduce deforestation and promote restoration • Improve soil health and water retention through sustainable land management practice • Support livelihoods of forest-dependent communities as well as the development of alternative income-generating activities • Address the drivers of deforestation and forest degradation unsustainable agriculture, mining, and logging practices, through policy and regulatory measures.

**Wetland
Forest**

0.65%

Mangrove and
freshwater
wetlands

- Enhance **carbon sequestration and storage** through conservation, restoration, and sustainable forest management practices, such as **reduced-impact logging and agroforestry**.
 - Support **livelihoods of local communities**
 - Address the **drivers** of wetland forest degradation
 - Enhance wetland forest **resilience to climate change** (e.g., sea level rise, flooding), through ecosystem-based adaptation measures (e.g., **restoration of natural wetland functions and establishment of buffer zones**).
-

Agriculture

Poverty in Rural Farmland

Issue: As the fourth-largest economic sector, agriculture represents 5.67% of the Dominican Republic's total GDP (Global Economy 2021) and 9% of the country's workforce (IFAD 2019). Due to unprecedented events such as climate change, the COVID-19 Global pandemic, and the effects of urbanization, farmers' numbers are decreasing, and many must rely on non-farming forms of income (IFAD 2019).

Recommendation: The International Fund for Agricultural Development (IFAD)'s main goal is to provide "access to income-generating activities on-farm and off-farm through employment or self-employment (entrepreneurship)" through low-interest loans (IFAD 2019). The Consulting team recommends partnering with IFAD in order to create a small, low-interest loan program available for low-income households.

Evidence: The current Rural Families' Productive Inclusion and Resilience Project with IFAD grants rural, low-income families the opportunity to utilize climate-smart agriculture through private-public partnerships specifically related to clean energy and water usage, improved access to sustainable farming practices and technology, and increase employment opportunities for the rural youth (Cortes Carrasbal 2022). The IFAD has done work in Mexico, Ecuador, and Argentina to reduce poverty in farmers and increase the usage of climate-smart agriculture (IFAD 2019). IFAD investments with other projects in the Dominican Republic aim to create 18,600 jobs, and working on a low-interest loan program can increase this number even more (Cortes Carrasbal 2022).

Droughts and Flooding

Issue: The Northeastern region of the Dominican Republic suffers from intense flooding while the Northwestern region experiences severe drought. Both floods and droughts lead to a decrease in overall economic activity for farmers, as they are unable to produce adequate livestock and crops given the lack of water or the destruction that flooding causes. Additionally, many people's houses and farmland are destroyed in floods, leaving them with minimal options for their livelihood. Places such as the capital, Santo Domingo, experience both droughts and floods depending on the season, and as the most populous area in the country, thousands of people now face starvation, dehydration, overheating, and the possibility of drowning.

Recommendation: There are several potential mitigation strategies to address climate change-induced natural disasters. The team recommends building aquifers that can hold water during floods so water can be utilized in future droughts; having water stocked up is imperative to the continued success of agriculture and the survival of people living in drought-prone areas. Additionally, creating an underground pipeline that can redirect flood waters to drought-prone areas can alleviate issues surrounding the transportation of water, and while this may be

expensive and time-consuming, it would be cheaper than flood recovery costs.

Evidence: The state of California in the United States suffers from both drought and floods and has been one of the first states to successfully create an aquifer system to hold flood waters in preparation for future droughts (Chiu 2023). It involves diverting rainwater towards aquifers that can hold the water until it is needed; by diverting rainwater in the Dominican Republic in a similar manner, local communities can attempt to both alleviate the damages created by flooding and prepare a plan for future droughts. In the same way, the option of diverting flood water to drought-prone areas could potentially mitigate the effects of droughts; creating pathways for the water to flow that allow it to bypass towns in flood zones and move towards other parts of the country that are at risk of drought can level the water amounts. Underground pipes are used in Fairfax County in the state of Virginia in the United States to bring flood water to a suitable outlet; in the case of the Dominican Republic, this outlet could be in the Northwestern region of the country (Northern Virginia Soil and Water Conservation District 2023).

Climate Smart Agriculture

Issue: The agriculture industry is one of the biggest producers of methane and the biggest consumers of water. The Dominican Republic's economy relies heavily on agriculture, and many of its citizens are small-land farmers. While no individual farmer is responsible for the negative effects of farming, the sheer mass of agricultural production can negatively impact the environment, especially air quality and water usage. Farmers are also subject to the negative effects of climate change, such as the previously discussed droughts and floods.

Recommendation: Drip irrigation is a potential solution to reduce water consumption and allow crops to flourish even in drought conditions. It involves putting tubing with emitters on the ground next to crops, as emitters slowly drip water onto the roots in the soil. Plants are not over/underwatered, so their quality improves and water consumption decreases (URI 2023). Alternatively, farmers can use a soaker hose, which is a porous hose that has a similar function to an emitter and works for plants that are close together (URI 2023). For air quality, farmers can use tactics such as planting cover crops with extra nutrients, using integrated pest management to reduce pesticides, and managing soil health through crop diversity and reducing tillage (Nebraska Corn Board 2023).

Evidence: Drip irrigation is frequently used in the Northeastern part of the United States and has seen a much higher success rate than normal sprinklers, which only get 65-75% of the water to reach the plants (URI 2023). The tactics to increase air quality are currently enforced in the state of Nebraska in the United States and have led to significant changes in overall air quality (Nebraska Corn Board 2023).

Conservation

Urban Heat

Issue: With a society that is 83% urbanized, land use policy has a major impact on the environmental fallout from urbanization. Urbanization, the expansion of cities, increases levels of deforestation, habitat loss, and the removal and pollution of freshwater (Uttara et al., n.d.). Urbanization also exacerbates a climate phenomenon known as urban heat; the rising of temperatures has an impact on the environment through rising Greenhouse Gases.

Recommendation: There are multiple methods to combat urban heat, including painting roofs in cities white. The painting of roofs white is a supportive strategy for reducing the temperatures of urban settings, but it can be an expensive methodology to utilize. A more cost-effective solution to reduce the urban heat in the Dominican Republic would be the use of white lime as well as a special reflective coating (Reality Check Team, 2019). The cost of this type of measure is \$0.02 per sq ft and upwards depending on the reflective coatings or membranes offered.

Evidence: In 2017, more than 3000 roofs were painted using both white lime and a special reflective coating in Bhopal, India (Reality Check Team, 2019). Bhopal is in central India and has a humid subtropical climate showcased by cool/dry winters and hot summers/humid monsoon season. The experiment found that solar reflective coatings on low-rise buildings saved energy load by 303 kWh in peak summer hours (Reality Check Team, 2019).

Industrialization

Issue: The Dominican Republic is home to the largest mine in Latin America, making the economy heavily reliant on the mining of resources. More than 30% of the GDP of the Dominican Republic is made up of the industrial sector. The mining of resources leads to high levels of environmental degradation. Not only are waterways polluted through the process of mining, but waterways are further contaminated by land minerals floating into the water.

Recommendation: A way to lower the environmental fallout from gold mining, especially its impact on the waterways of the area around the Pueblo Viejo mine, is a process known as Zero Liquid Discharge. Zero Liquid Discharge is when wastewater is reused in the process of mining for gold (Qureshi, 2019). The expensive disposal process can have a more efficient and cost-effective impact on the project's water supply through Zero Liquid Discharge. Gold has, historically, been harmful to the environment, but new methods of extraction - such as ZLD - can reduce the impact (Qureshi, 2019).

Evidence: In industrial nations (such as the United States, China, and India) regulations have led to many mining corporations utilizing Zero Liquid Discharge methods as a means to offset the high costs of water disposal. In India, the government created a policy to require textile plants above a certain size (generating more than 25 m³ of water waste per day) to install ZLD

facilities (Tong and Elimelech, 2016). Through the policy in India not only was water recovered but so were salts to use for direct use in the dyeing process specifically, leading to a more environmentally sound process (Tong and Elimelech, 2016).

Human Settlements

Working Opportunities

Issue: The Dominican Republic has experienced rapid economic growth for several years and recovered quickly from the novel coronavirus epidemic. However, due to a short period of time, the influx of people from the Dominican Republic into the city, and the lack of a significant increase in urban jobs, there was a mismatch between the rate of urban job creation and urban population growth. This has resulted in a large number of unemployed people in the city. The Dominican Republic's urban population has increased by 50% and the Dominican Republic has officially transformed from an agricultural-dominated society to an urban-dominated society (The World Bank, 2023).

Recommendation: Renewable energy has the potential to not only reduce greenhouse gas emissions but also bring significant economic benefits to the Dominican Republic, including the creation of new working opportunities. The development of renewable energy infrastructure can stimulate economic growth, create new jobs, and enhance energy security. Moreover, the operation and maintenance of renewable energy projects require a skilled workforce, including technicians and engineers who can operate and maintain the infrastructure. This can create additional job opportunities in the long term. Renewable energy can also create work in the manufacturing sector and energy efficiency programs. Since most of the renewable energy projects are carried out in remote areas far from the cities, this also helps the Dominican Republic to relieve the pressure of employment in the cities and can bring some of the unemployed urban population back to the rural areas to carry out renewable energy-related projects. It also eases the country's energy pressure and can reduce greenhouse gas emissions by increasing renewable energy development.

Evidence: One way renewable energy can create working opportunities is through the construction and installation of new renewable energy projects, such as wind and solar farms (International Renewable Energy Agency & International Labor Organization, 2022). These projects require significant investments in infrastructure, such as transmission lines, wind turbines, and solar panels, which can create jobs in construction, engineering, and installation. In 2021, direct employment in the hydropower sector was divided as follows: approximately two-thirds of the jobs were in manufacturing, 30% were related to construction and installation, and around 6% were dedicated to operation and maintenance (International Renewable Energy Agency & International Labor Organization, 2022). The production of wind turbines, solar panels, and other renewable energy components requires a significant amount of skilled labor

(International Renewable Energy Agency & International Labor Organization, 2022). By promoting the development of renewable energy infrastructure, the Dominican Republic can create new job opportunities in the manufacturing sector. Energy efficiency programs involve retrofitting buildings with energy-efficient technologies such as lighting, insulation, and HVAC systems (International Renewable Energy Agency & International Labor Organization, 2022). These programs can create jobs in the construction sector and increase the demand for skilled labor. A good example is the renewable energy project in China and Brazil. China has provided 5.4 million jobs nationwide through its renewable energy efforts, and this includes jobs in different stages of renewable energy (International Renewable Energy Agency & International Labor Organization, 2022). Meanwhile Brazil had an estimated 1.27 million renewable energy jobs (International Renewable Energy Agency & International Labor Organization, 2022). These renewable energy related jobs have on the one hand eased the pressure on urban employment and at the same time helped the country reduce greenhouse gas emissions. (see Appendix B. Case Study 13 & 14)

In conclusion, the development of renewable energy infrastructure in the Dominican Republic has the potential to create significant working opportunities in the construction, engineering, installation, and maintenance of renewable energy projects, as well as in the manufacturing and energy efficiency sectors. The promotion of renewable energy can reduce greenhouse gas emissions and bring significant economic benefits to the country, creating a more sustainable and prosperous future for its citizens.

Renewable Energy in Rural Areas

Issue: The Dominican Republic and Brazil both face the challenge of reducing their greenhouse gas emissions while transitioning to a more sustainable energy system. Both countries are highly dependent on fossil fuels for energy production, making them vulnerable to the impacts of climate change. The Dominican Republic is experiencing high levels of air pollution, deforestation, and water scarcity, highlighting the need to transition to more sustainable energy sources. The Dominican Republic is more dependent on fossil fuel combustion for energy production than Brazil. Fossil fuels account for 85% of energy production, but since the Dominican Republic has no natural resources for fossil fuels, these fossil fuel resources are all imported from abroad. As a result, the cost of energy production is relatively higher (International Energy Agency, n.d.).

Recommendation: The Dominican Republic can learn from Brazil's experience in promoting renewable energy to mitigate the impacts of climate change. The country can adopt similar programs to reduce its dependence on fossil fuels and promote sustainable development. Specifically, the Dominican Republic can adopt biofuels, wind energy, and solar energy programs to reduce its carbon footprint.

Evidence: Brazil is the world's second largest producer of sugarcane ethanol, and its implementation has led to a significant reduction in greenhouse gas emissions from the

transportation sector (Rossi et al., 2021). The Dominican Republic can promote the use of biofuels to reduce its dependence on fossil fuels in the transportation sector. The Dominican Republic also has a solid agricultural base and a climate relatively similar to that of Brazil. Therefore, it is possible to learn from Brazil in the production of sugarcane ethanol.

Brazil is also a global leader in wind energy production, with over 19 GW of installed capacity (Energy Information Administration, 2021). Brazil's investments in wind energy infrastructure, such as transmission lines and wind farms, have led to a significant reduction in greenhouse gas emissions from the electricity sector (Energy Information Administration, 2021). The Dominican Republic can encourage the development of similar projects to diversify its energy mix and reduce its dependence on fossil fuels.

Furthermore, Brazil has made significant investments in distributed solar energy systems, which has significantly increased the country's capacity for renewable energy (Energy Information Administration, 2021). The Dominican Republic can promote distributed solar energy and encourage the installation of solar panels in homes and businesses to reduce the country's dependence on fossil fuels in the electricity sector. Although the Dominican Republic is not comparable to Brazil in terms of size and economic volume, Brazil, as a country that has recently undergone an energy transition, has much to offer the Dominican Republic.

In conclusion, Brazil serves as a valuable model for the Dominican Republic in promoting renewable energy and reducing greenhouse gas emissions. Brazil's success in sugarcane ethanol production has led to a substantial decrease in emissions from the transportation sector, showcasing the potential of biofuels (Rossi et al., 2021). Additionally, Brazil's investments in wind energy infrastructure have resulted in a significant reduction in greenhouse gas emissions from the electricity sector, offering an example for the Dominican Republic to follow (Energy Information Administration, 2021). Moreover, Brazil's emphasis on distributed solar energy has expanded its renewable energy capacity, highlighting the benefits of solar power. By adopting similar strategies and investing in biofuels, wind energy, and distributed solar energy systems, the Dominican Republic can diversify its energy mix, reduce reliance on fossil fuels, and contribute to a more sustainable and greener future. Through these efforts, the Dominican Republic can achieve significant progress in mitigating climate change and promoting a sustainable energy transition.

Urban and Rural Tourism

Issue: The Dominican Republic's natural areas, such as tropical forests, coral reefs, and beaches, are significant draws for tourists. Tourism is an important economic source for the Dominican Republic, and the influx of tourists to the city provides a huge economic effect (WorldData.info, 2021). Unfortunately, tourists also put a great deal of pressure on the Dominican Republic's cities (Gibbons, 2023). These pressures are reflected in energy consumption, waste disposal, and other aspects.

Recommendation: To promote tourism to natural areas in the Dominican Republic while also

protecting the environment, two recommendations can be made. The first recommendation is to promote eco-tourism, which involves sustainable tourism activities such as hiking, birdwatching, and snorkeling. The second recommendation is to establish partnerships with local communities and involve them in tourism activities, such as community-based tourism and cultural tours. Third, the Dominican Republic Tourism Board can develop low-carbon transportation options to help travelers get to their destinations. This would reduce greenhouse gas emissions during transportation. The government of the Dominican Republic can combine ecotourism and community tourism to relieve social pressure on the city while bringing economic prosperity to the surrounding areas.

Evidence: Ecotourism can provide visitors with an authentic experience of the natural beauty of the country while also supporting local communities and preserving the environment. By promoting ecotourism, visitors can appreciate the natural areas without causing harm to the environment. Additionally, involving local communities in tourism activities can provide economic benefits while also ensuring that natural resources are protected. By promoting community-based tourism activities, such as cultural tours and local food experiences, visitors can learn more about the local culture and support local development.

To ensure that ecotourism activities do not harm naturally protected areas, it is important to implement strict regulations and guidelines, such as limiting the number of visitors to sensitive areas and educating tour operators and visitors on sustainable practices. By implementing these measures, the Dominican Republic can ensure that tourism activities support the protection and preservation of natural protected areas.

A study focuses on measuring carbon emissions generated by tourists visiting the Sekayu recreational forest in Terengganu, Malaysia (Bhuiyan et al., 2012), a region emphasizing ecotourism. The transportation sector is identified as the main contributor to carbon emissions in the tourism industry (Bhuiyan et al., 2012). Findings reveal that buses and motorcycles emit lower carbon compared to small and large cars (Bhuiyan et al., 2012). The study suggests initiatives such as low-carbon technologies, sustainable tourism practices, carbon taxes, government and tour operator efforts, and the development of tourism-friendly traffic systems to reduce carbon emissions in the ecotourism destination. Collaboration with international organizations is recommended to develop low-carbon ecotourism in the region (Bhuiyan et al., 2012).

In conclusion, ecotourism offers a sustainable way for visitors to appreciate the Dominican Republic's natural beauty while supporting local communities and preserving the environment. By implementing strict regulations, educating tour operators and visitors, and promoting sustainable practices, the country can ensure that tourism activities align with the protection of natural areas. Additionally, the study on carbon emissions from tourists visiting the Sekayu recreational forest in Malaysia emphasizes the need to address transportation-related emissions in the tourism industry (Bhuiyan et al., 2012). By adopting low-carbon technologies and collaborating with international organizations, the Dominican Republic can work towards reducing carbon emissions and promoting a sustainable future.

Tourism

Ecotourism

In recent decades, the tourism industry has seen an exceptional surge. Despite its benefits, there are certain challenges and tradeoffs arise when balancing tourism development with environmental preservation. Firstly, tourism is centered around pleasure-seeking, whereas sustainability emphasizes conservation and minimization of consumption. Secondly, while tourism can be a vital source of economic growth, it can result in environmental degradation both locally and globally (Eiseman, 2018). If tourism exceeds the local carrying capacity, the environment can be significantly impacted.

The tourism industry in the Dominican Republic, like many other countries, faces several challenges and barriers to moving towards sustainability. Specifically, in hotel and resort operations, all-inclusive models create fierce price competition between hotels and vacation resorts, which significantly impacts the service quality provided. The only objective that travel agents care about is increasing the number of visitors, ignoring the carrying capacity of the coastal territory (Navarro, 2019).

The inadequate training of workers in the tourist industry prevents sustainable tourism practices (Inter-American Development Bank [IDB], 2023). In addition, local culture and traditions are not included in tourism products, which might lead to long-term detrimental effects such as deficient maintenance of hotels and environmental deterioration (Regional Observatory on Planning for Development, n.d.).

Tourism practices such as transportation, accommodation, and restaurants all require a large amount of energy generated from fossil fuels, leading to an increase in GHG emissions and contributing to climate change impacts. The development of tourism infrastructure has led to land use change and resulted in the destruction of natural habitats and ecosystems.

Coastal & Marine Land

Issue: The Dominican Republic has a coastal length of 1668.3 km and insular platform areas of 11786 km², with diversified species and habitats: 200 beaches, 181 reef areas, 141 coastal lagoons, 41 rocky coasts, 25 dune areas, 49 estuaries, and 55 mangrove areas (Topodata, 2019). Climate change and variability impacts such as extreme weather events, sea level rise, and changes in precipitation patterns might make communities, infrastructure, and natural resources in coastal areas vulnerable, along with a high risk of degradation of soil, water, forests, and ecosystems. Ecotourism practices should be implemented to reduce carbon footprints, such as encouraging low-carbon transportation options, local sustainable food options, and supporting environmentally responsible accommodations.

Recommendation: Increase **education and awareness** by training tourists and tourism industry workers on environmentally-responsible tourism practices (see Appendix B. Case Study 1).

Evidence: One example of an environmentally-responsible tourism practice is the implementation of a sustainable tourism certification program for hotels and resorts. The program would require training and education for all staff on sustainable practices such as reducing waste and water consumption, using renewable energy, and promoting local sustainable food options. Additionally, sustainable tourism conferences could be hosted regularly to bring together stakeholders to share best practices and promote sustainable tourism initiatives. For tourists, the industry could offer ecotourism tours and establish interpretive centers located at popular tourist sites to educate people about the importance of preserving natural and cultural resources. Public campaigns can be launched through social media, tourist brochures, and other marketing materials to encourage people to use public transportation, reduce waste, and conserve water and energy during visiting (Bustinza, 2013).

Recommendation: Emphasize **local community engagement** to engage the local community as stakeholders to improve their socio-economic benefits and livelihoods.

Evidence: Community engagement refers to involving the local community in tourism activities and decision-making processes that affect them, which can lead to the creation of mutually beneficial relationships between the local citizens and the tourism industry. For example, eco-tourism activities such as nature walks or cultural tours can employ local guides, artisans, and other service providers. This can provide employment and economic opportunities for the local community, while also promoting the culture and traditions.

Recommendation: Develop **hotel waste regulations** with specific policies on hotel waste management, both solid and liquid waste.

Evidence: The government can set standards and guidelines for waste management practices, including waste reduction, recycling, and proper disposal of waste. The regulations and policies can be enforced through regular inspections and penalties for non-compliance. Specifically, the government of the Dominican Republic could work with the country's tourism industry to develop and implement waste management practices that are appropriate for the local context, as well as provide training to hotel staff and develop infrastructure and systems for waste disposal.

Recommendation: Promote **sustainable agriculture and fisheries practices** to establish marine protected areas to protect marine biodiversity and ecosystems and address biodiversity loss such as overfishing, hunting of endangered species, and destruction of habitats (see Appendix B. Case Study 2), as well as the **coral reef conservation** (see Appendix B. Case Study 3) and "**Blue Carbon**" coastal wetlands conservations (see Appendix B. Case Study 4 & 5).

Evidence: The Dominican Reef Network and The Nature Conservancy are collaborating on coral reef conservation in the Caribbean through an innovative and strategic approach, including the Climate Refugees that can sustainably use and restore coral reefs. This approach aims to protect relevant ecosystem services and benefit sustainable livelihoods, outreach, policy, and scaling activities. The partnership has developed various tools and capacities, such as coral reproduction laboratories, data, and maps.

Coastal wetlands, including mangroves, seagrasses, and salt marshes, are important ecosystems that provide a range of services, including carbon sequestration, erosion protection, and habitat for marine and terrestrial wildlife. These ecosystems have been identified as potential sources of "blue carbon," which refers to the carbon stored in coastal and marine ecosystems. The conservation and restoration of coastal wetlands can play a significant role in mitigating climate change by sequestering carbon from the atmosphere (UNFCCC, 2022).

Urbanization

Issue: Santo Domingo and Santiago are the two most prominent cities, which have a combined population of over 3 million people in the DR. The unequal distribution of economic growth and overburdened infrastructure might intensify environmental degradation since increased urbanization and industrialization can contribute to pollution, deforestation, and habitat loss.

Recommendation: Promote **Destination Management Organizations (DMOs)** and **develop green tourism infrastructure and public transportation.**

Evidence: DMOs have been effective in the Caribbean Island of Cozumel. Multiple organizations such as Cozumel Hotel Association, Cozumel Tourism Board, and Cozumel Cruise Association, are responsible for marketing, training, advocacy, and at the same time, working closely with local authorities to promote responsible tourism practices (Magio, 2021).

It is essential to build climate-resilient communities in particularly vulnerable areas and integrate ecosystem conservation, restoration, and climate change adaptation in rural communities (UNFCCC, 2022). To promote climate resilience in vulnerable areas, it is important to integrate ecosystem conservation, restoration, and climate change adaptation into rural communities. Sustainable urban planning and design practices involve green infrastructure development such as green roofs and walls, which would help mitigate the urban heat island effect, improve air quality, and enhance resource efficiency and social equity. The electrification of informal transportation systems is crucial in Latin America and the Caribbean, where 35% of greenhouse gas emissions from fuel combustion come from the transport sector. Specifically, National Urban Mobility Plans (NUMPs) are necessary to support the delivery of transportation and climate ambition, particularly with rapidly growing transport emissions. These plans can improve the capacity of cities to plan, finance, and implement sustainable, low-carbon transport projects and measures, thereby supporting the delivery of climate ambition. In addition, adjusting production and consumption patterns with a focus on rural regions and low-carbon economic sectors can

generate jobs and increase environmental resilience, strengthening human capacity for prosperity.

Forestry & Biodiversity

Issue: Deforestation in the Dominican Republic is driven by the expansion of agriculture and urbanization, leading to biodiversity loss and ecosystem degradation. In addition, the unsustainable use of forest resources, and lack of effective management and monitoring systems all contribute to the depletion of limited resources and have negative impacts on local communities.

Recommendation: Establish **sustainable forest management tours** (see Appendix B. Case Study 6), **forest restoration ecotourism** (see Appendix B. Case Study 7), and **conservation of endangered species** (see Appendix B. Case Study 8).

Evidence: Forest tours provide opportunities for individuals to learn about the conservation, restoration, and sustainable use of natural resources in forests. Sustainable tours include guided walks, educational sessions, workshops, etc (Monteverde Cloud Forest Biological Preserve, n.d.).

Forest restoration focuses on the conservation and restoration of forest ecosystems, including activities such as planting trees, engaging in educational sessions on forest ecology to promote sustainable forest management practices, generating income for local communities, and raising public awareness (Top Africa News, 2022).

Species conservation protects at-risk animal and plant species through activities such as habitat restoration, wildlife monitoring, and public education. Effective strategies should aim to preserve biodiversity, balance ecology, and benefit ecosystems (Top Africa News, 2022).

Protected Areas

Issue: Improved management of protected areas can enhance the protection of natural and cultural resources. It is crucial to prioritize climate adaptation and mitigation in protected areas, especially to restore degraded ecosystems, establish carbon sinks, and implement climate-resilient land-use practices.

Recommendation: **Strengthen environmental regulations and enforcement** (see Appendix B. Case Study 9) and **community engagement & Payment for Ecosystem Services (PES)** (see Appendix B. Case Study 10).

Evidence: Protected areas should be included in tourism practices and related laws and regulations. PES is an economic instrument that involves paying landowners or community

members for ecological services provided, including carbon sequestration, water filtration, habitat preservation, etc. The financial incentives for sustainable land use can help reduce the environmental impact of tourism while at the same time helping to reduce poverty and improve the livelihoods of local communities (Top Africa News, 2022; Travel Weekly, 2011).

Other Sectors

Issue: Besides the objective of achieving emission ambitions, the mitigation policies should also consider social issues such as the lack of coordination of policies between sectors and levels of government, equity, vulnerable groups, sustainability, etc.

Recommendation: **Support community-based tourism initiatives** (see Appendix B. Case Study 11), **stakeholder involvement**, and **green recovery plans** (see Appendix B. Case Study 12).

Evidence: The government should be responsible for empowering local communities to participate in decision-making processes and providing training and capacity-building opportunities. Additionally, to build stakeholder involvement, a multi-stakeholder platform could be established to encourage stakeholder engagement, aiming to include leaders from civil society organizations, local communities, and private sector entities in decision-making processes. The platform would help build institutional capacity, including appropriate frameworks, capacity building for local communities and government agencies, and partnerships between government, civil society, and the private sector. In addition, inter-agency committees could be established to enhance public awareness and participation and to coordinate policies between sectors and governments. By ensuring accountability and transparency, the updated system could improve communication between local and national authorities (United Nations Development Programme, 2012).

Green recovery plans, such as the Green Climate Fund, are particularly important for workforce transition in carbon-intensive industries such as tourism. They should include social protection systems and labor market regulations, especially addressing women, youth, and vulnerable groups. The program aims to support a green post-COVID economic recovery through innovative sustainable finance instruments such as thematic bonds, debt for climate swaps, and green loans, as well as climate-smart PPPs. Additionally, the program will facilitate the development of the country's ecotourism potential and a green job master plan (UNFCCC, 2022).

Waste Management

In the DR, waste management is a deteriorating problem due to a shortage in areas for sanitary landfills, a lack of awareness about recycling in the population, and a lack of legal instruments that are aimed at protecting air, water, and soil (Franco, E. F., Padrón Iglesia, W., & Pérez Teruel, 2022).

Waste Classification

Issue: A study conducted in Punal, Santiago, offers significant solutions to waste mismanagement. The study shows that only 31% of Dominican households execute waste classification before disposal (Franco, E. F., Padrón Iglesia, W., & Pérez Teruel, 2022). This shows a lack of correct practices to waste classification.

Recommendation: The government of the Dominican Republic should heavily promote waste recycling and classification programs on the local levels. Increasing awareness is a crucial step toward creating a culture around successful waste management habits. This would involve community activities such as posting flyers, holding town halls to discuss climate change and its effects, and offering classes that teach people how to recycle properly. Additionally, introducing recycling days in school classrooms can not only teach children to recycle, but to bring the practice to their own homes where they can teach their families.

Evidence: Of the households who were surveyed, 72% indicated that they would participate in recycling programs (Franco, E. F., Padrón Iglesia, W., & Pérez Teruel, 2022). The willingness to participate in such programs is a significant opportunity for the correct usage of waste. Indeed, programs of that nature exist, but the local population is unaware of them.

Agriculture and Livestock

Issue: Further investigation into the connection between agriculture and livestock offers another solution to waste management in the Dominican Republic. Since agriculture and livestock create massive amounts of organic solids, implementing a system that reuses that type of waste to produce energy, mainly biogases, is consequential.

Recommendation: We recommend the Dominican Republic government consider building more biodigesters nationally because that can (1) help solve waste management and (2) decrease the carbon footprint.

Evidence: Fortunately, previous examples of producing biogases exist in the Dominican Republic. For instance, the case of Agropecuaria Fernández Muñoz SRL (AGROFEM), which enables it to produce 70% of the required energy to operate its farms just from the excrement of livestock. This allowed the company to reduce its fossil fuel emissions. Nonetheless, further

research is required to assess the costs (Franco, E. F., Padrón Iglesia, W., & Pérez Teruel, 2022).

Public-Private Partnerships

Issue: We assess public-private partnership (PPPs) policies/strategies to be effective in solving waste management (Cointreau-Levine, 1994). This is because PPPs operate on three main principles: (1) a change of roles between the two sectors; the private sector should be tasked with service delivery and the public sector can be in charge of the supervisory role. (2) PPPs encourage partners to pursue one goal. (3) PPPs will address the interests of both sectors (Asomani, 2021).

Recommendation: We recommend the Dominican Republic capitalize on public-private partnerships between the local and national governments to further address waste management. Implementing these recommendations would yield positive results in the following categories: urbanization, industrial, and agricultural, which are key sectors in the Land Management and Land Use framework because it would bring the biggest stakeholders into the solution stage and give them an opportunity to express their needs and opinions. Also, these recommendations will improve the quality of life in the Dominican Republic, positively impacting human settlements, agriculture, water, and soil.

Evidence: One successful example of such a partnership is the Lagos Waste Management Authority in Nigeria (LAWMA). The government of Lagos collaborated with VisionScape Sanitation Solutions (VSS). The government assumes the advisory role, enacting policies, while VSS assumes the role of the investor, which entails building infrastructure and providing sanitary and waste-collecting vehicles (Aiyeloja and Adeyemo, 2019). Due to public-private partnerships, the city was able to improve its waste collection, and the process of reducing, reusing, and recycling, thus creating employment opportunities and a cleaner environment (Anestina et al., 2014).

Financial Recommendations

Organizations to Work With:

- IFAD: provides low-interest loans to help farmers become entrepreneurs
- World Bank: Dominican Republic currently has a \$750,000 grant with the World Bank to focus on climate change, funds multiple climate change projects around the world
- Green Climate Fund: funds climate change mitigation projects, currently has six projects within the Dominican Republic totaling \$53 million worth of financing (GCF DR 2022)
- Inter-American Development Bank (IDB): provides loans, grants, and technical assistance to promote economic development, reduce poverty, and address climate change in Latin America and the Caribbean.
- Global Environment Facility (GEF): provides funding to support projects that address global environmental challenges and climate change. The GEF has provided over \$4 billion in funding to support mitigation projects in Latin America and the Caribbean.
- United Nations Development Programme (UNDP): works with the government and other partners to identify opportunities for reducing greenhouse gas emissions and adapting to the impacts of climate change.

Grants to Apply for:

- The Climate Investment Funds (CIFs): provide funding for climate change mitigation and adaptation projects, including the Clean Technology Fund (CTF), Pilot Program for Climate Resilience (PPCR), Scaling-up Renewable Energy Program in Low-Income Countries (SREP), and the Strategic Climate Fund (SCF).
- Sustainable Energy and Climate Change Initiative (SECCI): promote sustainable energy and support countries in transition to low-carbon economies.
- LEED Building Efficiency: offers grants, loans, and loan guarantees to nations as a means to promote and create green sustainability in building energy efficiency. The organization has been involved in the Dominican Republic, with certification of more than 20 buildings in the nation.

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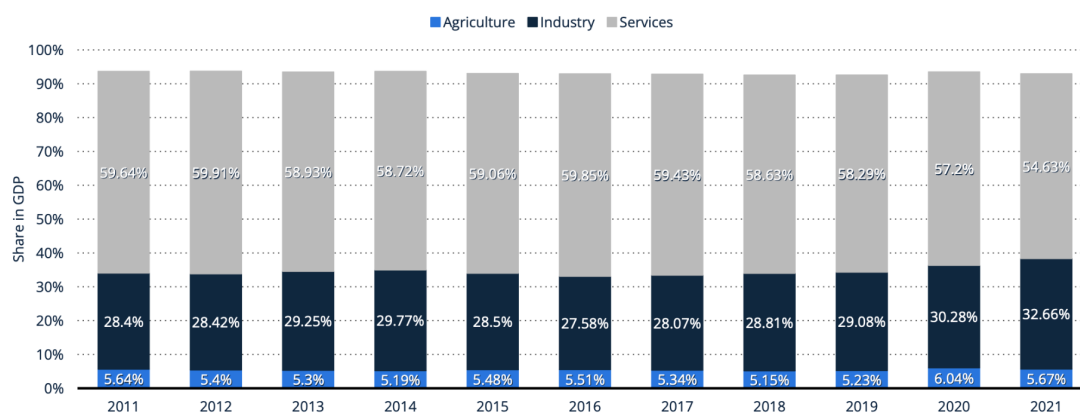
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Appendix A. Graphs

Dominican Republic: Share of economic sectors in the gross domestic product (GDP) from 2011 to 2021

Share of economic sectors in the GDP in Dominican Republic 2021



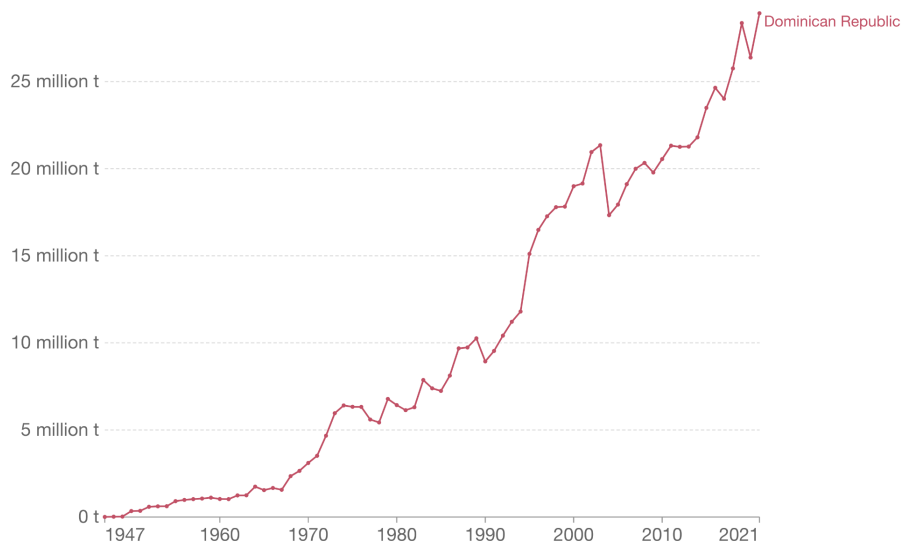
21 Description: This statistic shows the share of economic sectors in the gross domestic product (GDP) in Dominican Republic from 2011 to 2021. In 2021, the share of agriculture in Dominican Republic's gross domestic product was 5.67 percent, industry contributed approximately 32.66 percent and the services sector contributed about 54.63 percent. [Read more](#)
 Note(s): Dominican Republic
 Source(s): World Bank

statista

Annual CO₂ emissions

Carbon dioxide (CO₂) emissions from fossil fuels and industry¹. Land use change is not included.

Our World
in Data



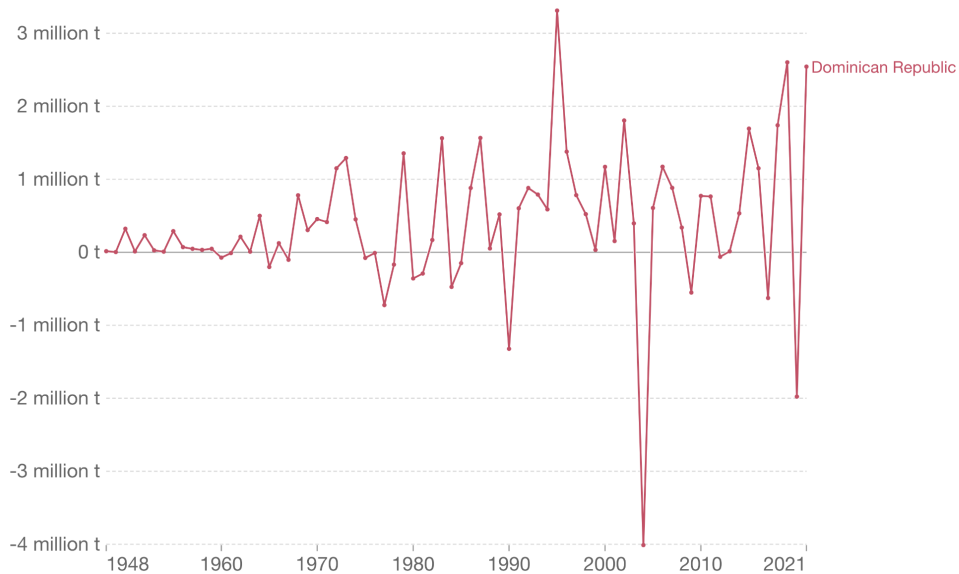
Source: Our World in Data based on the Global Carbon Project (2022)

OurWorldInData.org/co2-and-greenhouse-gas-emissions • CC BY

1. Fossil emissions: Fossil emissions measure the quantity of carbon dioxide (CO₂) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO₂ includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.

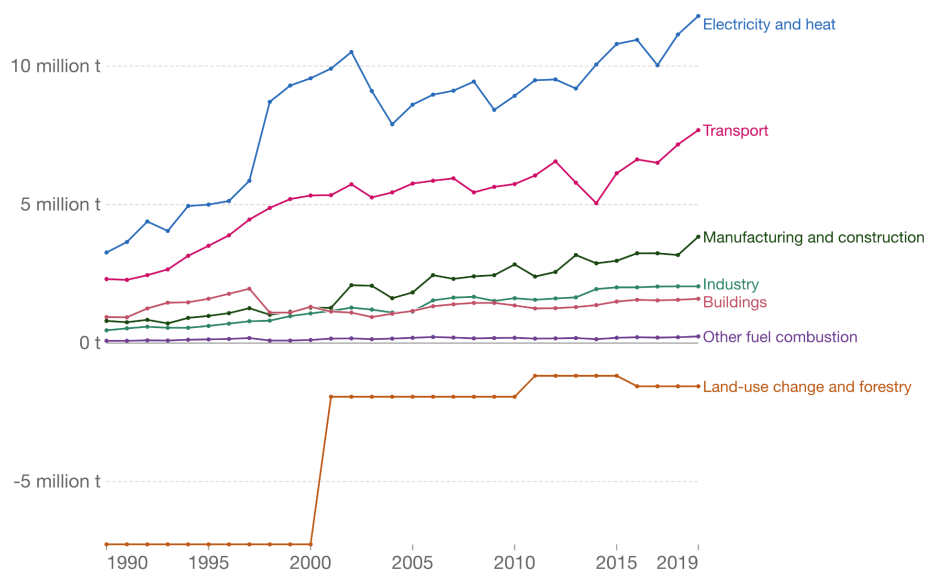
Year-on-year change in CO₂ emissions

Absolute annual change in carbon dioxide (CO₂) emissions, measured in tonnes.



Source: Our World in Data based on the Global Carbon Project (2022) OurWorldInData.org/co2-and-greenhouse-gas-emissions • CC BY

CO₂ emissions by sector, Dominican Republic



Source: Our World in Data based on Climate Analysis Indicators Tool (CAIT). OurWorldInData.org/co2-and-greenhouse-gas-emissions • CC BY

Appendix B. Case Studies

Case Study 1: Hotel Management in Peru

The Inkaterra Machu Picchu Pueblo Hotel in Peru is an example of a tourism operation that has achieved certification from the Global Sustainable Tourism Council (GSTC). This certification program evaluates tourism operations based on specific sustainability criteria related to environmental management, cultural preservation, and social responsibility. To receive certification, the hotel implemented initiatives such as waste reduction and recycling programs, energy-efficient lighting, and water conservation measures to reduce its environmental impact. The hotel also supports the cultural heritage of the local community by hiring local staff, supporting local artisans, and promoting traditional cultural practices. Additionally, the hotel supports local communities through education programs, employment opportunities, and conservation efforts.

Case Study 2: Fishery Regulation in the Bahamas

The Bahamas has established restrictions on fishing in certain areas and regulations for gear types. The regulations include restrictions on the size and number of fish that can be caught, as well as seasonal and geographic limitations on fishing activities. The government also enforces regulations on the use of fishing gear, such as banning the use of certain types of nets that can harm marine life. The Green Port Policy in Jamaica aims to lessen the negative effects of port operations on the environment. The policy outlines guidelines for managing port facilities, preventing marine pollution, implementing green technologies, and encouraging eco-friendly behavior among stakeholders.

Case Study 3: Coral Reef Restoration in Karayib Klima

Karayib Klima is a program that supports civil society organizations (CSOs) in developing climate resilience projects, including successful initiatives on coral reef restoration, community resilience, agroforestry, and education/awareness raising projects (UNFCCC, 2022).

Case Study 4: Coastal Management Foundation in Jamaica

For example, the Caribbean Coastal Areas Management Foundation (C-CAM) is a non-profit organization that works to manage and conserve the coastal resources of Jamaica's Montego Bay Marine Park and other areas in the Caribbean. C-CAM focuses on promoting sustainable use and management of coastal resources through community involvement, research, education, and other initiatives. Its projects include coral reef restoration, mangrove restoration, and community-based fisheries management. C-CAM works with various stakeholders, including government agencies, NGOs, and local communities, to achieve its goals.

Case Study 5: The Caribbean Aqua-Terrestrial Solutions (CATS) project

The Caribbean Aqua-Terrestrial Solutions (CATS) project is a regional initiative aimed at promoting sustainable natural resource management and biodiversity conservation in the Caribbean. It is supported by the United Nations Development Programme (UNDP) and involves

collaboration with governments, non-governmental organizations, and communities across the region. The project focuses on the development and implementation of ecosystem-based adaptation strategies to address the impacts of climate change on natural resources and local communities.

Case Study 6: Monteverde Cloud Forest Reserve in Costa Rica

The Monteverde Cloud Forest Reserve is a conservation area in Costa Rica managed by a non-profit organization. Covering an area of 10,500 hectares, the reserve is known for its rich biodiversity, including over 2,500 plant species, 100 mammal species, and 400 bird species. Established in 1972 by a group of scientists and local community members, the reserve offers ecotourism activities such as hiking trails, guided tours, and educational programs. These activities promote sustainable forest management practices and raise awareness about the importance of forest conservation among tourists. For instance, the Sustainable Farm Tour showcases organic farming techniques and the use of renewable energy sources to preserve the region's ecosystem. The Natural History Tour highlights the importance of preserving the biodiversity of the cloud forest and the role of ecotourism in supporting conservation efforts. The Monteverde Cloud Forest Reserve is an excellent example of ecotourism that promotes sustainable forest management practices while providing economic benefits to local communities (Monteverde Cloud Forest Biological Preserve, n.d.).

Case Study 7: National Park in Rwanda

In Rwanda, the Gishwati-Mukura National Park has implemented a forest restoration program that involves planting trees and restoring degraded forest ecosystems. The park also offers ecotourism activities such as bird watching, hiking, and cultural tours to promote conservation efforts and provide economic benefits. The Nyungwe Nziza Eco-tourism Village is a 121.7 hectares wetland park located right in the heart of its capital Kigali that provides visitors opportunities to experience local culture and contribute to forest restoration efforts through activities such as cultural dances, traditional cooking classes, and guided tours. The ecotourism park boasts ornamental ponds, gallery forests, medicinal plant gardens, paved walkways, cycle lanes, restaurants, recreational facilities, and other biodiversity services. Evidence shows that this program has helped to increase forest cover and biodiversity, as well as provide economic benefits for local communities (Top Africa News, 2022).

Case Study 8: Endangered Species Conservation in Rwanda

The Rwanda Development Board, along with conservation partners, has successfully increased the population of endangered mountain gorillas and their habitat through community-led conservation efforts. The Virunga Massif's mountain gorilla population has risen from 480 in 2010 to 604 in 2016, and the species has been downgraded from critically endangered to endangered on the IUCN Red List. Rwanda has also invested \$255 million in expanding the Volcanoes National Park by 23 percent, reintroducing lions and Eastern black rhinos, and translocating five additional rhinos in 2019 for genetic diversity. As a result, these endangered species' populations have increased, and the lion population has quadrupled since 2015, reaching 35 lions in 2020, and large mammal numbers have increased from 4,000 to over

13,500 since 2010, according to African Parks. Recently, the first white rhino calves were born in Rwanda after the translocation of 30 white rhinos to Akagera National Park in November 2021 (Top Africa News, 2022).

Case Study 9: Ecuador Conscious Tourism

The Galapagos Islands of Ecuador implemented a visitor limit of 240,000 per year, and tour operators must incorporate the Galapagos National Park Authority's new regulations designed to protect the local animal and plant life into their travel programs (Travel Weekly, 2011).

Eco-tourism practices include educating tourists on the importance of protecting the environment and wildlife, encouraging responsible behavior, and promoting eco-tourism activities such as hiking and wildlife viewing to encourage sustainable practices. The "conscious tourism" proposed by Ecuador included visitor redistribution by opening up other islands, altering route frequencies, etc. Also, the new regulations permit smaller boats for island visits, which allow visitors to see rare species such as the red-footed booby, the albatross, and the flightless cormorant.

Case Study 10: PES in Rwanda

The Government of Rwanda invested in law enforcement, community engagement, and education interventions to protect biodiversity in its five parks. Recently, it announced plans to expand Volcanoes National Park to increase its gorilla habitat, improve community livelihoods, and reduce human-wildlife conflict. The \$255 million expansion project will cover an area of 37.4 square kilometers, increasing the park's size by approximately 23%. To ensure the effective use of community benefit funds, Rwanda promotes local ownership and participation in conservation projects, such as payment for ecosystem services schemes and wildlife damage compensation funds. Rwanda aims to expand and maintain its protected areas as critical economic assets that promote climate resilience, biodiversity, and ecosystem services (Top Africa News, 2022).

Rwanda has implemented Payment for Ecosystem Services (PES), where beneficiaries pay providers for ecosystem services to incentivize conservation efforts. Rwanda is working with Costa Rica to develop a scalable PES system. Additionally, Rwanda has established Natural Capital Accounts (NCA) to track progress on socioeconomic and environmental indicators, integrating natural resources into economic analysis. Rwanda aims to allocate 37.7% of land to conservation in its National Land Use and Development Master Plan, highlighting its commitment to environmental protection and natural resource management for climate change preparedness (Top Africa News, 2022).

Case Study 11: Nam Ha Ecotourism Project in Laos

For instance, the Nam Ha Ecotourism Project in Laos is a community-based tourism initiative that is located in the Nam Ha National Protected Area of Luang Namtha Province in Laos. It was launched in 1999 to address the environmental degradation caused by illegal logging and hunting, and to provide alternative livelihoods for local communities. The project involves developing homestays, trekking routes, and other tourism activities managed by local

communities.

The project has achieved its goals by generating income for local communities, promoting the conservation of natural resources, improving infrastructure, and raising awareness of local culture among tourists. It has contributed to economic benefits for local communities and the conservation of the natural environment. The development of tourism infrastructure has also improved access to basic services and contributed to an improved quality of life for locals. The project has helped to raise awareness and appreciation of local culture among tourists by providing opportunities to learn about the local way of life (United Nations Development Programme, 2012).

Case Study 12: Climate and Green Financing Program in Chile

For example, Chile implemented a Climate and Green Financing Program that supports the country's commitment to carbon neutrality by 2050 in capacity building, technology development, transfer, climate finance, low carbon transportation, the construction of green public buildings, etc. (UNFCCC, 2022).

Case Study 13: Renewable Energy Working Opportunities in China

China added a record-breaking 53 GW of solar PV capacity and 49 GW of wind capacity in 2021, making it the largest renewable energy job market with 5.4 million workers. The country's dominance in solar PV employment reflects its position as the largest manufacturer of equipment and its commanding position in capacity installations. China's success largely reflects its infrastructure and industrial policies that built an integrated supply chain with large economies of scale, low labor costs, and a surge in offshore installations. The country accounted for more than 80% of global hydropower capacity additions in 2021, while bioenergy, geothermal heat and power, and concentrated solar power also saw notable increases. China's biofuels sector employed an estimated 51,000 people in 2021 (International Renewable Energy Agency & International Labor Organization, 2022).

Case Study 14: Renewable Energy Working Opportunities in Brazil

In 2021, Brazil had an estimated 1.27 million renewable energy jobs, with biofuels being the largest component of the country's renewable energy workforce. However, Brazil's ethanol output dropped by 23% from its 2019 peak, with corn ethanol production expanding. Biodiesel production continued to expand, reaching an estimated 6.76 billion litres in 2021. Brazil's wind power-generating capacity reached 21.2 GW, with about 80% of the installed capacity being in the northeast. The solar PV industry continued to grow rapidly in Brazil, with 5.5 GW of new capacity added in 2021, with two-thirds of the country's cumulative capacity in distributed solar PV systems (International Renewable Energy Agency & International Labor Organization, 2022).