Strategies to Measure Carbon Footprints for Carbon Offsetting: A Way Forward for Global Livingston Institute's Sustainability

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Acronyms & Definitions

Acronyms

- ACMI: African Carbon Markets Initiative
- ACX: Air Carbon Exchange
- BAU: Business as Usual
- CIF: Climate Investment Fund
- CO2: Carbon Dioxide
- CO2e: Carbon Dioxide Equivalent
- COP 27: 2022 United Nations Climate Change Conference
- ESG: Environmental, Social, and Governance
- GHG: Greenhouse Gas
- GLI: Global Livingston Institute
- ICAO: International Civil Aviation Organization
- ICEC: ICAO Carbon Emissions Calculator
- IFI: International Financial Institution
- INDC: Intended Nationally Determined Contribution
- IPCC: The Intergovernmental Panel on Climate Change
- NDC: Nationally Determined Contribution
- NSE: Nairobi Securities Exchange
- UK: the United Kingdom
- UNFCCC: United Nations Framework Convention on Climate Change

Definitions

- Carbon Offset Credit: A transferable instrument certified by governments or independent certification bodies to represent an emission reduction of one metric ton of CO2, or an equivalent amount of other GHGs (Broekhoff et al., 2019).
- Carbon Footprint: The quantity of greenhouse gas (GHG) expressed in terms of CO2-e, emitted into the atmosphere by an individual, organization, process, product, or event from within a specified boundary (Pandey et al., 2011).
- Carbon Offset: A reduction in GHG emissions or an increase in carbon storage used to compensate for emissions that occur elsewhere (Broekhoff et al., 2019).
- Greenhouse Gas: Gasses in the atmosphere such as water vapor, carbon dioxide, methane, and nitrous oxide that can absorb infrared radiation, trapping heat in the atmosphere. This greenhouse effect means that emissions of greenhouse gases due to human activity cause global warming (IPCC, 2019).
- Greenwashing: Behavior or activities that make people believe that a company is doing more to protect the environment than it really is (Cambridge Dictionary, 2023).
- Green Grabbing: A foreign appropriation of land and resources for environmental purposes resulting in the pattern of unjust development (Fairhead et al., 2012).
- Land Grabbing: Large-scale land acquisitions by private investors but also by public investors that buy land or lease it on a long-term basis (Global Agriculture, n.d.).

Executive Summary

Global Livingston Institute (GLI), a research and education-based nonprofit organization, is committed to educating students and community leaders on innovative approaches to international development and empowering awareness, collaboration, and personal growth. GLI asked a capstone team from the MPA program of Cornell University, Jeb E. Brooks School of Public Policy to examine the current carbon footprint produced by GLI and the ways to mitigate GLI's carbon emissions. The Cornell capstone team developed this report consisting of a thorough literature review, evaluation toolkits, and data analysis for GLI to transform its sustainability approaches and implement carbon footprint offsetting with feasible actions. The report also consists of recommendations regarding further actions that GLI can take to achieve carbon offset and the overall sustainability of the communities in which they work. Limitations apply to the research as it is not possible to include all aspects of the activities that were included when accounting for carbon footprints and researching for data. Case studies and findings presented in the research may also be limited because it was difficult to find cases suited for GLI due to differences in organizational structure, country contexts, and organizational sizes.

The core research results are as follows. First, the capstone team delves into the commitment of the Ugandan and Rwandan governments to Greenhouse Gas (GHG) emission reduction and climate change action. Both governments are committed to GHG emission reduction and have ambitious goals to achieve it. GLI's carbon footprint reduction strategy would align well with government initiatives. Currently, GLI's main carbon footprint areas that the capstone team categorizes are 1) flight, 2) transportation, 3) meals, 4) activities, and 5) accommodation. GLI puts efforts to offset their carbon emissions through using solar and batteries at Entusi Resort and Retreat Center, providing solar lanterns, practicing sustainable model farms, and opening recycling centers.

Additionally, there are certain calculators to evaluate carbon footprints such as the United Nations Framework Convention on Climate Change (UNFCCC) GHG Emissions Calculator which provides a comprehensive guideline to calculate emissions in different areas. As this guideline considers the best practices to calculate emissions in different areas, it can be helpful for GLI to measure its current carbon footprint. In addition to the calculators, the *Climate Neutral Now* Initiative by the UNFCCC may serve as a practical guideline for organizations to measure their Scope 1-3 emissions while promoting and facilitating the reduction of carbon footprints.

Furthermore, the capstone team identified organizations in East Africa with practices that GLI can follow to reduce its carbon footprint. The capstone team presents two case studies: Travelife and Carbon Tanzania. Travelife is a sustainability accreditation company that offers training, management, and certification initiatives for touring and safari companies. Travelife closely monitors the organization's impact on the environment such as its carbon footprint. Travelife allows organizations to incorporate useful tools to reduce their carbon emissions by helping other organizations to conduct sustainable planning, strategic management, and employee training. Carbon Tanzania works for sustainable development in urban areas of East Africa. It generates verified forest carbon offsets to reduce and offset carbon footprints.

Based on the research results, the capstone team presents the following recommendations, which are elaborated more in the report.

First, GLI should collect baseline information on its carbon footprint offsetting efforts. GLI has many areas that it works for offsetting, such as the provision of solar lamps, sustainable model farms, and recycling centers. Collecting baseline information on these efforts would help GLI to strategize the carbon footprint offsetting actions.

Second, GLI should join the Climate Neutral Now Initiative to measure the organization's Scope 1-3 emissions while offsetting carbon footprints.

Third, GLI should use existing tools to assess the current carbon footprints while utilizing internationally recognized tools to calculate the organizational current carbon footprints. The report presents the specific tools that will help GLI to achieve this goal.

Fourth, GLI should contact local green travel agencies in East Africa, such as Travelife and Carbon Tanzania.

Fifth, GLI should investigate similar organizations' efforts in reducing and offsetting carbon footprints by generating verified forest carbon offsets. This may be achieved by starting to contact the local green travel agencies and initiating collaborations on reducing carbon footprints for transportation in East Africa.

Sixth, the Cornell capstone team recommends GLI use airline companies based on their sustainability practices for flights. For example, GLI can use flights such as Delta flights for all business traveling. Delta Airlines is an industry leader in committing to sustainability as it is the first U.S. airline company that offers carbon offsets to customers. It has also been continuously growing its efforts in sustainability. GLI can additionally initiate organizational collaborations with Delta Airlines regarding GLI's carbon offsetting for flights.

Finally, GLI should expand its recycling activities. GLI should expand its recycling activities. While waste reduction, reuse, and recycling practices are being promoted to manage waste, they are not among the most common practices in Uganda. The most generic form of waste disposal in Uganda is open burning. This can be harmful as burning plastic emits deadly carcinogens as well as other toxins and greenhouse gases.

Literature Review

Introduction

Climate change is one of the biggest threats that the world faces. The world is seeing the effects of climate change such as floods, drought, and wildfire. Extreme weather occurs more frequently and more severely. About 14 percent of the world's population is expected to experience extreme heat waves every five years if the earth warms up by 1.5 degrees Celsius (Buis, 2019). Greenhouse gas (GHG) emissions are the main causes of climate change (Sun et al., 2022). The Intergovernmental Panel on Climate Change (IPCC) suggests that having at least a 50 percent chance to avoid the worst climate change effects requires the world to cut carbon dioxide (CO2) emissions by half by 2030 (Broekhoff et al., 2019). While CO2 is the most prevalent GHG that is emitted by human activities and is the most important pollutant to pay attention to, it is not the only pollutant for GHG emissions. Human beings generate numerous other GHGs which have greater heat-trapping effects than CO2 (Broekhoff et al., 2019). Thus, this paper illustrates GHG emissions in general rather than focusing only on CO2 emissions.

Originally, carbon footprint means the amount of land necessary to absorb all the CO2 produced by humanity during its lifespan. However, when global warming became more of a prominent issue on the world's environmental agenda, the use of carbon footprint became more prevalent on its own (Pandey et al., 2011). Currently, there is no clear agreement on the definition of carbon footprint within the literature. The capstone team adopts Pandey et al. (2011)'s carbon footprint definition, "the quantity of GHGs expressed in terms of CO2, emitted into the atmosphere by an individual, organization, process, product, or event from within a specified boundary" (p. 138). Defining a carbon footprint in this research is important to clearly present the research findings. In addition, carbon footprint allows for a quantitative depiction of GHG emissions which can support the management and assessment of mitigation strategies (Pandey et al., 2011).

The need for a dramatic reduction in GHG emissions requires an intense decline in the use of fossil fuels and a significant improvement in energy efficiency. This calls for worldwide action. Carbon offsetting has been one of the means to take action (Kollmuss et al., 2008). A carbon offset means "a reduction in GHG emissions or an increase in carbon storage that is used to compensate for emissions that occur elsewhere" (Broekhoff et al., 2019, p. 6). Another key term to keep in mind is the carbon offset credit, which is "a transferable instrument certified by governments or independent certification bodies to represent an emission reduction of one metric ton of CO2 or an equivalent amount of other GHGs" (Broekhoff et al., 2019, p. 6). Various activities such as renewable energy development that displaces fossil-fuel emissions, restrained deforestation, and destruction of high-potency GHGs like methane can reduce GHG emissions. The 2015 Paris Agreement is notable, as nearly every country in the world has committed to reducing GHG emissions and addressing climate change (Broekhoff et al., 2019).

Carbon Footprints in East Africa

East Africa is one of the most economically and politically vibrant regions (Bullock et al., 2021). Over the past 30 years, East African countries have experienced rapid economic growth and environmental changes (Bullock et al., 2021). Several countries from East Africa have ranked among the top ten in the world in terms of economic growth rate since the 1990s (Sun et al., 2022). Ethiopia and Uganda, for example, after the end of the civil wars in the 1990s, stabilized their governments and started to develop their economies. Large economies such as Kenya, Tanzania, and Ethiopia have included industrialization in their national economic development plans (Sun et al., 2022). At the beginning of the 21st century, all East African countries were to an extent agrarian, looking for ways to revitalize their economies. Today, many East African countries are at the more advanced stages of industrialization and urbanization. At this stage, economic development and emissions are highly connected (Sun et al., 2022). Kenya, Tanzania, and Ethiopia rank the highest in East Africa in terms of emissions by country (Sun et al., 2022). Uganda's GHG emissions are extremely erratic. They spiked between 2013 and 2015 as the country imported oil for the transportation sector. More than 80 percent of East Africa's emissions come

from Kenya, Tanzania, Ethiopia, and Uganda (Sun et al., 2022). Figure 1 below shows the breakdown of eight East African countries' CO2 emissions from 2000 to 2017.

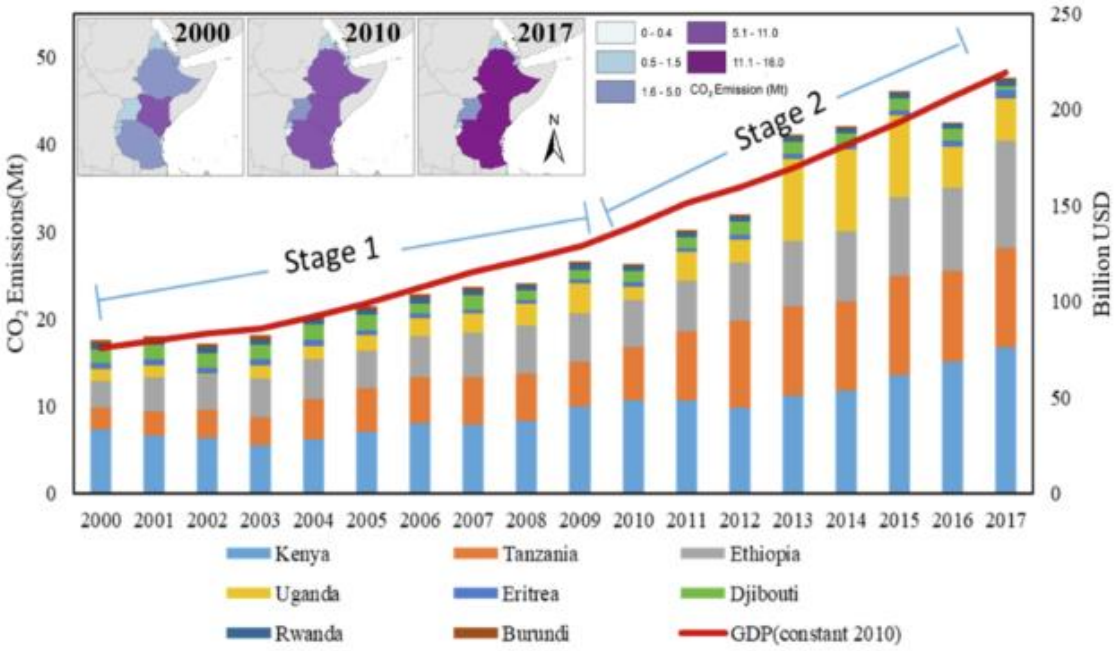

Figure 1. CO2 Emissions of Kenya, Tanzania, Ethiopia, Uganda, Eritrea, Djibouti, Rwanda, and Burundi from 2000 to 2017 (Source: Sun et al., 2022)

Efforts to Offset Carbon Footprint in East Africa

Offsetting carbon footprints is an important goal for both governments and individuals in East Africa, as the cost of climate change has run into billions of dollars and has been deteriorating economic growth to a large extent (Reports, 2021). For example, the energy sector has faced some problems because droughts have reduced the water level in reservoirs for hydroelectric power. Droughts have also impacted the agriculture sector by raising food prices as it has become more difficult to grow crops. Furthermore, coastal islands have been threatened because of melting polar ice caps. All these hinder economic growth in East Africa and the benefits that can be realized through it. Reducing carbon footprint will not only help the economy make progress but can also have a direct impact on poverty alleviation (Reports, 2021).

East African countries have generated initiatives to mitigate climate change. In 2015, Ethiopia submitted its Intended Nationally Determined Contribution (INDC), which was followed by other countries in East Africa (Sun et al., 2022). East African countries have declared commitments to the reduction of GHGs which ranges from 20 percent to 60 percent by 2030 (Sun et al., 2022). While doing so, the main emphasis for East African countries is to improve energy efficiency and the share of renewable energy generated (Sun et al., 2022). Countries in East Africa pursue renewable energy sources by utilizing their geographic resources (Sun et al., 2022). These resources include geothermal energy and hydro energy, which have become crucial in helping offset carbon footprint (Sun et al., 2022). Ethiopia and Kenya have used the Nile River and the East African Rift Valley for hydropower and geothermal energy. However, these efforts have not been sufficient as there is also a strong demand for coal and oil (Sun et al., 2022).

With regard to offsetting carbon footprints in East Africa, Kenya has achieved some milestones. In 2022, the Nairobi Securities Exchange (NSE) and the AirCarbon Exchange (ACX) signed a deal to set up Kenya's first carbon offset exchange (Onyango, 2022). This exchange uses emission trading, an

instrument used to offset carbon footprint. As per NSE, the deal was signed with the aim for ACX to develop a carbon exchange platform to shore up environmental projects as a part of innovative financing. Projects such as reforestation and land restoration are examples of environmental projects. Overall, for Kenya's financial ecosystem, a green portfolio at the Nairobi Securities Exchange creates an investment value chain to help with projects that are aimed towards climate change mitigation. This move has been seen by many as an opportunity to grow trust in the market and to build an Environmental, Social, and Governance (ESG) culture in Kenya. Similarly, companies like KenGen, Koko Networks, and Mumias have also shown interest in utilizing the carbon exchange (Onyango, 2022).

Kenya is also set to benefit from the new African Carbon Markets Initiative (ACMI), which was launched during the 2022 United Nations Climate Change Conference (COP 27). This targets the voluntary carbon market in Africa to produce 300 million carbon credits per year by 2030 and 1.5 billion credits per year by 2050 (Ogada, 2022). Furthermore, Kenya will also receive funding from the Nature, People, and Climate Investment Program which was launched by the Climate Investment Fund (CIF). This will help Kenyan farmers to benefit from carbon offset investments (Ogada, 2022).

Debates on Carbon Offsetting Initiatives in East Africa

Overall, East African countries are looking for schemes to increase the amount of money they receive to offset GHGs (Kabukuru, 2022). They are also looking for better prices regarding the carbon markets so that it can help them meet their targets for emission reductions and a transition into clean energy. Oftentimes, these schemes are criticized by environmental groups as the schemes allow organizations to continue polluting. While purchasing carbon offsets for carbon trading is cheaper in Africa than in many parts of the world, there have been transparency issues. Nevertheless, carbon credit schemes have had relative successes in Kenya, Tanzania, and Congo (Kabukuru, 2022).

In Uganda, one such initiative of integrated carbon offset and conservation was attempted in Mount Elgon National Park (Cavanagh & Benjaminsen, 2014). While the project had high potential, the project did not achieve its aim of success because of project implementation problems. The project was promoted as a "triple-win" for biodiversity conservation, mitigation of climate change, and socioeconomic development. However, evidence shows that there have been harmful consequences of forest conservation on the local people in Uganda and East Africa (Cavanagh & Benjaminsen, 2014).

On many occasions, NGOs and activists have opposed such projects by publishing controversial accounts of the dispossession of the rural population in Ugandan carbon offset forestry projects (Cavanagh & Benjaminsen, 2014). An example of such dispossession was in the project managed by New Forests Company, where more than 20,000 people were allegedly evicted for the project. The disputes were major because these projects were seen to employ exploitative practices and looked to be emblematic of the "green grabbing" processes and the "global land grab." An analysis of the historical and political aspects of the project also shows that narratives such as "triple-win" were decidedly selected. Furthermore, factors like the uncompensated dispossession of the rural community and the unachieved project goals on carbon sequestration made it difficult for the ambitions of the project to be realized. (Cavanagh & Benjaminsen, 2014).

Institutional Efforts to Offset Carbon Footprints

Many organizations make public announcements and generate plans for sustainable corporate strategies, but they do not execute those plans and initiatives (Rogelj et al., 2021). Organizations ought to consider the following questions before considering potential targets and strategies for carbon offsetting: a) the scope of the targets, b) how the targets and strategies are deemed adequate and fair, and c) concrete road maps towards and beyond net zero. While designing carbon offsetting strategies around these three questions, organizations need to be cautious as there is often confusion amongst the terms "carbon emissions reductions," "direct removals," and "carbon offsets." Direct carbon emissions reductions are those under the control of the organization, yet carbon offsets are "purchased reductions or removals

fulfilled by someone else, elsewhere" (Rogelj et al., 2021, p. 366). The general advice above may be helpful for GLI to design and implement its own carbon offsetting strategies.

Delta Airlines' effort in offsetting carbon footprints is leading the aerospace industry with an example (Rucinski & Sanicola, 2021). The company has not only spent $30 million to offset most of its 2020 impact on climate but also has strategized to reduce its GHG emissions and manage its environmental impact by having jet fuel as its chief focus during its sustainability efforts (Rucinski & Sanicola, 2021). Regarding jet fuel, which is the number one contributor to Delta's carbon footprint, Delta aims to replace 10 percent of its jet fuel refined from fossil fuels with sustainable aviation fuels by 2030 (Delta Air Lines, Inc., 2023). Furthermore, Delta has retired over 200 aircraft, while replacing them with aircraft that are 25 percent more fuel-efficient than the models being replaced (Delta Air Lines, Inc, 2023). For the organizational goal of net zero, Delta has eliminated 30 thousand pounds of waste annually since 2021, reducing their single-use plastics not only onboard but also in the Delta Sky Clubs (Delta Air Lines, Inc, 2023). Specifically, the Delta Sky Clubs recycle, compost, and provide eco-friendly food service items and packaging for to-go food items.

As the first U.S. airline to offer carbon offsets to customers and the only airline to cap GHGs at 2012 levels by purchasing carbon offsets, Delta Airlines has been an industry leader in committing to sustainability (Delta News Hub, 2018). In 2017 alone, Delta purchased more than 2.5 million carbon offsets; Delta purchased more than $8 million worth since it started the voluntary effort (Delta News Hub, 2018). The collaboration between Duke University and Delta Airlines is particularly notable. Ever since 2018, Delta and Duke purchased 5,000 carbon credits, simultaneously offsetting the carbon footprints from all Duke University business travel on Delta in the year 2017 (Delta News Hub, 2018). This continuing partnership between Delta and Duke to offset carbon emissions is not only novel but also inspiring (Delta News Hub, 2018). In addition, Delta Airlines has supported urban forestry in the Raleigh-Durham area through funding for planting and caring for over a thousand new trees (Delta News Hub, 2018).

The Swedish furniture giant IKEA has a net-zero target, which includes all emissions from its entire supply chain (Rogelj et al., 2021, p. 366). Similarly, Sony Group Corporation and Delta Airlines also have net-zero targets (Delta Air Lines, Inc, 2023; Sony Electronics Asia Pacific, 2023). By 2050, Microsoft has claimed to neutralize all CO2 that the company has emitted since its founding in 1975 (Rogelj et al., 2021, p. 366). In addition to this goal, Microsoft has committed to becoming carbon negative by 2030, which means reducing the entity's GHG emissions by more than half (Microsoft, 2023). One interesting note is that Microsoft invites third-party scientific advisors, i.e., independent evaluation companies, to review Microsoft's CO2 removal strategies and implementation process (Microsoft, 2023). In this way, Microsoft builds its credibility and transparency through scientific verification for its sustainability objectives. This strategy could potentially be applied for GLI, as the organization works towards offsetting its carbon footprint.

Sony Group Corporation, a Japanese multinational conglomerate corporation, has set a sustainability target called "Green Management," which is aimed to be achieved by 2025 (Sony Electronics Asia Pacific, 2023). This "Green Management" target is one of their medium-term environmental targets. The company, while aiming to achieve a zero environmental footprint by 2050, is progressively reducing all plastic packaging materials from its products. For instance, Sony launched Xperia PRO-I in 2021, which has zero plastic in its packaging with plastic components either replaced with paper materials or eliminated (Sony Electronics Asia Pacific, 2023). In addition to Sony's effort for zero plastic in their packaging, the organization has initiated and implemented a more sustainable paper policy for offsetting their carbon footprints (Sony Electronics Asia Pacific, 2023). One sustainability strategy by Sony is to purchase sustainable paper, such as FSC-certified paper and recycled paper. Sony makes their smartphone packaging from wastepaper that cannot be recycled into other paper products (Sony Electronics Asia Pacific, 2023). The innovative sustainability strategy is potentially beneficial for GLI to implement.

The United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC is a United Nations entity tasked with strategically helping countries respond to the threat of climate change (United Nations Climate Change, "About the Secretariat", 2023). The Convention's parent treaty is the 2015 Paris Agreement. The core objective of the UNFCCC is to keep the global average temperature rising this century as close to 1.5 degrees Celsius above pre-industrial levels. By having a near-universal membership (199 countries), the UNFCCC also aims to stabilize the GHG emissions in the atmosphere at a level that would prevent climate destruction by human beings (United Nations Climate Change, "About the Secretariat", 2023).

The Secretariat of the UNFCCC, which was established in 1992, organizes and supports negotiating sessions regarding sustainable strategies and climate change responses between two to four times per year (United Nations Climate Change, "About the Secretariat", 2023). The largest annual conference is the Conference of the Parties, which has about 25,000 participants. The conferences and meetings intend to drive forward the Paris Agreement's implementation on a country and regional level to build new climate action partnerships. The UNFCCC strives to keep all stakeholders informed on the conference's notes and negotiating process about climate action through its website and social media accounts (United Nations Climate Change, "About the Secretariat", 2023).

Data and Methodology

Research Problem & Significance

- Research Question: What is GLI's current carbon footprint and what are the ways to mitigate GLI's carbon emissions?
- Significance: Climate change is a big concern today, and organizations aim for sustainability to fight climate change. There is a dilemma though where organizations need to operate in a way that is profitable and viable. However, adopting sustainable alternatives is often more expensive and more difficult to proceed with. Therefore, most organizations find it hard to adopt these alternatives. But, in today's time, organizations need to think about sustainability for the long term. This interaction interested us in figuring out the best way to mitigate this dilemma, particularly for GLI.

Data & Limitations

For this project's purpose, the capstone team used GLI's internal documents and records and then consulted with GLI staff to provide relevant data. The data includes information about GLI's activities that generate carbon footprints. This data is relevant for the project as it helps answer the research question. In addition, the capstone team also collected data from secondary sources. This helped with the analysis and recommendations sections. The capstone team did not conduct any surveys or interviews in the community.

Limitations apply to the research as it is not possible to include all aspects of the activities that were included when accounting for carbon footprints and researching for data. Case studies and findings presented in the research may also be limited because it was difficult to find cases suited for GLI due to differences in organizational structure, country contexts, and organizational sizes.

Methodology

The methods employed for this project are case studies and secondary research. Case studies help generate an in-depth understanding of other organizations' efforts toward measuring and reducing carbon footprints. The capstone team utilized the existing data to inform the project when conducting secondary research analysis. Through this, the capstone team looks at the current tools and practices that are available to measure carbon footprints. It also helps provide recommendations for the best possible actions for GLI. In addition, a secondary analysis helps in understanding the international framework that is present.

Findings and Discussions

Ugandan & Rwandan Governments' Commitment to Climate Change Mitigation

GLI's mission is "to educate students and community leaders on innovative approaches to international development and empowering awareness, collaboration, and personal growth" (Global Livingston Institute, 2022). Because GLI's programs and projects take place in East Africa, specifically in Uganda and Rwanda, the commitments of these countries to GHG emission reduction and climate change action are significant for GLI as well. Both Uganda and Rwanda are committed to climate change mitigation, which can be shown through their policies. The capstone team researched possible programs and policies that apply to GLI, yet it was not found through secondary research. However, that does not mean that the applicable programs do not exist; it may just be that they can be known through local networks. The capstone team encourages GLI to seek possible programs that are applicable to GLI.

Uganda

Uganda is committed to GHG emission reduction. According to Uganda's 2022 Updated Nationally Determined Contribution (NDC), Uganda has set an ambitious economy-wide mitigation target. The government presents a 24.7 percent reduction below the Business as Usual (BAU) in 2030, which is an improvement from the 22 percent reduction target in 2016 (The Republic of Uganda Ministry of Water and Environment, 2022). Furthermore, the Ugandan government is strongly dedicated to increasing Uganda's capacity and involvement in the global carbon economy. The establishment of the Ugandan Carbon Bureau shows the government's commitment to preparing Uganda as a leading country in the East African carbon markets (Lyons & Westoby, 2014).

In 2021, President Museveni signed the National Climate Change Law, which formalizes Uganda's legal regime for climate change action (NDC Partnership, 2022; National Climate Change Act, 2021). Uganda's commissioner of the climate change department, Margaret Athieno Mwebesa, notes the act as "a big milestone since it provides the required enabling environment for enhancing the country's mitigation and adaptation ambitions in response to our commitments to the UNFCCC, the Kyoto Protocol, and the Paris Agreement" (NDC Partnership, 2022). The act is solely dedicated to climate change action. The Act (2021) states the following about itself:

> an act to give the force of law in Uganda to the United Nations Framework Convention on Climate Change, the Kyoto Protocol, and the Paris Agreement; to provide for climate change response measures; to provide for participation in climate change mechanisms; to provide for measuring of emissions, reporting and verification of information; to provide for institutional arrangements for coordinating and implementing climate change responses measures; to provide for financing for climate change; and for related matters.

This is Uganda's first-ever legislative framework, which shows Uganda's pledge to climate action.

In addition to the government's efforts, civil society also works to tackle climate change mitigation. Several districts in Uganda have launched the Local Climate Adaptive Living (LoCAL), which is a mechanism to incorporate climate change into local authorities' planning and budgeting designed and hosted by the UN Capital Development Fund (UNCDF) (UN Capital Development Fund (UNCDF), 2022; United Nations, n.d.). Civil society coalition such as Climate Action Network Uganda (CAN-U) works on climate change policy and advocacy to bridge the gap between climate change policy and implementation (Climate Action Network Uganda, n.d.). International organizations also have carried out climate change mitigation programs like climate-smart agriculture, education, and strengthened resilience programs (Care International, n.d.; FHI 360, n.d.).

Rwanda

The Government of Rwanda's support for climate action has been notable. Climate policy has been developing consistently throughout President Kagame's regime. Rwanda ratified the UNFCCC in

1998 (World Bank Group, 2022). Since 2011, Rwanda has been adopting a low-carbon growth strategy that focuses on climate change mitigation and development (Climate Action Tracker, 2022). Rwanda has strengthened its climate policy framework. It implemented the National Adaptation Program of Action (NAPA) in 2006, the Green Growth and Climate Resilience Strategy (GGCRS) in 2011, and the National Environment and Climate Change Policy (NECCP) in 2019. These various policies of Rwanda on climate action show Rwanda's commitment to climate mitigation.

Along with other climate action commitments, the Government of Rwanda also has set an ambitious target for decreasing GHG emissions. In 2018, the Rwandan government passed the Environment Law which includes provisions regarding human-induced GHG emissions reduction (Climate Action Tracker, 2022). It announced that by 2030, it aims for a 38 percent reduction of GHG compared to BAU (Ministry of Environment, 2020). Rwanda also has pledged to achieve net zero CO2 emissions by 2050 (Climate Action Tracker, 2022). Rwanda is the first African country to submit its updated NDC climate action plan under the Paris Agreement, which presents the government's commitment (Ministry of Environment, 2020). Rwanda revised the NDC in 2020 to improve its commitments to climate adaptation and mitigation (World Bank Group, 2022). Rwanda's 2020 NDC invests heavily in agriculture, forestry, urbanization, public health, and infrastructure (World Bank Group, 2022).

According to the World Bank (2022) report, Rwanda has three priority areas: 1) People and resource-oriented nature-smart development, 2) Low-carbon energy and transport solutions for climate-smart development, and 3) Climate-compatible urbanization. Rwanda is in the process of expanding electricity production from methane gas (World Bank Group, 2022). Climate Action Tracker report notes the uniqueness of Rwanda's methane gas production as it comes from the dissolved methane in the deep waters of Lake Kivu (Climate Action Tracker, 2022). In addition, the program areas of climate action include climate data and projections, sustainable forestry, agroforestry, biomass, ecotourism, conservation and payment for ecosystem services, low carbon urban systems, resilient transport systems, disaster management and disease prevention, and green industry and private sector development, etc. (Republic of Rwanda, n.d.).

Guidance for Carbon Footprints Reduction: UNFCCC *Climate Neutral Now* Initiative

UNFCCC secretariat launched the *Climate Neutral Now* Initiative in 2015 to "increase climate action by engaging non-Party stakeholders" —i.e., the sub-national governments, companies, organizations, and individuals (United Nations Climate Change, "Climate Neutral Now", 2023). Since 2015, more than 700 organizations around the world have become participants in this Initiative (United Nations Climate Change, "Climate Neutral Now", 2023). The mission of the Initiative is to promote the voluntary use of carbon market mechanisms recognized under the Convention on Climate Change of the UN ("The Path to Climate Neutrality", 2021; United Nations Climate Change).

The Initiative has evolved to become a tool for measuring Scope 1-3 emissions, raising awareness on climate change, for voluntary carbon offsetting, promoting, and facilitating the reduction of carbon footprint, and for international capacity building ("The Path to Climate Neutrality", 2021; United Nations Climate Change, "Climate Neutral Now", 2023). UNFCCC Secretariat (2021) offers definitions for Scope 1-3. The definitions are as follows:

- Scope 1 (direct emissions) are those from activities owned or controlled by the organization. Examples of Scope 1 emissions include emissions from combustion in owned or controlled boilers, furnaces, and vehicles; and emissions from chemical production in owned or controlled process equipment.

- Scope 2 (energy indirect) emissions are those released into the atmosphere that are associated with the consumption of purchased electricity, heat, steam, and cooling. These indirect emissions are a consequence of the organization's energy use but occur at sources that one does not own or control.
- Scope 3 (other indirect) emissions are a consequence of the actions that occur at sources one does not own or control and are not classed as Scope 2 emissions. Examples of Scope 3 are business travel by means not owned or controlled by the organization, waste disposal, materials, or fuels the organization purchases. Deciding if emissions from a vehicle, office, or factory that one uses are Scope 1 or Scope 3 may depend on how one defines their operational boundaries. Scope 3 emissions can be from activities that are upstream or downstream of the organization.

The Initiative has several objectives to help the participating member organizations. A participating organization, through the Initiative and the professional advice from the trained UNFCCC staff members, can understand their GHG footprints and receive advice on how to reduce their footprints and how to reduce costs—e.g., through increasing resource and energy efficiency while traveling. The Initiative additionally helps organizations to identify risks and opportunities arising from GHG emissions and related activities ("The Path to Climate Neutrality", 2021; United Nations Climate Change, "Climate Neutral Now", 2023).

Compared to other existing international initiatives for the reduction of carbon emissions—such as the Net Zero Coalition by the UN, the *Climate Neutral Now* Initiative is more feasible for GLI to put investments and efforts into for their organizational sustainability goals (United Nations Climate Actions, 2023). Although the Net Zero Coalition lines out the objectives that organizations should aim to achieve by the years 2030 and 2050, this initiative does not lay out the specific steps that organizations may follow to realize their sustainability goals (United Nations Climate Actions, 2023). Particularly, the Nationally Determined Contribution (NDC), a climate action plan within the Net Zero Coalition, only provides examples of climate advocacy groups' actions and reports of countries' processes on sustainable development (United Nations Climate Actions, 2023).

However, GLI needs a framework to follow to reduce and offset its emissions. With the UNFCCC's *Climate Neutral Now* Initiative, GLI can use the free GHG footprint calculator to estimate their carbon footprint and GHG emissions (United Nations Climate Change, "Measure Your Emissions", 2023). The *Climate Neutral Now* Initiative will encourage and support GLI and other interested stakeholders to act to achieve a climate-neutral world by 2050 as enshrined in the Paris Agreement (United Nations Climate Change, "Climate Neutral Now", 2023). The Initiative is a practical guide for GLI because of GLI's sustainable objective of promoting additional voluntary action on climate change (United Nations Climate Change, "Climate Neutral Now", 2023).

Furthermore, the initiative provides GLI with the recognition of sustainable development for the individual and organizations accordingly. This initiative is a critical step for an organization to: a) understand its emissions while measuring its GHG footprint, b) identify the main sources of those emissions and c) help the organization build its actionable plans regarding carbon offsetting (United Nations Climate Change, "Climate Neutral Now", 2023).

An organization may join the Initiative by signing the Climate Neutral Now Pledge. Then, the organization would follow the three steps: measure, reduce, and contribute (United Nations Climate Change, "Climate Neutral Now", 2023). Finally, the organization will report on its actions and achievements regarding carbon offsetting, which will be done on an annual basis. The report may be conducted either by the organization itself or by a third-party verified inventory (United Nations Climate Change, "Measure Your Emissions", 2023). As a participant, the organization itself may decide which scopes would be included in the organization's GHG footprint (United Nations Climate Change, "Measure Your Emissions", 2023).

To understand an organization's emissions and their sources, measuring the GHG footprints is an important step (United Nations Climate Change, "Climate Neutral Now", 2023). In addition, this will help build action plans to reduce those emissions. The UNFCCC "GHG Emissions Calculator" will help the organization decide the scopes to be included in the GHG footprints along with deciding whether to self-declare the emissions or to have a third party do so. The calculator, developed by the Climate Neutral Now team, is free of cost and has three distinct levels of recognition for GHG footprints—i.e., Bronze, Silver, and Gold.

- Bronze: In this recognition, an organization self-declares a GHG inventory, establishes a target with an incomplete reduction plan or no reduction plan at all, and contributes partially.
- Silver: In this recognition, a third party verifies the GHG inventory with incomplete Scope 3. The target is to achieve Net Zero by 2050 or earlier, has reduction plans with intermediate targets, and contributes fully with partial Scope 3.
- Gold: In this recognition, a third party verifies the GHG inventory with a full Scope 3, one achieves a minimum of 5 percent reduction yearly and has a full Scope 3 with full contribution (United Nations Climate Change, "Climate Neutral Now", 2023).

Evaluating GLI's Carbon Footprints and Offsetting Efforts

Organizations can use several types of calculators to measure their GHG emissions. This section provides toolkits for GLI to utilize when they measure and evaluate their carbon footprints. UNFCCC's methodology can be adopted to calculate GHG emissions for GLI. How it can be done is discussed in the next section.

UNFCCC's GHG Emissions Calculator

The UNFCCC secretariat came up with a GHG emissions calculator to provide a methodology to estimate GHG emissions, which is free and up to date (UNFCCC Secretariat, 2021). The information that UNFCCC provides is for reference purposes, and it does not reflect the policy or position of UNFCCC. In addition, the spreadsheet which is the guideline that UNFCCC provides does not replace a formal GHG inventory development process which may or may not be third-party verified (UNFCCC Secretariat, 2021). The capstone team follows UNFCCC's calculator because it is the most comprehensive guideline for calculation which considers the best practices for calculation in different areas. In addition, it is also free and up to date. In case of any questions regarding the calculation, the *Climate Neutral Now* team can be contacted at climateneutralnow@unfccc.int.

GLI's Carbon Footprint Areas

For GLI, the capstone team has categorized the broad areas where they could look to reduce their carbon footprints. The categories and the factors within it which affect carbon footprints are as follows:

- Flights: Dependent upon factors like the distance traveled and the airlines used.
- Transportation: Dependent upon factors like the type of vehicle, distance traveled, and fuel usage.
- Meals: Dependent upon factors like food source, waste, water, and packaging (water bottles, etc.).
- Activities: Dependent upon factors like electricity usage, materials used for the activity, vehicles used for activities (delivery vehicles, etc.), and freight transportation.
- Accommodation: Dependent upon factors like electricity, gas, and water waste.

A brief discussion on each broad area is given below:

Flights

Flights would include individual flying for work-related purposes. According to Climate Watch at the World Resources Institute's 2020 data, aviation contributes to around 1.9 percent of global greenhouse gas emissions (Ritchie et al., 2020).

UNFCCC's GHG Emissions Calculator recommends the use of the International Civil Aviation Organization Carbon Emissions Calculator (ICEC) for flights. The International Civil Aviation Organization (ICAO) developed a method to calculate CO2 emissions from air travel, which uses data such as aircraft types, route-specific data, passenger load factors, and cargo carried to do so (ICAO, n.d.). This allows passengers to learn about their individual emissions. ICEC is the only tool for calculating CO2 emissions from air travel that has been approved internationally. Using this tool, various individuals and organizations estimate their emissions for offsetting purposes.

If GLI used the ICAO Aviation Carbon Emissions Calculator for flights, it would be done in the following way:

- As per the sample trip itinerary provided by GLI, Day 0's activity includes departing from the U.S. and Day 1's activity includes arriving at Entebbe International Airport in Uganda.
- For example, a flight would be taken from Denver International Airport in the U.S. to Entebbe International Airport in Uganda. This flight has two layovers which include Seattle-Tacoma International Airport in Seattle and Hamad International Airport in Doha, Qatar. If a single person is flying a round trip in economy, their CO2/journey might be around 1951.7 kgs (about 4302.76 lbs.).
- Some research has shown that a single mature tree may absorb about 22 kgs of CO2 per year (European Environment Agency, n.d.). According to this calculation, at this rate, it would require around 89 trees to absorb one person's round trip from Denver International Airport to Entebbe International Airport.

The sample itinerary provided by GLI can be found in Appendix A. Further details of this calculation are given in Appendix B.

Transportation

Overall, transportation may include various forms such as road transport, aviation, shipping, rail, and pipeline. According to Climate Watch at the World Resources Institute's 2020 data, overall transportation contributes to around 16.2 percent and road transport contributes to around 11.9 percent of global greenhouse gas emissions (Ritchie et al., 2020).

For transportation-related factors, UNFCCC recommends UK Government GHG Conversion Factors for Company Reporting. For GLI, this specifically would be for fuels, owned vehicles, and employees commuting. UK Government GHG Conversion Factors are majorly for UK and international organizations to report their greenhouse gas emissions (Department for Energy Security and Net Zero & Department for Business, Energy & Industrial Strategy, 2020).

Using the UK Government GHG Conversion Factors, companies can calculate their emissions from the mileage traveled in company cars and use conversion factors appropriate to the type of car they are using. For example, in this method, if cars were to be categorized by size, they are categorized into small cars, medium cars, large cars, and average cars. If the car is petrol-based, a small car would emit 0.14836 kgs CO2e and 0.14769 kgs CO2 per km traveled (Department for Energy Security and Net Zero & Department for Business, Energy & Industrial Strategy, 2020). As this conversion factor provides a methodology to calculate emissions based on the car type and sizes, GLI can evaluate based on its car type.

If we assume that GLI uses a van to travel from Kampala to Lira and then from Lira to Lake Bunyonyi, the calculation of emissions would be done in the following ways:

- As per the UK Government GHG Conversion Factors, most vans would fall under the "Large Car" category.
- The approximate distance from Kampala to Lira is 337 KM and Lira to Lake Bunyonyi is 804 KM. This distance is based on the distance shown by Google Maps.

- If we suppose GLI's van is diesel-based, their conversion factor for kg CO_2 would be 0.20235. Therefore, GLI's total kg CO_2 emission would be 230.88.

  Please refer to Appendix C for further details of this calculation.

Meals

For meals-related factors, UNFCCC recommends using the Carbon Footprint Methodology for Olympic Games. For example, as per the Carbon Footprint Methodology for Olympic Games, the emission factors for a vegetarian meal, a meal with chicken, and a meal with beef are 2.85, 3.39, and 6.93 respectively (International Olympic Committee, 2018). Similarly, the emission factors for one cold or hot snack, one average meal, non-alcoholic beverage, and alcoholic beverage would be 2.02, 4.7, 0.2, and 1.87 respectively. The emissions are then calculated as the number of meals or drinks multiplied by the emission factors, which gives the emissions in the unit kgs of Carbon Dioxide Equivalent (CO2e) (International Olympic Committee, 2018). Appendix D shows the sample emission factors calculated for meals.

Activities

According to Climate Watch at the World Resources Institute's 2020 data, energy use in buildings accounts for 17.5 percent of the global greenhouse gas emissions out of which 6.6 percent is in commercial buildings and 10.9 is in residential buildings (Ritchie et al., 2020). On the other hand, shipping accounts for 1.7 percent of global greenhouse gas emissions. Similarly, fugitive emissions from energy production and unallocated fuel combustion account for 5.8 percent and 7.8 percent respectively (Ritchie et al., 2020).

For activities-related factors, UNFCCC recommends the UK Government GHG Conversion Factors for Company Reporting. For GLI, this may be useful for water (water supply and treatment), material use (primary material production), waste (landfill disposal), business travel by land, and freighting goods. Similarly, UNFCCC recommends IFI 2021 Harmonized Grid Emission Factor (GEF) data set for electricity and heat and the EcoAct Homeworking emissions whitepaper for the home office.

As per the International Financial Institutions (IFI) 2021 Harmonized Grid Emission Factor, for Uganda, the combined margin grid emission factor in gCO2/kWh is 116 for firm energy, 218 for intermittent energy, 116 for energy efficiency, and 116 for electricity consumption (UNFCCC, 2021). Similarly, the operating margin grid emission factor for Uganda in gCO2/kWh is 279. On the other hand, for Rwanda, the combined margin grid emission factor in gCO2/kWh is 416 for firm energy, 601 for intermittent energy, 416 for energy efficiency, and 416 for electricity consumption. Similarly, the operating margin grid emission factor for Rwanda in gCO2/kWh is 712 (UNFCCC, 2021).

Accommodation

Accommodation mostly includes hotel stays. UNFCCC recommends using the 2020 Cornell Hotel Sustainability Benchmarking Index to calculate the carbon footprint of hotels. This is a public data set that is published by Cornell's School of Hospitality Research which contains the average hotel performance with different hotels in different types of geographies (Greenview, n.d.). If hotels take part directly in this index, they receive a confidential report that practices benchmarking against their competitive set (Greenview, n.d.).

GLI's Carbon Footprint Offset Efforts

GLI puts efforts to offset carbon emissions. The areas include converting to solar or batteries at Entusi Resort and Retreat Center, providing solar lamps for education, model farming, and opening recycling centers in Uganda.

- Conversion to solar or batteries at Entusi Resort and Retreat Center
- Provision of solar lamps for education

- Model farm: Sustainable farming practices such as water reduction and permaculture techniques are taught to the community.
- Recycling center: In 2018, GLI opened a recycling center in Kabale to recycle plastic trash in Southern Uganda, in collaboration with Planet Buyback (The Global Livingston Institute, n.d.). The facility is entirely administered by residents and generates revenue and jobs. GLI created a recycling center in Lira, also in collaboration with Planet Buyback, and successfully gathered 20 tons of plastic. These initiatives also resulted in local-led public-private cooperation, as two rural communities explore conservation in their schools, churches, and local businesses (The Global Livingston Institute, n.d.).

Case Study: East African Carbon Offsetting Organizations

Some organizations in East Africa serve as industry leaders and positive examples of actively helping the reduction and offset of carbon footprints for companies. The capstone team analyzed two case studies that stand out among all industry leaders for carbon offsetting. The team chose these two case studies because they are applicable to GLI in aspects such as traveling and organizational structure.

Case Study #1: Travelife

Travelife is a leading system of certification and advice for green travel specifically in East Africa. The organization is a sustainability accreditation company that provides training, management, and certification initiatives for touring and safari companies that are committed to sustainability (Go2Africa, 2023). The sustainability certifications that Travelife provides help companies that hope to improve and independently verify their positive environmental impact. To achieve this objective, Travelife manages a company's products while closely monitoring their impacts on the environment—i.e., carbon footprints.

The core strategies that Travelife uses to help other companies achieve sustainability in East Africa are sustainable planning, management, training, and the incorporation of reporting tools on carbon footprints specifically regarding the travel activities of other companies (Go2Africa, 2023). The system that Travelife operates in East Africa helps touring agencies and safari companies comply with sustainability criteria while improving their social and environmental impacts around the globe. Organizations have collaborated with Travelife to influence their consumer demand, procurement policies, the sustainable development of destinations, as well as the environmental and cultural protection in East Africa.

GLI may reach out to Travelife via email (contact@go2africa.com) or this inquiry link (https://www.go2africa.com/enquire-now). The knowledge, solutions, and tools that Travelife offers may allow GLI to implement positive changes within GLI's businesses and supply changes (Go2Africa, 2023).

Case Study #2: Carbon Tanzania

Carbon Tanzania is another example of a leading organization that dedicates its effort to sustainable development in the urban areas of East Africa (Carbon Tanzania, 2020). As a small social enterprise, Carbon Tanzania provides the business framework and approach that ensures the realization of the sustainability values of collaborators, a network of stakeholders, and the forest communities themselves. Specifically, Carbon Tanzania empowers communities and local governments to realize values from the sustainable management of their resources. Their effort in helping organizations to reduce and offset carbon footprints is primarily in generating verified forest carbon offsets, which are sold on the voluntary market to other companies who are committed to sustainability (Carbon Tanzania, 2020).

By generating verified forest carbon offsets, Carbon Tanzania collaborates with companies to protect the forests and bring positive and measurable economic, social, and environmental benefits to local communities in East Africa (Projects of Carbon Tanzania, 2023). One important project that Carbon Tanzania is currently implementing is a conservation project for the Ntakata mountains in western

Tanzania. With collaborating companies that try to offset carbon emissions, Carbon Tanzania protects the habitats of large chimpanzee populations and the forested highlands connecting Mahale and Katavi National Parks and protecting critical chimpanzee habitats. Through strategic partnerships and collaborations, Carbon Tanzania pays its revenue directly to the communities in East Africa for sustainable development and livelihood needs—e.g., healthcare services, school feeds, and further education needs (Carbon Tanzania, 2020). Carbon Tanzania allows the communities in East Africa to have autonomy over what revenue is spent in areas regarding sustainable practices.

GLI may reach out to Travelife via email (info@carbontanzania.com) to seek collaboration and advice on implementing carbon offsetting strategies and obtaining the verified forest carbon offsets certification.

Ethical Issues in Carbon Footprints Offset Efforts

Carbon Credits

A low transaction cost would allow the creation of a tradeable permit for carbon emissions (Lejano et al., 2020). This would allow buyers and sellers to bargain for the right to emit and create efficiencies in the system. However, this also has some ethical issues. The main ethical issue is regarding socially unjust consequences such as the creation of a toxic hotspot through the transfer of air toxins. The transfer of credits affects some people and places disproportionately which is not internalized by market instruments such as carbon credits (Lejano et al., 2020).

The problems with carbon credits arise from the imperfect design of the carbon markets (Lejano et al., 2020). While there is bargaining for buying and selling carbon credits, not everyone who will be affected by the consequences can take part in it. This also allows the creation of sacrifice zones—a particular area accumulates all the adverse effects and emissions, as a substantial local emitter can purchase carbon credits from other areas with their ability to pay. Consequently, some underprivileged communities are becoming worse off environmentally, which raises inequity concerns. For example, in 2013, the state of California launched its cap-and-trade program setting a cap on emitters with 85 percent emission responsibilities. However, transactions of carbon credits were allowed through a centralized clearinghouse. Some investigations into this model such as Cushing et al. (2018) suggested that participants in this program were located disproportionately in those areas which were poor (Lejano et al., 2020).

Some carbon markets, like California's, allow all stakeholders to participate in the process in theory (Lejano et al., 2020). But this is still not possible due to various limitations such as the ability to pay, the acceptance to pay, and the difficulties with coming to a collective decision. In addition, ethical issues are also raised regarding the concept of being able to pay to avoid ethical obligations which are required to tackle the challenges of climate change (Lejano et al., 2020).

Greenwashing

There can be cases where businesses and organizations exaggerate the environmental benefits of their products or work, which affects their commitment to greater transparency and misleads the public (Iqbal, 2021). Sometimes, greenwashing can also bring positive impacts if it is not completely falsified. A company's extensive marketing on their product being environmentally friendly can help raise awareness and nudge consumers into making purchases that benefit the environment. However, consumers might be misled more often. An example of an exaggeration of the environmental benefits can be seen with paper straws—while it is more environmentally friendly than plastic straws, they may still harm the environment. Paper straws may still cause a lot of damage if there are difficulties in recycling as it may lead to landfills being filled. Here, a better solution would be reusable metal straws. Businesses and organizations may be causing more harm than good, but their marketing might make the public seem like their actions are benefiting the environment. This may lead to choices in favor of those businesses and

organizations which may harm the environment more. Therefore, such greenwashing with deception worsens environmental conditions (Iqbal, 2021).

Land Grabbing

Land grabbing refers to the contentious issue of large-scale land acquisition by companies, governments, or individuals (Land Grab, 2023). Ethical issues with land grabs are raised because it favors powerful actors more and leads to a violation of human rights for the underprivileged (Kleemann et al., 2013). This has a lot to do with the legal uncertainties and acquisition process due to local land users who are usually underprivileged having no voice. Lack of formal law, poorly enforced formal laws, and asymmetries related to power and information between investors and local people lead to displacement and human rights violations. Over the years, land grabbing has caused major issues for many farmers as they receive no compensation for their land. The farmers are then forced to move elsewhere and have a hard time making ends meet. Large-scale acquisitions also can increase institutional injustice through unequal power relations. Such acquisitions are found to be violating the right to property, the right to food, the right of workers employed on farms, and procedural rights like access to information and the ability to participate (Kleemann et al., 2013).

Green Grabbing

Green Grabbing refers to the appropriation of land and resources for environmental purposes (Fairhead et al., 2012). There has been a rising debate regarding green grabbing as ‘green’ credentials are used to justify the appropriation of land for environmental green agendas such as biodiversity conservation, biocarbon sequestration, biofuels, ecosystem services, ecotourism, or offsets. Green grabbing raises concerns because of how it alienates land and resources. It also has historical precedence as it builds upon the histories of colonial and neo-colonial resource alienation for environmental purposes (Fairhead et al., 2012). While the debate on land grabbing already highlights instances where ‘green’ credentials are used to justify appropriations of land for food or fuel, green grabbing has similar debates (Leach, 2012).

Recommendations

Gather information on GLI's carbon footprint offsetting

GLI puts efforts to offset its carbon footprints such as the use of solar and batteries at Entusi Resort and Retreat Center, the provision of solar lamps, sustainable model farms, and recycling centers. For GLI to know whether the actions they take to offset emissions are effective or not and to measure whether new actions have brought positive results or not, it is important to collect baseline data about their current carbon footprint offsetting activities.

Join the *Climate Neutral Now* Initiative

The initiative is a tool for measuring Scope 1-3 emissions and voluntarily offsetting carbon footprints. Based on the research findings in addition to the thorough literature review, the capstone team proposes a set of recommendations for GLI regarding carbon offsetting strategies. GLI should first join the *Climate Neutral Now* Initiative by the UNFCCC. This initiative is a helpful tool for GLI to measure Scope 1-3 emissions for the goal of offsetting carbon footprints.

Use existing tools to assess the current carbon footprints

GLI should use existing tools that are internationally recognized to calculate their current carbon footprints. We recommend using UNFCCC's GHG Emissions Calculator, which provides comprehensive guidelines and tools to measure emissions in different areas. The UNFCCC's GHG Emissions Calculator provides a free and up-to-date methodology to calculate GHG emissions for a range of areas.

Contact local green travel agencies in East Africa

Travel agencies like Travelife, a sustainability accreditation company, provide management and certification initiatives for touring and safari companies that are committed to sustainability.

Investigate similar organizations' efforts in reducing and offsetting carbon footprints by generating verified forest carbon offsets

Furthermore, GLI should investigate similar organizations' efforts in reducing and offsetting carbon footprints. GLI can start by contacting local green travel agencies in East Africa and by initiating collaborations on reducing carbon footprints for transportation, especially regarding commutes within East Africa. Case studies in the findings suggest that Travelife would be helpful for GLI's goal of carbon offsetting, as the organization is industry-leading in actively assisting companies and organizations that have businesses in East Africa to reduce and offset carbon footprints. Carbon Tanzania is another positive example that is dedicated to sustainable development in East Africa. Considering that Carbon Tanzania generates verified forest carbon offsets and pays its revenue directly to the communities in East Africa for sustainable development, GLI should initiate collaborations and strategic partnerships with Carbon Tanzania.

Use airline companies based on their sustainability practices for flights

One special note that could be inspiring for GLI's potential carbon offsetting strategies is to collaborate with airline companies that are highly committed to carbon offsetting. An example of one such airline is Delta Airlines. Delta Airlines is an industry leader in committing to sustainability, as it is the first U.S. airline company that offers carbon offsets to customers. It has also been continuously growing its efforts in sustainability. For example, ever since 2018, Duke University purchased carbon credits to offset Duke University's business travel on Delta. With their close strategic partnership, Delta Airlines even supported urban forestry in the Raleigh-Durham area (i.e., the region where Duke University is located) through funding for the planning of a thousand new trees. The collaboration between Duke University and Delta Airlines is notable for GLI because GLI could potentially do the same thing as Duke regarding carbon credit purchasing and carbon offsetting. The capstone team suggests

GLI initiate collaboration with airline companies such as Delta Airlines regarding GLI's carbon offsetting for flights.

Expand the recycling practices

GLI should expand the recycling practices as other waste management practices commonly used in Uganda are largely contributing to emissions. While waste reduction, reuse, and recycling practices are being promoted to manage waste, they are not among the most common practices in Uganda (Kinobe et al., 2015). For example, according to the 2015 data, Kampala, the capital of Uganda, produces about 180 tons of plastic waste every day while only 40-50 percent of the city's trash is collected and delivered to the Kiteezi landfill, which is a designated sanitary landfill (Balcom et al., 2021). Only 20 percent of trash is collected in Gulu, the second-largest populated city in Uganda. The most generic form of waste disposal in Uganda is open burning. This can be harmful as burning plastic emits deadly carcinogens as well as other toxins and greenhouse gases (Balcom et al., 2021). Plastic waste can also cause public health issues and agricultural crises. Plastic is frequently discarded which blocks drains and causes flooding and breeding grounds for mosquitoes that transmit malaria. In addition, discarded plastics may also get buried in the soil and disrupt crops (Balcom et al., 2021). Although there is still a need for a solid waste management strategy for waste reduction, recycling is a helpful activity for waste reduction (Kinobe et al., 2015). Thus, the capstone team suggests expanding GLI's recycling activities.

Appendices

Appendix A: GLI's Sample Trip Itinerary (Uganda)

Day 0

Depart from the U.S.

Day 1

Arrive at Entebbe International Airport, Uganda

- Transfer to lodging in Kampala, Uganda *(1-1.5-hour trip)*

Accommodations: Christian Glory House

Day 2

Kampala, Uganda

- Breakfast at Guest House
- Introductions & Activities
- Nasser: Background on Uganda
- Background/History of GLI
- Money Exchange / ATM
- Visit Uganda National Museum
- Lunch at 2k Restaurant
- Visit Thread of Life *(a tailoring/training organization run by Women from Katanga)*
- Free time to relax at the Guest House
- Evening Debrief
- Welcome Dinner

Accommodations: Christian Glory House

Day 3

Kampala, Uganda

- Breakfast at Guest House
- Brief walking Tour of Old Kampala (Nakasero Market, Old Taxi Park, Owino Market)
- Visit to National Mosque with Nasser
- Lunch at Ashra (Mosque) Restaurant
- Free time at Guest House
- Dinner

Accommodations: Christian Glory House

Day 4

Kampala, Uganda

- Breakfast at Guest House
- A session with Reach a Hand Uganda (RAHU)
- Lunch at Local Restaurant (Ugandan food)
- Visit Craft Market
- Free time to relax at the Guest House
- Evening Debrief
- Dinner

Accommodations: Christian Glory House

Day 5

Kampala to Lira, Uganda

- Early morning departure to Lira
- Lunch on the road
- Check-in & free time to relax
- Dinner at hotel

Day 6

Lira, Uganda

- Breakfast at hotel
- Visit GLI's Lira Recycling Center
- Lunch in town
- Free time to walk and explore Lira Town and local markets
- Dinner
- Evening Debrief

Day 7

Lira to Lake Bunyonyi, Uganda

- Breakfast at hotel
- Transfer to Lake Bunyonyi *(4-4.5-hour trip)*
- Lunch on the road
- Boat ride to Entusi *(15 minutes)*
- Welcome dinner at Entusi

Accommodations: Entusi Resort and Retreat Center

Day 8

Lake Bunyonyi, Uganda

- Breakfast at Entusi
- Morning debriefs
- Late morning visit to Bright's Village
- Return to Entusi for Lunch
- Afternoon of Options
- Swimming, canoeing, relaxing on the lake
- Visit Model Farm
- Visit Traditional Healer
- Dinner at Entusi
- Evening Debrief

Accommodations: Entusi Resort and Retreat Center

Day 9

Lake Bunyonyi, Uganda

- Breakfast at Entusi
- Travel into Kabale Town
- Visit GLI's Kabale Recycling Center

- Lunch in town
- Free time to walk and explore Kabale Town and local markets
- Travel back to Entusi
- Dinner at Entusi
- Evening Debrief

Accommodations: Entusi Resort and Retreat Center

Day 10

Lake Bunyonyi to Kampala, Uganda

- Farewell Breakfast
- Transfer to Kigali, Uganda *(~3-hour trip)*
- Lunch
- Check-in at Hotel
- Dinner

Accommodations: Garr Hotel

Day 11

Kampala, Uganda

- Breakfast at Hotel
- Final Debrief
- *(Optional)* Explore the city before the flight
- Afternoon/Evening transfer to Entebbe International Airport (EBB)

Accommodations: N/A

Day 12

Arrive in the U.S.

Appendix B: Sample per Person Carbon Emissions for Flights

For calculating the impacts related to flights, ICAO's Carbon Emission Calculator can be used. Since GLI's headquarter is in Denver, Colorado, the capstone team used Denver as the starting point and Entebbe as the destination. The route is randomly selected. The detail of the calculation is given below:

Table 1. Summary of Carbon Footprints: Denver – Entebbe Round Trip

Summary (Denver International Airport, USA to Entebbe International Airport, Uganda)				
Passengers	**Passengers' Total CO_2/Journey (KG)**	**Aircraft Fuel Burn/Journey (KG)**	**Cabin Class**	**Trip**
1	1951.7	283,881.1	Economy	Round Trip

Table 2. Detailed Information on Carbon Footprints: Denver- Entebbe Round Trip

Flight Stage Details				
Journey	**Distance (KM)**	**Aircraft**	**Aircraft Fuel Burn/leg (KG)**	**Passenger CO_2/pax/leg (KG)**
Denver International Airport, USA to Seattle-Tacoma International Airport, USA	1,643	319, 320, 321, 738, 739, 73H, 73J, 73W	7342.6	148.9
Seattle-Tacoma International Airport, USA to Hamad International Airport, Doha, Qatar	11,901	77W	109,380.2	598.4
Hamad International Airport, Doha, Qatar to Entebbe International Airport, Uganda	3478	332, 333, 788	25,232.2	227.7
Entebbe International Airport, Uganda to Hamad International Airport, Doha, Qatar	3,478	332, 333, 788	25,232.2	227.7
Hamad International Airport, Doha, Qatar to Seattle-Tacoma International Airport, USA	11,901	77W	109,380.2	598.4
Seattle-Tacoma International Airport, USA to Denver International Airport, USA	1,643	319, 320, 321, 738, 739, 73H, 73J, 73W	7313.7	150.6

Appendix C: Sample Carbon Emissions for Road Transportation

To figure out which category a car would fall under and what their emissions are for diesel and petrol, the following guidelines are provided:

Table 3. Categorization of Cars and the Conversion Factors

Cars (by size)	**Description**	**kg CO_2 (for km) for Diesel**	**kg CO_2 (for km) for Petrol**
Small Car	Petrol/LPG/CNG: Up to 1.4-liter engine; Diesel: Up to 1.7-liter engine; Others: Vehicles of similar size (i.e., market segment A or B)	0.13531	1.14769
Medium Car	Petrol/LPG/CNG: 1.4-to-2-liter engines; Diesel: 1.7-to-2.7-liter engines; Others: Vehicles of similar size (i.e., generally market segment C)	0.16453	0.18592
Large Car	Petrol/LPG/CNG: 2+ liter engine; Diesel: 2+litre engine; Others: Vehicles of similar size (i.e., generally market segment D and above)	0.20235	0.2774
Average Car	Unknown engine size	0.1666	0.17363

For calculating the impacts related to road travel in Uganda, the UK Government GHG Conversion Factors for Company Reporting can be used with GLI's itinerary given in Appendix A. A sample is given below, where we use Google Maps to estimate approximate distance and use the conversion factor for a diesel-based van (large car) to calculate kg CO_2 emissions:

Table 4. Sample Road Carbon Emission Calculations Using a Van

Start	**Destination**	**Distance (km)**	**Conversion Factor**	**Kg CO_2 emissions**
Kampala	Lira	337	0.20235	68.19
Lira	Lake Bunyonyi	804	0.20235	162.69
Lake Bunyonyi	Kampala	473	0.20235	95.71

Appendix D: Sample Carbon Emission Factors for Meals

For calculating the impacts related to breakfast, use the following emission factors depending on the type of breakfast (default data provided below) or model your country-specific breakfast:

Table 5. Sample Emission Factors for Breakfast

Parameter	**Emission factor**	**Unit**	**Source**
1 standard breakfast	0.84	Kg CO2-eq/breakfast	Based on WFLDB (2015)
1 gourmet breakfast	2.33	Kg CO2-eq/breakfast	Based on WFLDB (2015)

Table 6. Sample Emission Factors for Snacks

Item	**Standard breakfast**	**Gourmet breakfast**	**Unit**
Bakery	150	150	g
Coffee	1	1	unit
Milk	200	200	g
Butter	20	20	g
Jam	30	30	g
Sugar	6	6	g
Eggs	0	120	g
Bacon & Sausages	0	100	g
Orange Juice	0	400	g

Table 7. Sample Emission Factors for Meals

Parameter	**Emission factor**	**Unit**	**Source**
Meal, vegetarian	2.85	kg CO2-eq/meal	Based on WFLDB (2015)
Meal, with chicken	3.39	kg CO2-eq/meal	Based on WFLDB (2015)
Meal, with beef	6.93	kg CO2-eq/meal	Based on WFLDB (2015)

Table 8. Data and Assumptions for Meals

Item	**Meat, vegetarian**	**Meat, with chicken**	**Meat, with beef**	**Unit**
Chicken	0	200	0	unit
Beef	0	0	200	unit
Soybean	200	0	0	g
Potatoes	150	150	150	g
Rice	50	50	50	g
Tomatoes	50	50	50	g
Carrots	50	50	50	g
Yogurt or cheese	125	125	125	g
Cheese (soft)	0	0	0	g
Cheese (hard)	0	0	0	g
Bread	20	20	20	g
Pasta	50	50	50	g
Oil	20	20	20	g
Espresso	1	1	1	unit
Cream	20	20	20	g
Chocolate	25	25	25	g
Eggs	0	0	0	g
Boiling	2	2	2	unit
Frying	1	1	1	unit
Storage (chilled)	10	10	10	Liter.day
Ingredients supply	700	700	700	kgkm

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