

**ECONOMICS OF ECOSYSTEMS AND BIODIVERSITY
IN TANZANIA: THE CASE OF SOUTHERN
HIGHLANDS OF TANZANIA**

**DRAFT FINAL SCOPE FINALIZATION AND
SCENARIO DEVELOPMENT REPORT**

26th February 2020

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1.0 INTRODUCTION

1.1 Project Background

The UN Environment, with the support of the International Climate Initiative (IKI), have launched a three-year project (January 2017-December 2019) to support biodiversity and climate friendly land management in agricultural landscapes in four countries of Colombia, Kenya, Tanzania, and Thailand. Building upon The International Economics and Ecosystem Baseline (TEEB) initiative i.e. TEEB country studies particularly in the Rufiji River Basin which was conducted by Institute of Resource Assessment (IRA) in Tanzania between 2015 and 2017, the new study on TEEB for Agriculture and Food (TEEBAgriFood) is a follow up of the previous TEEB project which is of national interest through the Vice President’s Office (VPO) for Tanzania. Different Key Ministry sectors, institutions, organizations and NGOs will be involved in the TEEBAgriFood project as it will inform cross-sector policies for natural resources management, especially in relation to agriculture, artificial forestry, water resources and wildlife.

1.2 Description and Location of Southern Highlands of Tanzania

The Southern Highlands of Tanzania is a highland region in the southwestern part of the country at the northern end of Lake Nyasa and include portions of Iringa, Mbeya, Njombe, Rukwa, Ruvuma, and Songwe regions (**Figure 1**). These highlands comprise a number of plateaus and volcanic mountains including Rungwe, Poroto Mountains, Kitulo Plateau, Kipengere Range, and Livingstone Mountains. The eastern and western branches of the East African Rift Valley converge in these

highlands, whereby the Western Rift Valley continues south as the valley of Lake Nyasa.

1.3 Justification for the Project

Communities in the Southern Highlands particularly in Njombe, Iringa and Mbeya regions have for the last 30 years or so, been highly motivated to engage in plantation forestry at an unprecedented rate, such that this land use is competing with other land uses including agriculture, livestock keeping and natural resources conservation in particular natural forests and water. Most of the tree species planted in particular pines and eucalyptus are for commercial purposes (timber and poles). However, the actual and potential impact of such a rapid transformation of land use to the environment is not clearly known.

This study is intended to determine the current potentiality of land use



Figure 1: Map of Tanzania Showing Location of the Southern Highlands Regions

(e.g. crop production, pines and eucalyptus forestry, livestock raring, wildlife/biodiversity conservation) and evaluate the effects of such land use/cover and predict future changes and impacts employing the TEEBAgriFood Framework approach

1.4 Objectives of the Project

The project's overall objective is to mainstream the values of nature in decision-making by highlighting the several trade-offs made in land-use decisions, including hidden and often invisible contributions of nature to agricultural production, both positive and negative impacts of agriculture on biodiversity, human health, and other links of agricultural systems with communities and ecosystems. Subsequently, the project will provide policy strategies and engage with government and other stakeholders to guide the research scope and to report on findings and make recommendations.

The specific objectives therefore are:

1. Engage with diverse stakeholders at different times during the project implementation.
2. Undertake biophysical data collection/measurements on: land use/cover change; soil fertility, structure and suitability for agriculture; soil erosion & sedimentation; water quality & quantity; water consumption coefficients of planted tree/crop plants; and carbon sequestration/greenhouse gas footprint.
3. Undertake socio-economic data collection/measurements on: local and national food security; livelihoods and incomes; economic impacts to communities; value chain impacts to agro-processors, distributors or input suppliers.
4. Undertake analysis of: remotely sensed data; qualitative data; ecosystem service values; and scenario mapping of carbon/GHGs footprints.

5. Undertake policy review and engage with the Government following project implementation and recommendations.

2.0 CONCEPTUAL FRAMEWORK

The Southern Highlands of Tanzania at more than 1,600 meters above sea level (masl) and formed 3,250 million years ago (Cribb and Leedal, 1982; Kerfoot 1963-64a; Chapman and White (1970) were largely covered by I) Mountain Grasslands dominated by grasses (White 1983). This preponderance of this vegetation community is commonly attributed to the high frequency and extent of range/wild fires, which swept the eco-region grasslands for centuries, continuously eroding the margins of the once abundant Afromontane forests (White, 1983; Dowsett-Lemaire, 1989).

The dominant grass species in this vegetation type are *Loudetia simplex*, *Exothea abyssinica*, *Monocymbium cerasiiforme*, *Themeda triandra*, *Andropogon* spp., *Pennisetum* spp., and *Setaria* spp. (White 1983; Chapman and White 1970; Cribb and Leedal 1982). A number of herbs, sedges, and geophytes also occur within the grassland community (Kerfoot 1963-64a), as well as the occasional fire-resistant shrubs, usually of the genus *Protea* (White 1983). In areas of impeded drainage, permanent and seasonal bogs known as *dambos* may be found, dominated by grasses and sedges with remarkably abundant species including orchids (Cribb and Leedal 1982; Kerfoot 1963-64a).

Several other vegetation types are set within the mountain grassland matrix, the most prominent of which is the Afromontane forest, mainly confined to fire-sheltered pockets, moist escarpments, valleys and watercourses (Chapman and

White 1970; Kerfoot 1963-64a, Dowsett-Lemaire 1989). Afromontane forests are often characterized by epiphytes and lianes. Some of the dominant tree and shrub species include, *Parinari excelsa*, *Podocarpus latifolius*, and *Syzygium guineense* (Chapman and White 1970; Dowsett-Lemaire 1989; Kerfoot 1963-64a, White 1983). The most common constituents of the herbaceous layer are species of the family Acanthaceae, and of the genera *Impatiens*, *Begonia*, *Streptocarpus*, *Plectranthus* and *Peperomia* (White 1983; Dowsett-Lemaire 1989; Kerfoot 1963-64a). A fringe of smaller trees and shrubs, usually pioneer species, often surrounds forest patches, the width of which varies according to its exposure to fire (Chapman and White, 1970; Kerfoot, 1963-64a).

Lastly, the lower reaches of the Southern Rift montane areas (between 1,200 to 1,800 m) are often occupied by vegetation associated with the miombo including *Brachystegia*, *Julbernardia*, and *Isoberlinia* (Cribb and Leedal 1982).

Until the 1970s the main use of these grasslands was traditional livestock grazing. By the 1980s these ecosystems had come under rapid pine forestation (including eucalyptus species) by local communities including both farmers and livestock keepers, transforming the ecosystem into artificial forests. This was quickly followed by further transformation of some of the remaining grasslands into croplands for round potatoes, maize and beans and sometimes wheat and green peas for both commercial and subsistence purposes, thus slowly squeezing out free-ranging livestock rearing. This mixed land use change is believed by both ecologists and hydrologists to have led to dramatic shrinkage of mountain grasslands and wetlands which are associated with drying up of formerly perennial rivers and streams during the dry season and heavy flooding during the rainy

seasons. This is viewed as an indication of increased surface runoff and erosion and reduced recharge of groundwater systems within the ecosystem. The theory behind this assumption is the natural grasslands comprised a thick mat of live and dead grass that trapped most of the rainfall allowing it to slowly percolate down into the soil and further into the ground reserves with minimal or no significant surface run off. The coming of pine plantations greatly changed the characteristics of the vegetation cover which become more open and even bare encouraging more surface run-off.

Thus, developing scientific knowledge of the relationship between land uses/cover and ecosystem services change, such as water quality and quantity, food productivity and food security, as well as impacts to wildlife and biodiversity is the core objective of this study. Once those relationships are quantified, comparisons can be made among different future scenarios that will be determined by historical patterns of change and government consultations regarding future plans and policies.

The study shall therefore, quantify trade-offs between land use/cover scenarios and include policy recommendations to sustainably maximize benefits and mitigate the most significant trade-offs. The research team will also provide a policy strategy and will engage with government decision makers and other stakeholders to guide the research scope and to report on findings and make recommendations.

3.0 SCOPE FINALIZATION

In developing the project and implementation modalities, particularly on how and where this project will be implemented, an inception workshop facilitated by the

Vice President's (VPO) and UNEP was convened in Dodoma with participants from key sectors and institutions on May 2018. After the inception workshop and consultations, a technical committee met in August 2018 to determine and agree on the study scope, geographic boundaries, agricultural sectors, stakeholders and related agricultural policies as well as initiatives to be evaluated using the TEEBAgriFood Framework.

During the Dodoma inception workshop and subsequent follow-ups, it was decided that TEEB Country study inform land use policies in the Southern Highlands of Tanzania, which are critical for Tanzania's development, particularly as they relate to food and water security. Many projects that relate to agriculture and water as part of the Big Results Now (BRN) initiative and SAGCOT program are largely planned in these Southern Highlands. While there are potentials for competing water and land uses in the area, activities such as forestation of mountain grasslands and replacement of natural forests with pines, planned dam construction for power generation, wildlife conservation and commercial irrigation farming could have varied implications on water availability and use, and sustainable development in general. Hence the selection of the Southern highlands for the implementation of this study.

Within the Southern Highlands, a Private Forestry Programme (2017) estimated 207,000 ha of currently planted forests, covering approximately 1% of the study area. However, more than 70% of the plantation area is located outside the large government and company-owned plantations, suggesting the significant potential of smallholder woodlots which is fast being adapted (ibid). The majority of the forest plantations within the study area were located in Njombe (89,843 ha) and Iringa (85,919 ha) regions. The districts with the largest plantation areas are

Mufindi (52,558 ha), Makete (27,696 ha) and Njombe Urban (25,882 ha). It is for this reason that the TEEBAgriFood project is confined to catchments of Iringa, Njombe, and Mbeya regions, specifically within the Great Ruaha River Sub-catchment of the Rufiji River Basin.

4.0 ZONATION AND CURRENT MANAGEMENT OF THE STUDY AREA

Zonation of the study area is largely based on altitude from the sea level. The land elevation within the Great Ruaha River Basin (including the Little Ruaha Sub-Basin) ranges from 800 m to approximately 3000 m (Field measurements, 2019) with the highest point on Mt. Rungwe (approx. 2,981 masl). Differences among these zones and how they are currently managed is further elaborated in the following sub-sections.

4.1 The Mountain Highlands Zone

This zone is characterised by the Livingstone-Kipengere and Uporoto mountain ranges, including the central part of Njombe District, Wangingombe District, areas south of the TANZAM (Makambako to Mbeya) Highway, as well as parts of Mufindi District at an altitude of 1,600 – 3,000masl. The zone also includes Makete District and the southern part of Mbeya Rural District (**Figure 2**). Temperatures are normally below 15°C, with rainfall ranging between 1,000 to 1,600 mm per annum, falling in a single season from November through May. The dry and cold season occurs after the rain season, and it lasts from June to September (URT, 2013).

This zone constitutes the main sources of the Great Ruaha River (GRR) whereby a number of tributaries originate from the mountain grassland areas of Livingstone-Kipengele, Kitulo Plateau and Uporoto Mountains (**Photo 1**). Some of the most

significant tributaries (in terms of water discharge) include the Mbarali, Kimani, Ruaha or Ikuwo, and Misi or Chimala rivers. Others include the Ndembela, Madibira and Little Ruaha Rivers from Iringa Plateau. Almost all these rivers (except the Little Ruaha river) drain into the Ihefu (East) swamp. Minor sources of the Great Ruaha are the Uporoto Mountains draining into the Western Ihefu swamp via the Mpolo River. Unlike the rest of the Great Ruaha tributaries, the Mpolo originates from forested mountains and not Grassland Mountain.

Interpretation of the print lay downs dating back to 1948 and 1956 (photographs taken by the Royal Air Force of the British Government), shows that these areas (Livingstone-Kipengele, Kitulo Plateau and Uporoto Mountains) were traditionally covered with woodland,



Photo 1. Showing the Livingstone-Kipengele Mountains in Njombe Region

bushland, some scattered trees but largely with mountain grasslands.

Recent field observations showed that this region is fundamentally changed. It is now covered by relatively small patches of natural vegetation (forest/grasslands especially in some parts of Makete District



Photo 2: Typical Mountain Grasslands in Kitulo National Park

including the Kitulo Ranch and Kitulo National Park and Uporoto Forest Reserves the latter in Mbeya Rural, but largely dominated by forest plantations, mainly comprised of *Pinus species* (see **Photo 3**). Njombe and Iringa Regions are said to be the largest producers of soft timber in Tanzania (URT, 2013).



Photo 3: Typical Pinus Forest/Grasslands in Mufindi District (Mafinga area)

According to the local communities in these areas, almost 50% of the land in this zone is currently under cultivation of round potatoes as the principle crop for both food and cash. Njombe region is one of the biggest suppliers of round potatoes in the country, supplying over 75% of the produce in Tanzania. Other crops grown in smaller quantities include maize, fruits, wheat, vegetables, beans and peas. Around the mid-1990s and early 2000, crops such as pyrethrum were grown by almost 70% of farmers. However, due to lack of market, many farmers have withdrawn from this type of farming. On the other hand, in the years after 2000, horticultural particularly cultivation of apples and avocados has lately been a popular activity undertaken by almost every household (**Photo 4**). The area has immense opportunities for horticulture and companies like ARURE Flowers (local investor) and PRO-ECONOMY (International Investor) are already actively involved in this

area. Large-scale horticultural production for exportation is an opportunity in this area at the Regional level.



Photo 4: Showing Conversion of Pine Plantations into Croplands

Livestock keeping is a least activity undertaken in this area (about 5% of the land) because many grazing areas have been converted to other land uses such as crop cultivation and tree plantations (see above). Although communal livestock grazing areas have been specifically designated, they are said to be not respected as they are encroached upon by agriculture and settlement. The important animals kept are mainly oxen of local breed (*zebu*), specifically for ploughing the land and a few cows for milk. Other animals include goats, sheep, pigs and chickens.

4.2 The Midlands Zone

This zone includes the Usangu plains (i.e. Mbarali District which borders the Great Rift Valley, and also parts of Wanging'ombe District (Iringa region), as well as some parts of Kilolo and Iringa Rural Districts (Iringa Region) at an altitude between about 800 and 16000masl. It is in this zone that the Ihefu swamps are located and is from which the Great Ruaha River actually starts and traversing the Ruaha National park, and flows into the Mtera man-made reservoir before receiving the Little Ruaha River.

The Usangu Plains are a major paddy production area in Tanzania largely because of availability of extensive plains suitable for extensive agriculture and ample water from the Highland zone area for irrigation. According to Kashaigili et al. (2006), the Usangu Plains below 1,100masl are characterized by fans and Wetlands dominated by vertisols soil. The fans are alluvial deposits spreading from the base of the mountains onto the Usangu Plains. The natural vegetation in these areas comprises thorny woodland and wooded grassland, while the fans are fertile and largely cleared for cultivation. The Usangu Wetlands, located below the fans, comprise of the Western and Eastern Wetlands, which are divided by higher ground in the center of the Usangu Plains and joined only by a narrow band of land along the Great Ruaha River. The Western Wetland comprises seasonally flooded areas, which are not contiguous but broken into a number of independent wetlands. The Eastern Wetland comprises seasonally flooded grassland and a perennial swamp (mbuga or Ihefu). The Usangu Plains are thus drained by the Great Ruaha River, at a point where a rock outcrop acts as a natural dam controlling the flow from the Eastern Wetland.

Within the Usangu Plains, the dry season is a water-scarce period associated with conflicts and disputes over access to water. During this season, villagers along the rivers downstream of irrigated areas, divert water for various uses including domestic supply, irrigation and brick-making. Dry season irrigation is much less than wet season irrigation. It is estimated that it covers only about 2,500ha (SMUWC, 2001b). However, increasingly, rice farmers are planting before the start of the wet season in an attempt to meet early season. In this zone, agriculture was also reported by local communities to be the main activity undertaken by many people. Other crops include maize, groundnuts and vegetables.

Beef livestock keeping by traditional pastoralists is another activity noted to be pursued in the midland area especially of the Usangu Plains though by very few people. Thus, livestock numbers are relatively low. Dry-season flows are particularly problematic in this zone since during the early nineties, a series of zero flows in the GRR were recorded, alerting the Government Authorities about the possible hydrological and environmental changes in the Usangu Plains and upper catchments. The Usangu Basin covers an area of 21,500 km² forming the headwaters of the GRR. On average the Usangu Plains receives 600-800mm annual rainfall-all this rain falling in one season from around November to May.

4.3 The Lowland Zone

This Zone mainly along the Little Ruaha Catchment mostly refers to parts of Iringa District (Idodi and Pawaga Divisions). It is characterized by low mean annual rainfall of about 500–600mm, and temperatures of about 20–25°C. The Zone is semi-arid or commonly known as the marginal area, due to low mean rainfall which range

The zone has very rich soils suitable for agriculture but the agricultural production level is low due to unreliable rainfall. Therefore, farmers depend mainly on irrigated farms along the Little Ruaha River using traditional and improved schemes and canals. Crops grown in this zone include paddy, cotton, millet, cassava, groundnuts, bananas, onions, tomatoes and fruits such as mangoes, oranges and pawpaw.

Table 1: Irrigation Schemes along Little Ruaha River in Iringa District

Ward	Name of irrigation scheme	Type of grown crops	Time for Irrigation
Kalenga	Ibangamoyo	Maize, tomatoes and vegetables	Dry season
	Cherahani Mkoga	Maize, tomatoes and vegetables	Dry season
Ulanda	Mangalali	Maize, beans and vegetables, and tobacco	Dry season
Nzihi	Mlambalasi	Paddy, maize, beans and vegetables	Dry season
Kiwere	Mgela	Paddy, maize, beans and vegetables	Dry season
Mlowa	Mafuruto (148 hactares)	Maize, paddy and groundnuts	Dry season
Idodi	Luganga scheme (Magozi, Mlenge and Mkombozi villages)	Rice and maize	Rain season irrigation

Source: IRA and SUA survey Team, 2019



Photo 5: Water pumping and Intake for irrigation along Little Ruaha River in Iringa district. Source: IRA and SUA survey Team, 2019

5.0 SELECTION OF CATHMENT STUDY SITES

Catchment and site selection for further studies in the Mountain Highlands, Midlands and Lowlands was partially facilitated by the relevant district authorities, particularly Forestry staff who knew the areas well and directed the research team to potential sites. A Hand Held Global Positioning System (GPS) was used to locate and map the current situation on the ground in terms of land use/cover. The position (x, y Coordinates) will be integrated with remote sensing data for image interpretation and classification.

The selected Catchments for the study are: (1) the Little Ruaha River Catchment; (2) the Mbarali River Catchment; (3) the Misi/Chimala River Catchment; and (5) the Kimani River Catchment (**Figure 3**). These catchments will be studied in detail across the zones as described in Sub-sections 5.1 to 5.3 below.

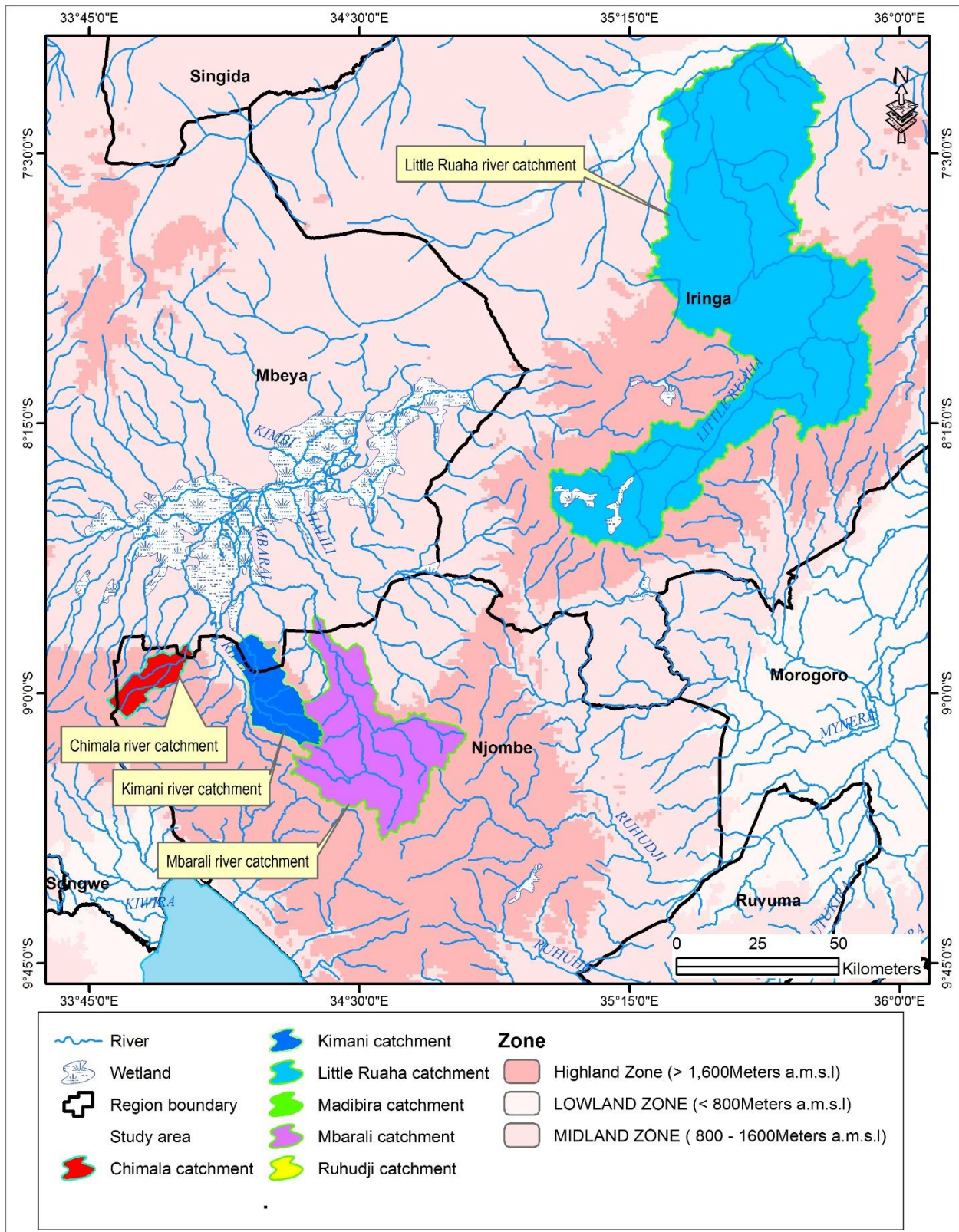


Figure 3: Selected River Catchments for the Detailed Study (Source; IRA GIS).

5.1 Mountain Highland Zone

In the Highland Zone, potential areas for detailed study sites include Sao Hill forest plantations and nearby wetlands (**Photo 6**); a site within the highland water sources of the Mbarali river along the Njombe /Makete road; Matamba village and Kitulo ranch and Kitulo National Park the headwaters of the Misi/Chimala (**Photo 7**).



(a)



(b)

Photo 6: Proposed Potential Study Sites: (a) Kitulo Ranch in Makete District and (b) Mafinga Wetlands, the source of the Little Ruaha River

5.2 Within the Midland Zone

In this zone sites identified include downstream the Mbarali river (Mbarali irrigation scheme area and Ihefu East); and downstream Misi/Chimala river (Kapunga irrigation scheme).

5.3 Within the Lowland Zone

In this zone, study sites may include either Pawaga and Idodi Divisions or both.

5.4 Conclusion

Thus, the study will evaluate land use change and biophysical measures within the 4 catchments which all feed the GRR. Also, the extent of a number of impacts will be measured and evaluated. Such impacts include:

- Soil erosion
- Soil sedimentation
- Downstream river/stream discharge
- Crop productivity/production
- Timber/poles production
- Livestock/wildlife performance

Only people living within these catchments? Impacts to communities near the catchments? How far away?

6.0 POLICY AND LEGISLATIVE FRAMEWORK FOR ECOSYSTEM USE AND MANAGEMENT

6.1 Introduction

This study examines the Economics of Ecosystems and Biodiversity (TEEB) for Agriculture and Food (TEEBAgriFood) and compares food-system value chains of alternative scenarios for land use and management within the Southern Highlands of Tanzania. One of the key aspects of this study is to determine the policy focus by engaging with representatives from various Ministries, Local Governments, Non-Governmental Organisations, and complementary research projects. This is because, to a large extent, what is happening in the Southern Highlands, and indeed in the whole of the country and the changes that we see have their root cause in the policies that are being developed and implemented; policies originating locally, nationally, regionally or with international influence or a combination of all that. To this end, an initial stakeholder consultation was undertaken in the month of November 2019 to identify the various current policies implemented in the Southern Highlands, the challenges thereof and future policy directions.

6.2 The Relevant Policy Issues

Below in Table 2 is a summary of the key emerging policy issues related to the various programmes and activities several stakeholders are implementing in the Southern Highlands of Tanzania. This summary is based on the consultations conducted in Dodoma.

Table 2: Matrix of Activities, their Policy Support and Key Issues to be considered

Name of Staff	Position	Institution/Ministry	On-going activities in the Southern Highlands	Relevant existing policy and laws that support current initiatives	Issues of concern
Ms. Kemilembe Mutasa	Acting Director of Environment,	Vice President's Office	<ul style="list-style-type: none"> • Implement a programme to plant 1 million trees across the country every year • Promote planting of tree species that are friendly to the environment • Support SAGCOT initiatives • VPO implemented a program to address challenges facing the Ihefu wetland 	<ul style="list-style-type: none"> • National Environmental Policy of 1997 that promotes tree planting • National Climate Change Strategy, 2012 • National Adaptation Program of Action, 2007 • Environmental Management Act 2004 	<ul style="list-style-type: none"> • Population influx in the Southern Highlands causing pressure on natural resources • Increased use of agrichemicals with its effect on soil and water quality • Increased demand on water for irrigation and other uses causing excessive pressure on water resources • A shift of land use to planting fast growing tree species that demand more water • Short term economic gains driving changes on land use to tree growing. • Influx of livestock keepers in the Southern Highlands marginal areas
Mr. Thomas Chali	Acting Assistant Director of Environment	Vice President's Office			
Eng. William Christian	Assistant Director, Designing and Construction,	Ministry of Water and Irrigation.	Provision of water for domestic and industrial uses	Water Policy 2002, which s under review Water Act 2019	<ul style="list-style-type: none"> • More emphasis in water supply with little attention on conservation of water catchment area • Tree planning is good but the question is what types of trees are planted? • Ministry of Water is rarely involved in the choice of trees to be planted • Research is needed before any tree species are planted in particular area • The concern about some tree species consuming more water is simply a matter of which species and where they were planted?
Prosper Buchafu	Acting Director, Policy and Planning.	Ministry of Water and Irrigation.	Provision of water for domestic and industrial uses		

Name of Staff	Position	Institution/Ministry	On-going activities in the Southern Highlands	Relevant existing policy and laws that support current initiatives	Issues of concern
					<ul style="list-style-type: none"> • Some tree species may protect water sources more than others. • Forest related industries do not utilize all aspects of tress thus leading to looses • How are different land uses allocated; do we consider long-term impacts?
Emilian Nyanda	Acting Head, Environmental Unit	Ministry of Energy	<ul style="list-style-type: none"> • Promotion of energy development projects – including renewable energy • Promote mini-hydros where management of catchment is easy • To ensure there is sustainability of energy generation 	National Energy Policy, 2003	<ul style="list-style-type: none"> • Inadequate use of renewable energy • Climate change may affect most hydropower stations • Encroachments to water sources affecting energy generation • Land conversion has negative effect to energy generation – hydropower • There are several mini hydros in the Southern Highlands that may be affected • Concerned about how to maintain sustainable energy generation • Inadequate integrated planning • Poor coordination among sectors • Inadequate empowerment of Env. Units in each sector • MNRT’s focus on commercial tree planting is not prioritising renewable energy
Dr. Ezekiel Mwakalukwa	Director – Division of Forest and Beekeeping	Ministry of Natural Resources and Tourism	Promoting Private Forest Programme – a program to plant trees on commercial basis	<ul style="list-style-type: none"> • National Forest Policy, 1998 • The Forest Act, 2002 • The Forest (Sustainable Utilization of Logs, Timber, Withies, Pals Charcoal) Regulations, 2019 	<ul style="list-style-type: none"> • Demand for forest product is increasing • Mainly supplier of forest products ha remained state/few private plantation • Previous community forest programs did not contribute to major changes • Private Forest Program largely donor funded
Deusdedit Bwoya	Assistant Director, Forest Development	Ministry of Natural Resources and Tourism			

Name of Staff	Position	Institution/Ministry	On-going activities in the Southern Highlands	Relevant existing policy and laws that support current initiatives	Issues of concern
Emmanuel Msoffe	National Program Coordinator	Ministry of Natural Resources and Tourism			
Amosy Kulwa Zephania	Director of Planning	Ministry of Livestock and Fisheries	<ul style="list-style-type: none"> • Support livestock keeping in Southern Highlands • 	<ul style="list-style-type: none"> • National Livestock Policy, 2006 • Livestock Sector Development Programme, 2011 • Tanzania Livestock Master Plan 2018-2023 	<ul style="list-style-type: none"> • Most land use plans do not designate livestockkeeping areas from farms • Most land use plans are based on detailed assessments of current and future needs – e.g. how many hectares are set aside for how many livestock etc • Inadequate institutional coordination among sectors working in the same areas • There is need for a national wide land use plan in which areas will set aside for livestock and other uses to avoid conflicts • Land Act 1999 does not address tenure rights for livestock keepers • Ministry of Lands, Housing and Human Settlement is focusing much on land use plans for settlements and does very little for issues such as land use for livestock keepers and others • Inadequate efforts to adopt holistic approaches when addressing natural resource challenges
Prosper Makundi	Acting Head, Environmental Management Unit (HEMU)	Ministry of Agriculture and Cooperatives	<ul style="list-style-type: none"> • Promoting agricultural production in Southern Highlands • Supporting programs that increase food and cash crop production • Strive to achieve food self sufficiency • Support cultivation of avocado and other horticultural products. 	<ul style="list-style-type: none"> • National Agricultural Policy, 2013 • Agricultural Sector Development Programme – Phase 1 & 2 (2006- to date) • Tanzania Development Vision 2025 • The National Strategy for Growth and Reduction of Poverty 1& 11 • Agricultural Sector Development Strategy 	<ul style="list-style-type: none"> • Concerned about expansion of tree growing in SH and its effect on water and agricultural land for food crops • Trees growing may reduce the amount of water that percolates down. • Weak institutional collaboration and collaboration • Tree growing in upland areas may push people to encroach marginal areas and cause land degradation • Climate change affecting water availability which affect crop production

Name of Staff	Position	Institution/Ministry	On-going activities in the Southern Highlands	Relevant existing policy and laws that support current initiatives	Issues of concern
			<ul style="list-style-type: none"> • Support improved agriculture using irrigation and modern technologies 	<ul style="list-style-type: none"> • Kilimo Kwanza • Tanzania Agriculture and Food Security Investment Plan 	<ul style="list-style-type: none"> • Governance issues especially inadequate enforcement of laws is a problem in the management of natural resources • Encroachment into catchment areas, • Soil erosion • Lack of national land use plan that would designate various land uses even at a general level to avoid land use conflicts
Martin Mwakalindile	Agricultural Officer	Ministry of Agriculture and Cooperatives			
Firmaj M. Banzi	Principal Agricultural Officer (Soils Science)	Ministry of Agriculture and Cooperatives			
Marco Jacob Ndonde	Director General	National Irrigation Commission	<ul style="list-style-type: none"> • Support development and operation of irrigation infrastructure to boost agriculture production 	<ul style="list-style-type: none"> • National Agricultural Policy, 2013 • Agricultural Sector Development Programme – Phase 1 & 2 (2006- to date) • Tanzania Development Vision 2025 • The National Strategy for Growth and Reduction of Poverty 1& 11 • Agricultural Sector Development Strategy • Kilimo Kwanza • Tanzania Agriculture and Food Security Investment Plan • National Irrigation Policy, 2010 • The National Irrigation Act, 2013 • The National Irrigation Act (Irrigation Regulations, 2015) • Aims to expand irrigation to 1 million hectares by 2035 	<ul style="list-style-type: none"> • Increased soil erosion that will affect irrigation infrastructure where land use is changed without adequate plans • Land use conflicts will increase where land is converted to something not compatible with the rest of land uses • Expanded tree growing in the SH will need Irrigation department to rethink about how to proceed because tree planting will have effect on water supply • Inadequate financial support hampers expanding irrigation farming. For example, the Commission will need 592 Billion Shillings to irrigate one million hectares • Inadequate extension services, especially on irrigation technologies and agronomy to ensure farmers and livestock keepers benefit more • Inadequate supply of better seeds to the farmers

Name of Staff	Position	Institution/Ministry	On-going activities in the Southern Highlands	Relevant existing policy and laws that support current initiatives	Issues of concern
					<ul style="list-style-type: none"> • Inadequate research that addresses farmers livelihood and how these could be improved • Inadequate expansion of irrigation activities - currently limited to paddy farming • Poor application of what has been taught to the farmers • Inadequate collaboration between Irrigation Commission and other departments including forest.

6.3 Private Forest Programme

Private Forest Programme (PFP) or “*Panda Miti Kibiashara*” as it is known in its Kiswahili name is perhaps the largest government led initiative to encourage private sector to plant trees on commercial basis.

The genesis for this programme is the earlier programmes such as the Community Forest Programmes of the 1970s including the various versions of the Participatory Forest Management and studies such as the National Forest Research Management (NAFORMA in 2015). Most of suitable land for trees plantations is under village jurisdiction; tree planting as state run and managed; seedlings were given for free and thus not well taken care of; there was inadequate follow up and no backward-forward linkages were created in the sub sector in order to add values.

Whilst this was going on, demand for softwood products was growing in Tanzania, although it was until recently being met by government managed forest resources, a major reduction in the supply of soft wood products has been noted in the last eight years or so.

Several studies were carried out to help find a solution to this problem and studies that were conducted in 2006/7 came up with the suggestions

to promote private tree planting in the Southern Highlands, Lake Zone, Arusha/Kilimanjaro and Central Zone.

The PFP initiative has been taken to address that gap in the supply of soft wood. The Tanzania PFP aims to increase the supply of soft wood products, raise rural incomes in target areas, which include nine districts in the southern highlands and Kilombero. The PFP is intended to reduce poverty and inequality by developing sustainable plantation forestry management, add value to the forest value chain and create employment.

PFP aims to support a range of intervention including participatory and sustainable land use planning; organizing tree growers into Tree Growers Associations (TGAs); capacity development of tree growers; support establishment of plantations; strengthen plantation management and extension services and improved industrial services of medium and small microenterprises (SMEs).

The PFP started in SH due to availability of conducive climate for pine and eucalyptus tree growing, availability of open land (grasslands) and water. After the SH, the PFP will move to the Lake Zone – Kahama and Mara.

6.3.1 PFP Status in the Southern Highlands

The programme is now running into its second phase that started in November 2019. There are more than 12,000 ha of tree farms while the target is to have 14,000ha of soft wood tree farms. Thus, local farms are expanding and more land is being put under pine and eucalyptus trees.

The Forest and Beekeeping Department is providing technical support, seeds (for 0.5ha) and support to establish trees seeds. Currently 8 trees seedling nurseries have been established and are owned by local communities and Tanzania Forest Services (TFS). Under the PFP, the government is working as facilitator while the TGAs determines prices and looks for markets; and facilitates land use plans. There are at the moment about 59 land use plans developed in the SH where PFP is operating. There is an apex body of TGAs that serves as a platform bringing together over 96 small groups with over 10,000 members. The FBD is enforcing keeping water catchments out of the PFP in order to preserve water sources. However:

- Grassland biodiversity is not prioritized, hence the continued clearance of mountain grasslands
- Mountain Grassland birds and related wildlife could be threatened by the changes

- Food security is threatened as more (crop) land is converted into tree plantations
- Both water quality and quantity is compromised

Phase II of the PFP is focusing on capacity development for forest management, firefighting, improving SMEs, strengthening the apex body of TGAs, and supporting forest and wood industries training at Mafinga. Plans are also underway to offer mobile training facilities in order to reach out to more remote rural areas and complete land use planning where these are yet to develop by-laws to govern and enforce approved land use plans.

6.3.2 Institutional collaboration

According to FBD, there is collaboration with local governments although more need to be done to improve this. However, there is limited collaboration with water associations, as PFP tends to work more closely with regional secretariats. The matrix Table 2 above lists several concerns raised by different stakeholders regarding this initiative and in particular with regard to collaboration and integrated planning.

6.4 Other Emerging Tree Planning Trends

There is currently an increasing shift in land use from crop/pines to avocado fruits planting for commercial purposes. This emerging trend is in response to economic desires for quick returns from land investments

compared with planting pines or eucalyptus trees that may take slightly longer to harvesting.

The short or long-term implications of this shift is yet to be understood but is critical that this change is adding yet another dimension on the land use conversion that is of interest to TEEB research. Cost/benefit assessment as well as agronomical and environmental assessment will be essential to provide insights into the short and long term implications on water, land, environment, economics and downstream changes of this new initiative vs pine and eucalyptus trees.

6.5 Policy Implications

The Table 2 matrix suggests several policy issues that call for further analysis. For example, the PFP as the largest private sector tree initiative is being questioned by various stakeholders with regard to its long-term implications on land use, water and natural resources in the SH in general and in the downstream areas of the Ruaha, Kilombero and Rufiji Rivers. These issues need to be addressed through policy decisions based on research. Also, issues related to collaboration between and among stakeholders are a matter of concern and will require policy decisions on how to strengthen and enforce effective collaboration that will minimize land use conflicts and degradation.

The promotion of the PFP and the emerging gradual shift to fruit trees growing is above all, an economic undertaking. Any policy change will have to address the opportunity cost of the created changes, which should ensure participants in the PFP and any other initiative are not losing out or being marginalized.

Similarly, the SH being a critical geography in terms of water supply to downstream areas in terms of agriculture, energy and domestic uses as well as a key food production zone in Tanzania, any development in the SH will need careful policy and planning processes in order to ensure a win-win situation is arrived at. Many of these issues will be further addressed in the next rounds of analysis.

7.0 ECOSYSTEM SERVICES FOR SCENARIO ANALYSIS IN TEEB PROJECT

7.1 Highland Mountain Area

1. Provision of food:
 - change in livestock (cattle) numbers
 - changes in crop (avocado, potatoes) production (e.g. tons or monetary)
2. Provision of raw materials:
 - change in availability of timber and poles (in volume m³, coverage e.g. ha or monetary)
3. Carbon sequestration:

- change in levels of stored carbon (tons/ha)
 - levels of avoided emissions (CO₂Equivalent)
4. Soil erosion and fertility:
- Nutrients contents and soil organic matter
 - Soil structure
 - change in extent of bare land (ha or km²)
 - change in erosion rates in tons/km²
5. Biodiversity:
- change in biodiversity levels (species richness and the Shannon-Wiener Diversity Indices)
6. Provision of fresh water:
- change in river flow (m³/sec); sediment transport

7.2 Midlands Area

1. Provision of food:
- changes in crop (avocado, potatoes and tea) production (e.g. tons or monetary)
 - change in livestock (cattle) numbers
2. Provision of raw materials:
- change in availability of timber and poles (in volume m³, coverage e.g. ha or monetary)
3. Carbon sequestration:
- change in levels of stored carbon (tons/ha)
 - levels of avoided emissions (CO₂Equivalent)
4. Soil erosion and soil fertility:
- Nutrients contents and soil organic matter
 - Soil structure
 - change in extent of bare land (ha or km²)

- change in erosion rates in tons/km²

5. Biodiversity:

- change in biodiversity levels (species richness and the Shannon-Wiener Diversity Indices)

6. Provision of fresh water:

- Change in river flow (m³/sec)
- Change in extent of bare land (ha or km²) or erosion rates in tons/km²

7.3 Lowland Area

1. Provision of food:

- change in livestock (cattle) numbers
- changes in crop (paddy, maize) production (e.g. tons/annum or monetary)

2. Carbon sequestration:

- change in levels of stored carbon (tons/ha)
- levels of avoided emissions (CO₂Equivalent)

3. Soil erosion and soil fertility:

- Nutrients contents and soil organic matter
- Soil structure
- change in extent of bare land (in ha or km²)
- change in erosion rates in tons/km²

4. Biodiversity:

- change in biodiversity levels (species richness and the Shannon-Wiener Diversity Indices)

5. Provision of fresh water:

- change in river flow (m³/sec) and water quality e.g. levels of sediment transport (tons/annum)

8.0 SCENARIO DEVELOPMENT FOR THE SELECTED ZONES

8.1 Mountain Highland Zone

In this zone, three scenarios will be examined: Under Scenario (i), the Business as Usual (BAU) mode will be upheld, without regulated management of common pool resources (grasslands) for grazing over the long-term (over 15-20 years); under Scenario (ii) would develop and apply effective community management plans on pool resources (grasslands) over the long-term (over 15-20 years); and Scenario (iii) implementation of Big Results Now (BRN) policy including expansion of dairy farming, horticultural farming etc over the long-term (over 15-20 years).

8.2 Midland Zone

In this zone we consider two scenarios i.e.: Scenario (i), examine the impacts on ecosystem services under the BAU scenario, whereby there is conversion of natural woodlands/forests into tea and exotics plantations over the medium term (5 to 10 years) and (ii) crop (paddy, maize, fruits, dairy farming, and free ranging traditional livestock keeping) cultivation as per the BRN initiative including fruits (avocado) production over the long term (15 to 20 years).

8.3 Lowland Zone

In this Zone we consider the impacts of applying land use planning for irrigation development whereby: under Scenario (i), Business as Usual (BAU) will be upheld, whereby the continuing development of all irrigation schemes as they come by without detailed screening for sustainability will be considered over the long-term (>15 to 20 years); and Scenario (ii), no development of irrigation projects in the Little Ruaha Catchment including those currently under different stages of development over medium term (5 to 10 years);

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