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Côte d'Ivoire : Sustainability In Cities

**Côte d'Ivoire Sustainability Realities and Solutions**

Côte d'Ivoire is a country known for its beautiful land and cultural diversity. It is the leading country in the exportation of cocoa, raw cashew nuts, coffee, and various types of oils. The production and exportation of these goods is what brings in a majority of the earnings for the country. More than two-thirds of the country works in the agricultural business, so the preservation of these farming lands is the key to maintaining the jobs of a majority of the population. When these lands used for agriculture are endangered, so are the lives of those who work in that business. The lack of sustainability in Côte d'Ivoire is contributing to the excessive amounts of pollution harming the land. “Climate change is already taking a toll on Côte d'Ivoire with rising temperatures, unpredictable weather patterns, and sea-level rise posing significant threats. The degradation of coastal areas, flooding, and pollution are affecting the livelihoods of millions of Ivorians.” (World Bank Group, 2023) Companies in the agriculture market have already begun reporting the effects of pollution on their revenues. If pollution levels continue to rise in Côte d'Ivoire, many lives will be forever affected. As of 2023, the CIA announced that the degree of risk for Ivoirians was very high. Sustainable living is one way to help lessen the effects of pollution. The cities in Côte d'Ivoire that are considered more urban could be improved with more sustainable practices, to improve the life of the people.

Côte d'Ivoire is a country found on the southern coast of West Africa, bordered by Liberia, Guinea, Mali, and Ghana. The country itself is made up mostly of rolling plains, with a more mountainous region in the northwest, near Guinea and Mali. The southern half of the country is made up of closed, low-lying evergreen and semi-deciduous forests, while the transition zone to the north is made up of forest-savannah mosaics. Primates such as chimpanzees, colobus monkeys, and mandrills, as well as forest elephants, leopards, and antelopes, live in the country's forests. Hippos, crocodiles and a variety of fish species are found in the Ivory Coast's rivers and wetlands. Cocoa, oil and gas, rubber, diamonds, cobalt, copper, timber, water and fish are the main natural resources of Cote d'Ivoire. The various flora and fauna are commonly used throughout the country by the people, from being used in cuisine to being used as items for selling.

There are eight main religions practiced in Côte d'Ivoire, each one different from another. This makes it hard to determine common practices throughout the country, due to the different religions playing a big part in household practices. But when taking religion out of the equation, the average household size rounds to about 5.2 persons per household. This is typically made up of a husband and wife, and their children, but as mentioned before, religion plays a part in the variations. Some households will have one husband and multiple wives, for in Côte d'Ivoire, polygamy relationships aren’t too uncommon. Alongside the husband and wives, the children live in the house until they’re adults, and sometimes grandparents or aunts and uncles will live in the house too. The Ivoirians prioritize family relationships, and it is shown in the household data. As of 2023, the percentage of the population living in urban areas is 53.1%. The family sizes in urban areas are typically smaller than in rural areas. The average age of a mother having her first child is 19-20 years old. Unfortunately, because the average age of a mother having her first child is so low, so are the average ages for marriage. “ Seven percent of women in Côte d'Ivoire are married before fifteen years of age, and 27% before the age of eighteen.” ( Canada, 2024) Women are estimated to attend any form of schooling for roughly ten years, while men attend it for eleven years on average. The literacy rate, using terms for children over fifteen who have the ability to fluently read and write, is 89.9%.

To understand the political situation in Côte d'Ivoire, one must first understand how it came to be. Over the past two decades, tensions have risen in the country due to civil unrest stemming from anti-government rebel groups, as they’ve been dubbed by the current governing individuals. As said by Patrick Meehan, writer for Open Democracy, “Much media coverage of conflict in the Ivory Coast relies on a familiar explanation of Africa's wars - that they stem from immutable tribal and sectarian differences.” (Meehan, P, 2011) After a protracted civil war, the country was effectively divided, with the government holding dominion over much of the south and the partisanship forces controlling nearly half the nation's territory to the north. A narrow belt in the geographic center of the nation has been under the jurisdiction of French forces and the United Nations’ Operations for Cote d'Ivoire for the majority of the eight years that have passed. Several agreements for peace have been made and then withdrawn, and after six delays, the elections that were first announced in 2005 ultimately took place in November and December of that year. However, rather than laying the conditions for a more achievable peace deal, the elections have reopened old scars, and the likelihood of civil strife has grown to its highest point since the year 2002. The primary reason for the inaction on environmental health and its improvement is the viability of this conflict. It's comprehensible for a government to be inclined to prioritize the safety and social order of its people as opposed to the environment. But due to less than optimum environmental conditions, Côte d'Ivoire's civilian population is growing increasingly unwell. One can only hope that the imminent threat of health issues will force the current administration to act to better the conditions around the country's ecosystem. Unfortunately, a nation cannot simply be improved overnight, and improvement always, no matter how minor, will always cost money. Money that this country cannot afford to spend frivolously. According to the 2024 Country Report on Côte d'Ivoire by the BTI Transformation Index, the nation already depends largely on foreign help.

The current president, as well as the core ruling team, is well aware that the international community (especially the United Nations and France) was essential in securing access to office, and that the country’s stability will depend on the government’s capacity to maintain international trust and reputation. This does not exclude the possibility of inconsistent policymaking or cases of rent-seeking within the administration. President Ouattara (as well as his prime ministers) has been considered a reliable partner by the international community. International trust in the economic reform program is certainly much greater than in the capacity of the government to promote a more inclusive democratization agenda. Ouattara’s decision to stand for a third term in the 2020 elections was a severe blow to his credibility, not only at home but also in the international environment. (BTI, 2024, Côte d’Ivoire)

In light of the president's former employment at the IMF, the government has successfully overseen its connections with the international community. The government's goals outlined in the National Development Strategy, as stated in the report, have been partially met thanks to foreign finances, albeit the majority of this funding was provided on a non-concessional basis. Both the previous and current National Development Strategies place a greater emphasis on raising private funding rather than leaning primarily on subsidized infrastructure funds since Côte d'Ivoire sought to become an "emergent economy," also stated in the report. Thus, the nation's international reputation has allowed for the filling of significant infrastructure gaps over the past five years. The document further states that the country’s debt percentages have increased in recent years.

Since 2013, there has been a slight upward trend in the debt-to-GDP ratio, which increased significantly during the last two years (from 38.4% in 2019 to 52.1% in 2021). The International Monetary Fund (IMF) perceives a moderate risk of debt distress, but with very limited space to absorb future shocks. In 2021/22, Côte d’Ivoire’s sovereign ratings also improved to historically high levels (Fitch has rated BB-), despite this rising debt. Côte d’Ivoire had a negative fiscal balance of -2.3% of GDP in 2019, according to the IMF, which further increased in 2020 to -5.9% of GDP due to a COVID-related reduction in revenues and additional spending. The overall fiscal deficit reached 5.1% of GDP in 2021, lower than anticipated. The authorities introduced a COVID-related fiscal package estimated to be worth about 2.4% of GDP cumulatively for 2020 and 2021. Measures to contain the impact of the Russian invasion in Ukraine, such as gasoline price caps, are expected to carry a fiscal cost of slightly over 1% of GDP during 2022. (BTI, 2024, Côte d’Ivoire)

This passage from the study explains why the nation's current financial crisis will not permit such extravagant spending, and why some solutions should be enacted later. These alternatives might be possible in the future when the nation's economy and political system are more stable.

To gain a deeper comprehension of the issue pollution brings to Côte d'Ivoire, data has to be collected thoroughly. To start off, in the last few years, Côte d'Ivoire has seen a substantial increase in its population.

In less than 40 years, 6.7 million inhabitants has increased exponentially to more than 22 million people. With approximately 29 million inhabitants, as of 2023, Cote d'Ivoire is the fifteenth largest country in Africa population-wise. Varying problems have arisen from overpopulation and the high-density populous zones.... the Ivorian government has taken interest in implementing activities and projects designed to upgrade urban living areas. This has occurred to a large extent in Abidjan in recent years with attempts to improve primary infrastructure (roads, water, and electricity) set in motion over the past forty years. (The Impacts of Cote d’Ivoire’s Urbanization, n.d.)

This has increased levels of air, water, and land pollution due to the extensive construction.  According to the World Bank, electrical consumption per capita has increased by more than two times over the last forty years. Côte d'Ivoire used approximately 91 kWh of electricity per capita in 1971 and approximately 203 kWh of electricity per capita in 2009. The increase in electricity use coincides with the growth of the urban population. This increasing carbon footprint of Côte d’Ivoire has resulted from the increase in industry and fuel/power and waste production in the urban centers. Waste water from Abidjan's slums has some of the most serious implications for the environment. The impact of poor waste management is felt even in towns miles from the capital. In addition, “Because of low formal collection rates, open dumping and burning in Côte d’Ivoire are commonly practiced. Even formally collected waste is often disposed of at unsanitary dumpsites without processing” (Pollution / Côte d’Ivoire*:* n.d.) These dump sites become the source of air, soil, and water pollution and pose a serious threat to public health. In 2018, Côte d’Ivoire produced over 4 million tons of solid waste, with 2.5 million tons left uncollected. Something worth noting is that most of the urban areas of Côte d'Ivoire are located near the coast, with scattered cities farther inland. This is crucial information because the urbanization of these coastal cities can have disastrous effects on the ocean. These polluted waters in Côte d'Ivoire have spread waterborne diseases such as diarrhea and cholera which have accounted for significant numbers of deaths both in adults and children under five years of age. This pollution also affects productivity and economic activities depressing property values, tourism, and fishing.

Plastic waste is also a problem contaminating marine waters. The combination of marine contamination and urban pollution have had an effect on air pollution. Air pollution is a serious health concern in the country and has been linked to respiratory tract diseases such as asthma and pneumonia. Most of the population is exposed to levels of air pollution that exceed the World Health Organization’s (WHO) guidelines. “According to the WHO, this exposure resulted in an estimated 34,000 premature deaths in Côte d'Ivoire in 2016, including 8,000 child deaths from respiratory infections.” (Pollution / Côte d’Ivoire*:* n.d.) Additional contributors to air pollution result from the burning of wood in the more rural areas of the country. Compounding the issues of waste management practices is the release of untreated water from industry being discharged into urban waters and the Atlantic Ocean. These pollution issues not only affect the health of its citizens but affect the production, exportation, and consumption of the country’s natural resources and trade system.

The blatantly obvious start to solving Côte d'Ivoire’s developing issues involving excessive urbanization is to start building sustainably. This can mean a lot of things. To begin, the growing population is forcing the government to build more in urban zones, so it would make sense to start building up rather than going out, decreasing the amount of land being diverted from the agriculture business. Building vertically won’t completely stop the spread of urbanization, and consequently, pollution, but it’s a start. To further help, building in a more sustainable fashion can improve ecological health. Green architecture is a newly prevalent form of sustainable building and can greatly improve the air quality of surrounding areas, as well as lessen the amount of pollution released into the environment. Green spaces are exemplary in terms of mental and physical wellbeing, but they are also known to help reduce pollution levels as well as promote biodiversity in nearby environments. Green spaces can include community farming spaces and gardens, or eco-friendly buildings. Fresh organic produce and flowers can be added to a neighborhood’s diet by city farms or community gardens. Furthermore, cities that prioritize traversing and pedestrian-oriented infrastructure benefit from more sustainable and enjoyable commutes, no matter the destination. This has many health benefits to the population of an area, as well as a healthy impact on the environment. But saving the country can’t just stop adding more sustainable buildings. City planning also needs to be prioritized. Infrastructure being built vertically rather than sprawling can reduce deforestation issues, as well as save money on construction costs, electricity and water bills, and taxes. Building green infrastructure can save money for more sustainable items such as solar panels, smart heating and cooling systems, and more natural and environmentally friendly manufacturing items. Sustainable building also reduces the ever-present carbon emissions. Public transportation to be made affordable and accessible also needs to be taken into consideration. Less harmful emissions from small motor vehicles can reduce a majority of the pollution being released into the atmosphere. This easier accessed public transportation can lead to easier accessible public resources such as recreational facilities, health centers, libraries, garbage collection services, and schools. This can stimulate public health, both physical and mental, and improve the economy.

Moving to the more environmentally based solutions, water conservation is a big issue because of Cote d’Ivoire’s location on the coast of the Atlantic Ocean. Restoring the rainforest’s natural wetlands and bodies of water are a good first step. Something the people can do is harvest rainwater and filter it for further use, which lowers the amount of water bottle plastics thrown out. Reusable bottles can also help on that front. Moving onto the unbridled amount of waste being produced annually, better waste management is a must. If properly controlled, cities can implement stricter recycling laws and programs, as well as stricter trash collecting policies, whether they apply to city run or private contracting businesses. Going paperless would also help with preventing deforestation, because the rainforests of Cote d’Ivoire are home to many unique and endangered species that need proper homes, untouched by humans. Technology that is powered by collected data can help the country monitor its product consumption and consequently contribute to the achievement of sustainable waste innovation.

The government might be presented with an assortment of solutions to address the environmental situation, but not all of these options are practical from an economic standpoint. One solution with little to no cost whatsoever may be adopting the Rwandan tradition ‘Umuganda’. It is a longstanding cultural-based tradition that originally was used to bring a community together to solve problems as one, but it has since developed into a way to keep the country clean and healthy, resulting in Rwanda being ranked the cleanest country in Africa. The country was one of the first around the world to completely ban plastic bags, and the country has kept up with this tradition that promotes camaraderie and environmental consciousness. According to the Rwandan Media Website, “On the last Saturday of each month, communities come together to do a variety of public works, which often include activities that promote infrastructure development and environmental protection. Rwandans between 18 and 65 are obliged to participate in these activities, and non-Rwandans living in Rwanda are encouraged to take part.” (Rwandapedia, n.d.) Also mentioned in the article, nearly 90% of all Rwandans and visitors to the country partake in the monthly tradition. During the Umuganda period, several projects were carried out such as constructing schools, hospitals, and hydroelectric plants; also, wetlands were restored and extremely productive agricultural plots were established. Between 2014 and 2019, Umuganda's average annual contribution to national development was anticipated to be around 21 million USD. Also stated on the website, this tradition boosts community morale and allows leaders within said community to bring various problems to attention to try and solve.

Whilst the main purpose of Umuganda is to undertake community work, after this work finishes, community members then meet to discuss important matters. This meeting provides a platform for leaders at each level of government, from the village up to the national level, to inform citizens about important news and announcements. It also serves as a forum in which community members are able to discuss any problems they or the community are facing and propose solutions together. This time is used for evaluating what the community has achieved and for planning activities for the next Umuganda a month later. (Rwandapedia, n.d.)

This custom can hopefully be integrated into Côte d'Ivoire's customs, as it has had a significant impact on its neighboring nations. This practice is not expected to cost anything considering it is something the community must be persuaded to do rather than a procedure that requires payment. After being processed, the items might be donated, repurposed, or broken down. Another possible solution that will likely cost minimal funding is the restoration of the country’s native coral reefs off the coast. Because Côte d'Ivoire is located on the southern coast of Africa, the country has access to the incredibly diverse ecosystems beneath the waves. Or they did at one point. This is no longer the case, as overfishing and water pollution has decreased the health and numbers of species in the waters, including the various coral species. In an effort to once more establish underwater biodiversity, Côte d'Ivoire has recently implemented its first protected marine area. The government has claimed that the marine conservation area, which encompasses an area of more than 1,000 square miles, or 2590 square kilometers, off the town of Grand-Bereby, is a component of an endeavor to align Ivory Coast's marine conservation efforts with United Nations aims. An article written about the country’s efforts by Alessandra Prentice states, “Researchers from the university helped Ivory Coast prepare the project by collecting data on the area’s marine animals, plants and the health of its waters. The work included surveying previously undocumented reefs and tagging turtles with GPS monitors,” and “The area includes a fully protected zone closed to all activities, and an eco-development zone that will support sustainable fishing practices and ecotourism activities, according to the university.” Ivory Coast, n.d.) These valiant attempts at beginning the journey to restoration of marine biodiversity proves that the government is willing to put in the effort into this field, meaning that reviving the coral reefs may be just as important to them. Off the coast of Florida, the Coral Restoration Foundation has begun replanting various coral species and helping grow coral reefs to how they once were. This movement has influenced other countries to do so as well, including Australia and Japan. The process includes using recycled metal materials welded together to make wiring that stretches across the ocean floor, followed by introducing native coral species to the wiring and keeping a close eye as they grow. This natural growth has attracted lots of diverse species to them, which is helping the process along. This movement can be implemented anywhere with native coral species, which Côte d'Ivoire does have. This solution also presents quite a few job opportunities, some of which may include divers, scientists or researchers, data analysts, and biologists, to name a few. The only parts of this solution that may cost some money are likely to be the boats, paying the people working on the project, and paying for supplies, which because they’re recycled items, shouldn't be too expensive. The coral will quite possibly be the most expensive part of the project, and that’s only because of the shipping from one part of the coast to another. The final possible solution that has minimal cost to accomplish is reviving the rainforests that were once abundant and full of life all over the country but are now few and far between. Approximately only half of the number of trees there were in 1960 remain as of today, and these numbers continue to decrease. The only way to prevent the various plant life in these forests from becoming endangered is to begin reforestation efforts all over the country. Quite a few countries around the globe have done the same, some examples being Burundi, the Dominican Republic, and Thailand. One major movement that is making a huge impact in reforestation efforts around the globe is Plant With Purpose, a community-led movement. The project’s official website has a real-time planted tree count- numbers are rising at this very moment- that is approximately at 74 million. These reforestation efforts within this program range from countries in South America, Africa, Asia, and even in some parts of Australia. The movement is a non-profit, relying entirely on donations and volunteers to help. This method would well-suit Côte d'Ivoire because of the country’s economic instability. The only costs that would need to be addressed would be seeds and perhaps travel costs, which could potentially be waived by transportation officials if given the opportunity by the government.

Aside from the minimal cost solutions, there are quite a few more expensive solutions that would require more effort and attentiveness from the government. To start off, Côte d'Ivoire is a coastal country, so the people have access to many different species of marine plants, including seaweed. This comes in handy when you look at the SWAY company, a business created by Julia Marsh in an attempt to replace harmful plastics with biodegradable seaweed alternatives. Her team- made up of various scientists and analysts- has come up with a plastic-like material made entirely from seaweed. Some potential buyers are hesitant at first because of the possibility of the seaweed affecting whatever is being packaged with said material, which is entirely understandable due to the lack of testing and vetting done on the product and its effects. But currently, the plastic alternative is not meant to be used on food or any product meant to ingested or applied on the body. Buyers may also be concerned about how long the product will last, or if it will decompose early. SWAY’s new business partner, EcoEnclose, another company focused on sustainability, has answered this question eagerly in their partnership announcement.

Currently, seaweed-derived films, and other biobased plastic alternatives are typically designed for composability. Depending on how the film is produced, it may also be water soluble, marine biodegradable, and/or able to naturally biodegrade if left as litter. The end-of-life outcomes depend on the specific composition of the packaging (i.e., what inputs besides seaweed, if any, have been added) and how it is manufactured. Home composability is Sway’s product portfolio mandate. In the case of our retail box collaboration, Sway’s seaweed-based product window can be removed from the recyclable box and composted either in home or industrial compost. (Doshi, S, Dowdling, J, 2023)

This possible solution also presents quite a lot of job opportunities for the citizens of Côte d'Ivoire, including factory workers, scientists, testing managers, advertising teams, and more. Another plus side to this idea is the product is less expensive to produce than plastic, especially in countries on coasts, for they have much easier access to seaweed. SWAY intends to help as many countries as possible, and with little cost as possible. The company’s five main impact points are as follows: ocean health, carbon sequestration, improved livelihoods, petroleum and plastic reduction, and improving soils.

“Seaweed farming can promote ocean health in a number of ways, including reversing acidification, cycling nutrients, and encouraging biodiversity. Unlike land crops, seaweed farms don’t require arable land, fresh water, or fertilizer to grow. New scientific studies suggest that seaweed farms can also store substantial amounts of living and sequestered carbon, Seaweed aquaculture offers climate-resilient economic opportunities in coastal communities threatened by climate change and overfishing, from Maine to Indonesia and all around the world. Plastic is made from petroleum, a foundational contributor to the climate crisis. Over the next 20 years, BP projects 95% of net growth in oil consumption will come from the plastics industry. Sway packaging shifts demand away from oil and toward a renewable resource. While traditional plastics persist for centuries Sway materials are home compostable, designed to rapidly decompose into a healthy soil amendment. Our packaging enables true biological circularity, the way nature intended,” (Impact, Sway, 2024)

This company’s assistance would without a doubt improve life in Côte d'Ivoire, even if it may be a bit of a struggle at first to convince the citizens of the country to try out seaweed as a plastic alternative. A solution that would most likely not be hard to convince civilians in urban cities to live with or abide by are floating gardens. Nanning, China, is by far one of the most incredible places in regard to its sustainability practices. The city was dubbed ‘The Green City’ after being rated one of the cleanest cities in China. According to the city’s most popular website for tourist information, the city has many practices they follow to maintain the perfect environment.

Nanning’s subtropical climate fosters lush vegetation, earning it the Green City moniker, which is reflected in its abundant parks, gardens, and the verdant landscape that encircles the cityscape. From a real estate perspective, Nanning’s environmental credentials are not just about aesthetics; they are integral to its urban planning and development strategy. The city’s approach to sustainability is comprehensive, covering everything from green spaces and air quality to energy-efficient buildings and waste management systems. This commitment to the environment enhances the quality of life for its residents and offers a blueprint for sustainable urban living.

Nanning represents a dynamic market where environmental sustainability is interwoven with economic growth. The city’s green initiatives, such as expansive parklands, pollution control, and eco-friendly public transportation, contribute to its appeal as a location for both residential and commercial investment. In essence, Nanning’s green ethos is not just about preserving the environment but also about creating a sustainable and attractive urban environment for people and businesses alike. (Editor, N. C. G. 2024)

The website also goes further in depth as to how the city maintains its perfect image, but one of the most commonly talked about implementations are the floating gardens above the parking lots within the city. These floating gardens are built above parking lot rows and have multiple purposes. For instance, the gardens built into the structures are not only meant to boost morale within the community, but also to attract native pollinators in order to repopulate said pollinators’ populations.

Côte d'Ivoire has approximately 52 recorded bee species native to the country, as stated by iNaturalist. This provides the perfect reasoning for creating the floating gardens, but they do more too. The floating gardens also provide shade for the cars parked beneath them, which has been greatly appreciated by the community. This successful idea could be easily implemented into Côte d'Ivoire’s more urban cities with a bit of money and time. One thing that could be added are solar panels on top of these gardens to further increase their usefulness. With the addition of solar panels, these gardens not only repopulate pollinators, boost community morale, and provide shade for cars, but they would also generate energy while doing so. This is an all-around wonderful idea, and as such, should be integrated into country plans as soon as possible.

The final solution that falls under the more costly solutions would be the CorPower Giant Buoy, an invention that utilizes wave motion to provide energy to nearby coastlines. This innovative idea is a cost effective and beneficial way of providing energy to cities without the problem of building power plants which more often than not contribute humongous amounts of pollution to the environment. This is a great alternative to polluting factories. It’s also convenient because Côte d'Ivoire is a coastal country and could greatly benefit from this invention. It not only generates energy sustainably, but it also provides job opportunities for civilians. The only downside would be the cost of the product and shipping, which is why this solution falls under this section.

Moving onto the most expensive solutions, ones that should be kept as possibilities for the near future, the ReLeaf project is a perfect idea for once Côte d'Ivoire has repopulated a good percentage of its trees, especially in urban areas. The Releaf project was created by sixteen year old scientist in Ukraine, Valentyn Frechka, when he won second place in the ‘Young Inventors Prize’ competition within the European Inventor Awards of 2024 with his innovative and environmentally progressive invention of sustainably made paper, forged from dead leaves in urban areas. In busy cities all over the world, fallen leaves are seen as unsightly and are often just swept into trash cans and carted off to dumps, where they can’t fertilize the already unhealthy soil. Valentyn, who has been intrigued by the concept of sustainable living without the need for deforestation, has grabbed the attention of many sustainability and environmentally friendly companies around the world. The challenge Valentyn attempted and successfully addressed is, as said in an article written about his success in the European Patent Office, “Annually, 1.4 billion trees become landfill waste due to packaging and paper waste, escalating global warming, air pollution, and biodiversity loss. This deforestation also worsens water cycle disruption and increases environmental management costs.” (Valentyn Frechka, 2023) Paper mills typically have a very large ecological footprint, not even regarding the amount of trees that are cut down to make the amount of paper used globally. The invention, named by Valentyn as ‘Releaf’ utilizes already dead pieces of nature to create biodegradable and perfectly usable pieces of paper, stored and shipped in environmentally friendly packaging. This technology has the potential to reduce the effects of deforestation around the world, which is a commendable first step toward cleaning up the planet. This project also has the capability to provide many people with jobs, including leaf collectors, factory workers, administrative workers, and more.

The second more costly recommendation would be the Silk Leaf Project. The Silk Leaf Project was created by RCA graduate Julian Melchiorri and is one of the most revolutionary inventions in the science world at the moment. It is the first artificial organism that can perform photosynthesis and generate its own energy. According to the project’s official website, “...the leaf contains chloroplasts taken from real plant cells. These are suspended in a silk protein material extracted directly from the fibers of silk, which has an amazing property of stabilizing molecules. When the leaf comes into contact with water and light, it converts it to oxygen, just like a natural leaf.” (The Silk Leaf, n.d.) It is composed of silk proteins and chloroplasts extracted directly, without harm, from leaves. The two of these together absorb carbon and produce oxygen, as is the process of photosynthesis. This invention can greatly benefit urban areas by creating oxygen within buildings, which drastically improves the surrounding air quality. In cities where the air quality is extremely bad, this can help counter the effects and slowly improve the surrounding atmosphere. These artificial leaves also have the potential to generate their own energy by eliminating chemical residues and sugars in the surrounding environment and converting them into energy. This can serve as another way of powering building while improving the quality of the environment. Yet again, it also provides civilians with job opportunities. A negative to this possible solution is the costs for purchasing, shipment, construction, and more. The product itself is very delicate to handle, and so it would have to be handled with care and precision, especially during installation. This recommendation would hopefully help make up for the lack of trees within the city, which would hopefully be a higher number than it is at the moment. The third and final recommendation that falls under the more extremely expensive solutions would be to switch public transportation, such as trains, to fully electric machinery. the country is to switch public transportation, such as trains, to fully electric machinery. Take India for example: the country has electrified over 94% of its railways, and nearly half of that has happened in just five years. Indian railways have electrified approximately 10,000 of its trains, out of a total 14,500. As of January of 2024, the Prime Minister of India, Narendra Modi, has announced that 100% of railways will be electrified within a few months, putting India at the top of sustainability charts globally. The reported total amount spent on electrifying railways since 2014 has been roughly $5.5 billion, but most of that is due to the high amounts of transportation in the urban areas of India. The ratio of urban areas in India to urban areas in Cote d’Ivoire is very different, for most of Cote d’Ivoire is land set aside to farm resources, give or take certain areas with larger or capital cities. The cost of electrifying railways in Cote d’Ivoire would most likely be a lot less than what India spent, but still high in numbers, meaning that funds would have to be pulled from another source, which is to be determined. But the payoff would be great; shortening transportation times would lead to more business, the use of electricity would reduce air pollution from the lack of diesel emissions. It would take merely a few years for the money spent to be paid back, and then multiplied over time. If India has had success with this idea, then so can Côte d'Ivoire with time and a better financial and economic situation.

The final set of recommendations for Côte d'Ivoire would be the ones more applicable to the more rural settings. As was stated earlier on, the country is not the richest, so most of the rural cities or towns are in impoverished conditions. This means that they may not have complete access, or access at all, to things such as electricity, public transport, filtered drinking water, etc. The lack of electricity would mean no air conditioning, which can be quite the problem in Côte d'Ivoire due to the nation’s high temperatures during the spring and summer seasons. A frankly ingenious solution to this problem would be one already successfully created, one with results. Cote d’Ivoire is a country by a coast, and in South Africa, nonetheless, meaning the temperatures can be quite high at times. The Ivoirians that don’t live in major cities often have trouble dealing with the heat when they don’t always have access to air conditioning or cooling systems. Bangladesh has come up with an environmentally friendly and successful way to combat the heat without the use of electricity. The process involved taking used plastic bottles, cleaning them, and cutting them in half, utilizing the top half that has the bottle cap. The bottle halves are then put into holes cut into simple cardboard pieces. The cardboard pieces with the bottle tops in them are then placed on the windows in the houses of civilians with the wider side facing outwards. Once that is complete, the work is done, and now the natural process occurs. Air is forced into the bottle holes and compressed in the tiny top, and when it moves into the houses, the air quickly expands, cooling the surrounding air up to 5℃, or 41℉. This can greatly impact civilian health and boost morale. This invention is called the Eco-Cooler, imagined and designed by Bangladesh native Ashis Paul, who wanted to help his community using recycled materials. The science behind the invention uses the basic principles of air compression and expansion to cool environments without the need for electricity, which many people in third world countries are in need of. In addition to the helpfulness of this invention, each Eco-Cooler unit can be made quickly and easily while using repurposed materials that would otherwise be discarded. This solution is not only sustainable, but incredibly useful to the rural population of Côte d'Ivoire.

The second and final solution meant to help the rural areas of the country is the Atmospheric Water Generator. The Moses West Foundation’s primary mission is to provide free water to those in need all over the world, believing water to be a resource that should be accessible to all. Using atmospheric water generation technology and machinery, this goal is already in reach. Moses West, a military veteran and scientist, has invented the technology that utilizes the water in the atmosphere in whatever location and condenses said water into filtered drinking water. The warmer and more humid the environment, the more water produced. This is especially useful for the poorer countries located inland with no access to the ocean’s water for filtering. These countries are especially vulnerable to the water crisis, and that has prompted West to create his technology. So far, the foundation has served in four countries, and has produced over six million gallons of filtered drinking water for charity, all free of charge. According to an article written on West’s accomplishments, “The internal components of the machine uses various filters, sterilization lights, and reverse osmosis to generate water from the humidity in the air” (Minervini, A. n.d.) West himself has stated that there is extensive science and mathematics used in the original design of the machinery, but once all the parts are ready for construction, he believes he could teach high school students around the world to construct the machine themselves. The accessibility of this technology is phenomenal. As claimed by the Moses West Foundation, “Each standard AWG machine can be built in 24 hours and hauled to its destination in the back of a truck. The smaller version of this highly portable machine can supply fresh water to at least 500 people… is able to custom build even bigger AWGs to supply water to larger populations–from the military bases to small towns and larger cities.” (Minervini, A. n.d.) The easy construction and accessibility of the machinery will allow poorer cities and areas around the globe to access the same filtered drinking water other first world countries already have access to. The overall topic of this paper is the sustainability or lack thereof in Côte d'Ivoire, and most of the solutions are centered around the more urban areas because said areas are taking over more of the country’s land, but one mustn’t forget about the rural areas, especially because that is where the people need the most help.

While these recommendations may help in the long run, they depend completely on how much the population cares about the environment and protecting it. Not everyone feels the need to help do their part in keeping the Earth clean and habitable, and so the solutions listed won’t completely solve the problems most prevalent in Cote d’Ivoire. Those in power in the country have taken strides towards this goal on their own though, implementing programs meant to improve sustainability and lower poverty rates within the country. The SCALA project, according to the Food and Agriculture Organization’s chapter in Cote d'Ivoire, “will strive to create an inclusive multi-stakeholder process between institutions and partners in Côte d'Ivoire that will help fill gaps, improve capacities and reach the country's climate targets,” (2024). The program intends to identify the needs of the country based on what is lacking and what needs adjustments or fixing.

Identify best solutions for climate resilience, decarbonization, gender inclusion potential and profitability all along the casher and cassava value chains… Strengthen institutional arrangements and capacities for planning and monitoring transformative climate action… Identify policy and financial measures to preserve forests and savannah and support resilient production of cashew and cassava. (citation, 2024- same as above)

These key actions have already produced wonderful results. Frameworks have been adopted to support future policy implementation, strengths and weaknesses have been identified within the agriculture business and plans have been crafted to curb the weaknesses while taking advantage of the strengths, and there has been a significant increase in investments towards climate-friendly practices, mainly through private sector engagement. Côte d’Ivoire has already seen immensely transformative results, according to the Food and Agriculture Organization. Natural resources have been preserved, all while improving agriculture, therefore producing more resilient food and livelihood systems. Alongside the improved farming results, there has been a significant increase in economic resilience through sustainable agricultural income and investments coming from the rural economy, also found within farming communities and organizations. Finally, there has been an enhancement in food security and rural employment, all with gender inclusivity and benefits for all working people. This is a fantastic improvement compared to the data and statistics gathered over the past few years in Cote d’Ivoire. The country had quickly and exponentially gone downhill regarding environmental health, but the populous and its governing members have started making a positive change.

Cote d’Ivoire is a beautiful country, full of many diverse plant and animal species, and it deserves to stay that way. Despite the rapid decline in environmental health, changes have begun to be made, and more can still be done. The country deserves to thrive, and the people of Cote d’Ivoire deserve to as well.

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