

Achieving Sustainable Forest Management in Tanzania: Evaluating the Effectiveness of Current  
Forest Protection Policies and Initiatives Designed to Stop Deforestation

By

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## Abstract

High rates of deforestation and forest degradation occurring in many tropical and subtropical forest are major global environmental issues. Specifically, deforestation and forest degradation are significant issues within Tanzania due to the fundamental role forests play in supporting local livelihoods, and the significance of Tanzania's forests in helping to mitigate climate change. This project uses the Driver-Pressure-State-Impact-Response (DPSIR) framework to evaluate Tanzania's National Forest Policy of 1998, Participatory Forest Management (PFM), and Reducing Emissions of Deforestation and Forest Degradation (REDD+) to determine if sustainable forest management is being achieved within the country. The project reveals that Tanzania's forest protection policies and initiatives are inadequate in achieving sustainable forest management as they do not effectively address the key drivers of deforestation and forest degradation including uncontrolled subsistence agriculture, charcoal consumption, illegal logging, in migration, and climate change. Furthermore, I discuss several recommendations for improved sustainable forest management in Tanzania.

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## **List of Abbreviations**

AFDB	African Development Bank
CBFM	Community-Based Forest Management
DANIDA	Danish Ministry of Foreign Affairs
DPSIR	Driver-Pressure-State-Impact-Response
EEA	European Environmental Agency
FAO	Food and Agriculture Organization
FBD	Forestry and Beekeeping Division
GVEP	Global Village Energy Partnership
IPCC	The Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
JFM	Joint Forest Management
JFMA	Joint Forest Management Agreements
LPG	Liquefied Petroleum Gas
MEM	Ministry of Energy and Minerals
MNRT	Ministry of Natural Resources and Tourism
NGOs	Non-Government Organizations
OECD	Organization for Economic Co-operation and Development
PAI	Population Action International
PFM	Participatory Forest Management



PRB	Population Research Bureau
PROFOR	Program on Forests
PSR	Pressure-State-Response
REDD+	Reducing Emissions from Deforestation and Forest Degradation
TFCG	Tanzania Forest Conservation Group
TFS	Tanzania Forest Service
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations High Commissioner for Refugees
UN-REDD	United Nations- Reducing Emissions from Deforestation and Forest Degradation
URT	United Republic of Tanzania
USAID	United States Agency for International Development
USD	United States Dollar
WWF	World Wide Fund for Nature

## **Chapter One: Introduction**

### **General Introduction**

Globally, forests cover more than 30 percent of the earth's surface, and are essential for life as they release oxygen into the atmosphere (WWF, 2011). Forests also provide a number of other essential services including supporting livelihoods, controlling water runoff, preventing soil erosion, conserving biodiversity, and helping to mitigate climate change (FAO, 2018). Specifically, forests account for 75 percent of terrestrial gross primary production (Beer et al., 2010), 80 percent of the earth's total plant biomass (Kindermann et al., 2008), and contain more carbon in biomass and soils than is stored in the atmosphere (Pan et al., 2011). In terms of distribution, data from the Food and Agriculture Organization (2010) show that the majority of the world's forests are in Europe (including the Russian Federation), and South America, followed by substantial forest cover in Africa, North and Central America, Asia, and Oceania. In particular, Africa has a forest cover of approximately 17 percent of the global forests, and the continent's forests, which mainly include tropical and sub-tropical forests, cover 23 percent of Africa's land area (FAO, 2010; FAO, 2012a).

Forests are highly economically significant as they contribute extensively to the global economy, and create more than 50 million jobs worldwide (World Bank, 2016). For many African countries such as the United Republic of Tanzania (URT), forests are an integral part of their economy (WWF, 2015). Additionally, forests serve as a major source of energy worldwide. For example, about 13 percent of households in Latin America and the Caribbean, 5 percent in Asia, and more than 27 percent in Africa meet their cooking energy needs from forests (FAO, 2014). Moreover, the dependence on wood and charcoal for cooking in Africa is projected to increase due to ongoing population growth within the region (UNEP, 2015a; FAO, 2014).

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Other significant functions of forests include maintaining global natural resources, and biodiversity of plant and animal species (Miura, 2015). In Africa, forests help to ensure clean water and provide habitats for numerous endemic species including globally recognized endangered species (WWF, 2015). Similarly, these environmental functions offer several socio-economic benefits to people in Africa particularly in rural areas (UNEP, 2015a). More than 1 billion people globally depend on the benefits derived from forests, with the majority being in Asia and Africa (World Bank, 2016).

Forests also play a fundamental role in helping to reduce the global impact of climate change (WWF, 2011). This is due to the vital role forests play in the world's carbon cycle as trees absorb carbon dioxide from the atmosphere and store it (Bala et al., 2007). Through this function, African forests have the potential to be a major carbon sink, however the continuing loss of forest cover in the region means that instead these forests could become a major source of emissions due to increasing human pressure and weak management (UNEP, 2015a). An analysis of three decades of tree growth and death from undisturbed tropical forests across Africa and the Amazon has found that the overall uptake of carbon into Earth's intact tropical forests peaked in the 1990s (Hubau et al., 2020). Specifically, intact tropical forests removed roughly 46 billion tonnes of carbon dioxide from the atmosphere in the 1990s, declining to an estimated 25 billion tonnes in the 2010s (Hubau et al., 2020). Furthermore, it is estimated that current deforestation in the tropics contributes 12 to 17 percent of annual global carbon dioxide emissions (IPCC, 2007; Van der Werf et al., 2009). Consequently, it is important to understand how forest protection policies and initiatives designed to reduce deforestation and forest degradation can be strengthened in order to sustain the multiple ecological benefits forests provide, while also protecting and improving local livelihoods that depend on forest resources.

### **Deforestation and Forest Degradation in Africa**

Generally, forest gain is occurring at higher latitudes and in richer countries, while forest loss continues in poor countries in the tropics (FAO, 2015a). Significant deforestation has been reported in Africa, where the loss of forests is estimated between 0.5 percent and 0.6 percent per year (Mabee, 2020, Figure 1). This is particularly problematic for countries where the likelihood of the eventual loss of forests, and the decline in their capacity to provide goods and services is of concern (Sloan & Sayer, 2015). One of the primary causes of deforestation and forest degradation within Africa is uncontrolled subsistence agriculture which is practiced by the majority of the continent's rural population (FAO, 2016). Other leading drivers of deforestation and forest degradation in the region include an overreliance on wood and charcoal, illegal logging, and climate change (Hosonuma et al., 2012; FAO, 2017a; IPCC, 2014).

Deforestation and conversion to agriculture affects approximately 80 percent of the forest each year, however the importance of subsistence versus commercial agriculture varies with geographic location (FAO, 2016; Hosonuma et al., 2012). The FAO (2016) states that in Africa local subsistence agriculture practiced by the rural majority has serious impacts on the continent's forest sector. Small-scale agricultural processes dominate deforestation and forest degradation in Africa as many poor households adopt low-risk, low-return agriculture in order to meet growing food demands (FAO, 2016, FAO, 2015b). Additionally, Kariuki (2011) highlights that Africa's forests will continue to be under pressure from agriculture due to increased land use and needs from within and outside the region.

Further, an overreliance on wood and charcoal also contributes to substantial deforestation and forest degradation in Africa (World Bank, 2011; Boucher et al., 2011). For example, in Tanzania firewood and charcoal remain the primary energy sources for cooking with

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more than 90 percent of households using firewood or charcoal (World Bank, 2009; Mwampamba, 2007). It has also been estimated that around 0.7 percent of forested land in Africa is needed for charcoal production each year (Santos et al., 2017). Additionally, the FAO reports that over 50 percent of the charcoal produced worldwide is produced in Africa in order to meet the energy demands of a growing urban population (FAO, 2017b; FAO, 2018). In the most sustainable scenario, African urban populations are projected to require 5.5 million tons of biomass for charcoal and 1.7 million tons for firewood (Santos et al., 2017). In the least sustainable scenario, African urban populations are projected to require 145.3 million tons of biomass for charcoal and 43.8 million tons of biomass for firewood (Santos et al., 2017). Unfortunately, firewood and charcoal use are expected to continue and be a major challenge to Africa's forest sector as other energy alternatives are not widely accessible (FAO, 2017b).

Another driver contributing to deforestation and forest degradation in Africa is illegal logging (Hosonuma et al., 2012; FAO, 2018). In Africa, illegal logging is fueled predominately by international demand and is made possible due to corruption and the lack of enforcement capable of protecting large forests within the region (UNEP, 2012a). Additionally, the increasing development of infrastructure such as roads that pass through remote forested areas increase the accessibility and further exploitation of otherwise inaccessible forested land (Kweka et al., 2015). As an example, Hoare (2015) found that in Cameroon over half of the timber harvested was done illegally, leading to revenue losses for the country. Similar situations have also been reported in other African countries including Tanzania, and the Republic of the Congo (Davie, 2013, Fuller, 2018).

Moreover, climate change is a driving force of deforestation and forest degradation in Africa (FAO, 2017a). Climate change is projected to alter existing weather patterns in Africa

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including temperature, precipitation, and extreme weather events (IPCC, 2014). These changes will not be uniform across Africa as different countries and regions will experience different changes (IPCC, 2014; FAO, 2017a). For example, in Tanzania climate change is projected to increase temperatures, and make rainfall patterns more variable (Luhunga et al., 2018; Conway et al., 2017). In addition to climate change as a driver, African forests are essential for climate change adaptation and mitigation (FAO, 2016; Miller & Cotter, 2013). Nogherotto et al. (2013) conducted a modelling study of complete deforestation in the Congo Basin in Africa and found a reduction in precipitation of up to 50 percent, and a significant warming of up to 4°C. Impacts of climate change due to deforestation and forest degradation have also been recorded in other countries including Tanzania, Kenya, and Mozambique (Miller & Cotter, 2013; FAO, 2017a). As a result, it is essential to safeguard Africa's forests as they slow the advancement of climate change, act as a barrier to desertification, underpin sustainable agricultural production, and support the livelihoods of the rural poor (Miller & Cotter, 2013; FAO, 2014).

### **Deforestation and Forest Degradation in Tanzania**

Tanzania, officially named the United Republic of Tanzania (URT) is located in Eastern Africa which is one of five sub-regions on the African continent (UN, 1999, Figure 2). Eastern Africa or East Africa contains 20 countries including Tanzania and has been highlighted globally as an important sub-region in relation to deforestation and forest degradation (UN, 1999; FAO, 2017a). Tanzania is one of the biggest countries in East Africa, and shares borders with eight countries. Its neighbours include Uganda to the north; Kenya to the northeast; Mozambique to the south; Zambia and Malawi to the southwest; Rwanda, Burundi, and the Democratic Republic of the Congo to the west; and the Indian ocean to the east.

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In terms of forest cover, Tanzania has 48 million hectares of forested land, which is over 50 percent of the total land area in Tanzania according to the most recent ground based national forest inventory conducted by the Tanzania Forest Services Agency (TFS, 2015; Malimbwi, & Zahabu, 2014; UNEP, 2015b). However, based on the most recent reports from the TFS and FAO, forest cover within Tanzania is being reduced by approximately 372 thousand hectares per year (TFS, 2015; FAO, 2015a). Furthermore, forest resources in southern Tanzania have been described as the most degraded in the country with Rufiji and Kilwa districts (Pwani and Lindi regions) being classified as ‘heavily degraded’ (Miya et al., 2012).

Deforestation and forest degradation in Tanzania are not only problematic due to the rate of forest loss, but also due to the high biodiversity of Tanzania’s forests. Tanzania’s Eastern Arc Mountains and coastal forests cover approximately 3 million hectares of forested area in Tanzania and contain a high density of plant and animal species found nowhere else in the world (TFS, 2015; Gereau et al., 2016). Godoy et al. (2011) found that deforestation rates in coastal forests in Tanzania have slowed from 1.0 percent per year, or > 3735 hectares per year during the 1990s, to 0.4 percent per year, or >1233 hectares during 2000-2007. Despite lower deforestation rates in 2000-2007, the percentage lost from within reserved areas has remained steady at 0.2 percent per year for both time periods (Godoy et al., 2011). This is problematic as these forests contain numerous endemic species at risk of extinction due to deforestation and forest degradation (Burgess et al., 2017; Godoy et al., 2011). For example, the forests in the Eastern Arc Mountains of Tanzania and Kenya contain 1500 endemic plant species and over 120 endemic vertebrate species in 2000 km<sup>2</sup>, the highest ratio for endemic species per area of all biodiversity hotspots worldwide (Myers et al., 2000; Skarbek, 2008).

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Moreover, forests in Tanzania are essential for local communities as they play a fundamental role in supporting livelihoods (Mustalahti et al., 2012). This tangible local level link to why forests need to be preserved is important as local people are not necessarily concerned with sustainability or carbon sequestration, but are instead concerned with their own relationship with the forest. According to the World Bank (2015a) over 70 percent of the population in Tanzania live in rural areas where their livelihoods and wellbeing are largely dependent on forests. Further, approximately, 43 percent of the population in Tanzania live below the internationally recognized poverty line of 1.25 USD per day, with 80 percent of the poor living in rural areas (World Bank, 2015a). Therefore, from a livelihood sufficiency perspective forests need to be sustainably managed in order to continue to support local livelihoods in Tanzania.

Tanzanian forests also play a significant role in mitigating climate change, and continuing deforestation and forest degradation in the country has been highlighted globally as an environmental issue (TFS, 2015; FAO, 2017a). It is estimated that forests in Tanzania store over 1 billion tonnes of carbon in aboveground and belowground biomass, with the woodlands storing 73 percent of the total carbon (TFS, 2015). Unfortunately, deforestation and forest degradation within Tanzania reduces carbon stocks while simultaneously contributing carbon dioxide into the atmosphere (Shemsanga et al., 2010; Sawe et al., 2014). Specifically, it is estimated that carbon storage in Tanzania's Eastern Arc Mountains is decreasing due to deforestation and forest degradation at a mean rate of 1.47 tonnes which corresponds to 2 percent of the stocks of carbon per year (Willcock et al., 2014). Another study by Lusambo et al. (2016) compared Tanzania's miombo woodlands under participatory forest management against miombo woodlands under no management, and found a higher average carbon stock in participatory managed forests (21.37 tonnes of carbon per hectare) compared to the open access



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forest (11.28 tonnes of carbon per hectare). Considering the important role forests in Tanzania play, successful forest management is needed in order to reduce deforestation and forest degradation across the country.

### **Sustainable Forest Management in Tanzania**

Over the past few decades the government of Tanzania has initiated several forest management strategies in an attempt to control deforestation and forest degradation. The National Forest Policy of 1998 recognizes the importance of forests to local wellbeing, and promotes sustainable forest management through the active engagement of rural communities (URT, 2001). As a result, the Ministry of Natural Resources and Tourism (MNRT) implemented Participatory Forest Management (PFM) including Community Based Forest Management (CBFM) and Joint Forest Management (JFM) strategies that seek to enhance community involvement in sustainable forest management (URT, 2001). Generally, PFM involves local communities being assigned a portion of forested land and being responsible for the sustainable use of the forest resources in that area (Blomley & Ramadhani, 2006). Additionally, more recently Reducing Emissions from Deforestation and Forest Degradation (REDD+) was launched in Tanzania (Lin et al., 2014). REDD+ is an international forest governance system with the goal of combating climate change, protecting biological diversity, and addressing poverty by offering incentives for reduced deforestation and forest degradation (UN-REDD, 2008).

Generally, these forest management strategies have improved forest protection in Tanzania. According to a report from the government of Tanzania, reserved forested areas occupy almost 50 percent of the total forest area in Tanzania (URT, 2016, Figure 3). Additionally, there are about 80 districts and more than 2000 villages engaged in PFM (Blomley

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& Iddi, 2009), and nine REDD+ pilot projects taking place in Tanzania (Blomley et al., 2017). Moreover, Tanzania's forest management strategies have been viewed as a model for sustainable forest management in Africa due to forest dependent communities being able to manage their forest resources with limited intervention from the government (Wily, 2002; Blomley et al., 2008; Banana et al., 2011). Despite this recognition, studies indicate that little progress is actually being made in controlling deforestation and forest degradation at the community level (Blomley et al., 2008; Burgess et al., 2010). This is because local governments and communities continue to experience significant challenges including the unsustainable utilization of forest resources (Blomley et al., 2008; Bayrak, & Marafa, 2016). In addition, other challenges persist including weak forest governance, and unclear benefits to the community for conserving forest resources (Blomley & Iddi 2009; Petersen & Sandhovel, 2001; Bayrak, & Marafa, 2016).

For these reasons, Tanzania provides an excellent case study to investigate the challenges that current forest protection policies and initiatives in Tanzania face in achieving sustainable forest management. This project aims to analyze whether Tanzania's national forest policy, PFM, and REDD+ effectively achieve sustainable forest management within the country using the Driver-Pressure-State-Impact-Response (DPSIR) framework. This is important as sustainably managed forests will increase the resilience of ecosystems and societies, and optimize the role of forests in storing carbon while also providing other environmental services (FAO, 2016).

### **Research Questions**

The overarching goal of this project is to assess whether current forest protection policies and initiatives in Tanzania are effectively achieving sustainable forest management. This goal will be addressed by exploring several key research questions.

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1. Using the DPSIR framework, what are the Drivers, Pressures, State, Impacts, and Responses to deforestation and forest degradation in Tanzania?
2. Do the current forest protection policies and initiatives in Tanzania effectively address the drivers of deforestation and forest deforestation within the country?
3. How can local communities and other actors such as non-governmental organizations be better engaged to achieve sustainable forest management in Tanzania?

### **Project Outline**

This project is organized into five chapters. Chapter one introduces the general issue and the rationale for investigating deforestation and forest degradation in Tanzania. Chapter two explains and justifies the project's methodology. Chapter three provides a review of the literature relevant to deforestation and forest degradation in Tanzania using the DPSIR framework. Chapter four analyzes the current forest protection policies and initiatives in Tanzania. Chapter five concludes by providing recommendations for improved forest management in Tanzania, the limitations within the current project, and areas for further research.

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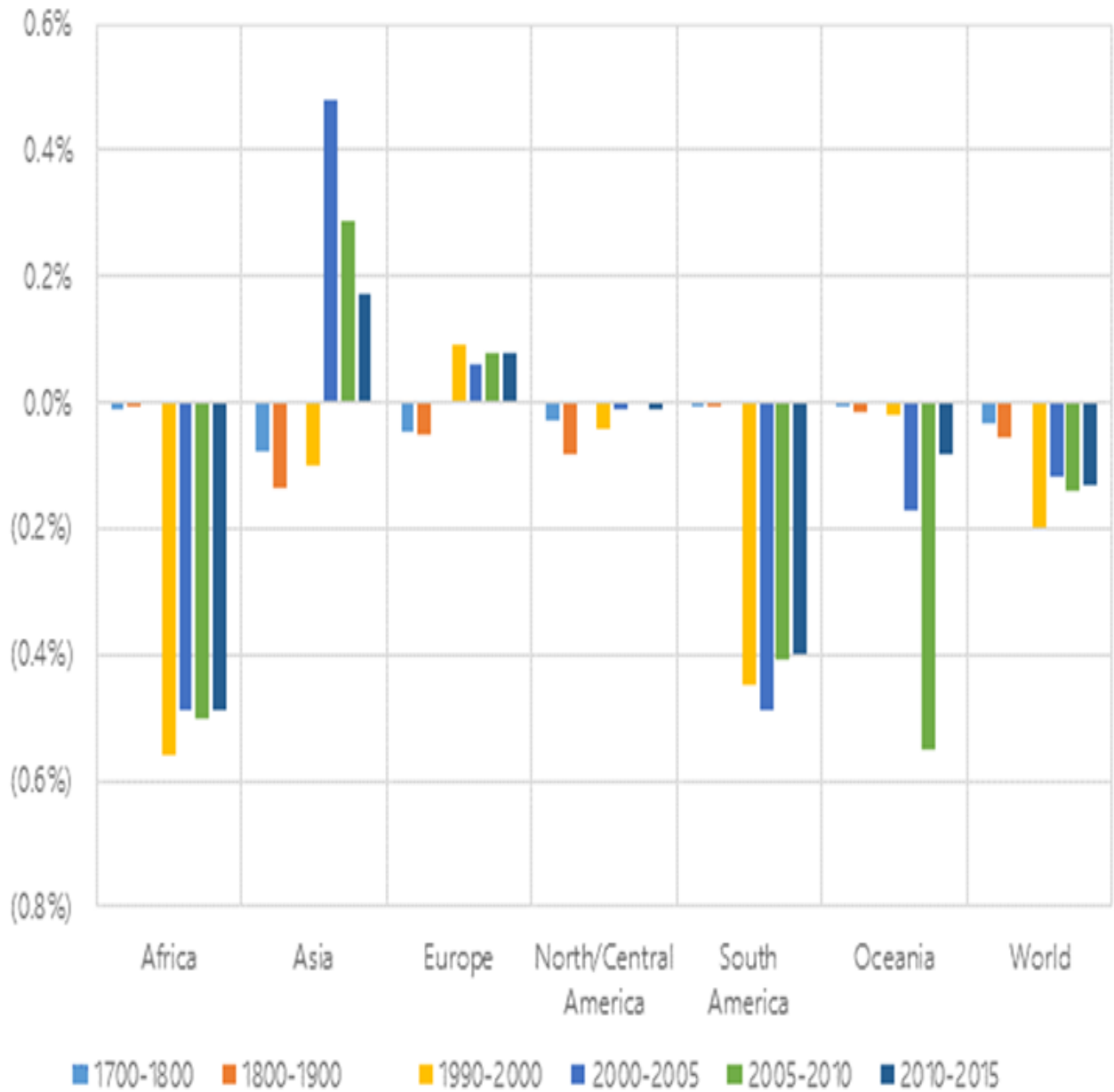


Figure 1. Annual rates of deforestation and afforestation, Mabee, 2020.

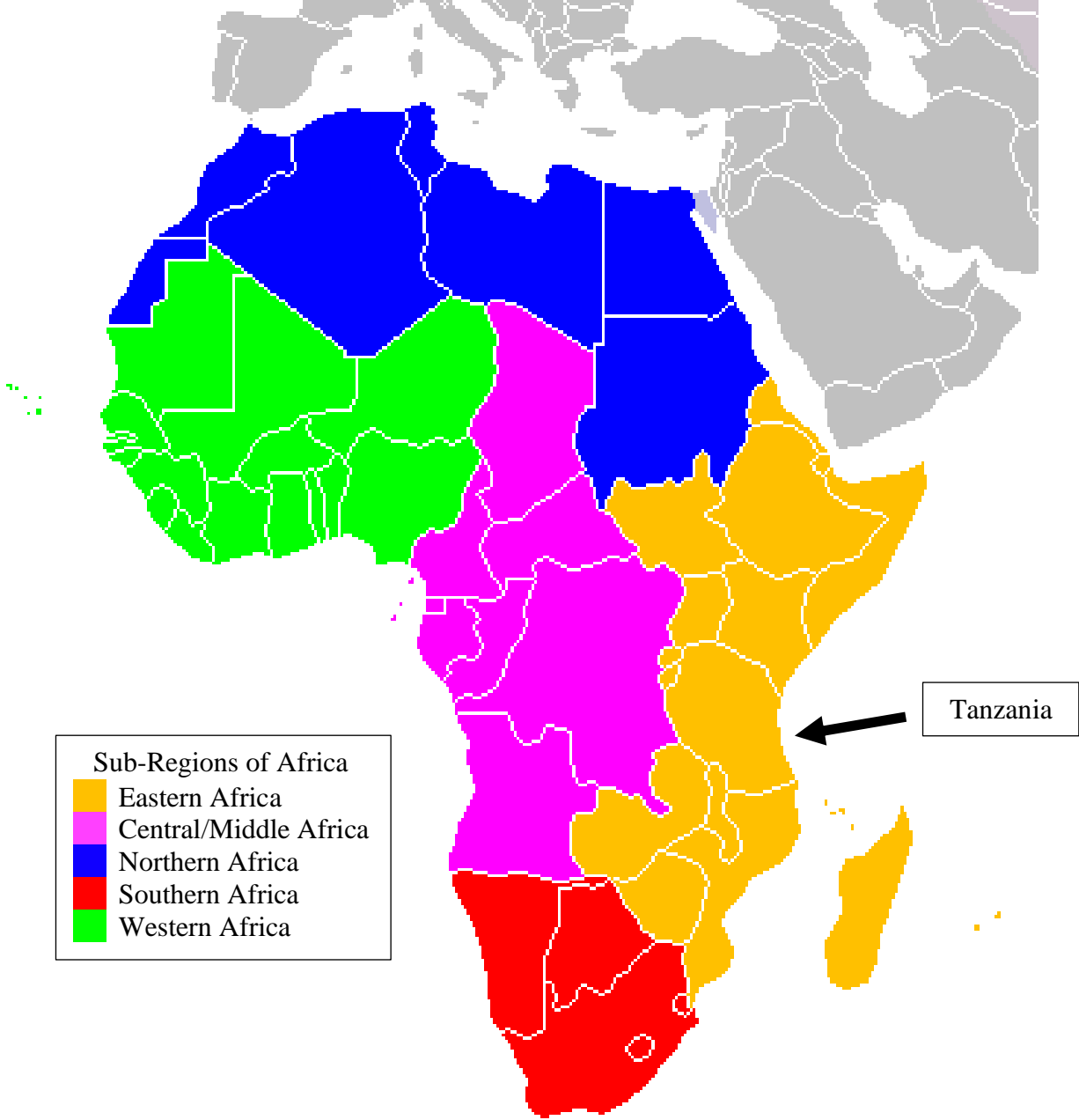


Figure 2. The five sub-regions of Africa according to the United Nations (1999).

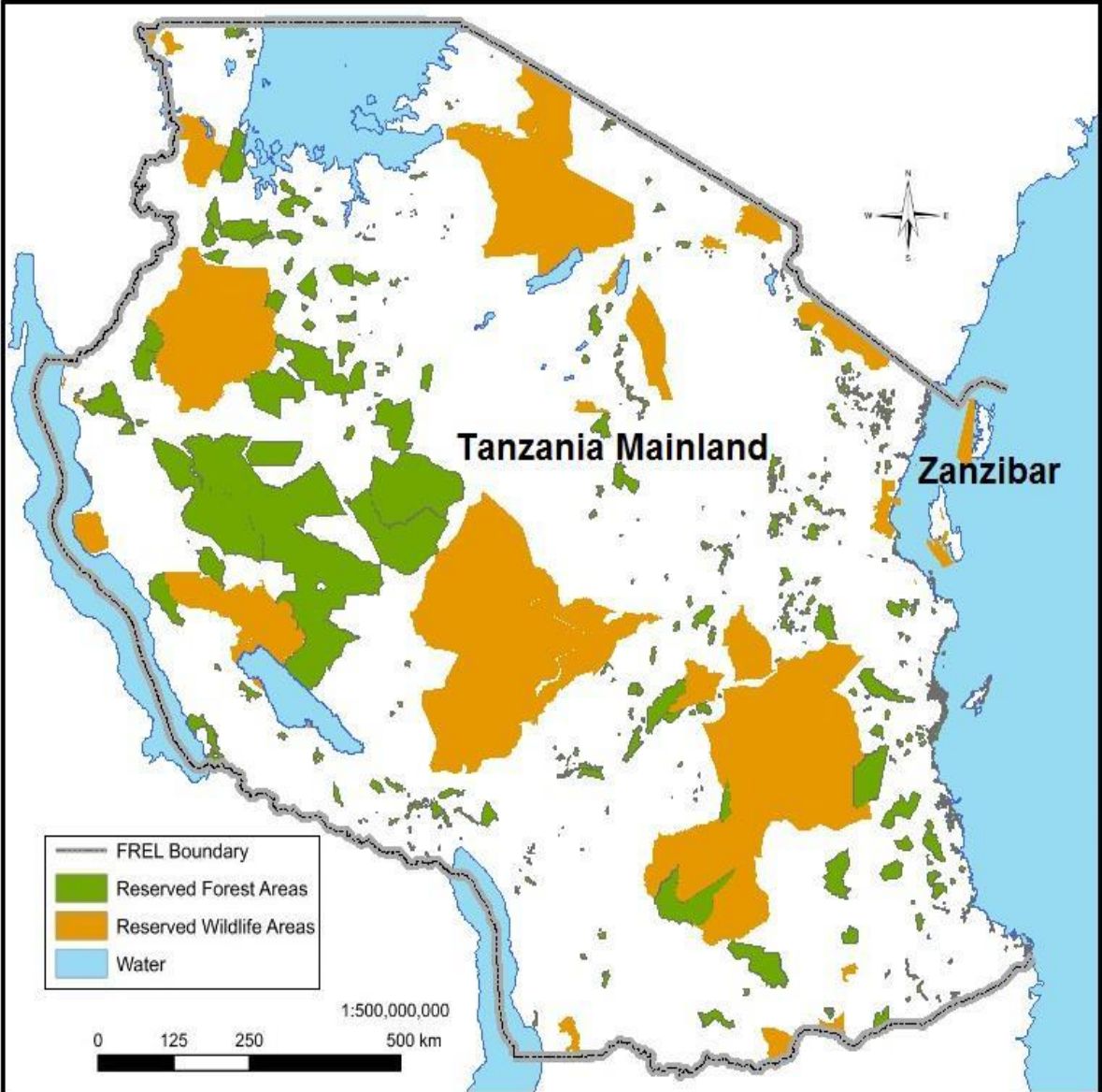


Figure 3. Forest and wildlife reserves in Tanzania, URT, 2016.

## **Chapter Two: Project Methodology**

### **Introduction**

This research project takes a qualitative approach to addressing the issue of deforestation and forest degradation in Tanzania. Qualitative research is typically exploratory in nature meaning that it provides answers by evaluating the relationship between what has been done and its anticipated impact (Stebbins, 2001). Furthermore, qualitative research often involves case studies that assess specific programs or initiatives (Simons, 2009; Yin, 2009). Specifically, this project examines the effectiveness of Tanzania's national forest policy, PFM, and REDD+ in achieving sustainable forest management within the country. This was done by collecting data through a document analysis with the use of the DPSIR framework. The purpose of this chapter is to include an overview of why Tanzania was chosen as the case study for this project, a discussion of why a document analysis was completed, a description of the documents used, and a discussion of the DPSIR framework and its strengths and weaknesses.

### **Case Study Description: Tanzania**

Tanzania is located in East Africa between longitude 29° and 41° East and latitude 1° and 12° South (TFS, 2015). The country covers a total of 947,600 km<sup>2</sup> including 61, 500 km<sup>2</sup> of inland water representing Lakes Victoria, Tanganyika, Nyasa, and other water bodies including small lakes, dams, and rivers (TFS, 2015; URT, 2013). Additionally, mainland Tanzania accounts for 945,100 km<sup>2</sup> (99.74% of the area) while the islands including Unguja (typically called Zanzibar), Pemba, and Mafia account for the remaining 2,500 km<sup>2</sup> (0.26%) (TFS, 2015). Mainland Tanzania is endowed with a wide range of natural resources including approximately 1400 kilometres of coastline which includes forests, mountains, rivers, lakes, and wildlife reserves and parks (TFS, 2015). Administratively, the mainland is divided into 26 regions, each

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of which has a high degree of autonomy in the administration of its development (URT, 2013, Figure 4). Each region is then divided into districts, which are subdivided into divisions, wards, and villages (TFS, 2015). The largest region leading in population size is Dar es Salaam which is located on the coast, and has 3,133 persons per square kilometre (URT, 2013).

Tanzania has 48 million hectares of forested land, which is one of the largest tree covers in the world with an estimated 77.2 billion trees in mainland Tanzania (TFS, 2015). However, forest cover within Tanzania is being reduced by approximately 372 thousand hectares per year, with older tree species becoming rare due to human impacts (TFS, 2015; FAO, 2015). This is problematic as Tanzanian forests are extremely valuable as they provide numerous benefits both regionally and internationally. These benefits include supporting the livelihoods of local communities particularly in rural areas (Mustalahti et al., 2012), containing a high density of plant and animal species found nowhere else in the world (TFS, 2015; Gereau et al., 2016), and having the ability to significantly reduce climate change through carbon sequestration (TFS, 2015; FAO, 2017a). Additionally, Tanzania's government along with numerous NGOs have recognized that deforestation and forest degradation in Tanzania is a problem, and have in response developed extensive forest protection policies and initiatives (Blomley et al., 2008; Bolin & Tassa, 2012). For these reasons, Tanzania was chosen as the case study, and its forest protection policies and initiatives are evaluated to determine if they successfully achieve sustainable forest management.



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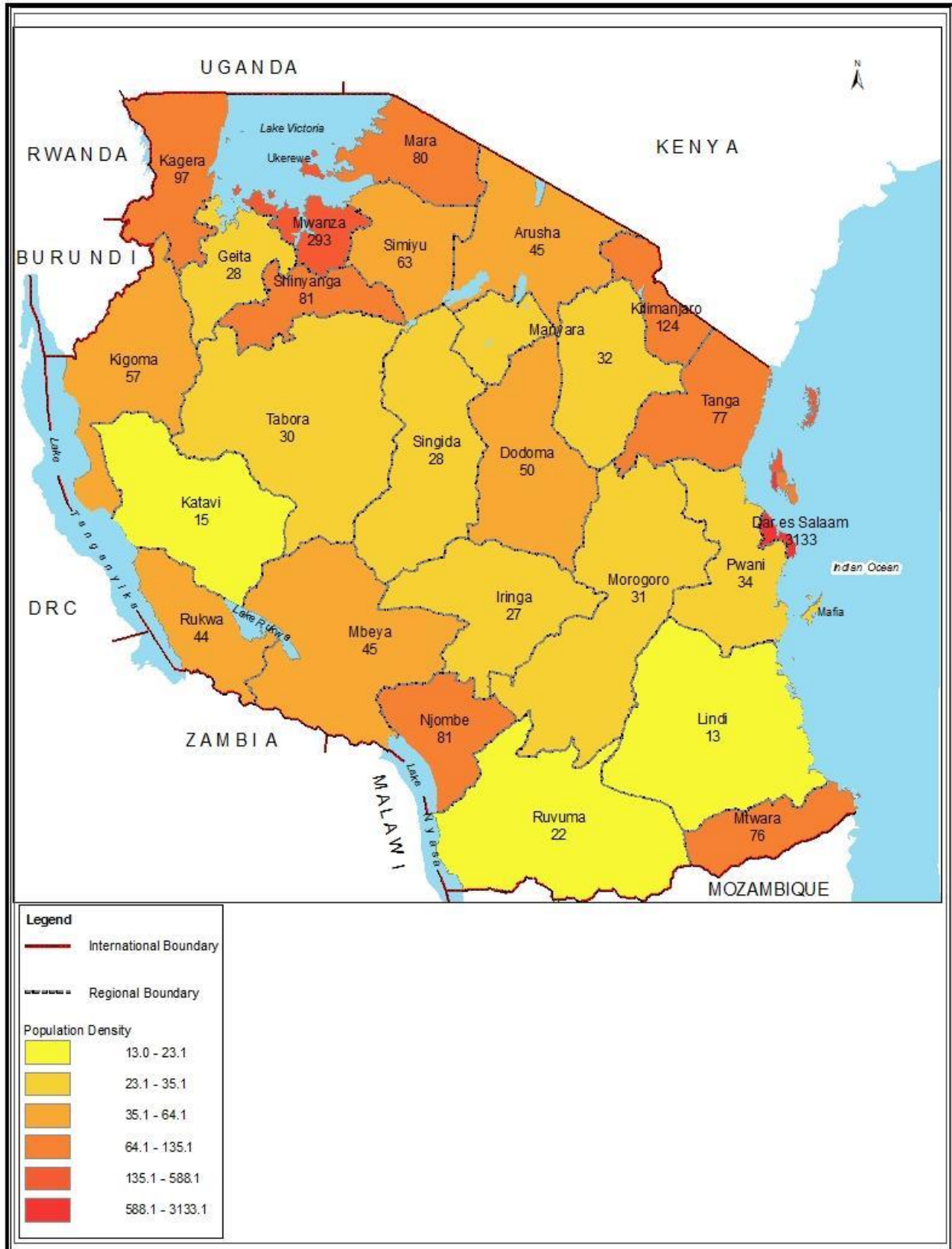


Figure 4. Regions in Tanzania and their population densities (persons per sq. km), URT, 2013.

## **Method and Methodology**

When conducting research it is important to identify the specific methods and methodologies that are being used, and to justify why they were chosen. Methods refer to the tools or approaches used to conduct research, such as the techniques, processes, and instruments used throughout all the stages of research (Wahyuni, 2012). Methodologies are the systematic, theoretical analysis of the methods applied in research, and specifically refer to the overall framework of philosophical assumptions and practical methods within which one chooses to conduct research (Wahyuni, 2012; Jonker & Pennink, 2010).

**Document analysis.** The method used in this project to analyze the current forest protection policies and initiatives in Tanzania is a document analysis of secondary data. A document analysis is a form of qualitative research in which the content of chosen documents is examined and interpreted in order to gain an understanding and develop empirical knowledge (Bowen, 2007; Corbin & Strauss, 2008). In terms of this project, the specific types of documents used include government sources, non-governmental organization (NGO) documents, scholarly papers, maps, and relevant media articles. These sources were obtained through Google Scholar searches, and internet searches at Queen's University Library. These documents were chosen in order to gain a thorough understanding of the different approaches, perspectives, and assumptions that exist in relation to the forest protection policies and initiatives in Tanzania.

There are both advantages and limitations to using a document analysis as a primary research method, but if a clear process is followed the advantages outweigh the limitations. As an advantage a document analysis is an effective and efficient way of gathering data as documents are often accessible, reliable, and practical resources (Bowen, 2007). A limitation of a document analysis is the potential biases in the documents themselves and in the interpretation of

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the results (Bowen, 2007). Although, if the subjectivity of the documents and how the data are presented is evaluated the credibility of the research can be preserved (Bowen, 2007). As a result, a document analysis was chosen to be used in this project as it is an effective and efficient way of collecting data in order to respond to the research questions.

Moreover, in this project the document analysis incorporates a multi-disciplinary approach as sustainability naturally requires that multiple perspectives be incorporated into the evaluation of an issue. First, a historical approach is used to understand deforestation and forest degradation in Tanzania and the local reliance on forests for livelihoods. Second, a climate science perspective is employed to understand the role of Tanzania's forest in the regulation of the global climate. Third, a development studies outlook allowed me to understand local poverty in Tanzania and the right for development and quality of life. Fourth, a policy perspective is deployed in order to understand and evaluate the specific forest protection policies and initiatives that exist in Tanzania.

**The DPSIR framework.** There are many different approaches that could be used to explore deforestation and forest degradation in Tanzania. A political ecology approach could be used which places emphasis on the social impacts of environmental changes, and looks at the relationships between political, economic, and social factors in relation to environmental issues (Walker, 2005). Another approach that could be used to assess sustainable forest management in Tanzania is a decolonial feminist approach as it acknowledges the heterogeneity of the category women, and in particular the coloniality of gender in relationships with the environment (Lugones, 2010). Although many approaches exist, this project uses the Driver-Pressure-State-Impact-Response (DPSIR) framework as it is a causal framework that identifies and evaluates

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the complex and multidimensional cause-and effect relationship between society and the environment (UNEP, 2012b).

The main objective of the DPSIR framework is to support the sustainable management of natural resources, with a specific aim to provide a common language for environmental managers, scientists, and stakeholders (Gari et al., 2015). As a result, the framework has been used in several reports and has been applied to many environmental problems including forest management, climate change, water quality, biodiversity, and sustainable development issues (Goll et al., 2014; Hengaju & Manandhar, 2015; Sarmin et al., 2016; Khajuria & Ravindranath, 2012; Nye, 2010). Specifically, the DPSIR framework has been used to assess the links between socio-economic drivers and observed water quality-related impacts on river ecosystems (Song & Frostell, 2012). The DPSIR framework has also been used to analyze the risks to biodiversity in a large-scale European research project (Maxim et al., 2009), and in the United Nations' Global Environmental Outlook assessments (UNEP, 2012b; UNEP, 2007).

The DPSIR framework emerged in the 1990s and is a modification of the Pressure-State-Response (PSR) framework initially developed by the Organization for Economic Co-operation and Development (OECD) to structure work on environmental policies and reporting (OECD, 2000). Later, the European Environmental Agency (EEA) proposed and widely adopted the use of the DPSIR framework, which distinguishes drivers, pressures, state, impacts, and responses (Gabrielsen & Bosch, 2003; Kristensen, 2004, Figure 5). According to the framework, Drivers such as the unsustainable consumption of natural resources exert Pressure on the environment and, as a consequence, the State of the environment changes, such as resource availability and biodiversity (UNEP, 2012b). This leads to Impacts on ecosystems, human health, and society which lead to Responses by society which can range from community action to international

agreements concerning the protection and management of the environment (UNEP, 2012b; Maxim et al., 2009).

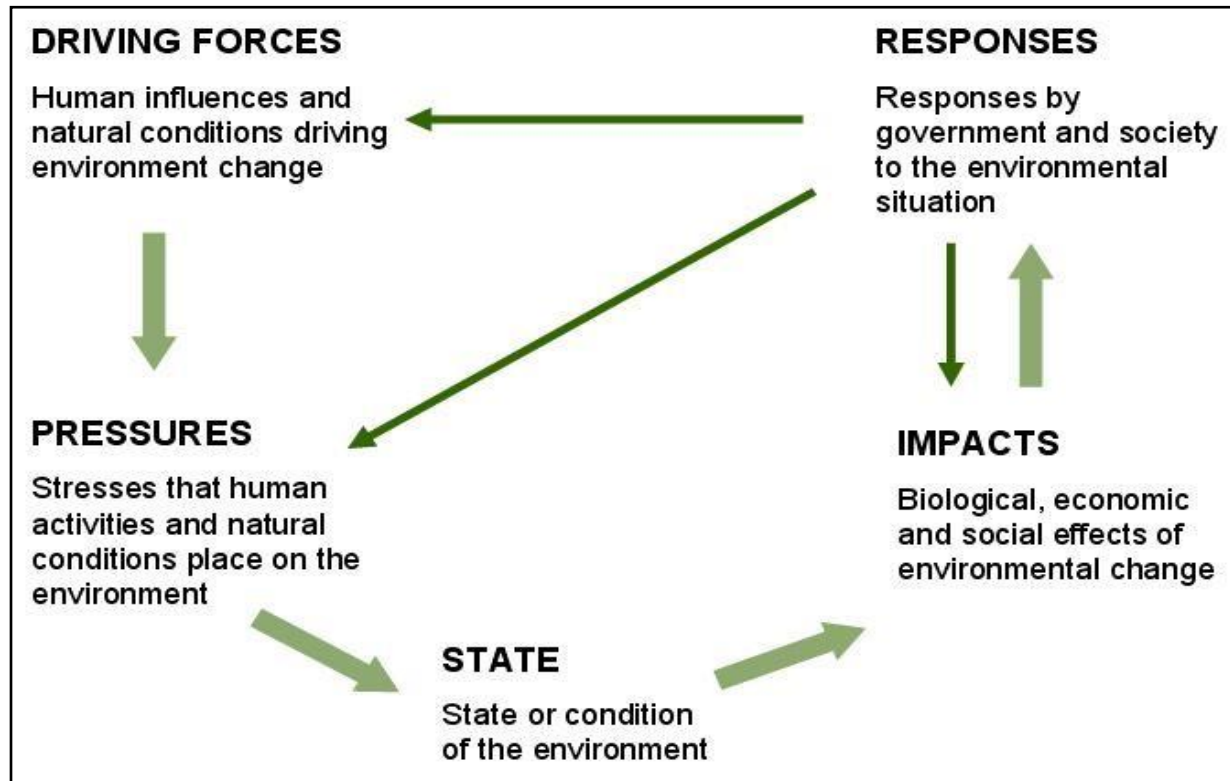


Figure 5. Diagram of DPSIR framework, Nye, 2010.

**Strengths.** The DPSIR’s popularity as a framework is due to its many strengths. For instance, the DPSIR framework is appreciated by many for its usefulness, reliability, and flexibility when used in research (Gari et al., 2015; Bell, 2012; Karageorgis et al., 2006). Secondly, using the DPSIR framework enables researchers to identify and demonstrate the interactions and interrelationships between human activities and the natural environment (Gari et al., 2015; Shao et al., 2014). Third, unlike other frameworks, the DPSIR framework is a multidisciplinary approach that can be used to examine and understand sustainability challenges at different levels (Gari et al., 2015; Bidone & Lacerda, 2004). Fourth, the DPSIR approach is recognized as an important means for enhancing knowledge and communication between researchers and decision makers (Tscherning et al., 2012; Hashemi et al., 2014). As a result, the

framework is a reliable way for governments, organizations, and individuals to investigate and find solutions to global environmental and sustainability challenges (Gari et al., 2015). Finally, the DPSIR framework has been found to be helpful in understanding what actions should be taken in the present and in the long-term to address environmental issues such as deforestation and forest degradation (Kristensen, 2004).

**Limitations.** While the DPSIR framework is used extensively, it has been subject to many criticisms (Gari et al., 2015). For instance, one criticism of the DPSIR is that the framework lacks precise definitions of the categories resulting in slight differences among studies, limiting the comparability (Cooper, 2012). Secondly, the DPSIR framework has been criticized for its simplicity as the real world is far more complex than can be expressed by simple casual relations (Gari et al., 2015; Niemeijer & Groot, 2008). Rekolainen et al. (2004) argues that the DPSIR framework creates a set of static indicators, and does not take into consideration the changing dynamics of an issue. Consequently, the interconnections between categories need to be considered, or else the DPSIR framework risks being a deterministic and linear description of environmental issues, which inevitably downplays the complexity of the environmental and socio-economic systems (Maxim et al., 2009; Lewison et al., 2016). A third criticism of the DPSIR framework is that it is often used as an expert device as it is devised and interpreted by specialists for application by policy makers (Bell, 2012; Svarstad et al., 2008). Ehara et al. (2018) argues that the framework's inability to incorporate the informal responses of people affected directly by changes in ecosystem services is an issue. However, Carr et al. (2007) argues that the DPSIR framework can incorporate indigenous knowledge if the expert using the framework considers it valuable.

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*The use of the DPSIR framework.* Despite its weaknesses, the DPSIR approach was used in this project as it provides a functional and reliable way of responding to the project's research questions. Specifically, the DPSIR framework can help provide an in-depth understanding of the root causes of deforestation and forest degradation in Tanzania and how these challenges could be addressed. Additionally, this project accounts for some of the limitations of the DPSIR framework by recognizing that local communities, particularly in rural areas, need to be properly involved in the responses to deforestation and forest degradation if sustainable forest management is going to be achieved within the country. Ultimately, using the DPSIR framework, this project provides a summary of the sustainable forest management challenges in Tanzania, and analyzes how effective the responses are at addressing these challenges.

## **Chapter Three: Literature Review**

### **Introduction**

This project examines the current forest protection policies and initiatives in Tanzania to determine if they are achieving sustainable forest management. The purpose of this chapter is to explore the contributions of previous studies concerning deforestation and forest degradation in Tanzania, and the challenges the country faces in achieving sustainable forest management. Specifically, this chapter includes an overview of Tanzania's socio-political history, the geography and climate of the country, and Tanzania's forest resources. Additionally, using the Driver-Pressure-State-Impact-Response (DPSIR) framework, this literature review includes a detailed look at what drives forest loss in Tanzania, the pressures, the state of the forests, and the environmental and socio-economic impacts of deforestation and forest degradation. Moreover, through the use of the DPSIR framework a detailed look at the responses to deforestation and forest degradation in Tanzania is provided. This is important as Tanzania has a large amount of forested land that has the potential to help reduce climate change if preserved (TFS, 2015), however the livelihoods of local people in Tanzania depend on the use of these forest resources (Mustalahti et al., 2012).

### **Socio-Political History of Tanzania**

Tanzania has a long history of colonial activity that has resulted in a number of national parks and forest reserves that clearly disregard the needs of local communities (Neumann, 2002; Mgaya, 2016). The United Republic of Tanzania (URT) gained its independence in 1961 after German and British forces pulled out of the east and west (Neumann, 2002). Since its independence, Tanzania has seen hostilities between park authorities and local communities rise (Neumann, 2002). Farmers and pastoralists have relentlessly confronted park authorities and



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conservation officials with challenges to the laws surrounding park access and wildlife controls (Neumann, 2002). Additionally, a number of studies in the late twentieth century began to criticize the implementation of national park policies for their disregard of local property and human rights (Arhem 1985; Collett 1988; Turton 1988). As a result, the need to reconcile forest and wildlife conservation with the needs of local people became paramount, and conservationists and state officials were pushed to reassess coercive park and wildlife protection policies (Kiss, 1990). This led to an emphasis on local participation and community development as the key to the future of forest protection and sustainability (Wells & Brandon 1992; Cleaver 1993).

This new emphasis on local participation and benefit sharing in conservation was an important shift, but there are still signs that forest protection initiatives and policies remain control orientated and do not adequately consider the value forests have for local people (Neumann, 1997; Mgya, 2016). As an example Neumann (2002) discusses Arusha National Park in Tanzania and how the park functions as a landscape of consumption for tourists, and that native communities from this area were forced to abandon their communities, ancestral sites, and meeting places within the park. Consequently, Tanzania still grapples with the conflict between colonial attempts at conservation such as national parks and wildlife protection areas, and the rights and livelihoods of local communities living in rural areas.

### **Geography and Climate of Tanzania**

The geography of Tanzania is diverse as a result a wide range of altitudes (URT, 2015). Tanzania is composed of many agro-ecological zones that have differences in topography and soils, altitude, growing seasons, and precipitation patterns. The main agro-ecological zones in Tanzania are: Coast, Arid Lands, Semi-Arid Lands, Plateaux, Southern and Western Highlands, Northern Highlands, and Alluvial Plains (URT, 2015; World Bank, 2015b; URT, 2014a, Figure

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6). As an example, Mount Kilimanjaro is located in the northern highlands agro-ecological zone, and is the highest point in Africa (5,950 metres) (URT, 2007).

Tanzania's climate also varies depending on the proximity to the ocean, the elevation, and the presence of large inland lakes (URT, 2015). For example, rainfall in Tanzania follows two distinct patterns. In the northeast and coastal areas there is a bimodal rainfall pattern bringing short rains from October to December and long rains from March to May (World Bank, 2015b; URT, 2014a). In the south and western areas there is a prolonged unimodal rainfall pattern during December to April (World Bank, 2015b; URT, 2014a). The climate of Tanzania is also influenced by monsoon winds; the southerly monsoons and the northerly monsoons (URT, 2015). Southerly monsoons typically bring lower temperatures and long rains, whereas northerly monsoons are characterised with high temperatures and short rains (URT, 2015; World Bank, 2015b). Finally, temperatures in Tanzania are typically higher between the months of December and March and lower during June and July (URT, 2015).

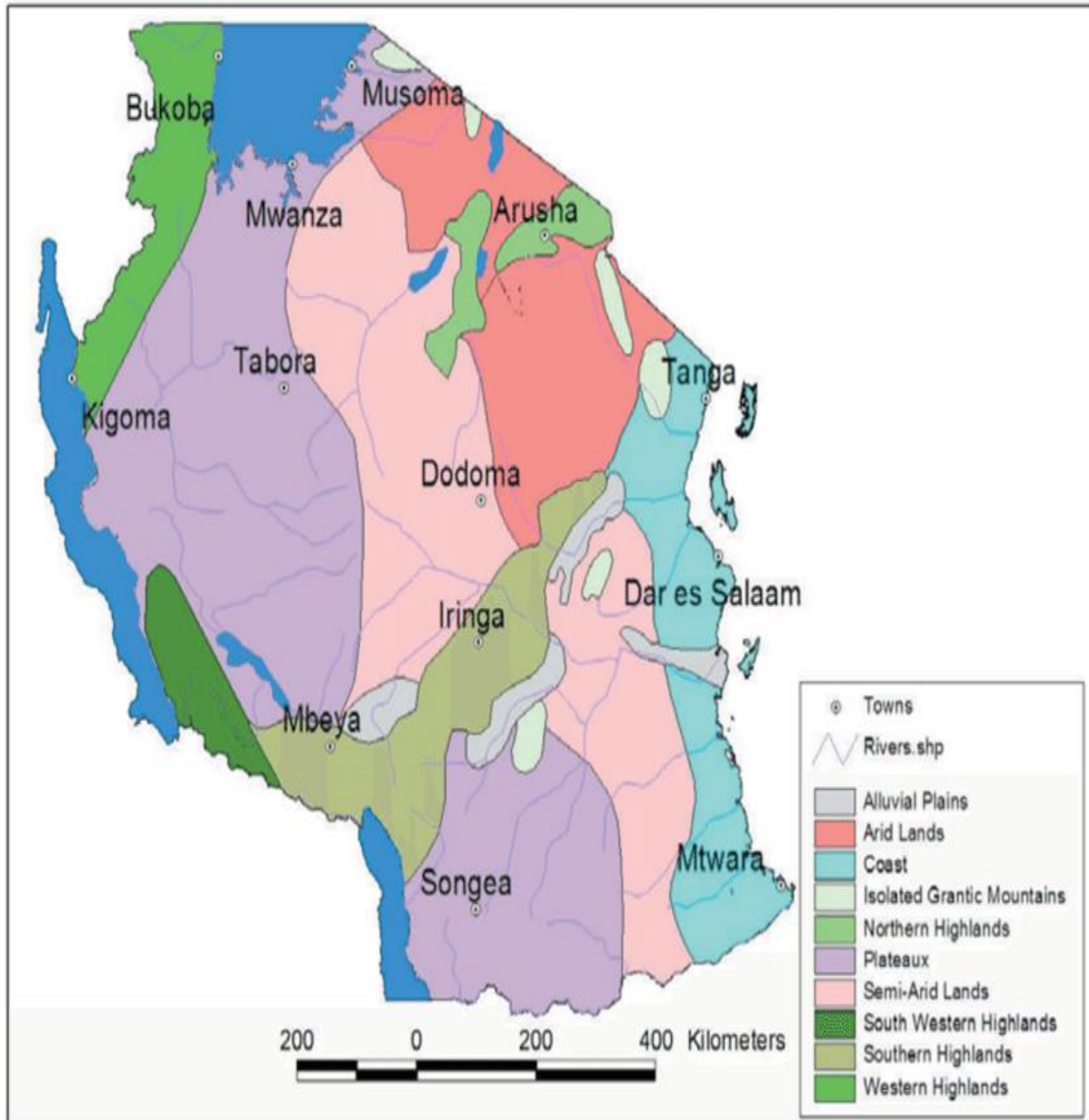


Figure 6. Tanzania’s agro-ecological zones, URT, 2014a.

### Forest Resources in Tanzania

Tanzania has large and valuable forest resources (USAID, 2012, Figure 7). Of Tanzania’s estimated 48 million hectares of forest, woodlands occupy about 90 percent of the total forest area, and the remainder is shared by mangrove forests, montane forests, small patches of coastal forest, and plantations (UNEP, 2015b; URT, 2016). The miombo woodlands are the most

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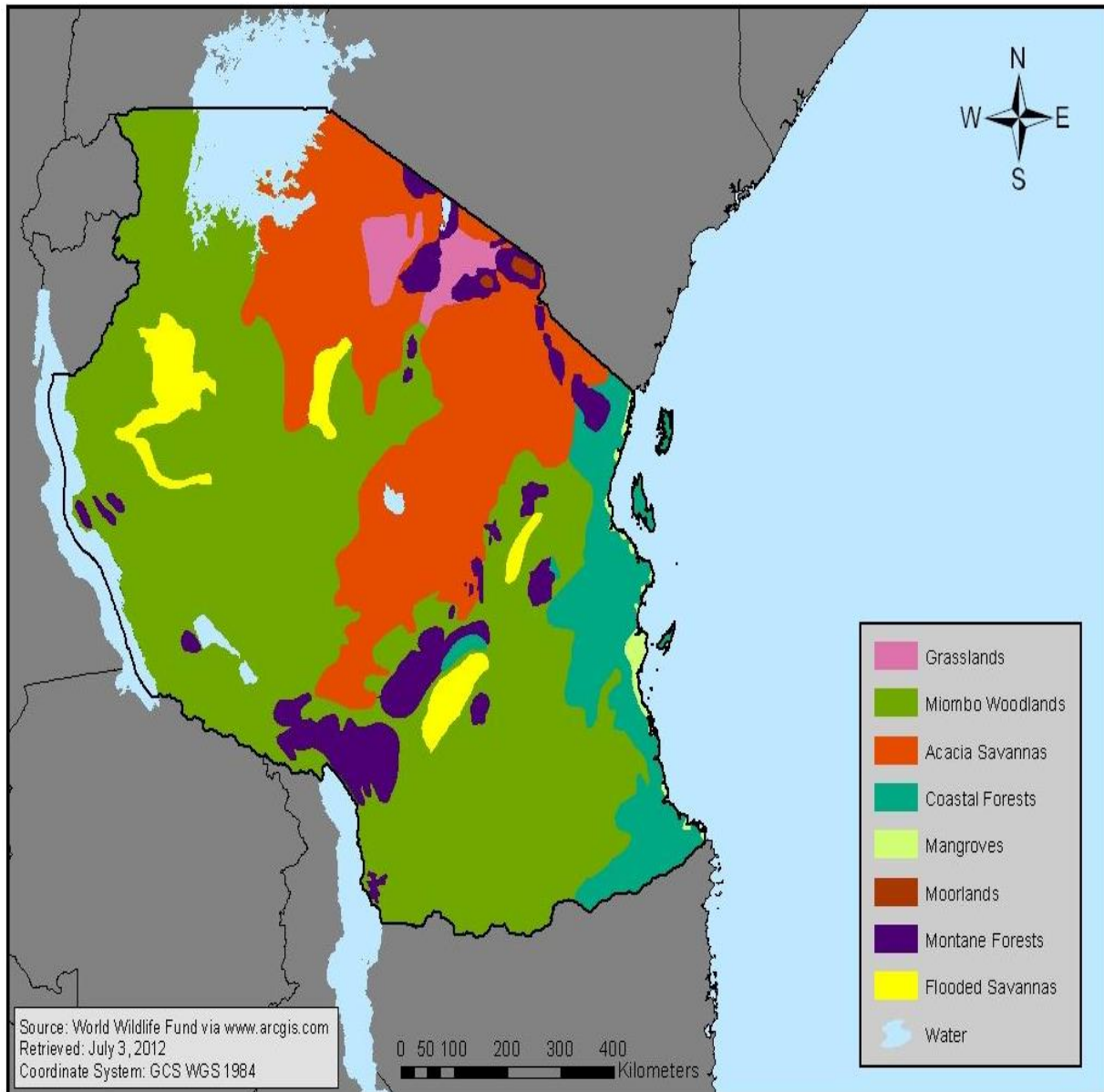
extensive woodland area, and are comprised of dry and wet woodlands (URT, 2009). These woodlands have a diversity of tree species and are largely found in the north and south of the country (Kajembe et al, 2015). Ecologically, miombo woodlands offer several environmental services to people and wildlife. For instance, the dry miombo woodlands contain species such as acacia and commiphora which play an important role in supporting wildlife habitats (URT, 2009). Additionally, dry miombo woodlands provide surrounding communities with numerous forest products, including firewood, construction materials, and non-wood forest products such as plant products with medicinal value (Topp-Jørgensen et al., 2005).

Tanzania also contains one of the largest areas of continuous mangrove forests in Africa (Beymer-Farris & Bassett, 2012). Mangroves are salt-tolerant forests or swamp ecosystems that occur along tropical and sub-tropical coastlines, and are the primary habitat of several marine species (Muhando & Rumisa, 2008; URT, 2009). Specifically, there are 10 different species of mangroves within Tanzania, and they all have a protected status with the MNRT being responsible for their management (Muhando & Rumisa, 2008; Beymer-Farris & Bassett, 2012). In addition to mangroves, there are adjacent coastal forests that contain many species of flora and fauna including numerous endemic species (URT, 2009). As a result, Tanzania's coastal forests are part of the Eastern African Coastal Forests which have been recognized globally as a biodiversity hotspot (Kajembe et al, 2015; UNDP, 2009).

Montane forests are located in the mountainous areas of Tanzania, and are distributed in the north and east of the country (URT, 2009). Like other forest types, montane forests provide several environmental benefits (Topp-Jørgensen et al., 2005). For instance, nearly all major rivers in the country depend on montane forests as a primary source of water (Topp-Jørgensen et al., 2005; URT, 2009). Additionally, montane forests provide habitat for many endemic species

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in Eastern Arc Mountains (URT, 2009). The Eastern Arc Mountains extend beyond Tanzania, and are recognized globally as a biodiversity hotspot (Kajembe et al, 2015; UNDP, 2009).



*Figure 7.* The locations of different forest types in Tanzania, USAID, 2012.

### **Forest Governance and Sustainable Forest Management**

Forest governance is an essential component for achieving sustainable forest management (FAO, 2012b; FAO, 2011). Overtime, forest governance has been described differently, and as a result there is no internationally agreed upon definition (Counsell, 2009; Agrawal et al., 2008;

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AFDB, 2018; FAO, 2012b). For this project, the definition of forest governance provided by the Food and Agriculture Organization (FAO) will be used. According to the FAO (2012b), forest governance is “a term used for describing the way in which people and organizations rule and regulate forests” (p.9). Specifically, this involves “how they allocate and secure access to, rights over, and benefits from forests, including the planning, monitoring, and control of their use, management, and conservation” (FAO, 2012b, p.9). Additionally, good forest governance must consider the six principles of good governance, which are participation, fairness, accountability, transparency, efficiency, and effectiveness (FAO, 2012b; FAO, 2011). This FAO description of forest governance provides a good starting point to help determine if Tanzania’s forest protection policies and initiatives are achieving sustainable forest management.

### **DPSIR Analysis on Deforestation and Forest Degradation in Tanzania**

In this section, the causes of deforestation and forest degradation in Tanzania will be discussed using the DPSIR framework in order to determine whether current forest protection policies and initiatives are effectively achieving sustainable forest management within the country.

**Drivers.** Drivers are often described as the direct or indirect causes of change in environmental conditions as a result of social, political, economic, or environmental factors (UNEP, 2012; Maxim et al., 2009). In the context of this project, the following drivers are identified as the main challenges to achieving sustainable forest management in Tanzania.

***Uncontrolled subsistence agriculture.*** Within Tanzania the dominant livelihood activity among rural communities is subsistence agriculture (URT, 2008a). Subsistence agriculture is when farm output is targeted to survival and is mostly for local requirements with little to no surplus (URT, 2008a). One approach to subsistence agricultural is shifting cultivation where an

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area of land is cleared of its vegetation and cultivated for a few years before being abandoned for a new plot of land due to low soil fertility (Grogan et al., 2012). Specifically, around 68 percent of the population in Tanzania is dependent on shifting cultivation for their livelihoods which results in large amounts of forested land being cleared using a technique known as slash and burn where existing vegetation is cut down and burned before being farmed (Luoga et al., 2000; Mwampamba, & Schwartz, 2011). These subsistence agricultural practices are largely uncontrolled and over time degrade forests in Tanzania on a large scale (Kibuga & Samweli, 2010; Mangora, 2012; URT, 2001). For example, a study conducted by Silangwa (2016) in the Mpanda district of Tanzania found that more than two thirds of farmers agreed that the landscape has become more open due to increased agricultural activities and settlements. Unfortunately, with the increased demand for land and food among subsistence farmers in Tanzania, these unsustainable farming practices will continue to cause forest loss and degradation across the country unless effort is made to lift the rural majority out of poverty and provide more sustainable agricultural practices (UNFCCC, 2007; Ellis, 2003).

***Charcoal consumption.*** An unsustainable dependence on charcoal is a significant challenge within Tanzania (Kessy et al., 2016; World Bank, 2009; Mwampamba, 2007; Miya et al., 2012). With the limited supply of electricity and other energy sources, fuelwood and charcoal remain the primary energy sources for cooking (Ahlborg & Sjötedt, 2015; Ishengoma, 2015, Table 1). While most of the charcoal is produced in rural areas, much of its consumption happens in towns and cities across the country (Ahrends et al., 2010; Miya et al., 2012). According to the World Bank (2009) Dar es Salaam (the largest city in Tanzania) consumes approximately half of Tanzania's annual consumption of charcoal. It is estimated that nationally Tanzania consumes approximately one million tons of charcoal annually, leading to over 100,000 hectares of forest

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loss each year (World Bank, 2009). Furthermore, much of the charcoal collected is produced from forests harvested illegally, and through unsustainable means of production (Kessy et al., 2016; Miya et al., 2012). Consequently, many forests in Tanzania are over-utilized and under significant pressure because of charcoal demand (World Bank, 2009). Although, some charcoal is produced legally and following management regulations, it is currently impossible to differentiate charcoal produced from legal and illegal sources. With the growing number of people and increased urbanization in Tanzania, charcoal will continue to pose a serious threat to Tanzania's forests unless actions are taken to limit charcoal consumption (World Bank, 2009; Mwampamba, 2007).

	2010			2012		
	Urban	Rural	Total	Urban	Rural	Total
Electricity	3.8	0.2	1.1	6.4	0.2	0.4
LPG/Natural gas	0.9	0.0	0.3	0.1	0.1	0.1
Paraffin/Kerosene	9.4	0.4	2.7	5.0	0.4	2.1
Charcoal	62.2	6.3	20.7	70.0	8.5	24.8
Wood	20.7	92.4	73.9	18.0	90.1	71.9
Other	3.0	0.7	1.3	0.5	0.7	0.7
Total	100	100	100	100	100	100

*Table 1.* Sources of energy for cooking in Tanzania, 2010 and 2012 (percent households), Ishengoma, 2015.

**Illegal logging.** In Tanzania, illegal logging is causing significant deforestation and forest degradation (Milledge et al., 2007). Although Tanzania's forestry sector offers opportunities to improve livelihoods and the local economy, its economic contribution has remained low due to corruption and the lack of government enforcement capable of protecting forest resources (Davie, 2013; Milledge et al., 2007). Davie (2013) found that most companies engaged in



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harvesting forest products within Tanzania did so without the appropriate government permits. Additionally, studies show that southern Tanzania has lost much of its income due to unregulated and unsustainable timber harvesting (Milledge et al., 2007; Davie, 2013). Moreover, the improvement of Tanzania's road network has also increased the rate of illegal logging as previously remote forested areas are now easily accessible (Milledge et al., 2007; Kideghesho, 2015). For example, forest inventories have rated most forests in southern Tanzania as 'degraded' or 'heavily degraded' with the main reason being the completion of the Mkapa Bridge which provides a permanent crossing over the Rufiji River, and direct access to cities and ports (Miya et al., 2012; Milledge et al., 2007; Kweka et al., 2015). Over the long-term, these unsustainable and illegal practices result in a significant loss of revenue for the country and forest dependent communities, harm conservation efforts, and support a culture of corruption (Davie, 2013).

***In migration.*** Tanzania, partly due to its location (surrounded by countries periodically affected by conflict) has a history of welcoming and assisting large numbers of refugees (World Bank, 2018). Tanzania's experience of accommodating refugees dates back to the colonial era when the country promoted an Open-Door Policy towards thousands of refugees (World Bank, 2018; Chaulia, 2003). However, starting in the 1990's a significant shift in Tanzania's position towards refugees occurred causing more restrictive policies and declining protection standards (Milner, 2013). While Tanzania has received refugees from various surrounding countries, most studies focus on the impact of the large amount of people fleeing Burundi and Rwanda in the 1990's (World Bank, 2018; UNHCR, 2003). It was estimated that over one million people sought refuge in western Tanzania during this period, and in some regions refugees outnumbered natives five to one (World Bank, 2018; Whitaker, 2002). Specifically, within western Tanzania,

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Kagera and Kigoma are the regions that border Burundi and Rwanda, and are the main locations in which these refugees settled (World Bank, 2018).

The influx of refugees in Tanzania has been found to be accompanied with an increase of severe environmental impacts including deforestation, soil erosion, land degradation, and unsustainable water extraction (World Bank, 2018; Whitaker 2002; Martin, 2005). Silangwa (2016) found that there is strong evidence to suggest that land degradation in Tanzania has mostly occurred due to in migration and increased human activities. In addition, Berry (2008) explains that the presence of refugees in Tanzania meant that it was necessary to travel much greater distances to find firewood than was necessary in prior years due to increased deforestation. Further, Ruiz and Vargas-Silva (2017) found that the overall increased exposure to refugees led to local women being less likely to engage in employment outside the household due to increased time spent collecting firewood. Although deforestation was a problem prior to the arrival of refugees, the presence of refugees across Tanzania has accelerated deforestation rates along with other environmental degradation (Berry, 2008).

***Climate change.*** Climate change is at both ends of deforestation and forest degradation in Tanzania in that it can be regarded as a driver and an impact. As a driver, climate change is projected to increase temperatures and create a more variable rainfall pattern throughout Tanzania, however the exact details differ among studies (FAO, 2017a; URT, 2014a; IPCC, 2014; Winthrop et al., 2018). Conway et al. (2017) projects that the entire country of Tanzania will experience a significant increase in temperature. On the other hand, Luhunga et al. (2018) predicts that temperatures will increase in Tanzania, but will vary regionally. For instance, the western parts of the country, and the southwestern and northeastern highlands were found to have the highest increase in temperature, and the coastal regions were found to have the lowest

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increase in temperature (Luhunga et al., 2018). As for precipitation, Luhunga et al. (2018) predicts that most of Tanzania is likely to experience increased rainfall especially in coastal regions, parts of northeastern highlands, and the northern regions (Luhunga et al., 2018). Luhunga et al. (2018) also projects that the southwestern highlands and western regions will experience decreased rainfall. Moreover, Conway et al. (2017) found strong evidence for a higher likelihood of dry spells and a higher likelihood of intense rainfall events and possible flooding.

These increasing temperatures and variable rainfall patterns will have significant impacts on forests within Tanzania. For example, climate change may change the biodiversity of Tanzania forests as different species try to adjust and cope with the changing environment (Shemsanga et al., 2010). Some changes in forest cover and species composition have already been recorded such as the increasing occurrence and severity of wild fires on Mount Kilimanjaro resulting in reduced forest size (Hemp, 2005), and the presence of invasive species in the East Usambara Mountains (Madoffee et al., 2006). Additionally, according to the URT (2007), the bulky forests of Tanzania are set to be shifted to drier ecosystems due to increased ambient temperatures and decreasing precipitation in certain areas. Finally, due to increased rainfall, and rising sea levels Tanzania's coastal forests are projected to experience extreme flooding (Paavola, 2004; Shemsanga et al., 2010). According to the URT (2007) these changes in forest types and species distribution will have major implications in the country.

**Pressures.** Pressures are described as the direct or indirect stressors on the functionality and quality of the environment resulting from the drivers (UNEP, 2012). Pressures can come in different forms including physical, chemical, or biological (Maxim et al., 2009). In the context of deforestation and forest degradation in Tanzania, the following pressures are discussed.

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**Population.** Tanzania is one of the most populous countries in Africa, with a population of more than 50 million people (PRB, 2015). Future projections suggest that Tanzania's population may more than double by 2050 unless serious interventions are implemented to lower birth rates (PRB, 2015). Additionally, the population in Tanzania is impacted significantly by migrants entering Tanzania (World Bank, 2018; PAI, 2011). Studies indicate that the current population increase in the country is exerting significant pressure on forests in Tanzania as the majority of the population depends on forest resources (Thaxton, 2007; Mkonda & He, 2017). This suggests that unless effective forest management strategies are put in place, the current population trends in Tanzania will have severe implications for the sustainability of forests in Tanzania (Kahyarara, 2017).

**Timber demand.** Tanzania exports a significant amount of wood products internationally. Milledge et al. (2007) found that over half of the timber products shipped from Tanzania during 2005 to 2006 were destined for China. Further, Milledge et al. (2007) highlights that the trade statistics show that China imported ten times more timber products from Tanzania than appear on Tanzania's own export records, suggesting that Tanzania collects only 10 percent of the revenue from these exports. Other markets that Tanzania serves include the Middle East, India, and neighbouring countries in East Africa (Milledge et al., 2007). The majority of these exports were undocumented and did not follow government procedures (Milledge et al., 2007). Moreover, the introduction of the Unity (Umoja) Bridge that provides a direct link between Tanzania and Mozambique has increased the illegal timber trade between the two countries (Davie, 2013). This can be attributed to a lack of monitoring, government controls, and staff involvement (Miya et al., 2012). As a result, the demand for timber contributes to unsustainable

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forest utilization, and accelerates deforestation and forest degradation within the country (Milledge et al., 2007).

**Poverty.** According to the World Bank (2015a) approximately 28 percent of the population in Tanzania lives below the basic needs poverty line. Further, almost 10 percent of the population lives in extreme poverty, meaning they do not have access to enough food to meet minimum nutritional requirements (World Bank, 2015a). Moreover, the World Bank (2015a) found that a large amount of the population in Tanzania is clustered around the basic needs poverty line, meaning that if the basic needs poverty line was decreased slightly by 25 percent, the rate of poverty would increase by more than 50 percent. Correspondingly, approximately 43 percent of the population in Tanzania lives below the internationally recognized poverty line of 1.25 USD per day, with 80 percent of the poor living in rural areas (World Bank, 2015a). The livelihood and wellbeing of people living in rural areas in Tanzania is largely dependent on forests and forest resources (World Bank, 2015a; FOA, 2008). Therefore, managing forest resources in Tanzania sustainably would significantly help alleviate poverty and unemployment (FAO, 2008). This is essential because with poverty, people are often careless about protecting the environment and are more concerned with the tangible resources and services that forests can provide in the moment (PROFOR, 2008; Soaga & Kolade, 2013).

**State.** State in the DPSIR framework refers to the state or condition of the environment. Specific definitions used to describe State are either issue-specific or more general (Maxim et al., 2009). For this project, the state of the environment will be described as the quantity and quality of the physical, biological, and chemical components of Tanzania's forests (Gabrielsen & Bosch, 2003).

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In Tanzania forest cover is declining by approximately 372 thousand hectares per year (TFS, 2015; FAO, 2015a). As a result, the FAO (2015a) rates Tanzania fifth among countries across the world with the greatest annual net loss of forested area (FAO, 2015a, Table 2). Moreover, Tanzania has a high degree of species endemism due to its unique topography, however these areas have high rates of threatened and endangered species (URT, 2015). For example, Tanzania ranks 15<sup>th</sup> globally with regard to the number of threatened species (URT, 2015). According to the 2013 IUCN RedList, there are at least 900 threatened species recorded in the country of which several are endangered (URT, 2015; URT, 2014b). This high level of threatened species is attributed to the overexploitation and increased degradation of Tanzania forests (URT, 2014b). Lastly, Tanzania contributes significantly to carbon sequestration as Tanzania's forests store over 1 billion tonnes of carbon (TFS, 2015). However, increased levels of harvesting forest resources has resulted in decreased carbon stocks (Shemsanga et al., 2010; Sawe et al., 2014). For example, Willcock et al. (2014) found that carbon storage in Tanzania was 2.1 tonnes per hectare lower in areas where logging was present, and 4.2 tonnes per hectare higher in areas under the control of local communities.

	Country	Annual forest area net loss	
		Area (thousand ha)	Rate (%)
1	Brazil	984	0.2
2	Indonesia	684	0.7
3	Myanmar	546	1.8
4	Nigeria	410	5.0
5	United Republic of Tanzania	372	0.8

Table 2. Top five countries with the greatest annual net loss of forest area from 2010-2015, FAO, 2015a.

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**Impacts.** Impacts are the consequences of the changes in the state of the environment. While some definitions of impacts only account for environmental changes (Maxim et al., 2009), others also account for the economic and social effects of environmental change (Gabrielsen & Bosch, 2003). The drivers and pressures of deforestation and forest degradation in Tanzania have both environmental and socio-economic impacts, which will be discussed.

**Climate change.** Climate change is an impact that has both global and regional effects. Globally, Tanzania's large forest areas have the capacity to play a major role in reducing climate change through carbon sequestration if sustainably managed (TFS, 2015; FAO, 2017a). For example, Tanzania's woodlands are sequestering 17.5 tonnes of carbon per hectare which is equal to 73 percent of the total carbon being sequestered within the country (TFS, 2015). However, due to the continuing deforestation and forest degradation within the country the ability of Tanzania's forests to act as a carbon sink is declining, and the amount of carbon dioxide being released into the atmosphere is increasing (Shemsanga et al., 2010; Sawe et al., 2014). For example, Willcock et al. (2014) found that carbon storage within Tanzania's Eastern Arc Mountains is decreasing by 1 tonne per hectare for every 1°C increase in mean annual monthly temperature range. This in turn contributes to the negative impacts of climate change which have implications worldwide (FAO, 2017a).

Regionally, climate studies in Tanzania suggest that ongoing changes in local climate conditions are a result of the unsustainable utilization of forests and forest resources (Foley et al., 2005; Godoy et al., 2011). According to the URT (2011b) the prolonged dry seasons in many parts of the country have been closely associated with forest loss, while similarly unpredictable rains and floods in other parts of the country have been identified to be a result of ongoing forest degradation in Tanzania. Further, according to the IPCC (2014) the health of many Tanzanians is

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impacted by climate change due to changing weather and climatic conditions. For example, increases in outbreaks and mortality rates of cholera and malaria are expected in Tanzania due to changes in temperatures and precipitation patterns (Shemsanga et al., 2010; URT, 2007; IPCC, 2014).

**Biodiversity loss.** Tanzania is recognized globally for its rich biodiversity and diverse forests (Myers et al., 2000). However, Tanzania's forest resources are in danger due to the uncontrolled exploitation of these resources (FAO, 2015a). The majority of Tanzania's mangrove forests are under serious pressure due to increased farming and human settlements (Taylor et al., 2003; URT, 2014c). Additionally, Burgess et al. (2002) identified several endemic species that are no longer present in the Uluguru Mountains in Tanzania due to increased deforestation and forest degradation. Further, it has been shown that wildlife populations in the Selous Game Reserve in Tanzania have been seriously reduced as a result of habitat loss (USAID, 2012).

**Socio-economic impacts.** The forest sector plays an important role in Tanzania's economy as the country's forests provide employment throughout the country (Malimbwi & Zahabu, 2008). Conversely, the unsustainable utilization of forest resources and weak forest management pose a serious threat to the country's economy and local livelihoods (Malimbwi & Zahabu, 2008; Davie, 2013). A study by Milledge et al. (2007) revealed that the losses of revenue to the Forestry and Beekeeping Division (FBD) in Tanzania amounted to up to 58 million USD annually. As a result, Tanzania needs to enhance sustainable forest management at the community level in order to avoid revenue loss at the local and national level.

**Implications for local livelihoods.** In Tanzania forests remain the primary source of livelihood for rural communities, and as a result forest loss has been linked to increased



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community conflict over access to land and forest resources (Blomley & Iddi, 2009; Milledge et al., 2007). For example, due to deforestation and forest degradation, access to suitable land for farming and grazing has become a major problem in Tanzania (Mwamfupe, 2015; Benjaminsen et al., 2009). This is due to a lack of reliable fertile land which forces subsistence farmers in Tanzania to farm outside their own community in search for land for cultivation (Mwamfupe, 2015). Similarly, pastoralists are in search of land and water sources for their animals resulting in conflicts with farmers due to limited access to viable land and resources (Mwamfupe, 2015). These conflicts remain constant as forests, land, and water resources are important to the livelihoods of rural communities, but are also vulnerable to unsustainable utilization (Mustalahti et al., 2012).

**Responses.** Responses are interventions that aim to prevent, ameliorate, or control environmental changes, and are initiated to stop the drivers or pressures from causing future impacts (Gabrielsen & Bosch, 2003; Baldwin et al., 2016). Responses can be implemented at different levels, most notably at the community, national, or international level (UNEP 2012b; Maxim et al., 2009). For the purposes of this project Tanzania's National Forest Policy of 1998, PFM, and REDD+ will be discussed as the responses to deforestation and forest degradation in Tanzania.

***Tanzania's national forest policy.*** Tanzania's current national forest policy was created by the MNRT in 1998, and details how the forests and their resources would be managed to ensure sustainability (URT, 1998). The formation of this national forest policy is based on three frameworks; macro-economic, environmental, and social (URT, 1998). These three frameworks work together to achieve sustainable forest management by preventing the degradation of land, ensuring sustainable and equitable use of resources, maintaining economic stability, and

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combating poverty (URT, 1998). Further, this policy emphasizes the decentralization of authority which emphasizes empowering communities in the management of forest resources (URT, 1998; Petersen & Sandhovel, 2001). However, this forest policy has gaps that need to be addressed as many policy strategies implemented by the MNRT have been guided by this policy (Blomley & Iddi, 2009). For example, the MNRT has tried to ban the charcoal trade and limit consumption as part of the effort to control deforestation and forest degradation (TFCG, 2016). These official bans were issued multiple times from 2003 to 2006 (Milledge et al., 2007). In addition, in 2017, the MNRT issued a charcoal ban that would prohibit the exporting of charcoal from its original source of production (Kitabu, 2017). Despite these bans to limit charcoal production, the higher costs of gas and electricity, and the inaccessibility of other energy sources remain a strong barrier to using more environmentally friendly energy sources (GVEP, 2012). Critics suggest that these bans were simply political statements as they offered no alternatives (TFCG, 2016).

***Participatory forest management (PFM).*** Faced with continuing deforestation and forest degradation, the government of Tanzania decided to involve local communities in forest management through Participatory Forest Management (PFM) (URT, 2008b, Figure 8). PFM was introduced in Tanzania in the early 1990's and was then introduced into law with the passing of the Forest Act of 2002 (Jacob, & Brockington, 2017; TFCG, 2009). PFM in Tanzania is strongly supported by the Forestry and Beekeeping Division (FBD) of the MNRT, and the Tanzania Forest Service (TFS) (Treue et al., 2014). PFM involves local communities being assigned a portion of forested area and being responsible for the sustainable use of the forest resources in that area (Blomley, & Ramadhani, 2006). There are two types of PFM including Joint Forest Management (JFM) and Community Based Forest Management (CBFM). The JFM program involves forests owned by either central or local governments on reserved land while

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the CBFM program applies to forests that are on village land (Salas, 2014). Through JFM the communities get user rights of state-owned forest land and the government and the communities co-manage the forests, whereas under CBFM the communities are the managers and owners of the forest (TFCG, 2009; Salas, 2014). Consequently, CBFM is the most popular form of PFM both in terms of the number of participating villages, and in terms of the total area of forest covered (TFCG, 2009). While PFM appears to be successful in many ways such as empowering local rural populations (URT, 2008b), many criticisms have recently questioned the reliability of this method and point to ways community management strategies are problematic (Blomley, & Iddi, 2009). It is still to be determined if PFM approaches deal effectively with the causes of deforestation, and this questions whether community based management strategies are actually successful in terms of reducing climate change through carbon sequestration, and in dealing with poverty and the dependence on forest resources in the country (Blomley et al., 2008; DANIDA, 2002).

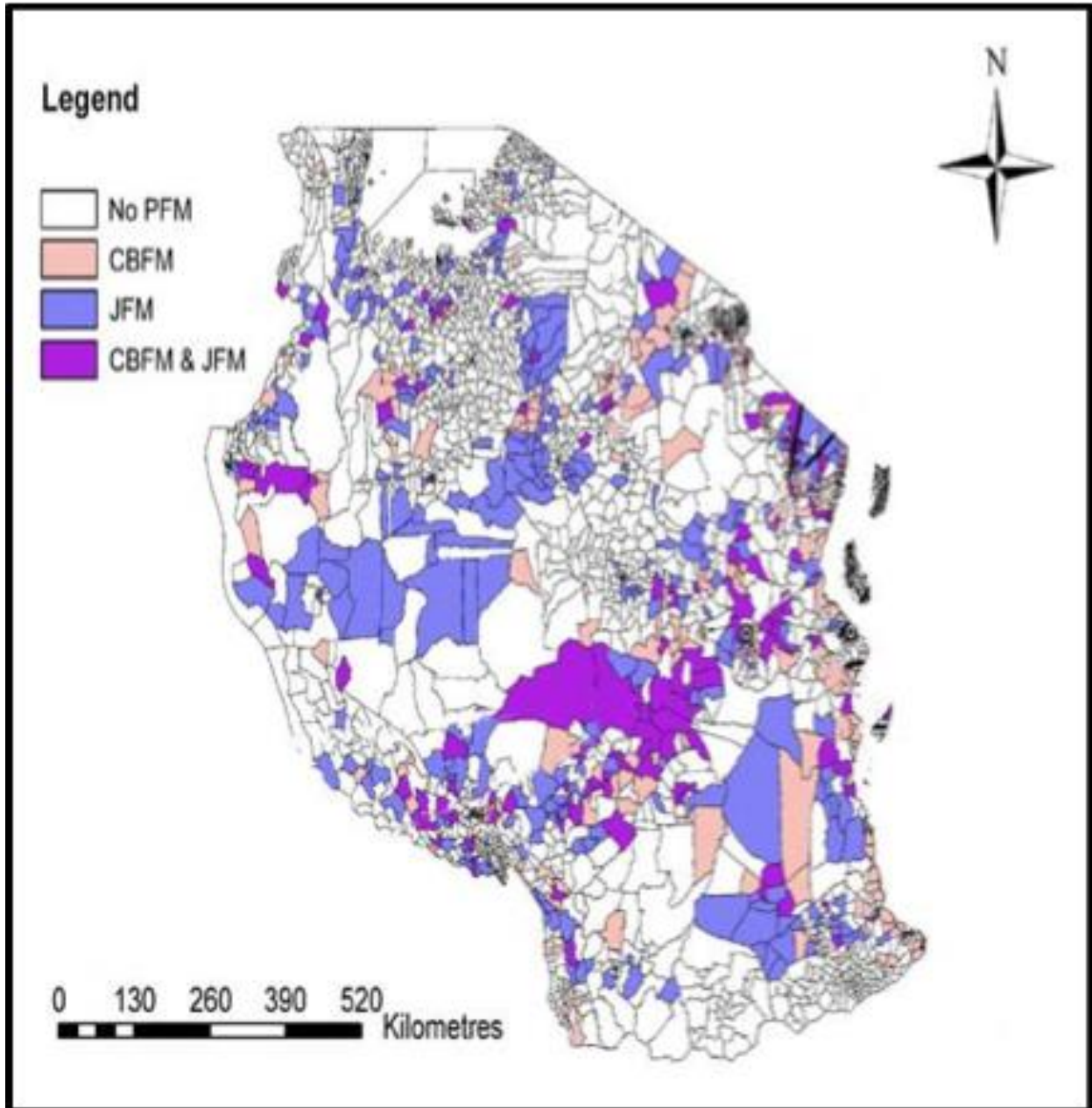


Figure 8. The spatial distribution of PFM in Tanzania, Treue et al., 2014.

**Reducing emissions of deforestation and forest degradation (REDD+).** The Reducing Emissions from Deforestation and Forest Degradation (REDD+) program is an international attempt to create a global forest governance system which would impact countries on national, regional, and local scales (Salas, 2014). REDD+ was launched in Tanzania in 2009 after the country received funding from the Norwegian government in 2008 to support a national REDD+

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framework and nine pilot projects (Blomley et al., 2017, Figure 9). It has been argued that REDD+ initiatives in Tanzania have the potential to provide even stronger local level incentives for forest management compared to traditional PFM methods (TFCG, 2009). Often times when local communities acquire a section of forest under PFM it is not in great condition, or the conservation status of the forests means that harvesting high value products such as timber is not allowed (TFCG, 2009). As a result, under PFM the costs of management may exceed the benefits which calls into question the long-term viability of these initiatives (TFCG, 2009). In an attempt to resolve this issue, it was argued that REDD+ could provide valuable income for remote communities as these areas are associated with high levels of poverty and have limited options for generating income (URT, 2008b). In addition, this would also support long-term forest management and the protection of forest resources (Beymer-Farris, & Bassett, 2012). While REDD+ is often perceived to be a worthwhile initiative, many criticisms exist (Burgess et al., 2010; Fisher et al., 2011; Lund et al., 2017). Recent research has found that many forest-dependent communities such as communities in Tanzania are not sufficiently involved in current REDD+ projects due to insufficient benefits (Danielsen et al., 2010; Lyster, 2011). As a result, there is a need to incorporate a more holistic approach that includes traditional forest management systems, and provides viable alternatives to loss of agricultural land (Bayrak, & Marafa, 2016). It has also been found that many REDD+ initiatives have been implemented where carbon and land tenure arrangements have not been clearly defined or effectively enforced causing implications for effectively reducing climate change through carbon sequestration (Sunderlin et al., 2014a; Benjaminsen, 2017).

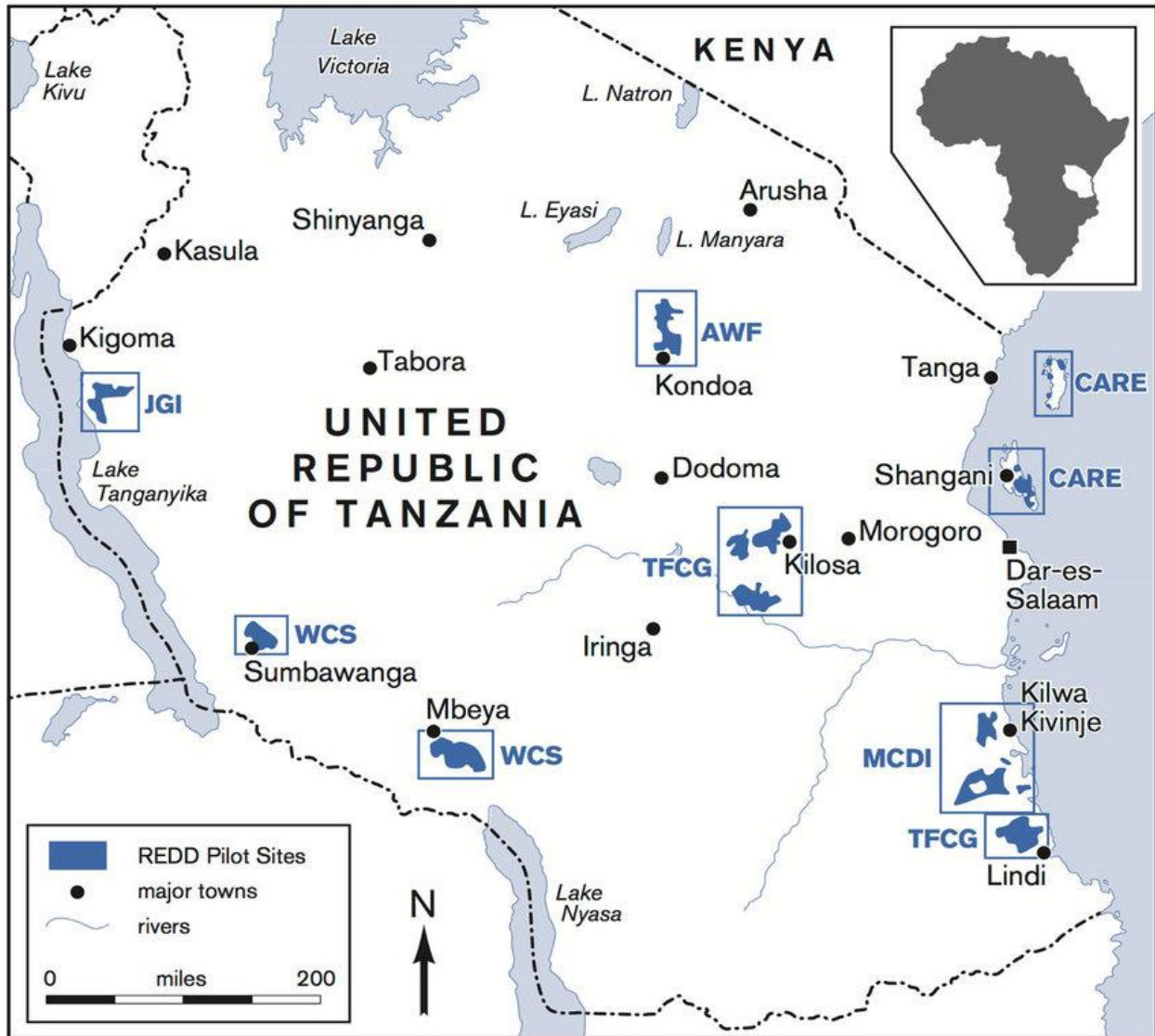


Figure 9. The locations of REDD+ pilot projects in Tanzania, Blomley et al., 2017.

### Research contribution

This literature review shows that previous studies have highlighted the importance of sustainable forest management in Tanzania, and the challenges Tanzania faces in reducing deforestation and forest degradation within the country. This project contributes to this literature by evaluating whether Tanzania’s forest protection policies and initiatives are currently successful in addressing the drivers of deforestation and forest degradation previously discussed in this chapter.

## Chapter Four: Analysis

### Introduction

Tanzania's forest areas and resources are being deforested, degraded, pressured, and driven by multiple factors (TFS, 2015; FAO, 2015a; Salas, 2014). The purpose of this chapter is to evaluate the responses to deforestation and forest degradation in Tanzania to determine if they are achieving or moving towards sustainable forest management. The responses analyzed include Tanzania's national forest policy, PFM, and REDD+ as these policies and initiatives were identified as the major responses to deforestation and forest degradation within the country. Specifically, these responses are evaluated by determining whether they adequately address the drivers of deforestation and forest degradation previously discussed using the DPSIR framework. Further, because the DPSIR framework is an analytic framework that forces the analysis to be categorized, it is important to identify the places where the categories of the framework overlap and interconnect. As a result, the interconnections between the drivers and pressures of deforestation and forest degradation will be highlighted in order to help determine whether Tanzania's forest protection policies and initiatives are achieving sustainable forest management, or at least moving in that direction.

### Interactions Between Drivers and Pressures in the DPSIR Framework

Just like any environmental issue, deforestation and forest degradation in Tanzania are complex as numerous drivers and pressures interact and overlap with one another. Climate change as a driver affects forests and forest resources in Tanzania, but also exacerbates other drivers such as charcoal consumption and uncontrolled subsistence agriculture by making Tanzania's forests and agricultural lands less healthy and productive. Furthermore, uncontrolled subsistence agriculture is linked to poverty as farmers may not have the capacity necessary to

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transition to more environmentally friendly farming techniques. Charcoal consumption is also linked to poverty as charcoal remains the only affordable energy source among the majority of communities in Tanzania. Additionally, in migration and population increases are linked to charcoal consumption as there are more people within the country that are dependent on forest resources. Finally, the timber demand exacerbates illegal logging by creating a large demand for Tanzania's forest resources often without allowing Tanzania to benefit economically. These interconnections are important to recognize as if one driver is not adequately addressed it can exacerbate other drivers or pressures, and result in forest management that is not sustainable.

### **Tanzania's National Forest Policy**

The national forest policy of 1998 is Tanzania's current national forest policy and is used as the basis for further policy strategies and forest protection initiatives (Blomley & Iddi, 2009). The stated goal of Tanzania's national forest policy is to support the sustainable development of Tanzania's forestry sector, and enhance the conservation of its natural resources for the benefit of present and future generations (URT, 1998). In order to achieve this goal the policy needs to effectively address the current drivers of deforestation and forest degradation in Tanzania, however based on an evaluation of this policy not all drivers are adequately addressed.

**Drivers not addressed.** Tanzania's national forest policy states that the main reasons for deforestation and forest degradation within the country are clearing land for agriculture, overgrazing, wildfires, charcoal burning, and the over-exploitation of wood resources (URT, 1998). This differs slightly from the drivers highlighted in this project, which include uncontrolled subsistence agriculture, charcoal consumption, illegal logging, in migration, and climate change (Table 3). These differences can be explained by the policy being over 20 years



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old and not based on the current literature concerning deforestation and forest degradation in Tanzania, and also the existence of several gaps within the policy.

Tanzania's national forest policy states that its forests are valuable due to their potential to recycle and fix carbon dioxide (URT, 1998), but does not recognize climate change as a driver. Further, the policy addresses wildfires and how they are a driving force of deforestation and forest degradation in Tanzania, but does not address how climate change is contributing to the increase of forest fires and forest loss. The policy also does not address climate change in terms of how changing weather patterns will negatively impact Tanzania's forests, or how climate change can exacerbate other drivers of deforestation and forest degradation. Ultimately, this national forest policy fails to recognize the severity of climate change, and does not adequately address the effect climate change has on forests in Tanzania.

Additionally, Tanzania's national forest policy does not discuss in migration as a driver of deforestation and forest degradation. Specifically, the policy does not address how the influx of refugees to Tanzania exacerbates the negative impacts on forests such as increased firewood collection and charcoal consumption. This is important as in migration intensifies the urgency to implement successful policy directives that promote sustainable forest management among rural communities in Tanzania.

Furthermore, Tanzania's national forest policy does recognize uncontrolled subsistence agriculture, charcoal consumption, and illegal logging as contributing significantly to deforestation and forest degradation in Tanzania, however it has been weak in addressing the effects of these drivers. This policy recognizes that the conversion to other land uses is an issue, yet lacks clear directives that limit shifting cultivation, unsustainable charcoal production, and deforestation caused by illegal logging.

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The drivers of deforestation and forest degradation in Tanzania’s national forest policy	The proposed drivers of deforestation and forest degradation in Tanzania
Clearing land for agriculture	Uncontrolled subsistence agriculture
Charcoal burning	Charcoal consumption
Over-exploitation of wood resources	Illegal logging
Wildfires	Climate change
Overgrazing	In migration

Table 3. Comparison of the drivers of deforestation and forest degradation in Tanzania, Author, 2020.

***Uncontrolled subsistence agriculture.*** Farming is important to the majority of rural communities in Tanzania, but there has not been enough done to educate and raise awareness on sustainable agriculture practices in these communities. As a result, the majority of subsistence farmers in Tanzania lack basic knowledge and awareness on environmentally friendly farming practices. To address this, the national forest policy states that extension services should be provided to forest dependent communities (policy statements 35 and 36) such as farmers, however does not detail what these services will include or how they will be implemented.

Policy statement 35: “To ensure increased awareness and skills amongst the people on sustainable management of forest resources, the forestry extension services will be strengthened” (URT, 1998, p. 30).

Policy statement 36: “Forestry related extension messages delivered by different natural resources management sectors and other related sectors will be harmonised through integrated planning, research and training” (URT, 1998, p. 30).

Moreover, a strong collaboration between government departments is required if more sustainable farming practices are going to be achieved, however policy efforts to address this are

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uncoordinated. Tanzania's national forest policy discusses strengthening collaboration between local government institutions in managing natural resources, but there is no specific information outlining how these institutions should interact and manage differing opinions and priorities. As a result, in order to address subsistence agriculture as a driver of deforestation and forest degradation in Tanzania, the national forest policy needs to include improved policy directives and implementation methods in order to ensure that extension services are provided to support rural communities.

***Charcoal consumption.*** The national forest policy has specific policy statements (policy statements 6 and 9) that aim to achieve sustainable forest management in Tanzania, however none of the statements clearly recognize charcoal as a fundamental problem that requires strong policy action. Moreover, the implementation and enforcement of these policy directives needs to be strengthened in order to successfully address charcoal consumption in Tanzania.

Policy Statement 6: "Village forest reserves will be managed by the village governments or other entities designated by village governments for this purpose. They will be managed for production and/or protection based on sustainable management objectives defined for each forest reserve. The management will be based on forest management plans" (URT, 1998, p. 18).

Policy Statement 9: "Establishment of private woodlots and plantations for woodfuel production will be encouraged and supported through research, extension services and financial incentives" (URT, 1998, p. 20).

As a result, Tanzania's national forest policy has failed to implement effective policy directives surrounding the issue of charcoal. Charcoal consumption in Tanzania is a complex issue, and in order for policy directives and regulations on charcoal use to be successful there needs to be an affordable alternative, which at the moment does not exist. Charcoal consumption

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also needs the cooperation and involvement of multiple groups including government departments and local communities in order to control its environmental impact.

*Illegal logging.* Tanzania's national forest policy also has specific policy directives surrounding the development of the forestry sector in Tanzania (policy statements 14 and 25), but none of these statements clearly address the effects of illegal logging. Specifically, these policy statements attempt to strengthen Tanzania's forestry sector by allowing national and international trading of forest products such as timber, however they do not describe what steps should be taken to reduce or eliminate the large amount of illegal logging already taking place within Tanzania.

Policy Statement 14: "Internal trade and exports of forest produce, excluding those regulated by international agreements of which Tanzania is a party, will be promoted. To prevent forest destruction and degradation through commercial exploitation, trade of certain forest products may be regulated" (URT, 1998, p. 23).

Policy Statement 25: "Legislation for the forest sector will be periodically updated and harmonised with the legislation of other related sectors" (URT, 1998, p. 27).

As a result, Tanzania's national forest policy struggles to effectively address illegal logging within the country as more focus is needed on ways to develop the sustainable production and trade of forest resources. More detail is also needed concerning how to harmonise the forestry sector with related sectors as the broad tendency to view the forestry sector in isolation from other sectors still exists, which results in little success in addressing illegal logging. For positive examples, countries such as Finland and Norway have managed to balance conserving their forests with also promoting sustainable investments (Lindstad, 2002).

### **Participatory Forest Management (PFM)**

The implementation of Tanzania's national forest policy in 1998 resulted in an increase in awareness and more positive attitudes towards PFM within the country (Hamza & Kimwer, 2007). The goal of PFM is to promote the sustainable use of forest resources, and to govern the forests at the lowest level of management possible for the benefit of local communities (Treue et al., 2014). However, the success of PFM (both CBFM and JFM) in achieving sustainable forest management in Tanzania remains unclear (Lund & Treue, 2008).

Recently, studies have shown that PFM has been more successful in forest conservation than other state forest management strategies in Tanzania. For example, it has been found that forests in Tanzania subject to either CBFM or JFM were likely to exhibit better forest condition responses than forests managed as Forest Reserves with no community involvement (Blomley et al., 2008; Treue et al., 2014). Further, a similar study of two forests in the Eastern Arc Mountains found that the greater tenure security and institutional autonomy associated with PFM contributed to more effective management, less illegal logging, and maintenance of forest condition (Persha & Blomley, 2009). Despite this evidence, the uncontrolled exploitation of forests under PFM has not ceased (Mbwambo et al., 2012). Persha and Blomley (2009) concluded that despite CBFM and JFM exhibiting better forest conservation results than forests under ordinary state management, generating livelihood benefits was a challenge for both decentralized strategies, and the uncontrolled exploitation of the forests have continued. Consequently, there are still many PFM projects in Tanzania that are not successful in achieving conservation goals or delivering benefits to rural communities (Salas, 2014).

**Inadequate incentives.** PFM does not adequately incentivize local communities to adopt sustainable forest management practices as communities are often faced with unclear benefits,

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and agreements are often left unsigned. It is expected that the local government in Tanzania would sign Joint Forest Management Agreements (JFMA) with village governments, giving land tenure rights to village governments (URT, 1998). However, due to several forest governance shortcomings, particularly the bureaucratic processes within the MNRT and other government institutions involved in land formalization processes, long delays between initiating the process of JFM and signing agreements exist (Schreckenber & Luttrell, 2009). This has been a barrier to village government's ability to formalize and utilize land and improve community livelihoods. As a result, many of the villages that were identified for JFM have either experienced long delays or not received signed agreements, and eventually these communities are less motivated to participate and conserve forest resources.

Furthermore, neither JFM or CBFM in their current form support an equitable distribution of the costs and benefits of a decentralized forest management approach (Vyamana, 2009; Lund & Treue, 2008). Specifically, both JFM and CBFM unintentionally exclude the poor, who cannot afford the initial investment costs for participation. This is due to the start-up costs of PFM being particularly high and although the government has channeled resources through NGOs and local governments, implementation is still limited and weak (MNRT, 2008). Similarly, administrative obstacles prevent the poorest community members from taking full advantage of the benefits of PFM as the benefits that are generated are often taken by community leaders such as village chairpersons, and barely benefit the community as a whole (Vyamana, 2009).

In addition, it has been determined that communities can often acquire degraded forests through PFM which does not benefit the community in the short-term as benefits are not realized until the forest has regenerated sufficiently to allow for sustainable usage (Vyamana, 2009;

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TFCG, 2009). As a result, in the short-term, communities must bear the management costs of PFM on the expectation of future benefits. This is problematic as local communities often do not have the resources to allow them to forego short-term benefits while also covering the management costs of PFM. The situation is different for PFM, particularly CBFM, in good condition forest, as income that is generated is used to cover management costs, making it more likely that communities will see immediate and long lasting benefits that maximize their wellbeing (Vyamana, 2009; Salas, 2014).

**Inadequate extension services.** Both CBFM and JFM lack basic extension services leaving local communities incapable of fully addressing the drivers of deforestation and forest degradation. PFM does not adequately address the issue of shifting cultivation as it does not provide alternatives to the loss of agricultural land. For example, during the implementation of CBFM and JFM there is a lack of enough forest staff to assist communities in acquiring the necessary knowledge and skills surrounding alternative farming strategies, and there is also a lack of resources such as equipment to support more environmental friendly farming practices (Hamza & Kimwer, 2007; Luoga et al., 2000). Additionally, many of the existing PFM forests have been found to be too small to supply communities with productive agricultural land as well as all the forest resources needed (Treue et al., 2014). Hence, the establishment of larger PFM forests as well as areas of productive farmland are necessary to counter deforestation and forest degradation in Tanzania.

PFM also does not adequately address the issue of charcoal consumption as many forested areas in Tanzania continue to be exploited due to the lack of affordable alternative energy sources. This was found to be an issue particularly with forest areas in close proximity to major urban centres where the demand for charcoal is very high. Specifically, the proximity to

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Dar es Salaam was found to have a major effect on harvesting rates irrespective of formal management regimes, be it CBFM, JFM, or governmental (non-PFM) (Treue et al., 2014).

Forests close to large urban centers such as Dar es Salaam are not being managed sustainably due to the high demand for charcoal, and the inability of any formal governance regime including PFM to control the external access to these forests. This is problematic as high rates of harvesting cause devastating impacts including the inability of rural communities in these areas to achieve sustainable forest management through PFM (Malimbwi et al., 2005; Ahrends et al., 2010).

Furthermore, PFM struggles to address the large amount of illegal logging taking place within the country. With PFM the community is responsible for enforcing restrictions over the harvesting of forest resources including reporting any illegal logging that takes place within their assigned forested area (Robinson & Lokina, 2011a). When communities report illegal logging to the authorities they often receive a share of the collected fine revenue as an incentive to continue to monitor and report any illegal logging (Robinson & Lokina, 2011a). However, it has been reported that if communities have access to alternative sources of forest resources such as forests not under PFM, local communities may respond by taking bribes from illegal loggers rather than honestly reporting the illegal collection of forest resources (Mustalahti & Lund, 2010). As a result, PFM especially JFM, does not adequately support local communities in sustainable forest management as it forces communities to assume the responsibility and bear the costs of dealing with illegal logging.

It has also been found that PFM implementation may have an impact on the non-PFM forest existing in and around the community. In the case of JFM, nearby non-JFM forest tends to become degraded once JFM agreements are in place implying a shift of degradation effects to



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non-JFM forests (Vyamana, 2009; Robinson & Lokina, 2011b). If forest degradation is simply being displaced to other areas, JFM is not achieving sustainable forest management. This is especially problematic in terms of climate change as the amount of carbon sequestration that is possible decreases, creating further implications for forest dependent communities. However, in CBFM and adjacent non-CBFM forest, it was found that the community responds by applying the rules and regulations of CBFM in all forest areas within their vicinity as they feel responsible for the sustainability of nearby forests as they are both the managers and owners under CBFM (Vyamana, 2009; Lupala et al., 2015). This implies that deforestation and forest degradation in these areas is being managed sustainably which allows for increased carbon sequestration, in addition to supporting the livelihoods of local communities.

### **Reducing Emissions From Deforestation and Forest Degradation (REDD+)**

REDD+ is an international forest governance system with the goal of mitigating climate change while also addressing poverty by offering incentives for reduced deforestation and forest degradation (UN-REDD, 2008). In Tanzania, REDD+ has been promoted by international donors and local and international NGOs as a strategy to tackle previous problems with the implementation of PFM in the country (Burgess et al., 2010; Blomley et al., 2017). Despite the large amount of financial support REDD+ has received in Tanzania, the initiative faces many of the same challenges as PFM including the inability to adequately address the drivers of deforestation and forest degradation, and conflicts over land tenure (Lund et al., 2017; Sunderlin et al., 2014b). In addition to these known problems under PFM, the introduction of REDD+ in Tanzania has created additional challenges related to the monitoring and sale of forest carbon (Lund et al., 2017). Consequently, REDD+ struggles to address the limitations of PFM, and also introduces new challenges to achieving sustainable forest management within Tanzania.

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**Existing challenges.** REDD+ does not adequately address the drivers of deforestation and forest degradation in Tanzania as its implementation strategies struggle to generate alternative long-term livelihood opportunities for local communities. Specifically, REDD+ has received significant funding from international donors such as the Government of Norway, however the majority of this funding has been used to cover consultancy and administrative expenses instead of being used to develop incentives and extension services for local communities (Lund et al., 2017; Burgess et al., 2010). For example, when REDD+ was first proposed in Tanzania it was supposed to include viable alternative livelihood activities such as conservation agriculture, vegetable farming, woodlots, and beekeeping (Lund et al., 2017). REDD+ was also supposed to help eliminate previous problems with PFM by providing extension services such as sustainable agricultural techniques, and improved technology such as high efficiency cooking stoves, and alternative energy sources (Kweka et al., 2015). Due to insignificant support these services have either not been developed or have only benefited a small proportion of households within REDD+ projects (Lund et al., 2017; Mutabazi et al., 2014). Consequently, REDD+ still does not address subsistence agriculture as it struggles to provide adequate alternatives to the loss of agricultural land. REDD+ also struggles to address the high demand for charcoal within Tanzania due to the lack of affordable alternative energy sources. Finally, REDD+ also struggles to address illegal logging as there is a high demand for forestry products, but no alternatives such as a well-managed sustainable forestry sector within the country.

Moreover, REDD+ struggles to address the drivers of deforestation and forest degradation in Tanzania as the distribution of carbon payments associated with REDD+ are not well managed due to issues with tenure and ownership rights. This is important as ensuring the

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equitable distribution of benefits to communities whose livelihoods are dependent on forest resources is crucial if forest conservation is to succeed and not leave forest communities worse off (Bayrak & Marafa, 2016; Mustalahti et al., 2012). Proper land tenure rights have also been found to encourage local communities to be more effective in the conservation of forest resources as they are adequately incentivized to be involved in all the phases of REDD+ ranging from participatory forest monitoring to having the legal authority to stop illegal forest exploitation by outsiders (Lawlor et al., 2010). However, it has been determined that REDD+ in Tanzania has been implemented in a context in which land tenure arrangements have not been clearly defined or effectively enforced (Sunderlin et al., 2014a). Specifically, many village tenure rights have not been formally recognized which presents issues for REDD+ as the effectiveness of the initiative depends on the ability and interest of local communities to sustainably manage their forests and enhance carbon stocks by addressing the drivers of deforestation and forest degradation (Dokken et al., 2014; Lund et al., 2017).

**Additional challenges.** REDD+ has been recognized globally as a viable option for addressing climate change as it attempts to protect forest carbon stocks in developing countries such as Tanzania (Bayrak & Marafa, 2016). REDD+ is different from other forest protection initiatives in Tanzania as it places a value on the country's forests by commodifying forest carbon which previously had no market value. It was thus expected that REDD+ could facilitate large reductions in greenhouse gas emissions by compensating forest owners and users for the loss of forest income and livelihood opportunities (Salas, 2014). However, issues related to the monitoring and reporting of changes in forest carbon stocks exist, which in turn questions the success of REDD+ in helping to reduce climate change. Specifically, REDD+ in Tanzania faces operational challenges as there is a lack of relevant data to set REDD+ baselines, and there is

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also a lack of technical capacity within the various agencies in Tanzania to carry out robust monitoring of carbon stock change (Lund et al., 2017; Burgess et al., 2010). This is largely due to the fact that the impact of deforestation and forest degradation on carbon storage is not well-known for many forest types across Tanzania due to insufficient data (Lund et al., 2017).

Additionally, REDD+ in Tanzania faces challenges with the marketing and sale of carbon stocks. What is perhaps most concerning is that so far none of the REDD+ projects set up with Norwegian support have yet to secure sales of verified carbon credits due to low carbon prices and weak global demand (Blomley et al., 2017; Lund et al., 2017). It has also been determined that the current voluntary market carbon price of around five USD per ton appears insufficient to compensate communities for not participating in opportunities such as agriculture and charcoal production (Lund et al., 2017). As a result, REDD+ projects may have exposed participating communities to a higher level of risk than if they had pursued more established markets for forest products such as firewood, charcoal, or timber. Ultimately, with future REDD+ funding uncertainties and low carbon prices, it remains more profitable for rural communities to cut down trees for farmland expansion, charcoal production, and illegal logging than to leave them standing for carbon sequestration. This is problematic as implementation of REDD+ projects, communities are being asked to forgo these forest-based activities and the associated benefits without being provided with adequate incentives in return.

### **Is Sustainable Forest Management Being Achieved in Tanzania?**

Addressing the drivers of deforestation and forest degradation is essential for achieving sustainable forest management in Tanzania. Tanzania's national forest policy, PFM, and REDD+ all struggle in addressing the drivers of deforestation and forest degradation, and as a result are not yet achieving sustainable forest management. Specifically, Tanzania's national forest policy

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needs to be updated to address the effects of the current drivers of deforestation and forest degradation. PFM, specifically CBFM is moving towards sustainable forest management as a clear definition of rights and responsibilities exist, allowing communities to benefit from managing forests sustainably. However, specific barriers including a failure to properly incentivize forest-dependent communities, and a lack of extension services hinders PFM from adequately addressing the drivers of deforestation and forest degradation. REDD+ is the most recent attempt at sustainable forest management in Tanzania, but it struggles just like PFM in addressing the drivers of deforestation and forest degradation, and also introduces new challenges concerning the monitoring and sale of forest carbon. Consequently, Tanzania's national forest policy, PFM, and REDD+ all struggle with delivering on the win-win promise of livelihood improvements and forest conservation, and therefore are not achieving sustainable forest management within the country.

**Chapter Five: Recommendations and Conclusions**

This chapter identifies key recommendations for improved sustainable forest management in Tanzania based on the analysis of Tanzania’s national forest policy, PFM, and REDD+. The proposed recommendations are discussed at different scales of analysis including at a micro-level focusing on individuals and forest dependent communities, a meso-level focusing on local government, and a macro-level focusing on national government and NGOs (Table 4). In addition, both short-term and long-term recommendations are provided for improved sustainable forest management in Tanzania. Furthermore, the limitations of this specific project are highlighted, and some areas for further research are discussed in order to enhance sustainable forest management in Tanzania.

**Recommendations for Improved Sustainable Forest Management**

	<b>Recommendations</b>
<b>Micro-level</b>	Improve and expand reforestation at the community level.
<b>Meso-level</b>	Develop adequate incentives for forest dependent communities.
<b>Macro-level</b>	Improve governmental support for forest extension services.
<b>Short-term</b>	Enforce the sustainable production and use of charcoal. Develop alternative energy sources to charcoal.
<b>Long-term</b>	Improve forest control and monitoring systems.

*Table 4.* Recommendations for improved sustainable forest management in Tanzania, Author, 2020.

**Development of adequate incentives for forest dependent communities.** One barrier to achieving sustainable forest management highlighted in this project is inadequate incentives for forest dependent communities. Currently, local communities participating in both PFM and REDD+ initiatives are faced with unclear benefits, and as a result are not properly incentivized to conserve forests and forest resources. Both PFM and REDD+ were expected to deliver

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widespread benefits to forest dependent communities in Tanzania, however it has been determined that these incentives have either not been properly developed or have only benefited a small proportion of community members (Lund & Treue, 2008; Lund et al., 2017). Therefore, it is recommended that the MNRT develop policy actions to support PFM and REDD+ in offering innovative incentives for forest conservation at the local level. This can be achieved by developing and implementing effective incentives that motivate rural communities to participate in sustainable forest management. In addition, it is recommended that there be an increase in government monitoring with respect to benefit sharing, as in some communities the benefits derived from forest protection initiatives are not shared equally among the community (Vyamana, 2009). It is therefore important for the local government to enforce village agreements and forest benefits in order to confirm that entire communities are benefiting, especially marginalized groups such as the poor.

**Improve governmental support for forest extension services.** This project also determined that Tanzania's forest protection policies and initiatives struggle to deliver adequate extension services to rural communities. As a result, in order to achieve sustainable forest management in Tanzania an increase in community extension services is needed. Fortunately, local and international NGOs play a large role in the sustainable management of forests in Tanzania, and as a result work to provide extension services to many rural communities. For example, NGOs have been highly involved in the promotion of environmentally friendly activities such as encouraging sustainable land use practices among subsistence farmers (Rutatora & Mattee, 2001). However, the majority of these projects were implemented with limited support from the MNRT, and as a result have only been successful within a small proportion of rural communities (Luoga et al., 2000). Consequently, it is recommended that the

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MNRT strengthen its relationship with NGOs involved in sustainable forest management within Tanzania particularly those working at the district and village level. This should include providing regular institutional support on technical and policy issues that need the direct engagement of the MNRT to remove administrative barriers that may limit the work of NGOs in advancing forest extension services and sustainable forest management.

**Improve and expand reforestation at the community level.** It has been shown that planting trees in order to restore previously forested areas has many environmental benefits including controlling water runoff, preserving biodiversity, and helping to mitigate climate change (Locatelli et al., 2015). Additionally, the reforestation of a previously forested area has many socio-economic benefits for rural communities in Tanzania. Tanzania's national forest policy does recognize and encourage tree planting activities throughout the country (URT, 1998), however local governments have done little to promote tree planting at the community level. Currently, most of the reforestation projects within the country are run by NGOs or individuals with limited knowledge on reforestation. This is problematic as careful planning has been found to have a profound impact on the success or failure of reforestation projects (Halperin, 2002). As a result, it is recommended that reforestation projects in Tanzania be carefully developed through regular training provided by the local government to rural community members on the importance and proper techniques of reforestation. This training will help to create a culture of conservation at the community level, and help increase the survival rate of planted trees through the promotion of effective management.

**Short-term recommendations.** Perhaps the most immediate action that is needed to improve sustainable forest management in Tanzania is to enforce the sustainable production and use of charcoal. The national government of Tanzania has been largely unsuccessful in the



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enforcement of environmentally friendly practices related to the overconsumption of charcoal. As a result, there is a need to design and implement incentives that promote and speed up the adoption of fuel efficient technologies for charcoal producers and consumers. This is important as the use of fuel efficient charcoal kilns has been found to be helpful in reducing the amount of annual forest loss associated with the charcoal sector (World Bank, 2009). Moreover, it has been shown that utilizing fuel efficient charcoal stoves has several benefits to charcoal users and the forests (Stevens et al., 2019). Although a lack of incentives has been a barrier to the adoption of these technologies, it is recommended that the government of Tanzania along with NGOs develop incentives to limit the overuse of forests in relation to charcoal production and consumption. Such incentives could include lowering taxes or fees on fuel efficient charcoal kilns and charcoal bags. This would encourage charcoal producers and consumers to switch from traditional charcoal to more fuel efficient production and consumption.

Additionally, since charcoal is a significant driver of deforestation and forest degradation within Tanzania strategies to develop alternative energy sources are needed. Charcoal remains the main energy source for cooking among the majority of households in Tanzania as affordable alternatives are not widely available. As a result, it is recommended that the Ministry of Energy and Minerals (MEM) along with the MNRT develop policy strategies that support alternative biomass energy projects, and alternative energy sources. Alternative biomass energy projects can include investing in alternative briquette producers such as in Kenya and Uganda where briquettes from organic materials including maize cobs and sugar cane waste are being produced (Hall, 2018). These organic materials are plentiful among rural communities in East Africa including Tanzania, and have been found to burn longer and cleaner than charcoal (Hall, 2018). Additionally, there is the potential for urban biowaste such as grass/leaf packaging used to

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transport fruit and vegetables, and cardboard waste, to be transformed into solid fuel (Lohri et al., 2015). This would help limit the overconsumption of charcoal within Tanzania as well as help resolve municipal solid waste management issues. As for alternative energy sources, Tanzania needs to address the root cause of the problem by making alternative energy sources such as liquefied petroleum gas (LPG) and electricity comparably affordable and accessible (World Bank, 2010).

**Long-term recommendations.** In order to protect Tanzania's forest areas and resources, the government of Tanzania needs strong institutional and reliable governance systems that can manage the national and international demand for forest products. Unfortunately, Tanzania has issues surrounding corruption and misconduct practices among government officials involved in the management of forests (Davie, 2013). As a result, forests and forest resources continue to have limited protection and management, and governments in Tanzania earn little in return from their vast amounts of forest resources. Consequently, it is important for the MNRT to strengthen measures that will control corruption, misconduct practices, and limit the over extraction of forest resources.

One way to control corruption and misconduct practices in relation to forest resources is to improve forest control and monitoring systems, particularly among the local government through the use of advanced systems such as remote sensing, and information and communications technologies. These technologies should be employed in all forested areas in Tanzania, particularly those involving illegal logging operations as they have been found to be a reliable tool for forest governance monitoring. It has been shown that countries that have adopted these systems have experienced an increase in compensation for their forest resources, and have significantly reduced the frequency of illegal logging activities (Athanasiadis et al., 2013).

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Moreover, through the use of these technologies, it is possible to track the origins of logged timber products which has been found to add value as legal products can be recognized and located (Tzoulis et al., 2014). As a result, these systems if implemented correctly would help to improve forest governance in Tanzania by supporting the legal and sustainable logging of forest resources, and in turn help reduce deforestation and forest degradation on a national scale.

### **Project Limitations**

Several potential limitations exist within the study design that may affect the interpretation of the results. One limitation of this project is that it uses already existing data to evaluate sustainable forest management in Tanzania, and as a result does not collect any primary data. This limitation in data is important to recognize as secondary data can contain potential biases within the documents themselves, in the perspectives of the original researcher, and in the interpretation of the results (Bowen, 2007). Additionally, collecting data directly from Tanzania could further inform this project as interviews with local government officials and community members involved in sustainable forest management activities could provide further insights as to why current attempts to limit deforestation and forest degradation are not as successful as initially intended.

Another limitation of this project is that not all the information required to definitively and comprehensively evaluate Tanzania's forest protection policies and initiatives was found. A lack of adequate studies regarding forest policy and governance issues in Tanzania was a barrier as there were few studies that analyzed Tanzania's national forest policy in significant detail. As a result, this project used mainly reports from government departments, particularly the MNRT to evaluate Tanzania's national forest policy. Additionally, only documents that were available in

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English were used despite some documents from the government of Tanzania being available in Swahili, an official language of the country.

A final limitation of this project is that it focuses broadly on the multiple forest protection policies and initiatives that exist in Tanzania, as opposed to focusing solely on one specific policy or initiative. Specifically, within this project Tanzania's national forest policy, PFM, and REDD+ are all evaluated at a national level to determine if sustainable forest management is being achieved. Further research that focuses solely on either the national forest policy, PFM, or REDD+ has the potential to allow for a more in depth analysis of the chosen policy or initiative, and could potentially provide additional recommendations concerning sustainable forest management. Moreover, the issue of deforestation and forest degradation in Tanzania could be analyzed within a specific area such as southern Tanzania, which has been found to contain the largest area of unprotected forests in the country (Milledge et al., 2007).

### **Future Research**

There are many possible and important directions for future research that arise from my results. One important direction would be to further explore the role of incentives for local communities participating in sustainable forest management. Since the majority of rural communities in Tanzania depend on forests and forest resources for their livelihood, developing adequate incentives for these communities is essential for reducing deforestation and forest degradation and achieving sustainable forest management. While there have been efforts to provide incentives to local communities in Tanzania through both PFM and REDD+, these incentives are not yet enough to provide tangible benefits to the rural majority or adequately address the drivers of deforestation and forest degradation. As a result, more research is needed

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to explore better ways to advance and integrate incentives into the initiatives that promote sustainable forest management within Tanzania.

A second direction for future research is related to the monitoring and reporting of forest carbon stocks within Tanzania. Specifically, REDD+ was found to struggle with the monitoring of forest carbon as there is a lack of relevant data to set REDD+ baselines, and there is also a lack of technical capacity within the various agencies in Tanzania to carry out robust monitoring of carbon stock change (Lund et al., 2017). As a result, there is a need for further research that addresses the impact of deforestation and forest degradation on carbon storage across the many forest types in Tanzania. This research is important as if REDD+ is going to have any success in addressing climate change the technical capacity to monitor and report the changes in forest carbon is necessary.

A third direction for future research is to explore the economic implications of forest loss. In Tanzania, the rate of deforestation and forest degradation has serious economic implications for the country (WWF, 2015), however there has been little exploration into how Tanzania's economy will be impacted. As a result, future research that examines the economic implications of deforestation and forest degradation in Tanzania and how it will impact the growth of other sectors is necessary. This research is important as it could help better understand how investing in sustainable forest management has financial returns both in the short and long term. Moreover, this research could help influence government decisions towards limiting the overutilization of forest resources and supporting sustainable forest management.

A final direction for future research is to explore the issue of gender inequality in relation to deforestation and forest degradation. In Tanzania, women and men often have differing roles and responsibilities within the community resulting in different uses and relationships with the

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forest (Ruiz & Vargas-Silva, 2017). Frequently these relationships result in social and economic inequalities that exclude women (and other marginalized groups, such as the poor) from fully participating in and benefiting from PFM and REDD+ initiatives. As a result, a gendered analysis of deforestation and forest degradation in Tanzania can offer critical inputs as gender equality and women's empowerment within Tanzania are key catalysts to reducing deforestation and forest degradation and achieving sustainable forest management.

### **Conclusion**

This project uses the DPSIR framework to evaluate Tanzania's national forest policy, PFM, and REDD+. The results indicate that deforestation and forest degradation is still a significant issue within Tanzania as its forest protection policies and initiatives are inadequate in achieving sustainable forest management within the country. Specifically, Tanzania's national forest policy is not achieving sustainable forest management as it does not deal effectively with the current drivers of deforestation and forest degradation. PFM, specifically CBFM is moving towards sustainable forest management as a clear definition of rights and responsibilities exist, allowing communities to benefit from managing forests sustainably. However, specific barriers including a failure to properly incentivize forest-dependent communities, and a lack of extension services hinders PFM from adequately addressing the drivers of deforestation and forest degradation. REDD+ struggles just like PFM in addressing the drivers of deforestation and forest degradation, but also introduces new challenges concerning the monitoring and sale of forest carbon. Consequently, REDD+ is not achieving sustainable forest management in Tanzania as it remains a top-down approach to dealing with the challenge of deforestation and forest degradation. Ultimately, evaluating these forest protection policies and initiatives can help current forest management within Tanzania become more effective in managing the country's

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vast forest resources. This is important as knowing how to properly manage forests is critical in a time when climate change is becoming more severe, and when local livelihoods are dependent on the use of these forests and forest resources.

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