Journal of Civil Engineering and Architecture 15 (2021) 547-559
doi: 10.17265/1934-7359/2021.11.001

Human Ways of Life and Environmental Sustainability: Congo Basin Case Study

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Abstract: The impact of human ways of life on environment is undisputed. Examples include roads and railroads constructions, industrial farming and mining, urban and industrial centers expansions, modification of rivers and lakes to build dams, etc. All these affect natural habitats, environment and the ecosystem. Human ways of life have impacted the physical environment in many ways, such as burning fossil fuels and deforestation that result in soil, water and air pollution. The Congo Basin rainforest depletion due to human ways of life has triggered soil and water degradation, caused greenhouse effect by releasing tons of carbon in the atmosphere, and is believed to accelerate climate change. This paper suggests that people's mindset can be transformed to transform human ways of life into best sustainability means that both improve living conditions and protect living environment. The case study is to illustrate that mindset transformation would enable the populations of the Congo Basin to go from complicity for deforestation to stewardship that uses local resources to improve living conditions while protecting living environment, and thus contributing to planet sustainability.

Key words: Congo basin, rainforest, deforestation, agriculture, farming, mining, greenhouse, climate change.

1. Introduction

Scientists agree that human ways of life impact the environment. It is recognized that there is a correlation between deforestation and greenhouse phenomenon that affects planetary climate stability. It is further recognized that Congo Basin rainforest is a major carbon sink that prevents greenhouse and helps stabilize climate change. So why is the world so concerned about carbon emissions watches idly the Congo Basin and the Amazon rainforests, the two major planetary carbon sinks, being destroyed at accelerated rate? What can be done to stow down and stop deforestation in the Congo Basin? This paper proposes an answer: the local populations of the Congo Basin are the answer. Focusing on the Congo Basin rainforest degradation, this paper argues that unless the local populations become part of dialogues and policies conception and implementation to stop deforestation, corporations and economic interests will only go for profits regardless of the dire consequences on planetary sustainability. Concrete action-plan is presented showing that mindset transformation of the Congo Basin populations will make of them stewards of their living environment and effective partners in the fight for planet sustainability.

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2. Congo Basin: A Major Carbon Sink for the Planet

Most of the Congo Basin rainforest is located in the Democratic Republic of Congo (DRC) [1], in central Africa, as shown in Fig. 1. A study conducted by the United States' National Aeronautics and Space Administration (NASA), the University of California, Los Angeles (UCLA) and the World Wide Fund for Nature-Germany produced high-resolution map of the amount and distribution of carbon stored in the rainforest of the DRC [2, 3]. It is determined that the equivalent of 85 billion tons of carbon dioxide is locked in the living vegetation of the DRC, which holds much of the Congo Basin rainforest, the second

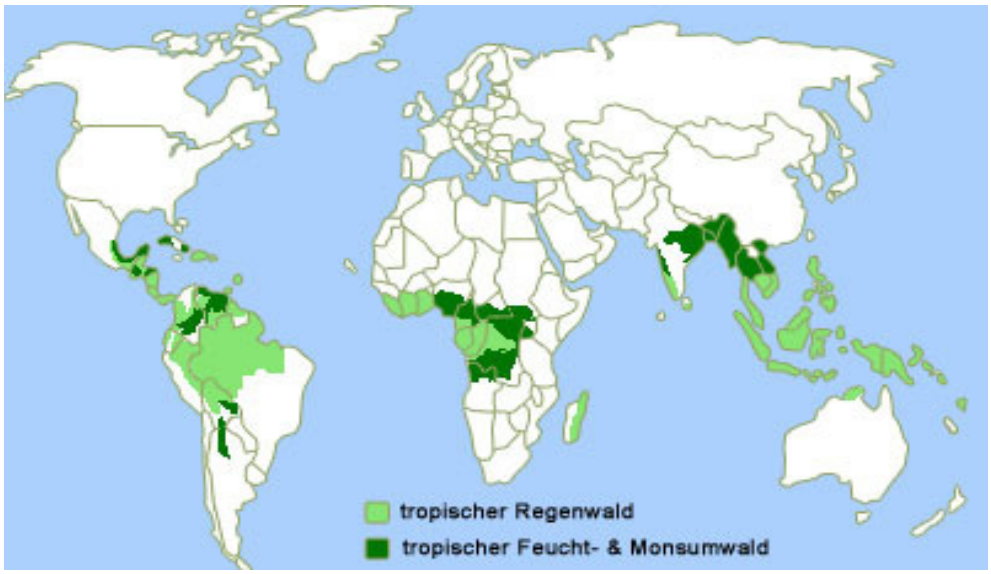

Fig. 1 Congo Basin on world map.

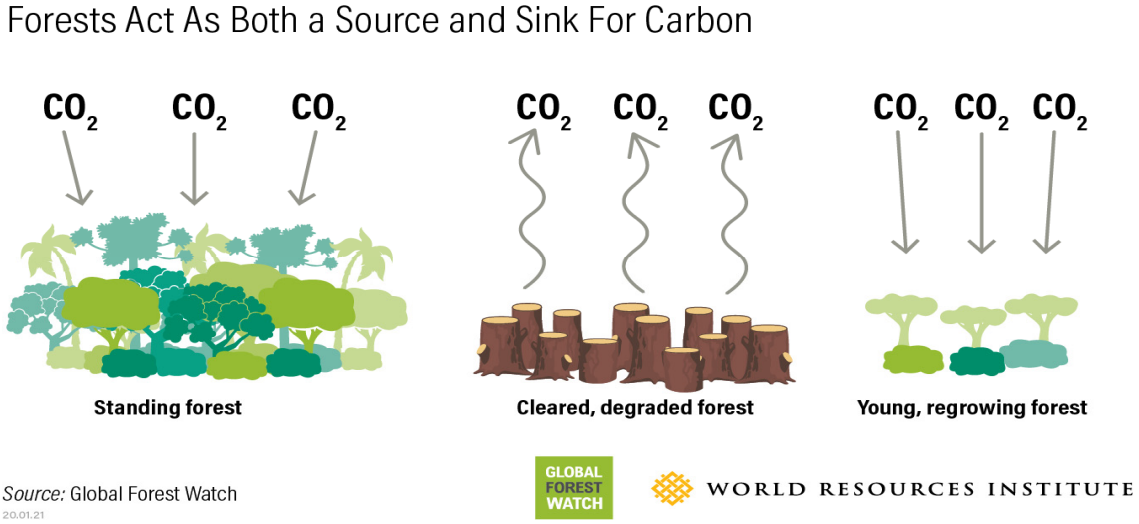

Fig. 2 Forest is source and sink for carbon.

largest tropical rainforest in the world, alongside the Amazon rainforest. The Congo Basin rainforest is estimated at 2 million square kilometers (8 hundred thousand square miles). When including secondary and savanna forest, the area equals about 3 million square kilometers (1.2 million square miles).

As illustrated in Fig. 2, forests act as a two-way highway, absorbing CO_2 when standing or regrowing, and releasing it when cleared or degraded [4]. It is estimated that the Congo's tropical rainforest sequesters 600 million metric tonnes more carbon dioxide per year than it emits. Moreover, for being taller and more resilient to climate change than the Amazon rainforest, the Congo Basin's trees soak up some 1.2 billion tonnes of carbon dioxide each year, and one third more carbon over the same area of land than those of the Amazon. Ultimately, at a global level, Congo's forests act as the planet's second lung, counterpart to the rapidly dwindling Amazon. The Congo Basin and the Amazon rainforests are the two major planetary carbon sinks, trapping carbon that could otherwise remain carbon dioxide in the air. The Congo Basin holds roughly 8 percent of the world's forest-based carbon [5-7].

3. Congo Basin Rainforest: From Carbon Sink to Carbon Source

Carbon sequestration capacity of the Congo Basin rainforest is rapidly declining due to deforestation [8]. Behind this forest loss lies a complex set of interdependent drivers related to human activities [9]. Some of these activities are direct drivers and some others are indirect drivers of canopy forest loss. The biggest drivers of deforestation in the Congo rainforest over the past 20 years have been small-scale subsistence agriculture, clearing for charcoal and fuelwood, urban expansion, and mining. Industrial logging, mining and farming are additional biggest drivers of forest degradation in the Congo Basin.

Studies are finding that at current trends, all primary rainforest in the Congo Basin could be cleared by the end of the century [10]. These deforestation activities, both artisanal and industrial, are allowed willingly or unwillingly by local populations in support of their ways of life. Thus, the Congo Basin populations, while striving to improve their living conditions, jeopardize their living environment and the planet sustainability [11, 12]. It is worth looking into some of these drivers of Congo Basin loss of its rainforest and how local populations are active agents of the deforestation through artisanal agriculture and mining, logging for habitat and fuelwood, and through industrial logging, mining and farming.

4. Settlements and Habitats

People have long lived in most regions of the Congo Basin. Over time, they became specialized in the exploitation of their natural environments. In 2018, it was estimated that 55.5% of the DRC populations lived in rural areas (see Fig. 3) [13].

Hence, the Congo Basin rainforest provides food, medicine, water, materials and shelter for over 75 million people. The people have historically specialized in hunting and fishing. Some inhabitants combine agriculture with hunting and fishing. In some areas, people raise small livestock and poultry and also mine copper, iron ore, and other minerals. In the grasslands, inhabitants confine themselves almost solely to agriculture, or combine agriculture with the raising of large livestock.

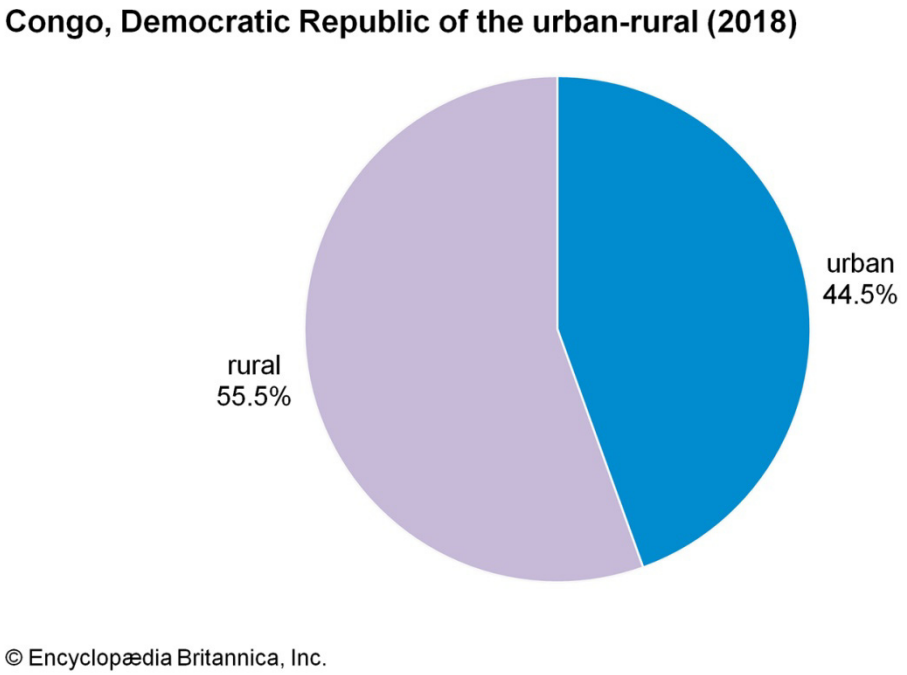

Fig. 3 Population ratio rural-urban in the DRC.

Fig. 4 House under construction.

Fig. 5 Two-level house suspended on tree.

The millions of people living in rural areas settle in scattered villages. The style of housing varies regionally, as does the general size of the villages. Fig. 4 shows a style of a house under construction on the ground [14], and Fig. 5 another style of a two-story house suspended on a tree [15]. The houses are made using poles, reed, stalks, ropes, leaves, etc. All the construction materials are directly harvested from the rainforest. A village with 10 to 25 houses is generally considered small, while one with 150 to 200 is large. The most populous areas are the savannah woodlands and, to some extent, the coastal regions, where the largest villages shelter some 300 to 500 families.

In normal conditions, the life span of a house ranges from 7 to 10 years before major repairs or complete replacement are undertaken. When 75 million people living in the rainforest region build, do major repairs or replacement of houses every 7 to 10

years, then the impact on the rainforest becomes visible.

5. Artisanal Agriculture

Inhabitants of the Congo Basin do small-scale agriculture for their subsistence. The practice is also known as slash-and-burn farming (see Fig. 6) [16]. Much of the DRC's population is dependent on slash-and-burn, rain-fed agriculture for its subsistence. This is a form of shifting agriculture where the natural vegetation is cut down and burned as a method of clearing the land for cultivation, and then, when the plot becomes infertile, the farmer moves to a new fresh forest to do the same thing again. When slush-and-burn farming is practiced by millions of people, then the rainforest gets destroyed rapidly.

In addition to progressive deforestation, slow regrowth of the forest, and lack of restoration of soil fertility, there are other problems that arise when the plots are far from the dwelling place. These other problems include crops protection from wild animals, crops transportation to the village, and the fact that families can not go farm far away when they have young children in their care.

While deforestation jeopardizes climate stability, the other host of problems ensures the farmers remain poor. In fact, the consequent vulnerability is reflected in the alarming levels of food insecurity due to disturbance of seasons, longer dry reason, heavy rain that destroy crops, etc. [17]. Hence, young farmers are often forced to abandon their lands, and migrate to city slums in the hope of making better life for themselves and their families. But in the slums, there is not enough work available, and the migrants and their families find themselves in yet worst hardships and living conditions, where they often get stuck for the rest of their lives [18].

6. Fuelwood

Fuelwood and charcoal represent a significant portion of all wood removal from the Congo Basin rainforest. Fuelwood serves foremost as cooking energy for households in the absence of accessible and affordable alternative energies [19]. In general, the trees are cut, kept under the sun to dry, and then burned directly to cook. Another technique consists of burning the dry wood into charcoals to be then used for cooking.

Fig. 6 Slush and burn for agriculture.

The DRC produced an estimated 54.7 million tons of fuelwood in 2009. Fuelwood and charcoals are used in rural villages, but the use of fuelwood is growing in cities and urban centers. Fuelwood consumption in DRC's urban centers is increasing thanks to a growing population and a lack of alternative energy sources, high unemployment, and inability to afford electric bills. Households depend largely on fuelwood for daily cooking. For example: 87% of the population in Kinshasa, the capital city of the DRC, rely on fuelwood and charcoals for cooking and heating; and 95% of the population in Kisangani, the third largest city of the DRC, do the same. Businesses, such as bakeries, breweries, restaurants, brick makers and aluminium forgers, also depend on fuelwood or charcoals for their daily operations [20].

Because of the weak implementation of forest legislations in the Congo Basin countries for multiple reasons, including mainly corruption and mismanagement, fuelwood and charcoals have come to mean deforestation, soil and environmental degradation.

7. Artisanal Mining

An artisanal mine is an informal operation, exploiting a mineral in an unplanned manner, using mostly manual methods and rudimentary tools/machinery. At artisanal or small-scale level, miners may operate individually using pick-axes, shovels, and pans to access and process alluvial deposits. Semi-mechanized operations may use a variety of mechanized tools and equipment to complement the manual labor force.

A typical artisanal mining site [21] is shown in Fig. 7. The work there requires clearing the area for extraction and digging. This visibly leads to deforestation and soil degradation. And when artisanal mining is practiced by millions of people, then it too will build noticeable deforestation effects.

8. Industrial Scale Agriculture

The Congo Basin is the target of international industrial-scale agriculture developers who are looking to cash in on new operations in Africa. A typical deforestation for industrial agriculture is shown in Fig. 8 [22]. These plantations, however, often fuel wide-scale deforestation and spark social conflicts.

Here, hundreds of square kilometres (miles) of rainforest are bulldozed for farming. This is an

Fig. 7 Typical artisanal mine.

Fig. 8 Aerial image of forest clearance for oil palm nursery.

intensive agriculture that is also characterized by an increased usage of chemical fertilizers, irrigation systems, pesticides, and mechanized technologies to increase agricultural productivity. The Congo Basin is dominated by small-scale agriculture, but the practice of large-scale agriculture for crops like rice, maize, palm oil, and banana is increasing. Industrial agriculture is practiced by foreign corporations that obtain farming licenses from local land management administration agencies. The licensing process often involves corruptions [23, 24] and disregard for local populations that are easily dispossessed and pushed out of their land concessions in favor of foreign corporations for large-scale farming.

9. Industrial Scale Logging

In the Congo Basin, industrial logging as shown in Fig. 9 [25] has increased dramatically in the past decade, mostly by foreign corporations. Industrial logging concessions cover about 60 million hectares (600 thousand square kilometers or 232 thousand square miles) of forest. Countries of the Congo Basin have most of their forest land governed by some form of forest management. But illegal logging is prevalent [26, 27]. Illegal logging comes in many forms, such as logging in protected areas, logging in established concessions but of prohibited species, or logging in established areas of legal species but more than the allowable cut. Illegal logging has contributed to conflicts with local populations, violence, human rights abuses, corruption, funding of armed conflicts and the worsening of poverty.

Studies have shown that the environmental effects of industrial logging include deforestation, the loss of biodiversity and the incredible emission of greenhouse gases.

10. Industrial Scale Mining

Most of the large-scale mining operations were established in the early nineties during colonial rules, and the areas since urbanized. Dikulushi copper mine shown in Fig. 10 is one of these old mine sites [28]. However, as mining explorations and development increase in areas not explored before, such as deep rainforest regions, rainforest reservations areas, so too the mining impact on the forest is increasing dramatically. Impacts of mining operations on forests occur at different stages of the operations (exploration, exploitation, and closure) and can be direct, indirect, and cumulative.

Fig. 9 Industrial logging in the DRC.

Fig. 10 Dikulushi copper mine in the southeast of the DRC.

The stages of exploration and exploitation include the following activities: site preparation, clearing and initial preparation for mining, construction of accommodations, construction of process and site facilities (for example, mills, offices), building roads and airstrips (installation of power lines and railway).

Mine site construction and ore extraction require vegetation and topsoil removal. Land clearing for site construction and mineral excavation increases the potential for significant soil erosion and sedimentation. If topsoils are not set aside and conserved for the reclamation phase, restoration of the forest ecosystem will be difficult, if not impossible. Soils that are not

conserved can be washed away into nearby rivers, streams, lakes, ocean shore, etc., causing sedimentation that can destroy aquatic habitat and result in a decline in fish species. Primary processing generally occurs at the mine site and consists of chemical, electric, or physical methods to separate the mineral from the ore body. The main concern at the processing stage is chemical and waste management.

Small-scale operations often discharge processing waste directly onto the ground or into waterways. Large-scale operations process high volumes of ore in a facility that might use significant quantities of water and energy. Effluents are typically discharged into artificially created holding ponds known as tailings impoundments. The effluent might contain trace amounts of mercury, cyanide, the target mineral, and other processing reagents. Disruptions in water cycles and water quality can lead to forest degradation, with changes in species composition and structure, and loss of biodiversity.

Mine closure and site rehabilitation take place after all economically viable minerals have been extracted. In large, well-run operations, planning for site rehabilitation often occurs during the exploration phase. Closure and site rehabilitation typically involve capping waste rock dumps to prevent acid mine drainage and other toxic effluents, replacing topsoils, recontouring the landscape, and revegetation. The site should be returned to a state that is deemed useful for the region's population, if not equivalent to the original landscape. But because of corruptions and mismanagement that dominate administrations in the Congo Basin countries, closure and site rehabilitation are often given short shrift; and in worse cases, little or no rehabilitation is conducted.

Studies have found that in many, if not most, cases, mines in the Congo Basin are poorly run, do not follow international best practices, they are unsafe and have significant direct, indirect, and cumulative negative impact on forests, soil, water, and the health of local populations [29].

11. Common to These Activities Are Deforestation and Release of Carbon

The above activities lead to deforestation in the Congo Basin. In the DRC, most of these activities are conducted in the rural areas where 55.5% of the populations live. On one hand, these rural populations contribute to deforestation through their own small scale activities [30]. On the other hand, they are used by big corporations in logging, farming and mining that produce deforestation at large/industrial scales, and are compensated with a survival salary.

The Congo Basin populations are agents of deforestations for survival reason. They are maintained poor and ignorant and do not know any better. The DRC is considered by the World Bank one of the poorest countries in the world based on gross domestic product (GDP) per capita. With two-thirds of Congolese living on less than $1.90 per day, the DRC ranks 179th out of 189 countries in the U.N.'s Human Development Index. A history of war and the ongoing conflict have resulted in poor economic development and chronic political instability. Currently, the DRC counts more than 4 million internally displaced people [31]. As of 2021, only 16% of Congolese households have access to grid electricity; this means that 84% of Congolese rely on fuelwood and charcoals for cooking and heating.

Here is an equation expressing the depletion of the Congo Basin rainforest that is transforming this major carbon sink into carbon source: wide spread corruption and mismanagement + wide spread poverty and ignorance + increasing speed of deforestation = Congo Basin ecosystem.

12. Local Populations Are Key to Solving the Congo Basin Ecosystem Equation

Forests in the DRC have been disappearing at increasing speed, with annual deforestation rates exceeding 1 million hectares (2.5 million acres) in the past five years and believed to have surged during the COVID-19 pandemic.

Poor governance and corruption are considered the biggest obstacles to protecting the country's forests from the pressures of subsistence agriculture and fuelwood collection, as well as the expansion of legal and illegal industrial operations.

On paper, the DRC has solid regulations regarding its forests. More than 40 laws, decrees and orders regulate the country's forest sector, most importantly the Forest Code of 2002. The DRC is also a signatory to 29 international conventions relating to the protection of the environment, including the Paris Agreement and the Brazzaville Declaration. Signed in 2018, the latter is supposed to protect the 145 million hectares (358 million acres) of the world's largest contiguous peatland area—an Alaska-sized expanse of forest in the DRC's Cuvette Centrale region. But already Greenpeace and Global Witness warn that industrial activities are taking place inside the area.

The truth of the matter is that the DRC has no national plan to fight deforestation. As long as local populations are not at the table of making and implementing the regulations [32], and as long as bureaucrats in the government alone craft the regulations they immediately disregard through corruptions, deforestation in the Congo Basin will march on, jeopardizing the entire planet sustainability, until one day, the world will wake up to planetary catastrophe, and it will be too late.

13. Stopping Congo Basin Deforestation Is Key to Planet Sustainability

We need to protect tropical forests from deforestation and degradation if we want to reduce emissions to the levels needed to protect the planet against the worst global warming impacts [33, 34]. Ending deforestation will not solve all of the global climate change problems, but carbon emission problems will not be solved if the terrible role of tropical deforestation is ignored.

The world is concerned about carbon emission problems [35]. In 2009, at a UN summit in Copenhagen, the issue was heavily debated. Although wealthy countries resisted calls to directly compensate poorer nations that are harmed by their carbon emissions, they agreed to channel $100 billion a year, starting in 2020, to developing countries to help curb their carbon footprint and cope with future climate impacts. As for today, the pledge is not met.

Also, the UN Forum on Forests (UNFF) carries out its forest financing activities through the Global Forest Financing Facilitation Network (GFFFN), and well-to-do countries pledge and donate to the fund. But curiously, the resources are often heavily spent on fossil-fuel projects. Furthermore, climate change money instead of being used to stop deforestation, it is rather spent by private investors in wealthy nations on projects such as solar plants. Overall, renewable-energy systems, energy-efficiency projects and sustainable transport take the lion's share of climate financing, and most of these projects take place in developed nations, not in the Congo Basin.

Energy experts say that the gap points to wider difficulties in refocusing financial systems towards a zero-carbon world, while too much money is still being spent supporting fossil fuels and other sources of greenhouse-gas emissions projects [36-38].

At the November 2020 Climate Dialogues, Intergovernmental Panel on Climate Change scientists were clear: immediate and urgent decarbonization is necessary and any delay adds to the burden on future generations. It is here suggested that one easy way for decarbonisation is to ensure that the Congo Basin plays its role of carbon sink, along with other remaining world forests like the amazon rainforest.

14. Money and Mind-Set Transformation Needed in the Congo Basin

Stopping deforestation will only be achieved by, through and with the populations of the Congo Basin. The same way poverty and ignorance made them actors and complicit of, and subjected to, the artisanal and industrial agriculture, logging, and mining; the

same way transformational mind-set will make of them actors and agents of change, fighters against deforestation, and stewards of planet sustainability. That is a novel approach, a new paradigm, a game changer, to imagine and develop.

It is here suggested that funds and resources spent on fighting climate change through conferences, summits and symposiums be boldly used to transform the populations of the Congo Basin into an army of actors and agents of change, fighters against deforestation, and stewards of planet sustainability.

It is about empowering local populations to develop simple, practical and smart techniques that are efficient for sustainable agriculture, construction and transportation, so they can improve their living conditions by reducing poverty, and in the process protect the vitality of their living environment.

It is not enough to simply distribute fertilizers to rural farmers for one season, construct/pave a road, install a water pump, build a library, build a school, build a clinic, etc. All this has been easily accomplished in the short run through charity works. More often than not, the quality and level of these services steadily diminishes because the people in the rural communities were not trained to create and sustain these services using local resources, nor did these services meet their priorities or lead to self-empowerment for durable outcome.

The local populations must be engaged to reinforce their priorities, to use local means and resources to develop products and services that meet their needs and protect their land, forest, waters and air, and lead to self-empowerment for durable and sustained economic growth.

Funds and resources to fight climate change must be used in the Congo Basin to transform rural schools and community colleges into creative centers where techniques and programs are conceived, developed and implemented to, for example, make fuelwood and charcoals in ways that allow quick replenishment of trees; develop techniques and methods of harvesting materials for house construction using for example trees that grow rapidly and can be planted for construction; develop techniques and methods for integrated and sustainable agriculture and farming, etc.

Hence, vibrant communities of producers and consumers that care for their land, forest, water, and air will become actors and agents of change, fighters against deforestation, and stewards of planet sustainability.

15. An Example of Transformational Action-Plan

This action-plan is intended to transform rural technical schools and community colleges in the Congo Basin into creative centers for sustainable development. Graduates of the programs will develop and possess the necessary skills to meet the need and demand for resource development and management, environmental protection, environmental assessment, water management, waste management, environmental research, and environmental education. They will develop innovative solutions and build their capacity for partnerships at the local, national, and international levels. They will become stewards of their environment, and of a sustainable development in the Congo Basin.

This example of action-program focuses on youth and rural schools to become creative centers that transform local ways of life into tools of environmental sustainability:

(1) Construction

- Design and build for local climate;
- Inventory and characterization of local construction materials;
- Smart logging for construction materials;
- Smart use of natural resources for construction purposes.

(2) Mechanical

- Inventory, characterization and development of local technologies to improve on the environment;

- Inventory of local renewable energy resources;
- Development of simple and pragmatic techniques for converting renewable energy to heat and electricity.

(3) Industrial

- Inventory, characterization and development of efficient local foundries and fabrication processes;
- Development of efficient local agricultural techniques, technologies and practices;
- Development of assessment techniques of impact of fabrications/productions on the environment (land, forest, water and air).

(4) Fostering Creative and Sustainable Development

- Integrate livestock, crop, energy productions, and aquaculture;
- Develop and produce efficient tools of work from local resources (using basic clean and sustainable technologies);
- Develop and utilize renewable energy from local resources;
- Emphasize entrepreneurial training where students are motivated to graduate with an environmentally friendly business project of their own to implement;
- Foster alumni networking and pro-environment actions.

16. Conclusion

Congo Basin case study illustrates that human ways of life can be a powerful tool for planet sustainability when people living deforestation are empowered to become aware of their stewardship role. This case study suggests a new paradigm, a novel approach, which calls for transformational mind-set that enables the local populations of the Congo Basin to become actors and agents of change, fighters against deforestation, and stewards of planet sustainability. In other words, local people are to transform their ways of life into means for sustainability that improve their local living conditions and protect their local living environment. Then they will guide how to effectively apply and implement international, regional, and national summits resolutions and policies, and how to work with private for-profit and not-for-profit advocacy organizations to achieve desired result. Then, planting trees, recycling, reforestation, research that includes satellite imaging and global monitoring, incentivizing green development and industry, will become more effective because done in coordination with local people's imagination and creativity. Otherwise, millions of dollars will continue to be wasted in wrong climate change fights, while deforestation and release of carbon in the atmosphere will continue, and planet sustainability will be in jeopardy.

References

[1] Congo Basin on World Map—Bing Images.

[2] Gray, E. 2017. "NASA Survey Technique Estimates Congo Forest's Carbon." https://climate.nasa.gov/news/2656/nasa-survey-technique-estimates-congo-forests-carbon/.

[3] NASA Earth Observatory. 1999. "Deforestation in the Democratic Republic of the Congo."

[4] Union of Concerned Scientists. 2012. "Tropical Deforestation and Global Warming." https://www.ucsusa.org/resources/tropical-deforestation-and-global-warming.

[5] Harris, N., and Gibbs, D. 2021. "Forests Absorb Twice As Much Carbon As They Emit Each Year." In *Quantifying Carbon Fluxes in the World's Forests*, World Resources Institute.

[6] Radford, T. 2020. "Vast Carbon Sink Found in Congo Basin." The Good Men Project.

[7] Looby, C. 2017. "Discovering the Congo Carbon Sink." www.mongabay.com.

[8] Grossman, D. 2020. "The Congo Rainforest Is Losing Ability to Absorb Carbon Dioxide. That's Bad for Climate Change." Pulitzer Center.

[9] Tchatchou, B., Sonwa, D. J., Ifo, S., and Tiani, A. M. 2015. "Deforestation and Forest Degradation in the Congo Basin: State of Knowledge, Current Causes and Perspectives."

[10] Erickson-Davis, M. 2018. "Congo Basin Rainforest May Be Gone by 2100, Study Finds."

[11] Megevand, C. 2013. *Deforestation Trends in the Congo Basin: Reconciling Economic Growth and Forest Protection (Directions in Development)*. Illustrated ed., World Bank Publications.

[12] Sonwa, D. 2014. "Sustainable Development in the Congo Basin: Moving Beyond the Biodiversity Agenda." *CIFOR*

Forests News.

[13] Congo Basin Settlement Pattern. https://www.britannica.com/place/Democratic-Republic-of-the-Congo/Government-and-society.

[14] "A House under Construction in the Congo Basin." 9c936db62875895d16a64bf1c26c7191.jpg, pinimg.com.

[15] "Two-Story House Suspended on a Tree." https://www.indietraveller.co/wp-content/uploads/2018/02/P1050180.jpg.

[16] Slush and Burn Agriculture—The DRC. https://www.flickr.com/photos/unep_dc/8539842154.

[17] Sonwa, D., et al. 2020. "Living under a Fluctuating Climate and a Drying Congo Basin." *Sustainability* 12 (7): 2936.

[18] Tongele, T. N. 2015. *Rise and Shine: Resilient People and Immense Resources in the Shadow of Death*. Green Ivy Publisher.

[19] Behrendt, H., Megevand, C., and Sander, K. 2013. "Deforestation Trends in the Congo Basin: Reconciling Economic Growth and Forest Protection." Working Paper 5, Wood-Based Biomass Energy.

[20] Schure, J., Ingram, V., Marien, J.-N., Nasi, R., and Dubiez, E. 2011. "Fuelwood for Urban Centres in the Democratic Republic of Congo." https://www.cifor.org/publications/pdf_files/infobrief/3678-brief.pdf.

[21] Hancock, T., ed. 2016. "Importance of Artisanal Mining Increases in DRC." https://www.miningweekly.com/article/importance-of-artisanal-mining-increases-in-drc-2016-11-17.

[22] GreenPeace USA. "Congo Basin Forests." https://www.greenpeace.org/usa/forests/congo-basin/.

[23] Pyhala, A., Orozco, A., and Counsell, S. 2016. "Protected Areas in the Congo Basin: Failing Both People and Biodiversity?" https://www.rainforestfoundationuk.org/media.ashx/protected-areas-in-the-congo-basin-failing-both-people-and-diversity-english.pdf.

[24] Engunda Ikala, A., Halleux, C., Mambeta, R., and Williams, L. 2018. "Tracking Deforestation in DRC's Forest Concessions Is Complicated." https://www.wri.org/insights/tracking-deforestation-drcs-forest-concessions-complicated.

[25] "Typical Industrial Logging." www.rainforestfoundationuk.org.

[26] Lawson, S. 2014. "Illegal Logging in the Democratic Republic of the Congo." https://www.chathamhouse.org/sites/default/files/home/chatham/public_html/sites/default/files/20140400LoggingDRCLawson.pdf.

[27] Schneider, V. 2020. "Poor Governance Fuels 'Horrible Dynamic' of Deforestation in DRC." https://news.mongabay.com/2020/12/poor-governance-fuels-horrible-dynamic-of-deforestation-in-drc/.

[28] Shihua, T. 2019. "China's JCHX Mining to Pay USD2.75 Million for DRC Copper Mines." https://www.yicaiglobal.com/news/china-jchx-mining-to-pay-usd275-million-for-drc-copper-mines.

[29] Campbell, J. 2020. "Why Cobalt Mining in the DRC Needs Urgent Attention." Retrieved from *Why Cobalt Mining in the DRC Needs Urgent Attention (cfr.org)*

[30] Tyukavina, A., et al. 2018. "Congo Basin Forest Loss Dominated by Increasing Smallholder Clearing." *Science Advances* 4 (11): eaat2993.

[31] The World Bank. 2021. "The World Bank in DRC: The World Bank is Helping to Fight Poverty and Improve Living Standards for the People of the Democratic Republic of Congo, through Education, Energy, Health and Other Social Services." *Democratic Republic of Congo Overview (worldbank.org)*

[32] Leonetti, C. 2010. *Indigenous Stewardship Methods and NRCS Conservation Practices—Guidebook*. USDA.

[33] Sinnassamy, J.-M. 2019. "The Congo Basin Is Critical to the Health of Our Planet." Global Environment Facility. https://www.thegef.org/blog/congo-basin-critical-health-our-planet.

[34] Smith, T. E. 2019. "The Future of the Planet is Africa." The Leonardo DiCaprio Foundation.

[35] Kerry, J. 2021. "Remarks on the Urgency of Global Climate Action." https://www.state.gov/remarks-on-the-urgency-of-global-climate-action/.

[36] Atyi, R. E. 2019. "Despite Size, Congo Basin Attracts Less Funding Than Other Major Forest Areas." *CIFOR Forests News*.

[37] Climate News Network. 2015. "Climate Cash Flow to Poorer Nations Is Still Too Slow."

[38] Yeo, S. 2019. "Where Climate Cash Is Flowing and Why It's Not Enough. Investments Need to Ramp Up to Keep Global Warming within Safe Thresholds." *Nature* 573: 328-31. https://doi,org/10.1038/d41586-019-02712-3.

[39] Harvey, F. 2020. "Finance Holds Climate Key but Poor Countries Fear Missing Out." Presented at Cop26: Glasgow Climate Change Conference 2021.

[40] Vidal, J. 2008. "Can Money Save the Congo Basin Rainforest?" *The Guardian*.