Chyulu Hills
REDD+ Project

PDD Cover Page

i. Project name:

The Chyulu Hills REDD+ Project

ii. Project location (country, sub-national jurisdiction(s)):

Kenya, Makueni County, Taita Taveta County and Kajiado County

iii. Project Proponent (organization and contact name with email address and phone number):

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v. Project start date, GHG accounting period and lifetime:

Project start date: 19 September, 2013
GHG accounting period: 19 September 2013 – 19 September, 2043
Project lifetime: 19 September 2013 – 19 September, 2043

vi. Whether the document relates to a full validation or a gap validation:

This PD relates to a full validation.

vii. History of CCB Status, where appropriate, including issuance date(s) of earlier Validation/ Verification Statements etc.:

No existing CCB history including any prior issuance or earlier validation statements.

viii. The edition of the CCB Standards being used for this validation

This project is being validated under the 2nd Edition of the CCB Standard.

ix. A brief summary of the project's expected climate, community and biodiversity benefits:

The CHRP aims to generate benefits in the areas of climate, community and biodiversity under both the Verified Carbon Standard (VCS) and Climate, Community and Biodiversity (CCB) standards. Its specific climate related goals are to prevent the emission of 37,765,494 t CO2e over the project's 30 year crediting period by stopping deforestation, forest degradation and grassland conversion. This will be achieved largely by enhancing and strengthening landscape protection, improving livestock management practices, employing forest rangers, bolstering employee motivation, creating alternative income, jobs and employment opportunities, and supporting stricter environmental law enforcement. Furthermore, it aspires to restore degraded forest and grassland areas, which will increase the quantity of sequestered carbon from woody biomass and soil. The establishment of tree nurseries, reforestation programs and other afforestation / reforestation (A/R) efforts are examples of some initiatives that will be undertaken to this end.

x. Which optional Gold Level criteria are being used and a brief description of the attributes that enable the project to qualify for each relevant Gold Level:

The Chyulu Hills REDD+ Project qualifies for Gold Level certification because of the exceptional benefits it will provide to the Climate, Community and Biodiversity aspects of the Project Area and Project Zone. Climate benefits include project activities to improve and diversify agricultural practices, mitigating the effects of the prolonged and more intense droughts due to climate change. Additionally, local institutional capacity building and the protection of the natural ecosystem will provide resilience in the community and natural systems to adapt to the effects of climate change. As Kenya is a classified as a low human development country by the UNDP, and experiences a high degree of poverty, inequality and population growth, the project will provide community benefits in the form of revenue sharing, alternative livelihood development, jobs, sustainable infrastructure development, environmental awareness & education and the introduction of many other environmentally friendly ideas. The project will utilize a benefit sharing mechanism that ensure all households are treated with equality, regardless of social or economic standing. Additionally, project benefits are designed to fight the root sources of poverty, providing new opportunities to local communities. Biodiversity benefits include protection and conservation of the many IUCN Red listed species within the project zone, including the Eastern Black Rhino, which is listed as an IUCN critically endangered species. The project has undertaken a number of measures to protect the habitats of these spectacular, yet endangered species and is committed to increasing their populations.

xi. Date of completion of this version of the PDD, and version number, as appropriate, and

Date: June 23rd, 2015
Version: 1.42

xii. Expected schedule for verification, if known.

January, 2016

The Chyulu Hills REDD+ Project

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Prepared By	Wildlife Works Carbon
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The Chyulu Hills REDD+ Project has been developed through a highly effective collaborative process between communities, landowners, public agencies, not for profit organizations and private sector partners. The partner organizations bring their strong commitment to conserving the Chyulu Hills Ecosystem together with an impressive range of skills and knowledge that are needed to develop and implement a successful and multi-faceted conservation project that integrates protection of an iconic ecosystem with supporting the economic and social well-being of local communities. It is therefore important to acknowledge the organizations and individuals for their distinct contributions.

Firstly we acknowledge the group of landholders who are traditional and long-term stewards of the Chyulu ecosystem. These include the Maasai leaders and people of the communally owned group ranches (Kuku, Kuku A, Rombo and Mbirikani) and the two community led non-profit organizations, Maasai Wilderness Conservation Trust (MWCT) and Big Life Foundation that support them in protecting their land and improving the lives of their communities. Kenya Wildlife Service (KWS) and Kenya Forest Service (KFS) hold and manage land in the Chyulu Hills landscape in trust for the benefit and enjoyment of the people of Kenya. We thank their respective Directors, headquarters staff, wardens, and field rangers.

From KWS, we would especially like to acknowledge the support and contributions by Dr. Erustus Kanga, Jane Wamboi, Robert Obrein, Godfrey Wakaba, Mathias Mwavita, Thomas Ogola and Ettah Muango. Within KFS, Alfred Gichu has strongly supported the work and its linkage to Kenya's National REDD program and Esther Keige has provided important legal counsel. The leadership and input from Samson Parashina and Luca Belpietro, Chairman and Director of MWCT; Richard Bonham, Craig Millar, Samar Ntalamia, and Jeremy Goss from the Big Life Foundation; and Neville Sheldrick and James Mbuthia from the David Sheldrick Wildlife Trust (DSWT) have been essential to the success of the development of the project

On the ground, The Chyulu Hills REDD+ project also would not have come about without the dedicated work of the Free Prior Informed Consent (FPIC) Officers, who spent many hours in community meetings and answering questions. Thank you to Rose Malenya and Alfred Masila (KWS), Daniel Ole Sambu and Anthony Kasanga (BLF), and Joseph Lairumbe and Danson Mositet (MWCT). A special thanks to Laurian Lenjo and Joseph Mwakima from Wildlife Works (WW) who provided guidance and assistance in the FPIC process across the entire landscape. Much praise is due to the teams who spent hundreds of hours in rugged field conditions to obtain vegetation measurements in the sample plots. This includes Mwololo Muasa as plot sampling leader, Joshua Kitiro, Moses Mwamodo, Mathias Mutule, Cyprian Mwawasi as team leaders and all of their respective team members. A very special thanks goes to Jamie Hendriksen from Wildlife Works for overall supervision and operational management of the plot team. Additionally, we'd like to thank Lana Muller and Dirk Van der Goes of MWCT for their supervision of the plot sampling, data entry and general collaboration with the PDD.

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The Chyulu Hills Ecosystem is one of Kenya's most unique landscapes. Ecologically and culturally rich, this landscape represents the best of Kenya's natural and cultural heritage. Thank you to all the partners in this project who are working to ensure that this special place is maintained for future generations.

ACRONYMS

ACoGS	Avoided Conversion of Grasslands and Shrublands
AFOLU	Agriculture, Forestry and Other Land Use
APD	Avoided Planned Deforestation
APC	Avoided Planned Conversion
AUC	Avoided Unplanned Conversion
AUDD	Avoided Unplanned Deforestation and/or Degradation
AWF	African Wildlife Foundation
BEM	Biomass Emission Model
CCB	Climate, Community and Biodiversity
CHRP	Chyulu Hills REDD+ Project
CI	Conservation International
DNA	Designated National Authority
DSWT	David Sheldrick Wildlife Trust
ER	Emissions Reductions
FAO	Food and Agricultural Organization
FCPF	Forest Carbon Partnership Facility
FPIC	Free, Prior and Informed Consent
GHG	Greenhouse Gas
GIS	Geographic Information System
GOK	Government of Kenya
GR	Group Ranch
HCV	High Conservation Value
IBA	Important Bird Area
KARI	Kenya Agricultural Research Institute
KBA	Key Biodiversity Area
KFS	Kenya Forest Service
KWS	Kenya Wildlife Service
KWTA	Kenya Water Tower Agency
MRV	Measuring, Reporting and Verification
MWCT	Maasai Wilderness Conservation Trust

NGO	Non-Governmental Organization
NPA	Natural Protected Area
NTFP	Non-Timber Forest Products
PAA	Project Accounting Area
PDD	Project Design Document
REDD	Reducing Emissions from Deforestation and forest Degradation
REDD+	Reducing Emissions from Deforestation and forest Degradation, plus Conservation, Sustainable management of forests, and enhancement of forest carbon stocks
R-PP	Readiness Preparation Proposal
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard
WWC	Wildlife Works Carbon

Table of Contents

ACKNOWLEDGEMENTS **2**

ACRONYMS **4**

1 GENERAL **12**

1.1 SUMMARY DESCRIPTION OF THE PROJECT (G3) 12

1.2 PROJECT LOCATION (G1 & G3) 13

1.2.1 Project Area Location and Basic Physical Parameters (G1.1) *15*

1.2.2 Boundaries of the Project Area and the Project Zone (G1.3) *18*

1.3 CONDITIONS PRIOR TO PROJECT INITIATION (G1) 22

1.3.1 Types and Condition of Vegetation within the Project Area (G1.2.) *22*

1.3.2 Current Carbon Stocks within the Project Area (G1.4.) *26*

1.3.3 Description of Communities Located in Project Zone, Including Basic Socio-Economic and Cultural Information (G1.5.) *27*

1.3.4 Current Land Use, Customary and Legal Property Rights, and any Ongoing or Unresolved Conflicts (G1.6). *35*

1.3.5 Current Biodiversity in Project Zone (species and ecosystems), and Threats to that Biodiversity (G1.7) *38*

1.3.6 High Conservation Values within the Project Zone (G1.8) *43*

1.4 PROJECT PROPONENT (G4) 47

1.4.1 Project Partners *48*

1.5 OTHER ENTITIES INVOLVED IN THE PROJECT (G4) 52

1.6 PROJECT START DATE (G3) 53

1.7 PROJECT CREDITING PERIOD (G3) 53

2 DESIGN **54**

2.1 SECTORAL SCOPE AND PROJECT TYPE 54

2.2 DESCRIPTION OF THE PROJECT ACTIVITY (G3) 54

2.3 MANAGEMENT OF RISKS TO PROJECT BENEFITS (G3) 60

2.3.1 Natural and Human-induced Risks to the Expected Climate, Community and Biodiversity Benefits, and Measures to Mitigate these Risks *60*

2.3.2 Measures Taken to Enhance CCB Benefits beyond the Project Lifetime *63*

2.4 MEASURES TO MAINTAIN HIGH CONSERVATION VALUES (G3) 64
2.5 PROJECT FINANCING (G3 & G4) 65
2.6 EMPLOYMENT OPPORTUNITIES AND WORKER SAFETY (G4) 65
2.6.1 Employee Orientation, Training and Capacity Building 65
2.6.2 Equal Opportunity for Employment 66
2.6.3 Employee Safety 66
2.7 STAKEHOLDERS (G3) 67
2.7.1 Community and Stakeholder Identification and Involvement in Project Design (G3.8) 67
2.7.2 Steps to Communicate and Publicize the CCB Public Comment Period (G3.9) 73
2.7.3 Process for Handling Unresolved Conflicts and Grievances (G3.10) 74
2.8 COMMERCIALLY SENSITIVE INFORMATION 74
3 LEGAL STATUS 74
3.1 COMPLIANCE WITH LAWS, STATUES, PROPERTY RIGHTS AND OTHER REGULATORY FRAMEWORKS (G4 & G5) 74
3.1.1 Employee Safety 74
3.1.2 Compliance with Relevant National and Local Laws, Regulations, and International Agreements (G5.1) 75
3.1.3 Approval from the Appropriate Authorities, Including Established Formal and/or Traditional Authorities Customarily Required by the Communities. (G5.2) 77
3.2 EVIDENCE OF RIGHT OF USE (G5) 77
3.3 EMISSIONS TRADING PROGRAMS AND OTHER BINDING LIMITS (CL1) 78
3.4 PARTICIPATION UNDER OTHER GHG PROGRAMS (CL1) 78
3.5 OTHER FORMS OF ENVIRONMENTAL CREDIT (CL1) 78
3.6 PROJECTS REJECTED BY OTHER GHG PROGRAMS (CL1) 78
3.7 RESPECT FOR RIGHTS AND NO INVOLUNTARY RELOCATION (G5) 78
3.7.1 Encroachment on Private, Community or Government Property without Free Prior and Informed Consent from those Affected by the Project (G5.3) 78
3.7.2 Involuntary Relocation of People or Activities Important for Livelihood or Culture (G5.4.) .. 79
3.8 ILLEGAL ACTIVITIES AND PROJECT BENEFITS (G5.5) 79
4 APPLICATION OF METHODOLOGY 79

4.1 TITLE AND REFERENCE OF METHODOLOGY 79
4.2 APPLICABILITY OF METHODOLOGY 79
4.3 METHODOLOGY DEVIATIONS 83
4.4 PROJECT BOUNDARY (G1) 83
4.4.1 Gases 83
4.4.2 Selected Carbon Pools 83
4.5 BASELINE SCENARIO (G2) 85
4.5.1 Most Likely Land Use Scenario in the Absence of the Project (G2.1) 85
4.5.2 How the 'Without Project' Scenario (baseline) would Affect Communities in the Project Zone (G2.4) 85
4.5.3 How the 'Without Project' (Baseline) Scenario would Affect Biodiversity in the Project Zone (G2.5) 89
4.5.4 Identifying the Agents and Drivers 92
4.5.5 Delineating the Project Accounting Areas 93
4.5.6 Baseline Types 95
4.5.7 Delineating Proxy Areas 97
4.5.8 Estimating the Deforestation Parameters 98
4.5.9 Determining γ 116
4.5.10 Determining q 116
4.5.11 The Decay Emissions Model 117
4.5.12 Baseline Scenario for Selected Carbon Pools 117
4.6 ADDITIONALITY (G2) 118
5 QUANTIFICATON OF GHG EMISSION REDUCTIONS AND REMOVALS (CLIMATE) 124
5.1 PROJECT SCALE AND ESTIMATED GHG EMISSION REDUCTIONS OR REMOVALS 124
5.2 LEAKAGE MANAGEMENT (CL2) 126
5.2.1 Leakage Mitigation Strategies 126
5.3 BASELINE EMISSIONS (G2) 126
5.3.1 Calculating Baseline Emissions from Biomass 127
5.3.2 Calculating Baseline Emissions from SOC for Baseline Types F-U1 and G-U1 127

5.3.3 Calculating Carbon Not Decayed in DW ... 127

5.3.4 Calculating Carbon Not Decayed in BGB ... 127

5.3.5 Calculating Carbon Not Decayed in SOC ... 128

5.4 PROJECT EMISSIONS (CL1) ... 128

5.4.1 Calculating Emissions from Changes in Project Stocks ... 128

5.4.2 Calculating Emissions from Burning ... 131

5.5 LEAKAGE (CL2) ... 131

5.5.1 Activity-Shifting Leakage ... 131

5.5.2 Market Leakage ... 135

5.6 SUMMARY OF GHG EMISSION REDUCTIONS AND REMOVALS (CL1 & CL2) ... 135

5.6.1 Determining Reversals ... 135

5.6.2 Determining Reversals as a Result of Baseline Re-evaluation ... 135

5.6.3 Quantifying Net Emission Reductions for a PAA ... 135

5.6.4 Quantifying Net Emission Reductions Across PAAs ... 136

5.6.5 Ex-Ante Estimation of NERs ... 136

5.6.6 Evaluating Project Performance ... 138

5.7 CLIMATE CHANGE ADAPTATION BENEFITS (GL1) ... 138

5.7.1 Identify likely regional climate change and climate variability scenarios and impacts, and potential changes in the local land-use from these scenarios in the absence of the project (GL1.1) 138

5.7.2 Identify any risks to the project's climate, community and biodiversity benefits and how these risks are being mitigated (GL1.2). ... 139

5.7.3 Demonstrate that current or anticipated climate changes are having or are likely to have an impact on the well-being of communities and/or biodiversity in the project zone (GL1.3) ... 140

5.7.4 Demonstrate that the project activities will assist communities and/or biodiversity to adapt to the probable impacts of climate change (GL1.4). ... 140

6 COMMUNITY ... 141

6.1 NET POSITIVE COMMUNITY IMPACTS (CM1) ... 141

6.1.1 Estimated Impacts on Communities from Project Activities (CM1.1) ... 141

6.1.2 No Negative Project Effects on the High Conservation Values listed in CCB indicators G1.8.4-6 (CM1.2) ... 149

6.2 NEGATIVE OFFSITE STAKEHOLDER IMPACTS (CM2) ... 150

6.2.1 Identify any Potential Negative Impacts on Offsite Stakeholders (CM2.1) ... 150

6.2.2 Plans to Mitigate Negative Impacts on Offsite Stakeholders (CM2.2) ... 150

6.2.3 Demonstrate no Net Negative Impacts on other Stakeholder Groups (CM2.3) ... 150

6.3 EXCEPTIONAL COMMUNITY BENEFITS (GL2) ... 150

6.3.1 Project Zone is in a Low Human Development Country (GL2.1). ... 150

6.3.2 Demonstrate that at least 50% of the households within the lowest category of well-being of community are likely to benefit from the projects (GL2.2). ... 151

6.3.3 Barriers or risks preventing benefits to go to poorer households (GL2.3). ... 151

6.3.4 Measures to identify poorer and more vulnerable households and individuals whose well-being may be negatively affected by the project, and that the project design includes measures to avoid any such impacts (GL2.4). ... 151

6.3.5 Community Impact Monitoring will be able to identify positive and negative impacts on poorer and more vulnerable groups Biodiversity (GL2.5). ... 151

7 NET POSITIVE BIODIVERSITY IMPACTS (B1) ... 152

7.1.1 Estimated Changes in Biodiversity in the Project Zone as a Result of the Project (B1.1) ... 152

7.1.2 No Negative Affect on HCVs as a Result of the Project (B1.2) ... 160

7.1.3 Species Used by the Project, Including and Invasive Species (B1.3) ... 161

7.1.4 Potential Adverse Effects of Non-native Species, Including Impacts on Native Species and Disease Introduction or Facilitation, and Justification for their Use over Native Species (B1.4) ... 161

7.1.5 Genetically Modified Organisms (B1.5) ... 161

7.2 NEGATIVE OFFSITE BIODIVERSITY IMPACTS (B2) ... 161

7.2.1 Potential Negative Offsite Impacts on Biodiversity (B2.1) ... 161

7.2.2 Mitigation of Potential Negative Offsite Impacts on Biodiversity (B2.2) ... 161

7.2.3 Evaluation of Unmitigated Negative Offsite Impacts against the Biodiversity Benefits of the Project within the Project Boundaries (B2.3) ... 161

7.3 EXCEPTIONAL BIODIVERSITY BENEFITS (GL3) ... 161

7.3.1 Vulnerability: Critically Endangered (CR) and Endangered (EN) species - presence of at least a single individual (GL3.1). ... 161

8 MONITORING 165

8.1 DESCRIPTION OF THE MONITORING PLAN (CL3, CM3 & B3) 165

8.1.1 Develop Plan for Community Monitoring (CM3.1) 165

8.1.2 Develop Plan for HCV Monitoring (CM3.2) 168

8.1.3 Commit to Developing a Full Monitoring Plan (CM3.3) 168

8.1.4 Initial Plan for Selecting Biodiversity Variables to be Monitored, and Monitoring Frequency (B3.1) 168

8.1.5 Initial Plan for Assessing the Effectiveness of Measures to Maintain or Enhance Biodiversity HCVs (B3.2) 170

8.2 DATA AND PARAMETERS AVAILABLE AT VALIDATION (CL3) 170

8.3 DATA AND PARAMETERS MONITORED (CL3, CM3 & B3) 183

9 BIBLIOGRAPHY 216

1 GENERAL

1.1 Summary Description of the Project (G3)

The Chyulu Hills REDD+ Project (CHRP) is a multi-partner initiative designed to promote climate change mitigation and adaptation, restore biodiversity and create alternative livelihoods under the United Nation scheme of Reducing Emissions from Deforestation and forest Degradation (REDD+). It is located in the Tsavo-Amboseli ecosystem in Southeastern Kenya and stretches over an area of 410,533.84 ha. Its main geographic feature is the volcanic Chyulu Hills mountain range, from which the project derives its name.

The Project Area comprises a great diversity of ecotopes, ranging from montane cloud forests to grassland savannah. A large variety of charismatic wildlife roams these landscapes, including populations of the increasingly threatened African Elephant (*Loxodonta africana*) and the critically endangered Black Rhino (*Diceros bicornis*). This wildlife has been living alongside traditional communities for generations. The Chyulu Hills also present a locally and regionally important water tower, which provides much of the surrounding landscape, as well as the coastal city of Mombasa, with a water source. This is just one example of the many ecosystem services the Chyulu Hill area provides to the region.

However, the area is under threat from being converted to a non-forest state due to unplanned agricultural expansion and unsustainable extractive practices such as charcoal burning and the collection of wood to make cultural artifacts. A major goal of the Project therefore, is to protect this vitally important ecosystem by providing economically viable and sustainable alternatives to its destruction.

The CHRP aims to generate benefits in the areas of climate, community and biodiversity under both the Verified Carbon Standard (VCS) and the Climate, Community and Biodiversity (CCB) standards. Its specific climate related goals are to prevent the emission of 37,765,494 t CO2e over the project's 30 year crediting period by stopping deforestation, forest degradation and grassland conversion. This will be achieved largely by employing forest rangers, bolstering employee motivation, creating alternative income and employment opportunities, and supporting stricter environmental law enforcement. Furthermore, it aspires to restore degraded forest and grassland areas, which will increase the quantity of sequestered carbon from woody biomass and soil. The establishment of tree nurseries, reforestation programs and other afforestation/reforestation (A/R) efforts are examples of some initiatives, which will be undertaken to this end.

The Project will also generate substantial community and biodiversity co-benefits. New and sustainable livelihood opportunities, such as direct employment, alternative income generating activities (IGAs) and initiatives to stimulate investment in businesses will be utilized to reduce pressure on the environment while significantly increasing community well-being. Additional programs will address food security, improve health and education facilities, as well as raise environmental awareness. Biodiversity co-benefits will be achieved through the greater protection of the Chyulu Hills ecosystem by increasing security, improved monitoring and the bolstering of wildlife-compensation schemes.

The CHRP's uniqueness lies in its eight constituent partners, each of which contributes specific and invaluable expertise. While some partners have long-standing, ground-based operations within the landscape, other partners offer more technical, political and governance expertise. The eight constituent partners include: Big Life Foundation, Maasai Wilderness Conservation Trust, Kenya Wildlife Service, Kenya Forest Service, David Sheldrick Wildlife Trust, African Wildlife Foundation, Conservation International and Wildlife Works. Together with the traditional landowners, this CHRP implementation

team presents an exceptionally strong partnership, which will ensure the successful execution of the project's objectives.

1.2 Project Location (G1 & G3)

The Chyulu Hills REDD+ Project is a multi-partner initiative (a joint group of partners who are hereafter referred to as the 'project partners'), designed to mitigate and adapt to climate change, restore biodiversity and create alternative livelihoods. A common aim of this project is to protect this vitally important ecosystem by providing viable alternatives to its destruction. Most of the project partners have long-standing, ground-based operations within the current landscape, while others will contribute through technical or political /governance expertise. A more detailed description of the nine project partners, a summary of their operations and their involvement in the project, can be found in section 1.4.1. The Project will be managed and operated from the Project Office, which has been given the mandate by the project proponent to administer carbon proceeds and develop management strategies, collaborate with the project partner operations on the ground and oversee general implementation of project activities and project operations in the Project Zone, on behalf of the project partners.

The Project Area is comprised of seven (7) land units. Each unit contains a unique tenure arrangement, and are listed as follows:

1. Mbirikani Group Ranch
2. Kuku Group Ranch
3. Kuku A Group Ranch[1]
4. Rombo Group Ranch
5. Chyulu Hills National Park
6. Southern Chyulu Extension (part of Tsavo West National Park)
7. Kibwezi Forest Reserve

[1] Kuku Group Ranch was divided into two separate Group Ranches in 1988, called Kuku A and Kuku Group Ranch.

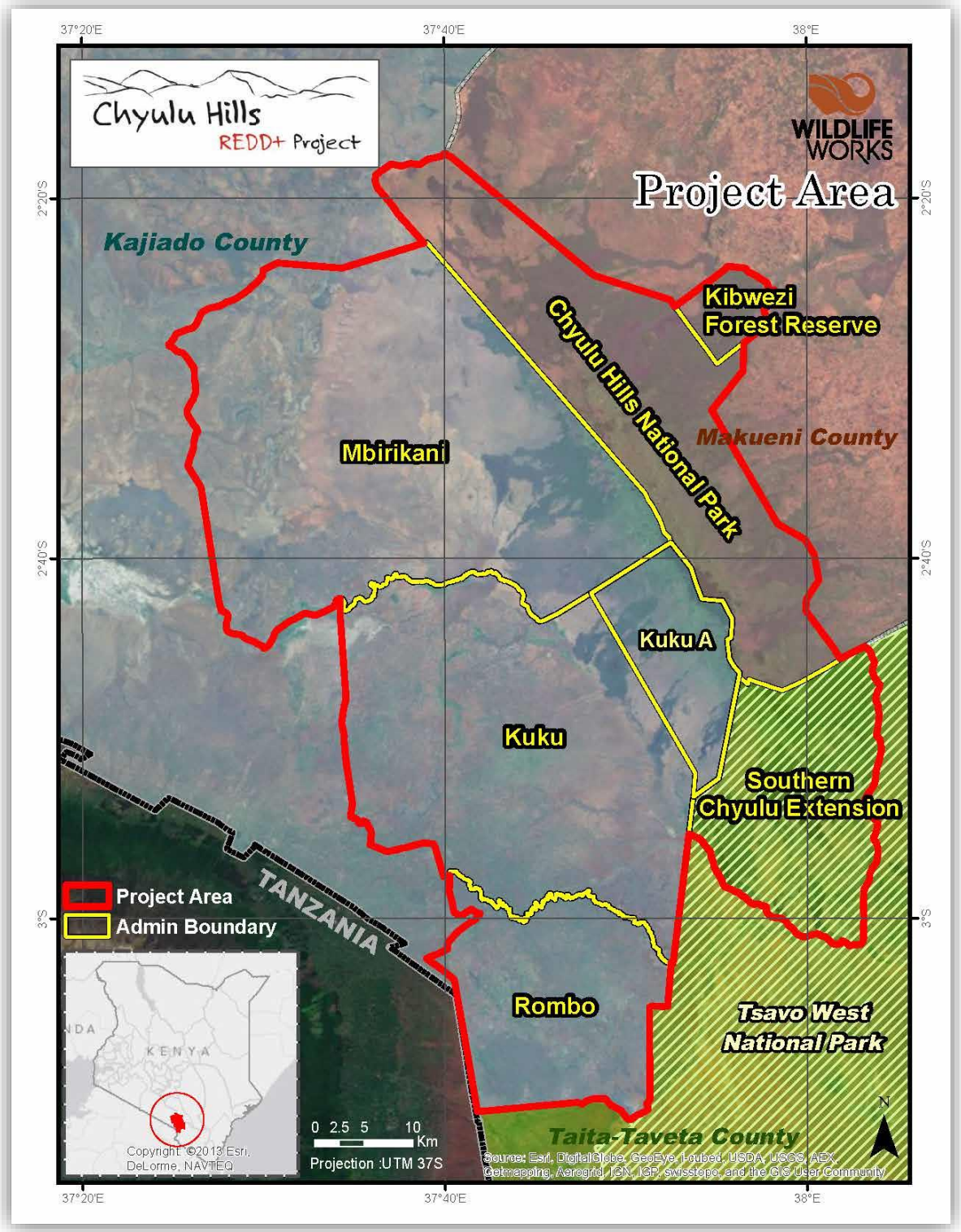


Figure 1: Chyulu Hills Project Area land units.

PDR.5 Credible documentation demonstrating control of the project area, or documentation that the provisos listed in the case of less than 80% project control at the time of validation delineated in section 5.1 of the methodology are met.

The Project Proponent possesses consensual control of the Project Area. Additionally, the land owners and/or custodians have clear and documented tenure over 100% of the project area. Please refer to Annex 2 for full proof of land ownership.

The four Group Ranches (GR) – Mbirikani GR, Kuku GR, Kuku A GR and Rombo GR, on the western side of the Project Area (Figure 1), are owned by local communities. They are managed by their respective Boards of Directors, who are elected on a periodic basis.

The Chyulu Hills National Park (CHNP) and Southern Chyulu Extension (SCE) land units, which fall at the edge of Tsavo West National Park, are under the mandate of Kenya Wildlife Service (KWS). While Kenya Forest Service (KFS) is the registered landowner of Kibwezi Forest Reserve on the eastern side of the Project Area (Figure 1), it leased the land to the David Sheldrick Wildlife Trust (DSWT) in 2009 for a period of 30 years. DSWT operates a high-end tourism lodge in the area.

1.2.1 Project Area Location and Basic Physical Parameters (G1.1)

Physical parameters

The Chyulu Hills REDD+ Project is located in Southeastern Kenya. The Project Area extends over three counties: Makueni County in the north and the east, Taita Taveta County in the south and Kajiado County in the west. The total area for all 7 land units under protection is 410,533.84 ha, while the Project Accounting Area covers a total of 374,677.64 ha. Its main geographical feature is the Chyulu Hills, a volcanic mountain range, about 150 km southeast of the Kenya Rift (Ritter & Kaspar, 1997), from which the project's name is derived. The Project Area is located ~150 km south of the Kenyan capital city of Nairobi and can be easily accessed by road via the Nairobi-Mombasa Highway on the east as well as the Emali-Oloitokitok road on the west. There are 15 usable airstrips in the Project Zone for access by light aircraft. Oloitokitok[2] (2.91° S, 37.52° E) on the west, Emali (2.09° S, 37.47° E) on the north and Mtito Andei (2.72° S, 38.20° E) on the east are the major towns directly adjacent to the Project Area.

[2] Oloitokitok is also referred to as Loitokitok.

Table 1. The land units in Project Area and their respective Kenyan counties.

County	Land unit
Kajiado	Mbirikani Group Ranch
	Kuku Group Ranch
	Kuku A Group Ranch
	Rombo Group Ranch
Makueni	Chyulu Hills National Park
	Kibwezi Forest
Taita-Taveta	Tsavo West National Park

Maps containing the PD requirements listed below in detail are contained in the following appendices to this document. Appendix A – Map of the Project Area, Appendix B – Map of Topography (DEM based), Appendix B – Map of Roads and Infrastructure, as well as major rivers and streams, and Appendix B – Map of Land use/Vegetation Cover.

The geographic or physical boundaries of the project area must be clearly delineated using, at minimum, the following:

- Name of the project area (compartment or allotment number, local name)
- Digital maps of the area, including geographic coordinates of vertices
- Total land area
- Details of ownership, including user rights and/or land tenure information
- Topography
- Roads
- Major rivers and perennial streams
- Land use/vegetation type classification

PDR.4 A digital (GIS-based) map of the project area with at least the above minimum requirements for delineation of the geographic boundaries.

Geology

The Kenyan Rift Valley is part of the East African Rift System that extends from the Afar Triple junction through Ethiopia and Kenya into Northern Tanzania and dissects Kenya from north to south (Späth *et al*., 2000). The Chyulu Hills are a young Quaternary volcanic field, surrounded by the Mozambique belt (Novak *et al*., 1997). The hills lie about 150km southeast of the Kenyan rift, close to the border of Tanzania, just 40km northeast of Mt. Kilimanjaro (ibid.). They comprise a large number of free-standing and coalesced volcanoes, cinder cones and numerous lava flows (Späth *et al*., 2000, p.337). The majority of eruptions occurred during the Late Pleistocene and Holocene, when mainly basaltic lava erupted through a NNW-SSE fissure system. The most recent lava flows are still un-vegetated and only date back

to less than two hundred years ago. The Sheitani lava feature extends south from the Chyulu Hills and was created in the late 1800s. The Sheitani lava field stretches over a distance of 8km, has a width of 1.6km and a depth of 5m. The Leviathan Cave, on the east of the hills, was discovered in 1975 and represents one of the longest lava tubes in the world.

Topography

The project site varies in altitude. Mbirikani GR in the northwest is a fairly flat expansive plain, while Kuku Group Ranch (Kuku A GR and Kuku GR) and Rombo GR feature a more hilly terrain. There are a number of denuded volcanic edifices and cinder cones on the western side of the hills. The surrounding plains rise from an elevation of less than 900 m above sea level (ASL) to a maximum elevation of 2175m ASL at the peak of the Chyulu Hills, which is also the highest elevation in the Project Area. The Chyulu Hills themselves are almost 100 km long and up to 30 km wide, covering an area of approximately 2,840 km^2 or 284,000 ha (Späth *et al.*, 2000). Detailed maps of slope, aspect and elevation can be found in Appendix B.

Soil

The Project Area lies in the Southeastern region of Kenya, which is characterized by its marginally fertile and other saline soils, with patches of deep well-drained soils. In the Chyulu Hills area, the main soils are Lithosols on the lava flows, Andosols on coarse ash deposits and deep Luvisols on the flatter plains (Touber, 1983). Soils covering gneissic basement complex are normally sandy and well drained, but susceptible to erosion. The plains in the northwestern portion of the project, mainly in Mbirikani GR, consist of dark clays with vertic and saline-sodic properties (ibid.). Soil fertility increases again towards the slopes of Kilimanjaro, in the south of the project area, where there exists more agriculture. Please refer to the map in Appendix B for a detailed depiction of soil type and distribution.

Climate, precipitation and hydrology

The region's climate is semi-arid to arid, falling into the Agroclimatic Zones V and VI (Sombroek *et al*., 1982). There are two rainy seasons a year. The "short rains" fall from November to December, while the "long rains" occur from March to May (Ntiati, 2002). Average rainfall in the greater Project Zone averages approximately 500mm per year, whereas the Chyulu Hills receive up to 700mm per year. In the bush land area, rainfall ranges from 350 mm to 700 mm (Western *et al*., 2009). In the nearby Amboseli, temperatures range from annual highs in the mid-30s°C (86° - 104° F) in February to lows around 20°C (68° - 77° F) in July (Altmann *et al*., 2002). Droughts frequently occur in the region (Western *et al*., 2009), and during this century droughts have been recorded in 2001 and 2006-2007 (Ojwang *et al*., 2006). The most severe drought in recent history occurred only a few years ago, in 2009.

Hydrology

High orographic rainfall and condensation (from mist in the cloud forest) make the Chyulu Hills a locally and regionally important water tower. Rainwater percolates into the ground due to the porous nature of the rock and emerges again at numerous springs. The Mzima Springs in the Southeast of the Project Area is an important spring system and supplies water to many cities and communities in Southeastern Kenyan and the coast region. This includes the cities of Voi, Maungu, Taru and Kenya's second largest city of Mombasa, which receives approximately 30% of its water from the pipeline (Mombasa Water, 2014). Mzima Springs also supplies larger rivers and streams in the more arid parts of Southeastern and Eastern Kenya with water, in particular the Tsavo / Galana system. In addition to Mzima Springs, there are a number of other springs in the Project Zone, including Umani Springs and Kiboko Springs.

There are also a number of seasonal rivers and streams in the Project Zone, which originate from rainfall. On Kuku GR, the Mokoine River, the Nolturesh River and several of its tributaries, such as Kikangorot, are the principal watercourses of the bush land area (Please see the map of rivers in Appendix B and below for a detailed picture of river location and density in the Project Zone). Rain and run-off from Mt. Kilimanjaro supply the Southwestern corner of the Project Zone with water, providing sufficient enough supply for rain-fed cultivation. The 24 inch-diameter Nolturesh water pipeline runs from the spring on Mt. Kilimanjaro, through Mbirikani GR on the western side of the Project Area up to the Nairobi-Mombasa highway at Sultan Hamud and beyond. It covers a distance of 200km to supply water to the towns close to Nairobi, namely Machakos, Athi-River and Kajiado (Ntiati, 2002). Water off-take is found to be unsustainable (ibid.), leaving the actual Nolturesh stream with insufficient water to run the 150km to Tsavo West National Park. The stream now dries up 33 km from the source, thereby compromising water supply to pastoral people, livestock and wildlife alike downstream.

Wetlands are also present, but following unsustainable water offtake and increased agricultural activities, they have been drying up in recent years. The largest swamp used to be Leinkati Swamp, at the border between Mbirikani and Kuku GR, which is also a largely cultivated area. There are a few smaller swamps including Kimana Swamp on Mbirikani and Esoitpus and Olpusare Swamp on Kuku Group Ranch.

1.2.2 Boundaries of the Project Area and the Project Zone (G1.3)

Project Area boundaries

As described previously, the Project Area is made up of seven different land units. The northern border of the Project is delineated by the northern edge of Chyulu Hills National park, which sits directly adjacent to the KARI Kiboko research centre. The eastern boundary roughly follows the Chyulu Hills National Park boundary. However, it also includes the Kibwezi Forest Reserve, which is partially bisected by the Nairobi-Mombasa Highway and borders the railway line. The Southern Chyulu Extension follows the Kilaguni – Mzima Springs Road in a southerly direction until reaching the Mzima Springs. The boundary then follows the Nolturesh River until reaching the boundary of Tsavo West National Park and adjacent Rombo GR. The most southerly Project point is (3.12° S, 37.84° E) and follows a straight line westward to the Tanzanian border. The western boundary of Kuku GR follows the Nolturesh pipeline. Mbirikani GR is divided by the Kikangorot stream. The border is the Merrueshi River and joins Chyulu Hills NP in a northeastern direction. A detailed map of the Project Area is shown in Figure 2 below and in Appendix A.

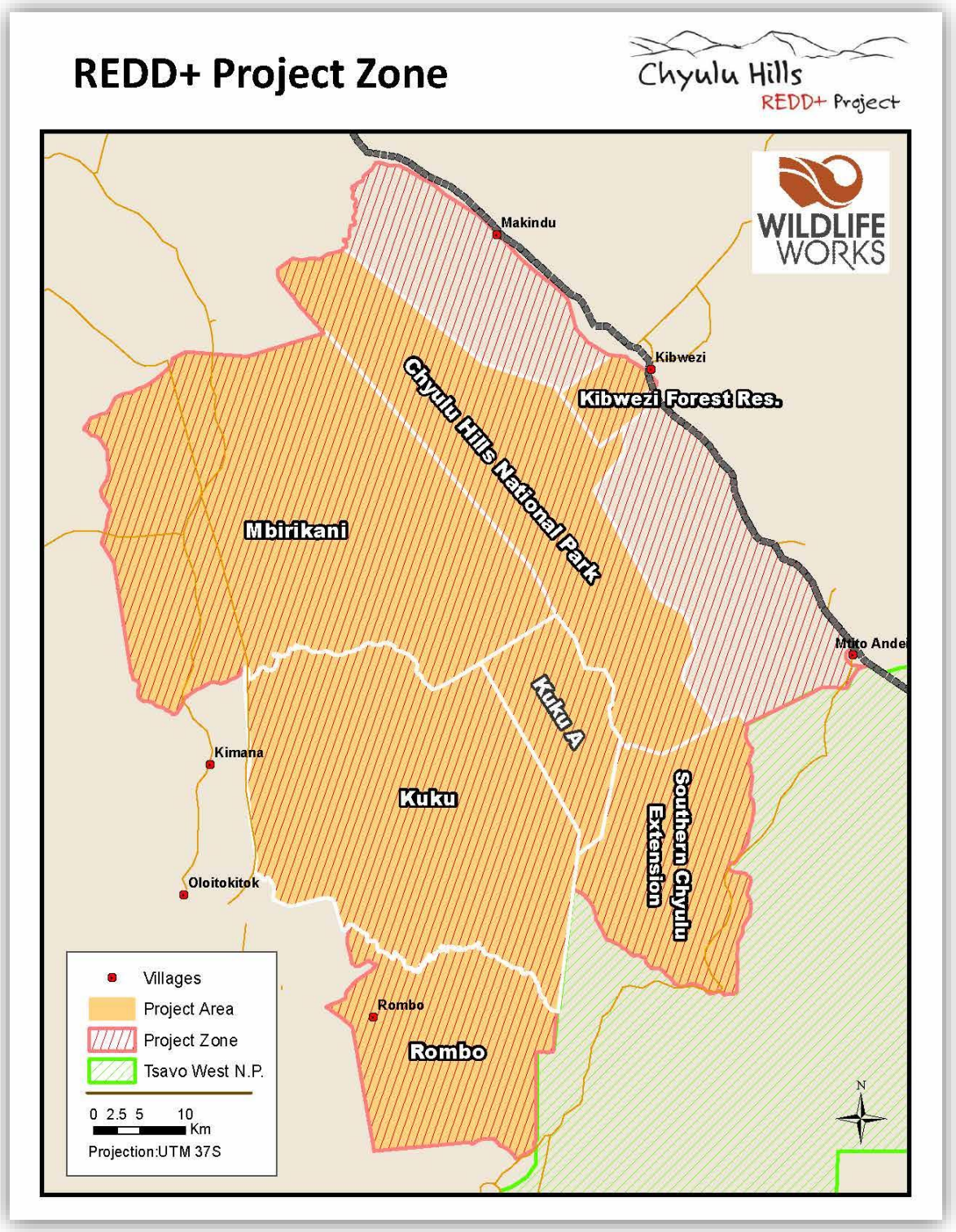


Figure 2: The Chyulu Hills REDD+ Project Zone

Table 2: Project Area boundaries.

Boundary	Location
Northern Boundary	Merrueshi Seasonal River
Northern Extent GPS Point	2.21° S, 37.70° E
Eastern Boundary	KARI Kiboko research Centre Community land
Eastern Extent GPS Point	2.84° S, 38.07° E
Southern Boundary	Mzima Springs, Tsavo West National Park
Southern Extent GPS Point	3.19° S, 37.84° E
Western Boundary	Tanzanian border Emali-Oloitoktok Highway Amboseli National Park
Western Extent GPS Point	2.47° S, 38.07° E

Project Zone

According to the CCB standard version 2, the Project Zone is defined as “the Project Area and the land within the boundaries of the adjacent communities potentially affected by the project”. The Project Zone is seen in Figure 2 above. In the case of the Chyulu Hills REDD+ Project, these communities are defined as those living adjacent to the project area who would be directly affected by the project in some way. This includes many of the rural communities on the eastern side of the Project Area. It excludes, however, the larger towns of Makindu, Kibwezi and Mtito Andei, as there are a wider array of alternative livelihood options in those locales, and they are considered to be insulated from the effects of the Project. Thus, the border of Chyulu Hills NP and KARI Kiboko demarcates the eastern border of the Project Zone.

For the remaining boundaries, the borders of the Project Zone are the same as the borders of the Project Area. In this region the communities who will mainly be affected by the Project live inside the REDD+ Project Area. Additionally, the boundary of the Project Zone is the same as the Project Area in Tsavo West NP, as there are no communities residing in the national park who could be affected by the Project.

The primary reason for a difference in the delineation of the Project Zone between the Eastern and Western side of the Project Area is the difference in land ownership on each side and the effects that has on resource access. The Eastern side of the Project is a national park and national forest reserve, and as such the communities living outside the boundaries are more reliant on the resources inside the Project

Area. Firstly, the majority of the deforestation threat on the Project's eastern side is from the communities pushing up against the Project's boundaries, including along the national parks and forest reserve boundaries. It must also be noted that there are no communities residing inside the Project Area on the eastern side, they all travel into the Project Area for resources. Therefore a buffer for the Project Zone was created on the eastern side. This threat is already visible, and the encroachment is spatially explicit in nature, pushing toward the project accounting area in a directional attack on the weakly protected areas.

Whereas, on the Western side of the Project Area the land is owned in Group Ranches, where the communities located in and residents of the area generally have ownership stakes in the ranch. Therefore the boundaries are more often enforced, and any resource use on the ranch is done with the permission, whether official or tacit, of the ranch owners. The communities on the Western side of the Project include Maasai pastoralists and sedentary agriculturalist living within the Project Area as well as people and communities living in the out-areas within the Project Area boundaries (areas not included in carbon accounting). The reasoning for including these communities as part of the Project Zone is that it is them who continuously depend on the land that they live on and derive livelihood, well-being and cultural values from it. The primary threat to this region of the Project Area comes from these communities sub-dividing the ranches and fencing individual plots for conversion to agriculture. In times of stress (drought years or times where the rains are late), outside mobile people (Maasai herders) may move in from the adjacent ranches and beyond. According to local feedback and expert knowledge however, this is against the will of local landowners, who are however powerless to resist them. Building further on expert insight, this is not a frequent event as it only occurs in times of stress. As such, the level of use of these user groups is considered insignificant given that they come from distant places and have very limited dependence on the site. It would therefore not only be unfair to the landowners to spread the project benefits over a larger area, but also impossible to define who these mobile peoples are exactly, as they are unlikely to be the same people if and when they would return in a few years down the line. Therefore, since the group ranches are privately owned by the ranching companies, and do not have a legal protection, it is essential that the Project benefits and activities are focused on the communities living on the ranches and that are owners in the ranch. They are the primary peoples being affected by the Project and have the greatest ability to affect the Project's success.

The same applies to the charcoal burners living adjacent to the Project Area boundary on the Western side (Loitokitok etc). According to expert knowledge, while these people do occasionally utilize the Project Area for charcoal production, they are not sedentary on the Project Area or even undertaking frequent incursions, but instead move in for a limited period of time before continuing to other places. As such, they have very limited dependence on the site, as they are not local and are able to move on as and when they desire. As they have very limited dependence on the Project Area, and their livelihoods are not dependent on the solely on the Project Area resources, it would be unfair and ineffective to include the entirety of these communities in the Project Zone.

It also cannot be justified to include only parts of the neighboring group ranch(es) in the Project Zone while excluding other parts of those same group ranches. This would lead to resentment and jealously in the communities that live inside the Project Accounting Area (as defined in VM0009) that are included in the Project Zone versus the ones whom are excluded. Similarly, we cannot include entire group ranches outside of the Project Accounting Area, as this would stretch the minimal carbon financing over too many people and communities and minimize the effectiveness of the Project. Additionally, the communities inside the Project who fully depend on the Project Area would rightfully be wondering why other

communities who are outside the Project Area to the west and not dependent on the Project Area for resources were receiving benefits of the Project.

1.3 Conditions Prior to Project Initiation (G1)

1.3.1 Types and Condition of Vegetation within the Project Area (G1.2.)

The Project Area is made up of a heterogeneous landscape that features a transition from lowland dry savannah grassland and Acacia-Commiphora forest, through a volcanic gradient, to an area dominated by a moist, dense cloud forest. To satisfy accounting criteria for the VCS methodology VM0009, the Project Area is separated into Project Accounting Areas (PAAs), which separate the REDD+ project into homogenous areas of baseline scenario type (i.e. threat type and level, vegetation classification, potential agents of conversion, etc.). It should be noted that PAA represent strata which serve the sole purpose of rendering the calculation of emissions reductions (carbon accounting) more accurate. They do not represent physical boundaries within the Project Area and the PAAs will not be treated differently from one another throughout the project accounting period. The Chyulu Hills REDD+ Project has been separated into two Project Accounting Areas (PAAs), based on land cover sub-strata. The first is represented by native grassland and the second is all forested lands. Because of the diversity of natural land cover throughout the project, the Project Area is an important ecological zone, boasting with a wide range of floral and faunal biodiversity.

A land cover classification of the Project Area is shown below in Figure 3. Land Cover data were provided by the African Wildlife Foundation (AWF), a project partner, and are based on combined remote sensing and ground-based mapping. This classification defines 7 land classes, which are based on land cover types. Land cover classes include ‘Grassland’, ‘Acacia-Savannah Mosaic’, ‘Lava Forest’, ‘Lava Forest Sparse/Low’, ‘Cloud Forest’, ‘Woodland/Thicket and ‘Woodland – Sparse/Low’. The Grassland PAA contains only the Grassland land cover strata, with the balance of the land cover strata being present in both the protected and unprotected Forested PAA (see PAA map below). For a detailed vegetation map of the Project Area, please see the Figure 3 below and Appendix B. A detailed description of each important vegetation land cover is given below:

Grassland

The vegetation in the grassland land cover stratum is consistent with that of a typical lowland dry Kenyan savannah. This stratum represents the lowest elevation of the Project Area, receives relatively low rainfall and has few natural surface water sources. The grassland stratum is typified by large areas of native grasses with patches of low-density tree canopy cover. The primary tree species present are *Acacia mellifera, Balanites aegyptiaca, Commiphora africana* and *Acacia tortilis*. Woody shrub species are present at low densities (17.97 t CO2e / Ha), dominated by saplings of *Acacia mellifera, Grewia bicolor* and *Cordia sinensis*. The average Diameter at Breast Height (dbh) observed for trees is 9.0 cm, canopy height on average is 3.4 m and average tree canopy cover for the grasslands PAA is 7.9%.

This stratum is primarily in a native grassland state that is consistent with its historic condition. The grassland land cover stratum provides significant habitat for a typical African savannah community, including a diverse array of native ungulates, such as antelopes, common zebra, and Cape buffalo. These ungulates in turn provide a very important food source for the larger carnivores present in the Project Area.

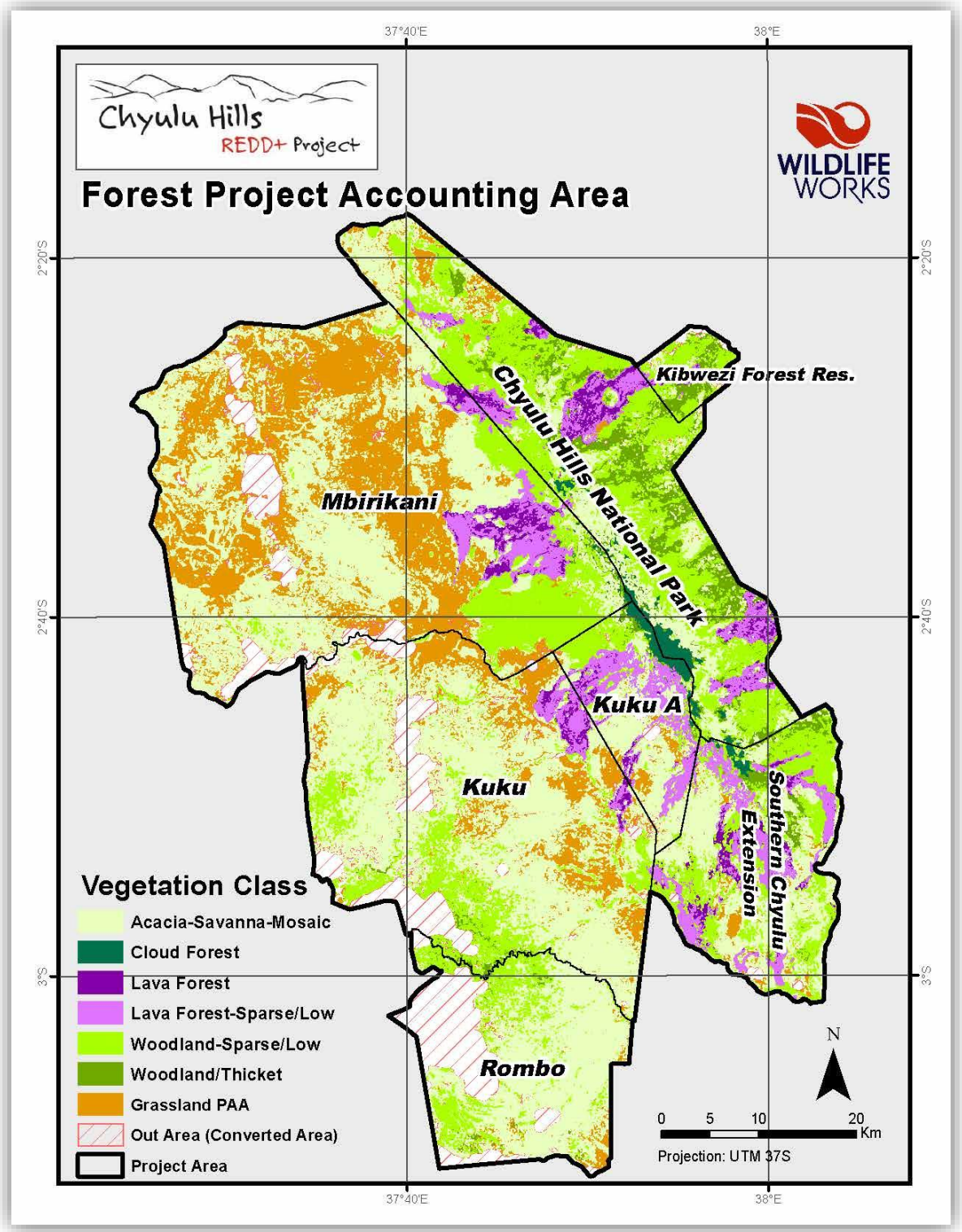


Figure 3: Project Area land cover

Acacia-Savannah Mosaic Forest

The Acacia-Savannah mosaic land cover stratum is an Acacia-Commiphora lowland dry forest. This forested stratum features a moderate tree canopy with an understory of grasses and shrubs. There are 38 tree species found in this stratum, with the dominant species being *Acacia mellifera, Commiphora africana*, various other Commiphora species, *Acacia hockii* and *Acacia tortilis*. The average dbh observed for trees was 10.5 cm, the canopy height on average is 3.9 m, and tree canopy density was calculated to be 16.2%, meeting the Kenyan definition of forest, which is defined as at least 15% cover with a canopy height of greater than 2 meters. As this was the forest stratum with the lowest mean carbon stock (20.07 t CO2e/Ha), canopy cover was calculated only for this forest stratum (to compare to the Kenyan DNA definition) as well as the grassland strata (to ensure that it did not meet the definition of forest. See above).

The flora species present in this area are generally drought-tolerant, using several different strategies for preserving moisture in this semi-arid environment. These include dropping foliage or closing leaves during dry periods to reduce water loss from transpiration as well as photosynthesis through the bark of the trees Weeks and Simpson, 2007). This accounts for the low leaf area index (LAI) found with most of the tree species in this stratum. Commiphora species in particular have adapted to dry weather conditions by gaining chlorophyll cells beneath their thin, opaque bark, thereby enabling photosynthesis to continue through their bark during the leaf-off season. Their leaves are quite small to begin with, and generally cannot be seen from space. The primary shrub species in the Acacia-Savannah Mosaic stratum are saplings of the tree species *Acacia mellifera*, *Acacia Senegal, Acacia drepanolobium*, and *Commiphora africana*, and pure shrub species *Cordia sinensis* and *Grewia bicolor*.

In terms of the species distribution and forest structure, this stratum is generally found to be in its historically natural state. It is believed that the structure of this forest is influenced by the activity of the African elephants (*Loxidonta africana*), which cause significant damage to trees as they feed, killing the trees over time or in some cases knocking them over, causing sporadic patches of open canopy. This leads to significant areas of regeneration, as these patches allow grasses and woody shrubs to thrive. As a conservative measure, we have chosen not to include downed the woody carbon pool in this REDD+ project, even though a significant amount of dead woody material can be present due to elephant damage. There is some evidence of degradation due to harvesting of trees for charcoal production, firewood, wood for carving and poles. Grazing has additionally caused some degradation.

Table 3. Tree metrics for the most sparse project forest stratum compared to the Kenyan DNA forest definition.

Metric	Foerest Stratum Metric	Kenyan Forest Definition Threshold
Average Tree Canopy Cover (%)	16.2 %	15 %
Average Tree Height (m)	3.7 m	2 m

Woodland/Thicket and Woodland-Sparse/Low Forest

The Woodland-Sparse/Low and Woodland/Thicket strata are very similar in species composition and forest structure, with the main contrasts being the relative frequency of each species. These forest strata are also of a dryland forest type, and contain drought tolerant species. The tree canopy is denser and the mean carbon stock (78.5 and 110.0 t CO2e/Ha respectively) is therefore higher than the abovementioned Acacia-Savannah Mosaic stratum, with no patches of grassland interspersed. The forest inventory identified 116 tree species in the Woodland/Thicket stratum versus 115 species in the Woodland-Sparse/Low stratum. The primary species in the Woodland-Sparse/Low stratum are *Dombeya rotundifolia, Commiphora baluensis, Acacia mellifera, Commiphora eminii* and *Ozoroa insignis*. The average dbh observed for trees in the Woodland-Sparse/Low stratum was 12.29 cm, and the canopy height on average was 5.34 m. In the Woodland/Thicket stratum the primary species observed were *Diospyros consolatae, Commiphora eminii, Mystroxylon aethiopicum, Combretum schumannii* and *Olea africana*. The average dbh observed for trees in the Woodland/Thicket stratum was 12.05 cm, and the canopy height on average was 6.14 m. In the Woodland-Sparse-Low stratum there were 114 species found with the dominant shrub species observed including seedlings of *Acacia brevispica, Vepris simplicifolia, Dombeya kirkii, Grewia bicolor* and seedlings *Acacia mellifera*. In the Woodland/Thicket stratum there were 91 different shrub species observed, with the primary shrub species being *Dombeya kirkii*, *Croton dichogamus, Rhus natalensis, Alchornea racemosa* and seedlings of *Commiphora eminii*.

This stratum is generally found to be in its historic natural state in terms of the species distribution and forest structure. As with the Acacia-Savannah Mosaic stratum, it is also believed that the structure of this forest type is influenced by the activity of the African elephants (*Loxidonta africana*), which cause significant damage to trees as they feed, killing the trees over time or in some cases knocking them over causing patches of open tree canopy. This leads to significant areas of regeneration, allowing grasses and woody shrubs to thrive in the patches of open forest canopy. As in the aforementioned Acacia-Savannah Mosaic stratum, there is some evidence of degradation is observed due to charcoal production and grazing.

Lava Forest and Lava Forest Sparse/Low

The Chyulu Hills are a volcanic range featuring recent lava flow. The hills contain rocky, shallow soils comprised largely of volcanic rock. Despite the presence of dense lava on or near the surface, tree and shrub cover is significant. These two strata are very similar in species composition and forest structure, and are primarily distinguished by the density of the forest canopy, with the Lava Forest Sparse/Low being a less dense forest type with a more open canopy. It is generally believed that this is due to the fact that the Lava Forest Sparse/Low stratum is growing on more recent lava flow, which has not degraded as much as the lava flows in the Lava Forest stratum. The forest type is a dry, upland forest with an open canopy mix of drought tolerant species and a low-density understory. The primary tree species observed in the Lava Forest Sparse/Low stratum are *Diospyros consolatae, Olea africana, Commiphora eminii, Pappea capensis* and *Albizia grandibracteata*. The primary species observed in the Lava Forest stratum are *Diospyros consolatae, Olea africana, Pappea capensis, Commiphora eminii* and *Haplocoelum foliolosum*. The average dbh observed for trees in the Lava Forest Sparse/Low stratum is 11.85 cm, and the canopy height on average is 5.6 m, whereas in the Lava forest the mean dbh is 11.32 cm, and the mean tree height is 5.3 m. Mean carbon stocks for each stratum are (57.82 and 79.45 t CO2e/Ha in the Lava Forest Sparse/Low and Lava Forest strata respectively). The primary shrub species observed in the Lava Forest Sparse/Low stratum are saplings of *Acacia gerrardii, Cordia monoica, Euphorbia*

tenuispinosa, Acacia brevispica and *Commiphora eminii*. In the Lava Forest stratum, the primary shrub species include *Rhus natalensis, Diospyros consolata, Euclea divinorum, Dombeya kirkii* and *Euphorbia tenuispinosa*.

This stratum is generally found to be in its historic natural state in terms of the species distribution and forest structure. There is some evidence of degradation due to harvesting of trees for charcoal production, firewood, wood for carving and poles. Both of these strata contain several tree species of high conservation value, including African Blackwood *(Dalbergia melanoxylon*), African wild olive (*Olea africana*) and Sandalwood (*Osyris lanceolata*).

Cloud Forest

On the peaks of the Chyulu Hills, at elevations above 1,800 m, the cloud forest stratum is dominant. This land cover stratum is characterized as a montane type forest, with a dense tree canopy and understory comprised of moist species. This forest has a high incidence of low-level cloud cover, often at the tree canopy height, resulting in extremely humid conditions. This results in a lush appearance, with a high occurrence of mosses and thick understory vegetation. The dominant tree species observed in this stratum are *Croton macrostachyus, Ficus sycomorus, Vepris nobilis, Mystroxylon aethiopicum* and *Strombosia scheffleri*. The mean tree dbh is 24.42 cm and average canopy height is 11.0 m. Mean carbon stocks for this stratum are high (1110.55 t CO2e/Ha) The primary shrub species observed in the Cloud Forest stratum are seedlings of the tree species *Piper capense, Ficus sycomorus, Tabernaemontana stapfiana, Catha edulis* and *Strombosia scheffleri*.

The Cloud Forest's influence on the project's ecology and biodiversity cannot be overstated. It is the primary water source for much of the surrounding area. Additionally, the cloud forest is a very important and extremely rare reservoir for both plant and animal biodiversity, as the majority of this forested stratum has already been lost from the greater region. Cloud forest is generally found to be in its historic natural state in terms of its species distribution and forest structure. There is some evidence of degradation due to harvesting of trees for charcoal production, firewood, wood for carving and poles. Based on historical observation of similar geographies and deforestation agents throughout the reference area, the cloud forest ecosystem faces threat of conversion to a non-forest state due to unsustainable timber cutting for charcoal, forest products and timber for building. Threats to this area also include the harvesting of tree species for their value in woodcarvings and other craft products, as well as deforestation for charcoal burning.

1.3.2 Current Carbon Stocks within the Project Area (G1.4.)

Carbon stocks have been estimated using the Verified Carbon Standard (VCS) methodology VM0009 'Methodology for Avoided Ecosystem Conversion' v3.0. This methodology was originally validated with VCS in January 2011, with version 2 validated in 2012. A third major revision was conducted to include the AFOLU (Agriculture, Forestry and Other Land Uses) category Avoided Conversion of Grasslands and Shrublands (ACoGS). Version 3.0 of VM0009 was successfully validated in June, 2014 under the VCS double approval process.

Table 4 depicts current measured carbon stocks within the Project Area by land cover stratum, as further defined in section 1.3.1. Values below have been calculated using the methods of carbon accounting detailed in the VCS Methodology VM0009 and this VCS / CCB validated PD.

Table 4. A summary of Current Carbon Stocks within the Project Accounting Area

Stratum	Area (ha)	Mean Carbon Stock (t CO2e / ha)	Standard Error (t CO2e /ha)	Mean dbh (cm)	Average height (m)
Grassland	109,131	17.97	4.55	10.15	3.7
Acacia-Savannah Mosaic	151,499	20.07	2.43	10.50	3.9
Cloud Forest	4,823	1110.55	270.63	24.42	11.0
Lava Forest	16,718	79.45	9.91	11.32	5.3
Lava Forest Sparse/Low	14,558	57.82	11.95	11.85	5.7
Woodland / Thicket	24,874	110.00	17.35	12.05	6.1
Woodland – Sparse/Low	53,075	78.50	8.98	12.30	5.3

1.3.3 Description of Communities Located in Project Zone, Including Basic Socio-Economic and Cultural Information (G1.5.)

Project Zone Communities

The Project Zone is socially, economically and culturally diverse. The surrounding communities can be most accurately and coherently understood by dividing the Project Zone into two; the western side (Kajiado County) and the eastern side (Makueni County). Most data is obtained from Government statistics, which are categorized according to pre-devolution districts, namely Loitokitok and Kibwezi. In addition, some independent studies have been carried out within the land units, providing further valuable insight. Figure 4 shows the major cities towns, villages and other place-names within the defined Project Zone, which encompasses the Project Area as well as the surrounding areas and communities affected by the Project (see description and map of the Project Zone in Section 1.22 above). Please also refer to Appendix G for a larger, more detailed rendition of the map below.

Demographic information

Western side, Kajiado County, Loitokitok District

According to the 2009 Kenya Population and Housing Census, there are 137,496 people living in former Loitokitok District, which encompasses the Entonet, Mbirikani, Kimana, Central, Lenkism and Rombo divisions. The average population density is 21 people per km^2 (Seno and Tome, 2013). The Group Ranches within the Project Area have a combined population of 27,750 (Kenya Open Data, retrieved 20 November 2013).

Eastern side, Makueni County, Kibwezi District

According to the Kibwezi District Development Plan (KDDP) (2009), the population on the eastern side of the hills (Kibwezi District) is 296,768 people in 2012. The population between the Nairobi-Mombasa highway and the Project Area boundary is estimated at about 100,000 people. Density varies according to location, but averages at 73 persons per square kilometer (Muriuki *et al*., 2013). The largest town on the eastern side is Mtito Andei with an estimated population of approximately 100,000 people in 2012 (KDDP, 2009).

The population is predominantly young, with more than half of the population below the age of 18 (151,861 people). In 2008, young people made up 58.8% of the total population, which explains the high dependence ratio for the area (KDDP, 2009). Average individual household size is 7, and average life expectancy is 39.6 and 46.1 years for males and females respectively. The sex ratio of males and females is 1: 1.1 (KDDP, 2009).

Two thirds of the community lives in brick-walled houses with corrugated iron sheet roofs, but a substantial number live in mud-walled houses often with grass thatched roofs (Muriuki *et al.,* 2013). Only about 7% of the population has access to electricity from either the main electrical grid or solar power.

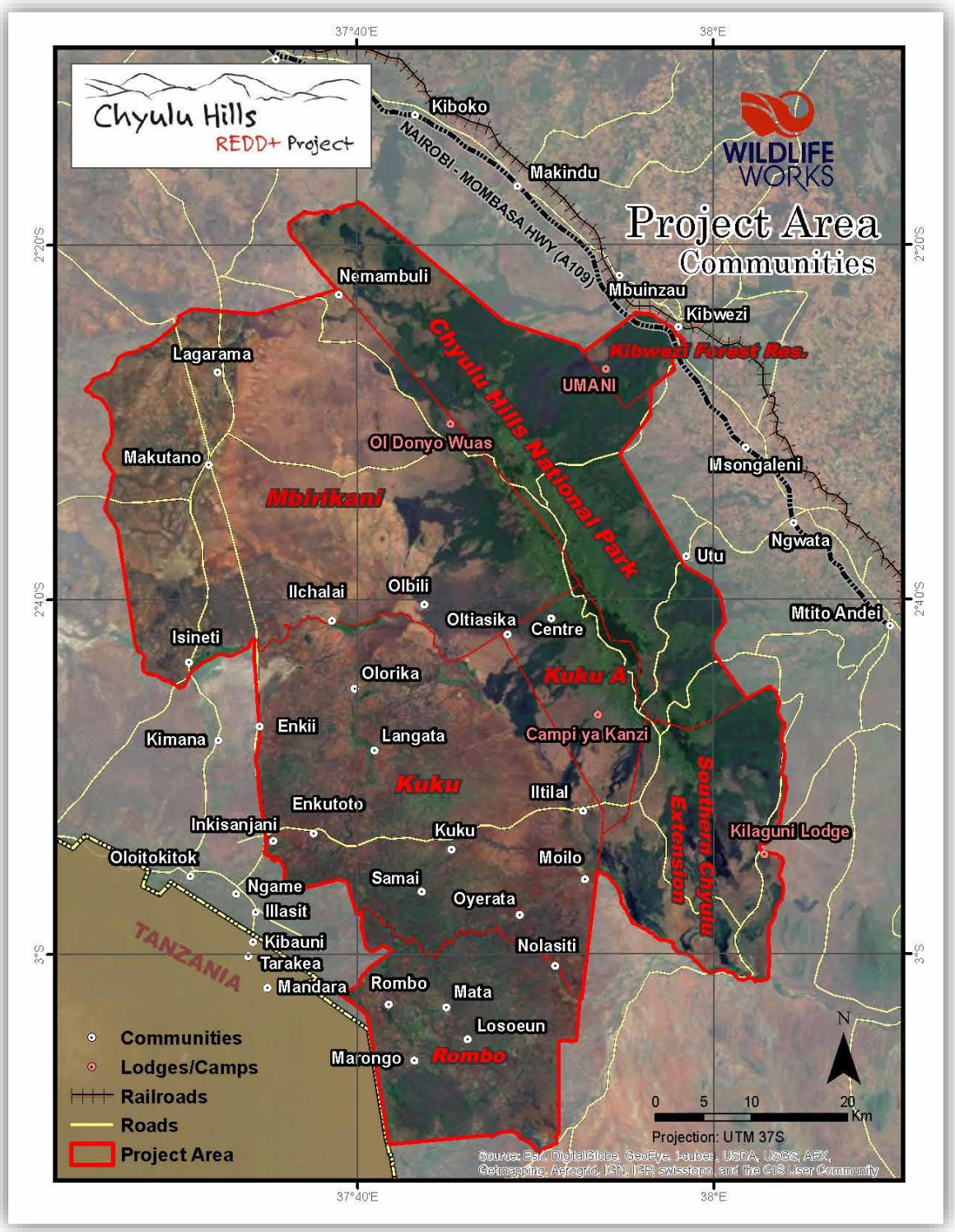


Figure 4: Major cities, village and towns in the Project Zone.

Poverty

Western side, Kajiado County, Loitokitok District

The proportion of poor living in Loitokitok District is high. According to the Loitokitok District Development Plan (LDDP, 2009), poverty is perceived as the inability of an individual or household to afford basic needs such as food, clothing, housing, health, education and security. The official figure of people living in absolute poverty in 2008 was 50%, where urban poverty was 52% and rural poverty 48% (LDDP, 2009). For this study, poverty line was defined as KSh 1,562 (approximately USD $22) a month for rural communities and KSh 2,913 (approximately USD $42) a month for urban communities.

Traditionally Maasai culture defines wealth by the number of livestock held by an individual. That said, Ntiati (2002) carried out a wealth ranking exercise with 40 participants from 6 group ranches (Olgulului, Kimana, Kuku, Rombo, Mbirikani, Eselenkei) in a youth workshop. Together they devised the following categories to delineate wealth levels:

1. Wealthy: > 100 cows
2. Average: > 60 and < 100 cows
3. Poor: > 20 and < 60 cows
4. Very poor: < 20 cows.

Applying these categories to the 6 group ranches, Ntiati concluded that 60-85% of the GRs fall within the “poor” and “very poor” categories. This result is much higher than the national average; at the time of the study (2001), 52% of Kenyans were living below the poverty line (Ntiati, 2002). Classification of wealth based on livestock is becoming obsolete, and future wealth assessments will be based on financial criteria.

Eastern side, Makueni County, Kibwezi District

The mean monthly income in Makueni County averages at Ksh 5,506 (US $60) (Muriuki *et al.*, 2013), and compared to poverty levels of other Counties in Kenya, Makueni County falls towards the poorer end of the spectrum. The KDDP (2009) indicates that 64.2% (165,972 people) of the population is living in absolute poverty, which contributes 3.8% to the national poverty level. In general, this area is quite poor.

Livelihood activities and Economic diversity

Western side, Kajiado County, Loitokitok District

Pastoralism is still the predominant livelihood activity in the west of the Project Area. According to a study undertaken by Best and Goss (unpublished, 2014), 100% of the 248 interviewed households on Mbirikani GR owned livestock, either for subsistence uses or for sale at nearby markets. Western *et al.,* (2009) counted between 50-80,000 livestock on Mbirikani GR during an aerial survey, while in 2012, the estimated number of livestock on Kuku GR was 29,300 (Müller and van der Goes, unpublished, 2012).

With a shift towards sedentism, as outlined above, many households have adopted agricultural lifestyles and are diversifying their livelihoods. This trend has been captured in numerous studies (Thornton *et al*., 2006, Seno & Tome, 2013) and serves to reduce absolute dependence on livestock. Campbell *et al.* (2003) documents how through the 1970s and 1980s government policy encouraged the sub-division of

land into small agricultural plots, especially in areas of permanent water sources. While immigrants, mainly Kikuyus and Kambas, initially drove the increase in agriculture in this region, more recently it has been lead by significant numbers of Maasai who have taken up more permanent cultivation (Ntiati, 2002). With this trend towards an agricultural lifestyle, the Maasai have moved from being true pastoralists to a more sedentary herder-farmer system (Campbell *et al.*, 2003). Additionally, with the prior immigrations Maasai are no longer dominant ethnically in the region, and mixed livestock–cultivated crop agricultural techniques have largely replaced pastoralism (Campbell *et al.*, 2000). With the increased sub-division of land for agricultural purposes, especially land with permanent water sources or more reliable rainfall, the area available for herding livestock has been significantly reduced (Ntiati, 2002). As well, many of the most reliable water sources have now been fenced into agricultural plots, vastly reducing the water available to herders and wildlife, especially during the dry-season. To reduce human-wildlife conflicts KWS has erected a 62 km electric fence in Kimana-Namelok. However, this has not only significantly reduced the land and water sources available for livestock and wildlife, but also largely shifted the human-wildlife conflicts to unprotected communities (Ntiati, 2002). Agriculture in this region is carried out for both subsistence and commercial purposes. Produce is sold locally, but some is also transported to major markets in Nairobi and Mombasa.

Eco-tourism is another income-garnering activity found within the Project Zone. There are two high-end lodges in the Project Area itself, one on Mbirkani and one on Kuku GR, and two world-famous National Parks (Tsavo West and Amboseli NP) in close proximity to the project. Tourism presents an attractive livelihood activity for local inhabitants. Both lodges are also highly involved in wildlife conservation as a parallel activity, thereby representing limited potential job opportunities, such as guides, rangers or scouts. A small percentage of local people own small businesses, mainly in the major market locations, or act as business middlemen (Best & Goss, 2014).

Eastern side, Makueni County, Kibwezi District

Job opportunities are few, with only 15% of the population employed within the formal sector (Muriuki *et al.*, 2013). Agriculture is the most important economic activity on the eastern side of the Project Zone. Seventy (70%) of the people surrounding the project are engaged in crop farming (KDDP, 2009). The average subsistence farm size is 2.1 ha, whilst the average commercial farm size is 20 ha. The main cultivated crops are maize, green grams, pigeon peas and beans (Muriuki *et al*., 2013). The majority of farmers cultivate along the rivers and streams, such as the Kibwezi and Kiboko River. Climatic variability, water shortages and droughts, however, lead to frequent crop failures and food insecurity is consistently high.

Many farms also rear livestock. Muriuki *et al*., (2013) identified that livestock acts as disposable capital and insurance against loss of crop production. Whilst cattle are also seen as an indicator of household wealth, the most abundant animals were goats, followed by chicken and cattle (ibid). The Kenya Meat Commmission has recently been revitalized and farmers are now able to sell their meat at the local market in Kibwezi and Makindu.

Trade and Tourism represent another income activities. There are 98 trading centers in the district (KDDP, 2009), which are mainly scattered along the Nairobi-Mombasa highway. There are registered retail and wholesale traders, yet the majority are informal micro businesses and hawkers. There are approximately 314 small hotels catering for the local travelers, mainly for truck drivers who transport goods along the highway.

Charcoal burning and woodcarving are other economic activities, as is bee keeping. There are a total of 38,023 beehive apiaries, and in 2007 the annual honey production was 202,000 kg, with a value of Ksh 20,200,000 (US $234,884) (KDDP, 2009). These products are either sold directly along the highway or transported to Nairobi as in the case of charcoal.

Food security

Western side, Kajiado County, Loitokitok District

A comprehensive study undertaken by Thornton *et al*., (2006) applied the Pastoral Household and Economic Wellbeing Simulator (PHEWS) model to their study area in Southern Kajiado County. This study sheds light on well-being defined in terms of food security. The PHEWS model was originally designed and calibrated for the Ngorongoro Conservation Area (NCA) and is described in Thornton *et al*., (2003). It provides a good indication of the well-being in a pastoralist society, as it tracks the flow of cash and dietary energy in agro-pastoralist households. Food security is established by the amount of external calories required each month by a household. Thornton *et al*., (2006) concludes that most of the households in the study required some external calories and that only 30-46% of all calories were “home produced”, thus concluding that food shortage and poverty remain prevalent. Local stakeholders confirmed the occurrence of monthly food shortages.

Eastern side, Makueni County, Kibwezi District

Food security is a critical issue in Kibwezi district. Recent trends of unreliable rainfall and rising temperatures coupled with the historically poor soils have led to frequent crop failures. According to Jätzold and Schmidt (1983), Makueni County is suitable for growing millet and cotton, rearing livestock, and lowland ranching. However, the main cultivated crops are maize, cowpeas, pigeon peas and beans. Maize is by far the most dominant crop grown (82% of crop area), however, the choice of seeds is usually a less drought resistant variety (Speranza *et al.,* 2008), making the crops vulnerable and further contributing to food insecurity. Furthermore, agricultural intensification practices are not widespread, and adoption rates for water and soil conservation methods are low (ibid).

Food shortages are common. According to the KDDP (2009), food poverty is experienced by 57.2% of the total population. Speranza *et al*., (2008) found that in normal years households usually experience food shortages in the months of January and February, and some intervals in June and December. This is exacerbated in years of drought, such as the 1999/2000 drought in which 91% of households experienced between 3 and 5 months of food shortage (ibid).

Public Health

Western side, Kajiado County, Loitokitok District

There are two health centres, 12 dispensaries and 7 private clinics in the former Loitokitok District, with a total bed capacity of 188 (LDDP, 2009). The doctor-patient ratio is 1:30,000 and the average distance to health facility is 30km. The HIV prevalence rate for this area is 5.7%, only 18.5% of women receive antenatal care, and the percentage of children vaccinated barely reaches 40% (ibid.).

Eastern side, Makueni County, Kibwezi District

Kibwezi has been recognized as a severely underserved area in Kenya in terms of health facilities. There are three hospitals in the district, four health centers and 18 dispensaries. The doctor-patient ratio is 1: 32,654. HIV prevalence is 9%, though Muriuki *et al*., (2013) indicated that it can be up to 30% close to the Nairobi-Mombasa highway. The diseases, which are more prevalent, have been identified as malaria, diarrhea and respiratory diseases.

Education

Western side, Kajiado County, Loitokitok District

The education standard in Loitokitok District is poor. According to the Ministry of Education (n.d.), the main challenges to education include low enrolment, low transition rates, poor primary school performance and gender imbalance. According to the 2009 census, 35% of boys and 46% of girls in rural Loitokitok have never attended school (Kenya Open data, retrieved 25 February 2014). The percentages for not attending school are lower in urban Loitokitok however, with only 9% of boys and 11% of girls never having attended school.

Transition rates from primary into secondary school are also extremely low, standing at 43.5% (Ministry of Education, n.d,). Similar can be said of academic attainment, with the Kenya Certificate of Primary Education (KCPE) results from 2006 and 2007 revealing very low performance. The mean score in 2007 was 239.29 / 500, signifying a drop from 246.22/500 in 2006 (ibid.).

Finally, with regards to gender imbalance, the percentage of girls attending school is lower than boys, and this disparity increases diversely with age. While 42% of rural girls attend primary school for instance, only 6% proceed onto secondary school. Attendance for rural boys shows similar discrepancy in terms of primary and secondary school attendance, at is 49% and 8% respectively (Kenya Open Data, retrieved 25 February 2014).

Eastern side, Makueni County, Kibwezi District

According to the KDDP (2009), 92.3% of the male population aged 15 and above is able to read and write. The equivalent figure for the female population is 77.7%. As in the western side of the Chyulu Hills, transition rates are very poor. Muriuki *et al.*, (2013) found that two-thirds of the population has only attended primary school, while 14% (men) and 12% (women) proceeded to secondary school. A very small number completed tertiary education, totaling 2.5% of men and 1.7% of women (ibid).

Water availability

Western side, Kajiado County, Loitokitok District

Water is a scarce resource in this arid to semi-arid environment. Rivers and other water points have run dry due to unregulated off-take for irrigation and degradation of water catchments. Wetlands have also been negatively impacted, many of them drying up in the wake of increased sedentism and cultivation. Part of the community, closer to developed infrastructure, has access to piped water. The other communities within the Project Zone depend on boreholes and wells. A significant number of people also tap the Nolturesh water pipeline illegally.

Eastern side, Makueni County, Kibwezi District

A total of 7,387 households (18.6%) have access to piped water, while 15,633 households (39.4%) have access to potable water (KDDP, 2009). In Kibwezi, a quarter of the households rely on springs, wells and boreholes to access their water, many of which are seasonal (Muriuki et al, 2013). The average walking distance to the nearest water point is 3.5 km. A number of households have also started to install rainwater harvesting, which has proven to be a relatively good drought mitigation measure (Muriuki et al, 2013).

Nonetheless, water remains a very scarce resource in this region. Although there are a number of rivers on the Eastern side of the Chyulu Hills that receive water from springs and seepages, including the Kiboko, Kibwezi, and Mtito Andei rivers (Blackie, 1984), this is not sufficient to support the increasing trends in human population and agricultural activities in the area. In addition, in recent years there has been an observed trend of falling water levels due to unregulated and unsustainable water off-take. This is particularly noticeable at Umani Spring, following the implementation of the Umani Mtito Andei Water project (EAWS, 2014). Due to water over-abstraction, the ecosystem has already shown signs of receding ground-water levels, including tree deaths and the drying out of perennial wetlands. Any reduction in water flow at the spring may also lead to serious social consequences in the surrounding communities as they seek to share the diminishing water quantities of the spring and replace this important resource.

Finally, the Mzima Springs to the south of the Chyulu Hills has the highest water outflow of the Chyulu Hills springs. A pipeline was built in 1957 to supply the Southern region of Kenya and the city of Mombasa with water. With such a large number of people depending on this vital water source, it highlights the importance for protecting the Chyulu Hills water tower.

Cultural diversity

Western side, Kajiado County, Loitokitok District

A variety of ethnic groups live on the western side of the hills. The area was traditionally mainly inhabited by Maasai, but with a constant influx of immigrants there has been a subsequent decline in the proportion of Maasai in the region. In 1969, the Maasai ethnic group made up 78% of the population of the Loitokitok District, while according to the 1999 population census, the proportion had declined to 50% (Ntiati, 2002). Immigrants from other areas of Kenya make up the balance, with the majority being Kikuyu and Kamba, who have mainly settled in perceived high potential agricultural areas and urban centers (ibid). There are also some Taita, and Chagga, from Tanzania, living in the area.

Many Maasai continue to practice their traditional lifestyle. For generations their social roles, status and wealth have been closely connected to their livestock and even today livestock is an important component of everyday life. Traditional pastoralists strive to increase herd size as this is seen to improve their social standing. The productivity of such a production system, however, depends mainly on animal management techniques, water availability and distribution, and the quantity and quality of forage (Bekure et al, 1991). Therefore, with population increases it can consequently result in over-grazing and over-stocking on the landscape.

Inequality between men and women is pronounced, and women are culturally and educationally marginalized (Ntiati, 2002). According to some Group Ranch regulations, women are unable to be registered as GR members. Ntiati (2002) found that Maasai women are very passive regarding land issues, and that this submissiveness will present an obstacle for future access and land rights for female stakeholders.

Eastern side, Makueni County, Kibwezi District

Ethnically, the eastern side is dominated by the Kamba tribe. Other ethnic groups include the Kikuyu, Taita, Luyha and Maasai.

Gender inequality in this region is significant. As outlined above, small-scale farming and livestock rearing are the main livelihood activities. According to the KDDP (2009), 80% of these activities are carried out and managed by women. However, women are seen to hold a lower position in the family and in the society at large, and therefore do not have control over production assets such as land and capital (ibid.). Furthermore, property is usually registered in the name of males.

1.3.4 Current Land Use, Customary and Legal Property Rights, and any Ongoing or Unresolved Conflicts (G1.6).

Land use

Land use is described in this section according to the communities that are currently living in or around the Project Area. Additionally, a distinction between intended and actual land-use is important to recognize, not only to exhibit the current status of the Project Area, but also to show the intended effects of the REDD+ Project over its lifetime. For example, several land units within the Project Area are officially protected as conservation areas, but in actuality these areas face the same threats of deforestation and conversion by consumptive land use activities as the other non-protected land units. In the group ranches, the majority of local communities practice pastoralism, with an increasing trend towards more sedentary subsistence-based agriculture.

The predominant consumptive land uses in the Project Zone fall into four categories: agriculture, pastoralism, agro-pastoralism and extractive forest resource activities. Tourism represents the prevalent non-consumptive land use present in the Project Area.

Agriculture is mainly practiced directly to the east of the Project Area and in the southwest, on the slopes of Kilimanjaro. Some households cultivate their produce through rain-fed practices, growing mainly maize and beans for subsistence use. In addition, “slash and burn” agriculture is expanding in the area along the waterways and the Nolturesh water pipeline where irrigated plots closer to the pipeline and swamps allow cultivation of maize, beans, potatoes and other vegetables both for subsistence use as well as for commerce (Thornton *et al.,* 2006).

Pastoralism is another main land use and has been the traditional land use widely practiced in the western part of the Project Area. Pastoralists herd a large number of cattle, sheep and goats. They have seasonal grazing patterns, and move into the Chyulu Hills forest during the dry season depending on the pasture quality in the lowlands. Mobile pastoralism has been the traditional livelihood of the Maasai, but other ethnic groups in the area also practice it. Some pastoralists use their livestock for subsistence use only, while others engage in livestock trading.

A third category of consumptive land use is agro-pastoralism, which is a combination of the two previous livelihood activities. With an increasing human population as well as a shift in land tenure from communal to individual land areas adjacent to the Project Area, the land is no longer able to support pure pastoralism (Thornton *et al*., 2006). As a consequence, the majority of pastoralists began to engage in cultivation, which saw a further uptake following the devastating drought of 2009. In addition, some people collect honey for sale, particularly on the eastern side of the hills.

The last consumptive land use category includes extractive activities, which are dependent on the forest resources. Charcoaling, logging and woodcarvings are main economic activities, and pose a threat to the ecosystem, particularly in the protected areas, where extraction is an illegal offence. The stimulant Khat (*Catha edulis*), also locally known as miraa, grows in the ecosystem at higher altitudes and is harvested for sale. These activities largely result in deforestation and degradation of the forest through the harvesting of trees. Illegal incursions by pastoralists into the protected areas of the Project Area, in search of pasture, further exacerbate the situation, especially since they are often the cause of anthropogenic fires.

Finally, tourism is a major non-consumptive activity in the Chyulu Hills landscape, with several tourist facilities, lodges and camps located in the ecosystem. Two high-end lodges that are located within the Project Area, include one on Mbirikani GR and one on Kuku A GR. These generate important income for the community through a daily tourist conservation fees. These funds flow directly back into the community via direct payment as well as funding other community development and conservation programs. There are a number of additional tourist lodges and camps in Tsavo West National Park and the Kibwezi Forest Reserve.

Customary and Legal Property Rights

Within the Project Zone there are several land use and tenure systems, which are recognized in both statutory and customary rights regimes. The Group Ranches are recognized as part of the customary lands of the Il Kisongo group of the Maasai. The inhabitants of these areas have a recognized claim on resource access and use.

The concept of communally owned Group Ranches and the establishment of the first land parcel under this scheme date back to mid-1960s and early 1970s. Among other reasons, it was perceived that individual smallholders would not be able to afford necessary ranch inputs (such as cattle dips), while additionally limited access to water and restricted forage made a pastoralist lifestyle near impossible. By definition, a Group Ranch is a livestock production system or enterprise where a group of people jointly own freehold title to land, maintain agreed stocking levels and herd their individually owned livestock collectively (Ministry of Agriculture, 1968). Tenure of the Group Ranch is formalized under the Land (Group Representatives) Act of Kenya (2010). This status imbues the inhabitants of these areas with a recognized right to land access and use, as well as a claim to benefit streams from the land, as defined by Kibugi (2009). All management of the ranch affairs is carried out by a Group Ranch Committee.

In recent years, however, many of the formally established Group Ranches have gone through a process of subdivision. This is true because of the desire to own individual title deeds, frustrations from nonfunctioning Group Ranch operations, and the preference for individual production over group production (Veit, 2011). This trend persists, but the process is slow and also has many opponents.

Resource use, tenure and access of the Chyulu Hills National Park and the Southern Chyulu Extension in the Tsavo West National Park fall under the jurisdiction of the Kenya Wildlife Service as mandated in the Wildlife Conservation and Management Act (2013). The land within the boundaries of these two land units is held in trust by the national Government of Kenya for the people of Kenya. Thus, the National Parks are under the mandate of the Kenya Wildlife Service. The exception to this rule is water and water resources, which are governed by the Water Act (2002).

The Kibwezi Forest Reserve was established by the colonial government in the 1930s and has been governed by the Forest Department and it's descendent, the Kenya Forest Service (KFS) since its creation. The tenure and access rights are defined in the Forests Act (2005) and the Government of

Kenya holds the forest in trust for the people of Kenya. Under the Forest Act (2005), the Kenya Forest Service also reserves the right to lease or concession the forest reserve to a third party for the proper management of the forest. In the case of Kibwezi, in 2011, the KFS awarded a concession to the David Sheldrick Wildlife Trust (DSWT), a project partner, for a period of 30 years, expressly for conservation management. This concession is a management agreement, which affords the DSWT the management rights to the forest and its resources in return for a performance-based concession payment.

The Kenya Agricultural Research Institute (KARI) is a research parastatal organization, which was established by the Science and Technology Act (1979). In a similar fashion to the KWS and KFS, KARI holds the tenure and resource rights to several properties in the country including the Kiboko property, which forms the northeastern portion of the Project Zone.

The table below lists the entities who either own or possess customary rights over each administrative unit within the Chyulu Hills REDD+ Project Area.

Table 5. Land Ownership according to Project Area Administrative Unit

Land Owner / Custodian	Project Administrative Unit
Community Shareholders	Mbirikani Group Ranch
Community Shareholders	Kuku Group Ranch
Community Shareholders	Kuku A Group Ranch
Community Shareholders	Rombo Group Ranch
Kenya Wildlife Service (KWS)	Southern Chyulu Extension, Chyulu Hills NP
Kenya Forest Service (KFS)	
KFS / David Sheldrick Wildlife Trust	Kibwezi Forest Reserve

Ongoing or unresolved conflicts

There have been two categories of land disputes in the Project Area, the first is minor boundary disputes in the Group Ranches and the second is an unresolved court case concerning the land in the Chyulu National Park.

There were two disputes over ranch boundaries and the Chyulu Hills National Park boundary, however these both have been solved amicably between the parties through the involvement of surveyors. These two disputes include:

- 2012: Mbirikani Group Ranch (MGR) – Chyulu Hills National Park (CHNP).
  There was a dispute regarding the boundary between MGR and CHNP. With the involvement of an independently hired surveyor, facilitated through the African Wildlife Foundation (AWF), this dispute was fully resolved on amicable grounds.

- 2011: Kuku A Group Ranch – Chyulu Hills National Park (CHNP)
  A dispute exited between Kuku A Group Ranch and KWS regarding the Chyulu Hills National Park boundary. This issue was resolved with thanks to MWCT. MWCT called a special general meeting and funded a surveyor to verify the beacons and boundary. After seeing official findings, both parties were satisfied and issue resolved amicably.

To date there is one unresolved court case that was filed 19 years ago. This concerns some land in the northern part of the Chyulu Hills National Park. Machakos Hccc court case 475 was filed in 1995 by Mikulolo Ranching and Directed Agriculture Co Ltd. following the gazettement of the Chyulu Hills National Park and consequent movement of people residing within the National Park, which was ordered by the Office of the President. It concerns an area of 7,600 hectares of farming land. The case is filed against the Kenyan government, namely the District Commissioner of Makueni County, The Hon. Attorney General and KWS. KWS did not order the movement of people but merely fulfilled its official obligations assisting in implementation of court orders.

Efforts to resolve the Mukulolo court case, which was filed in 1995, have increased in 2014 and 2015. This resolution was initiated when the plaintiff, Mukulolo Ranching and Directed Company Ltd, asked for a temporary injunction on the 21 November 2014 at the Machakos High Court. The following events show the progress in efforts to resolve the dispute.

- 11 December 2014: the Court granted temporary orders (court injunction).
- 17 February 2015: the Court stated that the order given earlier to maintain what is status quo was extended. There was confusion of what the Status Quo was on the land. The Court ordered the parties to resolve the dispute through involvement of a surveyor and field visit.
- 14 March 2015: Surveyor and advocates met. The case was to be mentioned on 17 March 2015. The Court ordered that the surveying of the land and boundaries shall take place within the next 45 days, beginning on the 17th of March. In collaboration with the County Land registrar. County Land surveyor, the surveyors appointed by the parties (KWS and plaintiffs).
- 17 March 2015: Parties confirmed that the visit was conducted. Photographs were adduced in Court. The Makueni County, KWS and plaintiffs surveyors were to obtain all information and determine all beacons. The Court decided that the status quo was to remain till matter determined.
  The Status quo is defined as followed:
  - No further construction of structures
  - Those in occupation remain
  - No felling of trees
  - No new cultivation
  - No killing of wildlife.
  - Cattle to remain on ground and allowed to water.

Parties further agreed on details of surveying. KWS to provide an independent person and the County surveyor shall be the lead surveyor. A report shall be produced by the lead surveyor, which KWS may agree to, or else file separate report. Costs are to be covered by plaintiffs. The Attorney General said to liaise with Land Registrar and Makueni Surveyor to collaborate. Further, the Court ordered the surveyor to liaise, and to determine the boundaries CHNP Land Reference 24362. KWS shall provide the Deed Plan, Survey Plan and Title Deed to the County Surveyor.

The exercise commenced on the first of April. According to informal information provided by the KWS Surveyor, the plaintiffs have no survey plan that supports their claim and no land titles. The matter is to be mentioned in Court on the 26th of May 2015.

1.3.5 Current Biodiversity in Project Zone (species and ecosystems), and Threats to that Biodiversity (G1.7)

The Project Zone features an extraordinary diversity of habitat types, ecotypes and species. The detailed information that follows was mainly obtained through research of academic articles and specialist papers. Numerous site surveys and key informants possessing valuable expert knowledge also helped to compile the following biodiversity data.

1.3.5.1 Wetlands

Springs: The importance of the Chyulu Hills as a water tower has been described in previous sections of this document. Rainwater percolates through the rock and volcanic ash of the Chyulu Hills and emerges in numerous springs. The Mzima Spring is located in Tsavo West National Park, approximately 55 km south of the Chyulu Hills. It is the largest and most important spring in the Project Zone, and for most of Southeastern Kenya. As a result of the natural filtration process the water from the spring is extremely pure. At the spring's source there are two large pools, surrounded by lush vegetation. Further downstream some of the water from the spring flows underground, with the rest of the outflow joining the Tsavo River via the Mzima River (Blackie, 1984). The spring is a major tourist attraction and presents a stark contrast to its semi-arid surroundings. It boasts numerous fruiting trees, including fig trees, dates and waterberries. It is also home to a small but diverse population of hippos and crocodiles, invertebrates, fish and birds. The spring additionally is an important water point for migrating wildlife. The Mzima Spring area houses an important diversity of tree species, including most importantly:

- *Newtonia hilbdebrandtii*
- *Acacia xanthophloea*
- *Acacia tortillis*
- *Acacia nilotica*
- *Acacia elatior*
- *Ficus sp.*
- *Ficus thoningii*
- *Ficus sur*
- *Ficus sycamorus*
- *Hyphenae compressae*
- *Phoenix reclinata*
- *Delonix elata*
- *Cordia monoica*

Smaller springs include Umani Springs, Kibwezi Springs and Kiboko Springs, all of which are located along the eastern side of the hills.

Rivers: The Mzima Springs feed the Tsavo and Galana Rivers with water. Tsavo River is the only perennial river in the Tsavo Conservation Area (TCA) and originates on Mt. Kilimanjaro, and merges downstream with the Athi River in Tsavo East National Park to form the Galana River. It is important to the survival of riverine forests, swamps and wetlands adjacent to the river.

The Nolturesh River, with its headwaters also from Mt. Kilimanjaro, is the main water source on the western side of the Project Area. As outlined in 1.2.1., most of the water is being diverted via the water pipeline to areas close to Nairobi. Furthermore, its banks have become severely eroded and adjacent areas heavily overgrazed (Githaiga *et al*., 2003).

Swamps: There are a number of swamps in the Project Area. These include the Kimana Swamp on Mbirikani GR, the Leikati swamp between Mbirikani and Kuku GR, and Esoitpus Swamp and Olpusare Swamp on Kuku GR.

1.3.5.2 Grasslands

East Africa is a center of genetic diversity for grasses (Reid *et al*., 2005). The western side of the Project Area features large areas of grassland, mainly on Mbirikani Group Ranch. These have traditional served as Maasai rangelands and play a very important role as grazing grounds for livestock and wildlife alike. There have been several attempts to classify grasslands in sub-Sahara into distinct classes (see Pratt and Gwynne, 1977 and Herlocker, 1999 for more details). Species composition is relatively uniform across the grassland area and perennial grass species make up most of the grazable area (Bekure *et al*., 1991). Four principal grassland communities have been identified, based on dominant genera *(Chloris, Digitaria, Pennisetum* and *Sporobolus)* (ibid).

1.3.5.3 Forests

Four broad types of forest are found in the Project Area, with these divisions dictated largely by changes in elevation, moisture and soil type. Forest types include the lowland dry forests of Acacia-Savannah Mosaic, Woodlands, Lava Forests and Cloud Forests. The forested areas are centered on the Chyulu Hills, with the Cloud Forests on the top of the hill, and the other forest types found in a mosaic of patches along the elevation gradient of the Chyulu Hills. The primary differences between the forest types in the Project Area are their species composition, canopy density and amount and species of understory vegetation. As a result of the elevation and moisture gradient present in the Project Area, the forests contain a very large breadth of both plant and animal biodiversity. Local communities utilize these forest areas for a number of uses, including for building materials, firewood collection and other traditional uses, such as obtaining poles to be used as the traditional Maasai spear. A large number of species are also used in traditional medicine. Kiringe (2006) found that a total of 41 plant species are used as traditional remedies, 54% of which are obtained from trees within the woodlands.

The upland Cloud Forest is classified as a montane cloud forest and grows at 1200 m in elevation and above. In Africa, many of these forests grow in isolated patches and current scientific knowledge regarding their species diversity and distribution is still relatively limited. In the Project Area, there are patches of montane cloud forest growing in the Chyulu Hills. The most frequent species are *Ficus spp*., *Neoboutonia macrocalyx*, *Tabernaemontana stapfiana, Strombosia scheffleri, Cassipourea malosana, Olea capensis* and *Ilex mitis*, with islands guarded by *Erythrina abyssinica.* The Cloud Forest area is additionally essential for the water tower ecological service that it provides as a water tower. As aforementioned, it acts to capture the significant quantity of moisture that falls on Chyulu Hills, enabling it to percolate through the volcanic ash and rock into the underground aquifers, which then feed a number of springs including most notably the Mzima Springs. The Cloud Forest atop Chyulu Hills is therefore integral in helping sustain one of the most significant water sources for people and wildlife in Southeastern Kenya. The forested areas of the project are also home to a number of endangered and endemic species, such as African stinkwood (*Prunus africana*), which is classified as vulnerable (VU) on the IUCN Red List.

1.3.5.4 Animal diversity

Mammal diversity

The Project Area is home to an incredible array of wildlife. Most famously, the area boasts the iconic ‘big five’, that is: the African elephant (*Loxodonta Africana*), Black rhinoceros (*Diceros bicornis*), African buffalo (*Syncerus caffer*), Leopard (*Panthera pardus*) and Lion (*Panthera leo*). In addition to these

charismatic megafauna, there are a large number of equally-aesthetic animals. These include predators such as jackal (Canis *spp.),* wild dog (*Lycaon pictus*)**,** cheetah (*Acinonyx jubatus*)*,* spotted and striped hyena (*Crocuta crocuta* and *Hyaena hyaena*), as well as large numbers of antelopes, including Thompson's (*Eudorcas thomsonii*) and Grant's gazelle (*Nanger granti*)*,* eland (*Taurotragus oryx*)*,* bushbuck (*Tragelaphus scriptus*), Mountain Reedbuck (*Redunca fulvorufula*), Steinbok (*Rhapicerus campestris*), Coke's hartebeest (*Alcelaphus buselaphus cokii*), Fringe-eared oryx (*Oryx beisa callotis*), Gerenuk (*Litocranius walleri*), Impala (*Aepyceros melampus*), Lesser kudu (*Tragelaphus imberbis*), wildebeest (*Connochaetes taurinus*) and Kirk's DikDik (*Madoqua kirkii*). Finally, there are also Burchell's zebra (*Equus burchelli*)*,* Warthogs (*Phacochoerus africanus*), Bushpigs (*Potamochoerus porcus*), and Maasai giraffes (*Giraffa camelopardalis tippelskirchi*)*.* Whilst this is a non-exhaustive list, it nonetheless usefully indicates the great mammal diversity of the Project Area.

Bird diversity

Due to its topographic features, the Project Zone acts as an important habitat as well as stop-over point for a large number of birds, many of which are threatened and/or endemic.

Such species include the IUCN Red listed Abbott's Starling (*Cinnyricinclus femoralis*), which lives on a few montane forest patches in Kenya and Tanzania and is classified as vulnerable (VU). This bird uses the Chyulu Hills mainly as a stopping point between Mount Kilimanjaro and the central Kenyan highlands (Bennun and Njoroge, seen 12 February 2014). Endemic bird species include *Francolinus shelleyi* (macarthuri), *Pogonocichla stellata* (macarthuri) and *Zoothera gurneyi* (chyulu). Regionally threatened species include *Hieraaetus ayresii* (status unknown); *Stephanoaetus coronatus* (status unknown) and the vulnerable *Polemaetus bellicosus* (ibid). Finally, Ostriches (*Struthio camelus)* are found in the lower areas of the Project Zone.

Amphibians, reptiles, insects

The Chyulu Hills area is home to a large array of butterflies. Endemic species include *Pentila tropicalis chyulu, Acraea anacreon chyulu, Papilio desmondi desmondi* and the near-endemic *Amauris echeria chyuluensis.* Two amphibian taxa, *Afrixalus pygmaeus septentrionalis* and *Hyperolius sheldricki*, are also endemic. Reptile diversity is also significant and includes snakes, such as the black mamba (*Dendroaspis polylepis*), puff adder (*Bitis peringueyi*), rock python (*Python molurus*), as well as a number of different species of gecko, and lizard.

1.3.5.5 Threats to the biodiversity

1. Land conversion and unsustainable water offtake

Threats to this habitat are many and varied. Waterways are threatened due to unregulated water off-take, agricultural expansion and degradation of water catchments. This is accompanied by siltation and eutrophication, with its long-term impacts upon the land, such as dying swamps.

2. Deforestation and forest fires

Forested areas are at major risk from deforestation and degradation.

As further described in Sections 4.5.8.1 (Delineating Reference Areas) and 4.6 (Additionality) there is evidence of significant encroachment into the Project Area already, including within the land units that are officially protected. Forested and/or native grassland areas are cleared the same way they have been for generations, with the deforestation and conversion generally accomplished by hand through an unplanned process to meet immediate familial nourishment requirements (subsistence farming). These

subsistence farming practices represent the primary cause of deforestation and conversion in the low-lying portions of the Project Area. Both the grassland project accounting area and forest project accounting areas of the Project Area face the same threat and pattern of deforestation and conversion, as both the dry-land ecosystem typical in Southeastern Kenya, comprised of low lying forest, shrubland and grassland, exhibit similar characteristics.

In the hills, gathering or harvesting of wood for the production of carvings is rampant and ongoing. Over-extraction is commonplace and woodcarvers now venture deep into the national parks and the forest reserve as these are the only remaining sources of the desired wood species remaining in the area. Often the carvers reside in the Project Area, where they perform the wood carving activity in-situ.

Illegal charcoal production in the Project Zone is a significant driver of deforestation, particularly on the eastern boundaries of the Project Area. Charcoal is produced either by targeted cutting of specific species across a larger area, or clear-felling areas and burning the trees in earthen kilns, usually built at the site of deforestation itself. This activity leads to significant forest degradation, and often results in eventual deforestation.

Firewood is also collected on a large scale and anthropogenic fires are a common occurrence.

There is significant evidence that the boundaries of even the protected portions of the Project boundaries are not enforced (see Section 4.6), and that there is a substantial amount of uncontrolled access into protected areas that leads to rampant conversion.

3. Poaching and habitat loss

Subsistence poaching of small game is still carried out in the area and is mainly a threat to small antelopes. More worrisome however, is the threat of elephant and black rhino poaching has increased significantly in the last few years and is a serious menace for the critically endangered rhino population living in the sanctuary.

4. Habitat fragmentation

Habitat loss due to agricultural expansion, settlements and fences may influence wildlife migration routes, causing habitat fragmentation.

5. Climate Change

Climate change in Southeastern Kenya will result in increasing average temperatures, produce more frequent and prolonged droughts (Downing *et al*., 2008), and reduce the productivity of the traditional subsistence crops grown by local farmers who already experience low variability and diversity of crops. High reliance on subsistence agriculture due to low skills and lack of knowledge concerning other income-generating activities can lead to severe vulnerability to climate change, which in turn poses a large risk to biodiversity. The 2009 drought, for example, had devastating effects on wildlife numbers (Worden *et al*., 2010).

Increases in drought and decreased rainfall forces local smallholder farmers to rapidly expand, in search of more fertile locations, leading to increased threat of encroachment into the Project Area, and, as a result, heavy threats to both flora (through deforestation) and fauna (from increased poaching activities). Failed crops trigger increases in poaching for bush meat, which will be stressed by even lower rainfall and higher median temperatures in the future, and wildlife populations may be less able to withstand further stress from poaching.

1.3.6 High Conservation Values within the Project Zone (G1.8)

1.3.6.1 Globally, regionally or nationally significant concentrations of biodiversity values

Due to its diversity in landscapes, habitats and species, the Project Zone contains a number of biodiversity values that are significant on a global, regional and national level.

1.3.6.2 Protected Areas

The Project Zone contains two land units that are Protected Areas, namely the Chyulu Hills National Park and the Tsavo West National Park. Both of these fall into IUCN Protected Area Management Category II. In addition, these parks are part of the greater Tsavo Conservation Area (TCA), which is globally recognized for its large elephant population.

Tsavo West NP and the Rhino Area in the Chyulu Hills NP have also been identified as being amongst Kenya's 80 Key Biodiversity Areas (KBAs)(UNEP-WCMC, seen 11 February 2014). These Key Biodiversity Areas are areas of high priority for conservation. They are identified using globally standard criteria and thresholds, based on the needs of biodiversity requiring safeguards at the site scale. These criteria take into account vulnerability and irreplaceability of species (Langhammer *et al*., 2007). Important Bird Areas (IBA) are an extension of Key Biodiversity Areas. Parts of the Chyulu Hills have been identified as an IBA (026) for Kenya, as has Tsavo West National Park (027) (Bird Life International, seen 11 February 2014). The efficacy of the protection status of both of the aforementioned areas is under question, as both locations have seen moderate to severe pressure from encroachment, poaching and illegal charcoaling / wood extraction.

1.3.6.3 Threatened Species

There are a number of species in the Project Area that are classified as either near threatened, vulnerable, endangered or critically endangered. The following lists threatened species according to the IUCN within the Project Area:

Near Threatened (T):

- Leopard (*Panthera pardus*)
- Gerenuk (*Litocranius walleri*)
- Lesser kudu (*Tragelaphus imberbis)*
- Thompson's gazelle (*Eudorcas thomsonii)*
- Rock python (*Python molurus*)

Vulnerable (VU):

- African Elephant (*Loxodonta Africana*)
- Cheetah (*Acinonyx jubatus*)
- Lion (*Panthera leo*)
- Abbott's Starling (*Cinnyricinclus femoralis*)
- Martial Eagle *(Polemaetus bellicosus)*
- African Stinkwood (Prunus Africana)

Endangered (EN):

- Wild dogs (*Lycaon pictus*)

- Basra reed warbler (*Acrocephalus griseldis*)
- East African Yellowwood *(Podocarpus usambarensis)*
- White-backed Vulture (*Gyps africanus*)

Critically endangered (CR):

- Black rhinos (Diceros bicornis): a small population of black rhinos lives in the Rhino sanctuary in the northern part of the Project Area. The rhino area remains severely threatened.

1.3.6.4 Species Endemic to the Chyulu Hills Ecosystem

There are a number of sub-species that are endemic to the Chyulu Hills ecosystem present in the Project Area, particularly in Chyulu Hills National Park. These endemic sub-species will be monitored under our outlined Biodiversity Monitoring Plan. This may reflect the relatively young age (in evolutionary terms) of these hills. More research needs to be undertaken to investigate further endemism in the area. The following species and/or subspecies are known to be endemic in the Project Area:

Table 6. Sub-Species endemic to the Chyulu Hills ecosystem found Within the Project Area

Fauna	Common Description	Linnean Taxonomy
Birds		
	Shelley's Francolin White-starred Robin Orange Ground Thrush	*Francolinus shelleyi* *Pogonocichla stellata* *Zoothera gurneyi Chyulu*
Butterflies		
		Pentila tropicalis chyulu *Acraea anacreon chyulu* *Papilio desmondi desmondi* *Amauris echeria chyuluensis*
Amphibians		
		Afrixalus pygmaeus septentrionalis *Hyperolius sheldricki*

1.3.6.5 Areas that support significant concentrations of a species during any time in their life cycle (e.g. migrations, feeding grounds, breeding areas).

Okello (2009) and Okello (2011) highlight the importance of both Kimana GR and Mbirikani GR respectively as critical dispersal areas for wildlife. Generally speaking, the Project Area acts as an important corridor for wildlife, particularly for elephants and lions. Blanc *et al*., (2003) identified that over 80% of the known elephant range lies outside of protected areas. A study conducted by Kioko & Seno (2011) investigated four migration corridors in the Tsavo-Amboseli-Kilimanjaro ecosystem and highlighted their importance in the face of increased human population, land conversion, sub-division and other threats. Areas such as the Kimana Sanctuary on Kimana Group Ranch, which borders Kuku GR and Mbirikani GR, as well as Amboseli National Park, are important concentration areas for bull elephants during the dry season and the point from which they make forays into the adjacent dispersal areas (Kioko *et al*., 2006). Elephants are a keystone and flagship species whose conservation is key to the survival of other species. Together with elephants, Kioko & Seno (2011) identified over 17 other large mammal species that used the corridors as the only conduits for migrate back and forth to Kimana Sanctuary and

the adjacent dispersal area. It is therefore necessary to ensure that the effects of habitat loss and fragmentation are minimized by promoting habitat connectivity through corridors.

The Tsavo-Amboseli-Kilimanjaro ecosystem is also an important dispersal area for lions. According to Frank *et al*., (2006), the estimated number of lions living in the Tsavo ecosystem is the second largest in Kenya. However, lion populations face severe pressure as they are still killed out of retaliation for livestock loss or for the traditional Maasai practices of *Olamaiyo* (young men proving their manhood). Although historic and current scientific data is incomplete, there is consensus amongst experts that lion numbers in Kenya have decline substantially over the course of the last decade (ibid). It is therefore important to further protect the lion population in the Project Area, in order to halt further decline in their numbers.

1.3.6.6 Globally, regionally or nationally significant large landscape-level areas where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance

As highlighted above, the Project Area is part of the Tsavo Conservation Area and offers landscape-connectivity within Kenya as well as into Tanzania. In addition, the Project Area is located in the Somali-Maasai Biome, which expands from the Horn of Africa down to Northern Tanzania, and contains a suite of habitats and viable populations of species. 60 of the 92 species in the Somali-Maasai biome have been recorded in Tsavo, and thus the Project Area plays a vital role in maintaining these natural patterns of species distribution and abundance.

1.3.6.7 Threatened or Rare Ecosystems

The Chyulu Hills ecosystem has itself been identified as having incredible ecological value. In its submission to UNESCO for the inclusion of Tsavo Parks and the Chyulu Hills Complex as a World Heritage Site, KWS noted, “The volcanic hills of Chyulu, ash cones and craters are outstanding examples of the major stages of the earth's history. Presence of numerous plant taxa, epiphytes, saprophytes and the beautiful montane forests also indicate on-going ecological and biological processes. Chyulu is an important corridor for Elephants that move from Tsavo to Amboseli game reserve” (KWS, 2010). This is also important in the debate about climate change, resilience and adaptation. As richness in biological diversity indicates an underlying richness in the ecological processes which result in the biodiversity. Evidence from multiple ecosystems at a variety of temporal and spatial scales suggests that biological diversity acts to stabilize ecosystem functioning in the face of environmental fluctuation (Thompson *et al.,* 2009, Cleland, 2011). The montane cloud forest is equally of great conservation concern due to its vital role as a water catchment, yet it is under substantial risk of severe deforestation, as previously outlined. The Project Area is home to a considerable number of endemic species, whilst also providing a last refuge for the critically endangered black rhino population. It is an area of outstanding scenic value, with Mt. Kilimanjaro in the backdrop and the Chyulu Hills rising high above the great plains of Tsavo and Amboseli

1.3.6.8 Areas that provide basic ecosystem services in critical situations (e.g. watershed protection, erosion control)

Critical ecosystem services are those services where their disruption of such would pose a threat of severe, catastrophic or cumulative negative impacts on welfare, health or survival of local communities (Brown *et al*., 2013, p. 37). In the Chyulu Hills REDD+ Project it has been identified that High Conservation Values (HCV) exist in the areas of hydrological services and erosion control. These are described in more detail below.

1.3.6.9 Hydrological services

The Chyulu Hills mountain range at large has been identified as of HCV location due to its vital importance as a water catchment. According to the Kenya Water Tower Agency (KWTA), “Kenya is endowed with a number of smaller water towers, many of them located in arid and semi-arid areas where they play a critical role as sources of water for pastoral communities, as well as sources of piped water for urban settlements” (KWTA, seen 12 February 2014) of which the Chyulu Hills are one. The springs (including Kiboko, Umani and Mzima Springs) are critical for providing clean drinking water, water for cooking, washing and irrigation. The predominantly poor and rural population is therefore highly dependent on the continued supply of clean water.

In addition, the 220 km long Mzima pipeline runs from Mzima Springs in Tsavo West National Park to the coastal city of Mombasa. Administered by the Coast Water Board Services, it is one of the main water supplier to the city of Mombasa and its environs. This highlights the importance of the Chyulu Hills as a critical water catchment area.

It is important to note that in recent years a significant drop in water levels has been observed throughout the Project Area. As outlined in section 1.3.3, this has been particularly noticeable at Umani Spring. Local water off-take therefore needs to be regulated and administered appropriately and any plans for future abstraction need to be reviewed. Over-abstraction could have devastating consequences on water availability within the landscape itself, which would impact the local and regional communities, and wildlife alike.

1.3.6.10 Erosion control

According to the HCV Network Toolkit, the grasslands within the Project Area are classified as being of HCV such that their loss would lead to serious soil erosion and desertification. This is particularly the case in arid and semi-aid areas of the Project Area, where soil fertility is low. The grassland / shrubland areas in the west of the Project Area therefore qualify as HCVs. Due to the reduction in availability of traditional grazing land in Kajiado County resulting from sub-division of adjacent Group Ranches, there is increased pressure on the Project Area. It is therefore important to design a regulated grazing management and zoning plan in these ranches to prevent soil erosion resulting from over-grazing.

1.3.6.11 Areas that are fundamental to meeting the basic needs of local communities (e.g. for essential food, fuel, fodder, medicines or building materials without readily available alternatives)

Local communities rely on natural resources in the Project Zone and the surrounding areas to satisfy their basic needs. In particular, pastoralists depend on a number of provisioning services, which classify as being of HCV. Building materials such as poles and sticks are sought after, as they are required to build the traditional Maasai house, the *boma*. With the seasonal change in grazing patterns, the demand for such is maintained, as new *bomas* are established on a periodic basis. Further, cooking uses firewood within and around the Project Zone.

As such, the Project will seek to provide ready alternatives to the unsustainable extraction of wood products. The resources needs of the communities in the Project Zone that leads to deforestation, degradation, and conservation is an important subject for FPIC and other community meetings. The project activities are additionally all focused on reducing the resource needs of the communities in the Project Area specifically, and the Project Zone more broadly. This includes such activities as improved and intensified agricultural techniques, sustainable charcoal, tree nurseries and alternative income sources.

There are also a number of NTFPs and medicinal plants that are important in Maasai culture. These include, for example, barks and leaves from trees which are used in the post-natal treatment of women, branches from *Acacia mellifera* for the traditional Maasai spear shaft as well as *Thunbergia holstii* for warriors' perfume. These are consumed in relatively small amounts and carbon accounting does not track consumption of these products separately in forest biomass monitoring. Local stakeholders will continue to collect NTFPs and small amounts of wood from the Project Zone, and it is believed that no alternatives need to be sought at this time.

Finally, as outlined in the HCV Network Toolkit (Brown *et al*., 2013), fodder and grazing land with no readily available alternative represent HCVs. Local communities are dependent on the plains of the Group Ranches for pasture for their livestock. In dry spells, they become more dependent on areas of higher altitude, and typically graze close to the Chyulu Hills National Park.

1.3.6.12 Areas that are critical for the traditional cultural identity of communities (e.g. areas of cultural, ecological, economic or religious significance identified in cooperation with the communities)

To the Chyulu Hills REDD+ Project's knowledge, there are no globally or locally recognized areas that are critical for the traditional cultural identity of the communities. Moreover, upon consultation, it was found that no sacred sites have been established within the Project Area, with the exception of a single fig tree within Chyulu Hills National Park. This tree serves as the site for slaughtering a black sheep in times that rains are late. Such ceremony only occurs during times of prolonged drought and it can also be undertaken under any other fig tree in a different location.

Given the above, the Maasai, as mentioned earlier, do maintain a significant level of traditional practices. Their lifestyle is not only extremely valuable in terms of their own culture, but it also provides a means for revenue generation through tourism. The aim of the REDD+ Project is to bolster and accentuate such traditional practices, and through strong collaboration with local communities, will identify key areas which are required to be preserved, and use Carbon resources to protect the traditional lifestyle of the local stakeholders. Carbon must be seen as a *positive force* in the eyes of the local communities. Should this fail, it is understood that the Project will likely fail as well.

1.4 Project Proponent (G4)

The Project Proponent for the Chyulu Hills REDD+ Project is the Chyulu Hills Conservation Trust. The Project Proponent will govern the Project Office, which will handle day to day operations.

The implementation of project activities will be undertaken by the Project Office. The role of the project office is to coordinate all project activities, ensure maintenance of the carbon stock, carry out carbon analysis and monitoring and conduct all external audits. It also collaborates with the project partners, responds to community inquiries and assists in the protection of biodiversity. A Carbon Office shall be established which will hold regular business hours and will be readily available for members of the community to receive information about and education on REDD+, to express any concerns or grievances and interact with the Project Proponent in an open and free fashion.

An advisory committee will oversee the overall strategic direction of the project. This committee is made up of representatives from the project partners and stakeholders, and will meet on a regular, recurring basis.

The project operations on the ground will be coordinated though the project office, but will be carried out by the various project partners themselves. BLF, MWCT, KWS, KFS and DSWT still continue their independent activities in addition to the activities specific to the Chyulu Hills REDD+ Project. The project partners' role is to assist in the implementation of the REDD+ project activities and to act as a link between the communities' needs and the Project Office.

1.4.1 Project Partners

Big Life Foundation

The Big Life Foundation (BLF) is a Kenyan–registered Trust based on Mbirikani GR. It was founded by photographer Nick Brandt and conservationist Richard Bonham in September 2010 with the aim of enhancing the protection of the Amboseli-Tsavo ecosystem through a holistic conservation model. Prior to this initiative, Richard Bonham had been running the Maasai Preservation Trust (MPT) for over 20 years. The entities merged in 2010. Currently, BLF uses many of MPT's strategies in a community collaborative approach to address the region's greatest wildlife threats, reduce the loss of wildlife to poaching, defeat the ivory trade, mitigate human-wildlife conflict, protect the great predators, and manage scarce and fragile natural resources. It recognizes that for the Maasai residents of Mbirikani Group Ranch and the Amboseli-Tsavo ecosystem as a whole, the cost of living with wildlife currently exceeds the benefits and therefore works to shift this dichotomy.

BLF operates a large number of different projects, ranging from a Game Scouts and Security Programme, to a Predator Compensation Fund, the Moran Education Initiative (MEI), Wildlife Scholarships Programme, and Alternative Livelihoods Programme. Currently BLF employs 260 staff in its Kenyan and an additional 55 staff in its Tanzanian operations, with 31 outposts and 15 vehicles helping to protect 2 million acres of wilderness in the Amboseli-Tsavo ecosystem. In addition, Big Life works with an advisory committee of 17 members that represent the community in decision-making regarding new projects and activities (outlined in detail in 2.7.1.). BLF thus has significant influence on the Chyulu Hills REDD+ Project's operations and activities and many of the carbon project's activities will be coordinated through Big Life.

BLF's primary role in the REDD+ project will be focused on anti-poaching and security measures, as they have long-term experience in this field as well as expert knowledge of the landscape. BLF will also be instrumental in the running of the predator compensation scheme for their area of influence. Their local expertise will also be of value when determining what other income generating activities shall be implemented and they have a voting seat on the Board of Trustees.

Maasai Wilderness Conservation Trust

The Maasai Wilderness Conservation Trust (MWCT) is a Kenyan registered trust and was set up in 2000 by Luca Belpietro, Antonella Bonomi and Samson Parashina on Kuku GR. The goal of MWCT is to protect the wilderness, wildlife and cultural heritage across the Tsavo-Amboseli ecosystem by providing sustainable economic benefits to the local Maasai people. MWCT is a pioneering partnership between professional conservationists and dynamic young Maasai leaders.

MWCT has a holistic approach and operates different programmes that aim to improve the lives and promote sustainable economic benefits to the local Maasai community. In return, they are asked to protect their natural resources. Its activities are focused on three different areas, namely conservation, health and education. In addition, Campi Ya Kanzi, a high-end tourism lodge, provides direct economic income to the communities through the conservation fee that each guest pays. Overall, MWCT employs 250 people, 88% of which are Maasai from the local Maasai communities.

MWCT currently employs 101 local Maasai as community rangers to protect the wildlife and wilderness on Kuku Group Ranch. In addition, young Maasai warriors are employed as “Simba Scouts” to protect and monitor the lions in the ecosystem and to prevent and stop lion hunts. However, in a landscape of the scale of the Project Area, and featuring such varied and often challenging terrain, many more rangers and equipment are desperately needed in order to properly protect the ecosystem from deforestation threat.

MWCT will be responsible for running anti-poaching activities, predator compensation schemes and improved livestock management on Kuku A, Kuku and Rombo with close collaboration with the Project Office. MWCT’s expert knowledge in the area and established community relations will also assist in the execution of other project activities, including support for local schools, healthcare staff and facilities, water supplies, bursaries, women’s programs, and the development of holistic grazing regimes for livestock.

Kenya Wildlife Service

The Kenya Wildlife Service (KWS) is a Kenya state corporation established by an Act of Parliament and the Wildlife (Conservation and Management) Act No.16 of 1989 with the mandate to conserve and manage wildlife in Kenya, and to enforce related laws and regulations. Its mission is to “save the last great species and places on Earth for humanity”.

KWS is the mandated authority for both the Chyulu Hills National Park (with its headquarters near Kibwezi town) and the Southern Chyulu Extension in the Tsavo West National Park (with headquarters near Mtito Andei). KWS manages the wildlife, wildlife habitat, security and tourism in the parks. In addition, KWS runs a number of community projects, aiming to raise environmental awareness through education and also it also deals with human-wildlife conflict mitigation. KWS will thus have significant impact on the day-to-day operations of the REDD+ project, particularly in terms of security and protection of the habitat areas it encompasses which includes the significant carbon stocks of the cloud forest.

KWS’s mandate is the continued management of the national parks, and thus they will mainly provide operational assistance and collaboration for the newly employed carbon rangers in close partnership with the Project office. KWS will also be in charge of running the predator compensation scheme and human-wildlife mitigation initiatives on the eastern side of the project area as well as ensure continued community engagement through their outreaches.

Kenya Forest Service

Kenya Forest Service (KFS) is a State Corporation established in February 2007 under the Forest Act 2005 to conserve, develop and sustainably manage forest resources for Kenya's socio-economic development. Its vision is “to be the leading organization of excellence in sustainable forest management and conservation globally” (KFS website, retrieved 13 December 2013). KFS is the landowner of the Kibwezi Forest Reserve, which was gazetted in 1936. A concession agreement was granted to the David Sheldrick Wildlife Trust (DSWT) in 2009, which handed over the management rights to the DSWT for 30 years.

KFS is a department of the Ministry of Forestry and Wildlife, which is mandated to develop the National REDD+ Strategy and launch the National REDD+ Programme, through its input into the National REDD+ Coordination Office. With KFS as a key stakeholder in the Chyulu Hills REDD+ Project, it is anticipated that the implementation of the CHRP will influence policy and programme design at the national level. With the broad scope and scale of the CHRP, it is also anticipated that KFS will play a key role in advocacy for the project at a national level. With the broad scope and scale of the CHRP, it is also anticipated that KFS will play a key role in advocacy for the project at a national level.

David Sheldrick Wildlife Trust

The David Sheldrick Wildlife Trust is a wildlife conservation charity registered in Kenya. Separate entities that represent the Trust are also registered in both the United Kingdom and the United States. The trust was established in 1977 by Dr. Dame Daphne Sheldrick, in honor of the memory of her late husband, famous naturalist and founding Warden of Tsavo National Park, David Leslie William Sheldrick. Today, it runs the world's most successful orphan-elephant rescue and rehabilitation program and is one of the pioneering conservation organizations for wildlife and habitat protection in East Africa (DSWT website, seen 13 December 2013).

The DSWT operates in several locations in Kenya. One of their projects is the Kibwezi Forest, whose main focus is habitat protection and conservation. The DSWT has a 30-year concession with the KFS for the Kibwezi Forest, which writes over management rights to the trust. There is a self-catering high-end tourist facility at Umani Springs within the Kibwezi Forest, allowing a small number of tourists to enjoy the forest and its biodiversity. In addition, the DSWT collaborates with the surrounding communities by organizing educational visits of schools to the area. A regulated scheme set up by KFS also allows women to collect dead firewood from the forest for a small fee. In addition, the DSWT operates a de-snaring and anti-poaching team in the Chyulu Hills National Park.

DSWT's responsibility will be in partnering with rangers from KWS, MWCT, BLF and newly employed carbon rangers to coordinate anti-poaching and security activities. DSWT will continue to coordinate with the Project Office in community outreach, bursary schemes, community projects and capacity building.

The African Wildlife Foundation

The African Wildlife Foundation (AWF) is an international conservation organization founded in 1961, then called the African Wildlife Leadership Foundation. AWF is the largest conservation NGO working exclusively on African conservation issues. Its purpose is to develop sustainable systems within Africa's landscape, taking into account the needs of biodiversity and communities alike. It focuses on a landscape-level approach by identifying large, ecologically-important areas that typically span national boundaries.

Previously, AWF has provided grants to on-the-ground operations in the Chyulu Hills, including BLF and KWS. AWF has aided in the execution of Free, Prior and Informed Consent (FPIC) with the communities and landowners as well as assisting with the carbon accounting work.

Once the REDD+ project is established and validated, AWF's involvement will mainly be in an advisory capacity as well as potentially providing some further funding for additional projects. Through their long-term involvement, mainly through BLF and KWS, valuable lessons can be learnt from their experience and hence their opinions will be valuable in assisting in decision-makings by the Board of Trustees.

Conservation International

Conservation International (CI) is a non-profit environmental organization, set up in 1989, with headquarters in Arlington, Virginia. It is one of the largest conservation organizations headquartered in the US, with close to 1,000 employees worldwide. Its vision is to protect nature, and its biodiversity, for the benefit of humanity.

CI is one of the leading developers and implementers of forest carbon projects, including REDD+ and A/R, and is building a diverse global portfolio of site-level initiatives, with projects already verified under the Verified Carbon Standard (VCS) and/or the Climate, Community and Biodiversity Standards (CCBS) in Peru, Fiji, the Philippines, Brazil, and Madagascar. At the national level, CI advises numerous countries on REDD+ policy and UNFCCC negotiations, as well as on REDD-Readiness and Measuring, Monitoring, Reporting and Verification (MRV) issues and is testing the development of nested approaches to REDD-plus in order to link its ground activities with national REDD frameworks, including with the governments of Peru and Madagascar. CI also a global leader in developing funding and financing mechanisms for REDD+.

CI has a close link to MWCT and has supported them financially since 2011. CI's role within the REDD+ project is to drive the legal side of the partnership, providing international exposure and to support the MWCT management of the Carbon Office. CI has also offered valuable contributions to the REDD+ project by sharing their knowledge and experience in the development of REDD+ projects and other large conservation initiatives.

CI's primary responsibility in the REDD+ project will be continued technical support for project development and implementation and the selling and marketing of carbon credits, once the project is verified and credits have been issued. CI has significant experience and a track record of selling REDD credits and will continue to support the Chyulu project.

Wildlife Works Carbon

Wildlife Works Carbon (WWC) is a community/conservation focused, for-profit organization established in 1998. It is the world's leading REDD+ project development and management company, with an effective approach to applying innovative market-based solutions to the conservation of forest and biodiversity. Its headquarters are in Mill Valley, California, but WWC's operations are focused in Africa, and in fact expand across the globe. In 2011, WWC's Kasigau Corridor REDD+ Project became the world's first dual VCS / CCB validated and verified project. WWC followed this in 2012 with the validation and verification of the Lac Mai Ndombe REDD+ project in the Democratic Republic of Congo, another first of its kind. Wildlife Works has over a decade of experience in operating successful conservation projects in East and Central Africa.

In 2013, WWC was contracted by the project partners to assist with the establishment of the Chyulu Hills REDD+ Project. In particular, WWC is expected to carry out technical project development, oversee FPIC activities, draft all project design documents and manage the accreditation audits.

WWC's involvement after validation will be as an advisory partner, if and when desired by the Board of Trustee and Project office. WWC has extensive experience in the management and implementation of REDD+ project activities in southeastern Kenya. Wildlife Works also has significant experience in developing the market for REDD credits and will assist the project in its future marketing and sales of credits.

1.5 Other Entities Involved in the Project (G4)

There have been several other organizations that have been critical to the authoring of this document and will continue to be essential to the success of the project:

1. The University of California, Santa Barbara: Wildlife Works engaged several students in the Geography Department to collect and interpret imagery for the Biomass Emissions Model

   Contact: Dr. Greg Husak, Department of Geography. husak@geog.ucsb.edu.

2. The Kenya Land Conservation Trust (KLCT): KLCT provided advice on land tenure issues and legal entity structures. Kenya Land Conservation Trust. P.O. Box 1582-00502, Nairobi, Kenya. info@klct.or.ke

   Contact: Elizabeth Gitari, Legal/Program Officer. Karen Nairobi, Kenya. wgitari@klct.or.ke

3. The legal offices of Freshfields, Bruckhaus, Deringer: Freshfields provided legal advice and support for development of legal agreements in relation to the REDD+ Project.

   Contact: Max Cairnduff, max.cainduff@freshfields.com.

4. The legal offices of Raffman, Dhanji, Elms and Virdee: Guy Elms provided pro-bono work for the Project partners. His function is to assist Freshfields in interpreting Kenyan law for the Project.

   Contact: Guy Elms. elms@rev.co.ke.

5. The REDD+ Coordination Office within in the Ministry of Forestry and Wildlife: The REDD+ Coordination Office has the mandate to develop the national REDD+ Program for the country of Kenya.

   Contact: Permanent Secretary for the Ministry of Forestry and Wildlife. Alfred Gichu. alfredgichu@yahoo.com.

The Chyulu Hills REDD+ Project is managed and operated by a pool of qualified staff, who each possess long-standing experience and a positive track-record in their respective fields. Below is a listing of the key positions and project-specific technical skills deemed necessary for the successful operation of the REDD+ Project. Between the Project partners and their advisors, the Project possesses all of the following skills:

- Project Management
  - Strong knowledge of REDD+, third-party crediting and good leadership skills required. Experience of African conservation project, security matters and on-the-ground operations deemed necessary. Knowledge of Swahili and/or Maa beneficial.
- Carbon Accounting
  - Excellent knowledge of carbon accounting, GIS and remote sensing necessary. Experience in VCS and CCB crediting advantageous. Attention to detail and ability to train plot samplers required.
- Social and Biodiversity Monitoring
  - Thorough understanding of Monitoring, Reporting and Verification (MRV) requirements necessary. Background in monitoring and research beneficial. Knowledge of Swahili and/or Maa required.

- Operations and Administration
  - Experience in African on-the-ground security operations, mechanical skills and ability for quick assessment in security cases required. Good leadership and coordination skills necessary. Basic knowledge of Swahili and/or Maa beneficial.
- Community Engagement
  - Strong understanding of REDD+, fluency in Swahili and/or Maa and good presentation skills required. Enthusiasm to engage with local community and willingness to answer recurring questions to the same preciseness needed. Preferably from local communities.

1.6 Project Start Date (G3)

PDR.6 Project Start Date.

The project start date for the Chyulu Hills REDD+ Project is the date on which the biomass sample plot sampling commenced: 19 September, 2013. This is ultimately the date when carbon-related activities began in the landscape and therefore marks the project start date.

1.7 Project Crediting Period (G3)

PDR.7 The project crediting period start date and length.

The project lifetime will be 30 years commencing from the Project start date of 19 September 2013. The GHG accounting period will be the same 30 years as the lifetime of the project.

PDR.8 Dates for mandatory baseline reevaluation after the project start date.

Per the VCS guidelines, a mandatory baseline re-evaluation is to be executed at a minimum of every 10 years after the project start. Therefore, there will be a mandatory baseline re-evaluation on or before 19 September 2023 and on or before 19 September, 2033.

PDR.9 A timeline including the first anticipated monitoring period showing when project activities will be implemented.

Table 7: Proposed Project timeline including project activities and first and second monitoring milestones.

Date	Project Activity or Event
19 September 2013	Project start date and project crediting start date.
June 2014	MOU signed among Project partners establishing Project Proponent, project office agreement and project operating structure
July 2014	Project Document Public Comment Period
September 2014	Project Validation
October – December 2014	Participatory Rural Appraisal
November 2014	Establishment of Project Ranger force
November 2014	Tree nursery established
January 2015	First project verification event
January 2016	Second project verification event

PDR.10 A timeline for anticipated subsequent monitoring periods.

The following diagram depicts the proposed Chyulu Hills REDD+ Project validation and verification timeline.

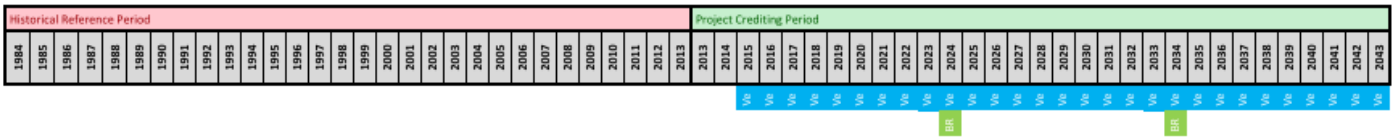


Figure 5: Project verification and baseline re-evaluation timeline (Ve= Verification event; BR= Baseline Re-evaluation).

2 DESIGN

2.1 Sectoral Scope and Project Type

The Chyulu Hills REDD+ Project falls under the VCS sectoral scope 14: – Agriculture. Forestry, and Other Land Uses (AFOLU), under the categories Reduced Emissions from Deforestation and Degradation (REDD) and Avoided Conversion of Grasslands and Shrublands (ACoGS). Specifically the project falls under the REDD category Avoided Unplanned Deforestation (AUD) and ACoGS category Avoided Unplanned Conversion (AUC). The project is eligible under these categories by the definitions provided in the VCS AFOLU Requirements version 3.4 published 8 October 2013 by virtue of the fact that it prevents emissions that would have otherwise taken place through unplanned deforestation and native grassland conversion.

2.2 Description of the Project Activity (G3)

The Chyulu Hills REDD+ Project activities build on the knowledge of the project partners, who have been engaging with local communities for many years and have collaborated with these communities to identify their needs. Through their respective advisory committees (outlined in more detail in 2.7.1.), communities have been engaged in designing the following Project activities. Existing project partners' activities have been met with success, but their effectiveness and scope of the activities has been limited by a lack of sustainable and consistent funding. Therefore, the most effective manner that has been identified with which to achieve the climate, community and biodiversity objectives of the project is to enhance, expand and make sustainable these on-going project activities. Supporting these operations financially with carbon revenue, and operationally and politically with project resources will be the most direct way to deliver benefits to the communities in a timely fashion. It is envisioned that several new activities, directly supporting the sustainability of the REDD+ Project while simultaneously providing alternative means to the local communities, will be enacted with the introduction of carbon revenue.

Through further consultation of key informants, and drawing on the information from FPIC meetings and existing literature, proposed project activities fall into five areas. These five activity areas have been identified as general Focal Issues and are explained in more detail in sections 4.5.2 and 4.5.3. Existing and envisioned activities are described below, followed by a description of the 5 activity areas that will serve as a framework for activity implementation:

Enhancement and Strengthening of Landscape Protection

The primary project activity is to enhance the ability to defend the Project Area barriers (both from human and other invasive species) and prosecute criminal activity. Poaching is a serious concern within the Project Area. Two of the most widely poached megafauna species, Elephants and Black Rhino are present in the Project Area, and the project will seek to reduce poaching activities targeting these and other species. The key aspects of this activity category include:

- Enhancement / bolstering of Ranger Force
    - Enhancement of biodiversity monitoring and training in conservation principles
    - Build New Ranger Stations
    - Purchase additional Vehicles
    - Bolster Communications / monitoring equipment
- Improved fire response and management
- Enhancement of partner coordination to better facilitate protection of the Project Area
- Development of an improved / holistic grazing scheme
- Engagement with local law enforcement and political leaders to support awareness, protection and prosecution.

Predator Loss Compensation Schemes

Human wildlife conflict presents an on-going problem for local farmers and pastoralists. Often, farmers suffer from crop damage and pastoralists must endure predators killing / injuring their livestock. Predator compensation schemes offer alleviation to this on-going problem, and it is envisaged that carbon proceeds (i.e. additional funding) can drastically improve perception toward wildlife conservation if these animals are not viewed as a purely negative force. Compensation schemes have been shown to improve tolerance and perception toward wildlife, an essential issue in the Project Zone (Maclennan *et al*., 2009). Big Life Foundation and MWCT already have compensation schemes underway, but these require significant revenue to reach a proper level of efficacy for the Project Zone.

It is also envisioned that the elephant crop damage compensation scheme will be augmented. Currently, a large source of conflict exists in the form of elephants trampling and destroying crops as well as presenting physical danger to farmers and pastoralists. An elephant compensation schemes is currently managed by KWS, but it requires improvement in order to affect the entire Project Area and increase tolerance toward this flagship species.

Livestock Management

In order to promote a more sustainable use of pastures within the project area, the REDD+ Project will endeavor to engage in ecological livestock management activities, both for the benefit of livestock and wildlife. The ultimate goal of the activity will be to reduce livestock numbers and impact on the landscape. The following methods will be utilized:

- Rotational grazing
- cattle dips
- veterinary assistance
- restoration of wetlands

- facilitation to markets

The ultimate aim of the activity is to create a higher carrying capacity for the community land as well as a lower quantity and a higher quality of livestock. An improved rotational grazing programs and increased access to markets will additionally serve as a prominent activity within the MWCT areas to reduce forest fire threat.

Bursaries and Scholarships

A major problem with the educational system in Kenya is cost. While primary schools do not charge tuition, all supplies and uniforms are chargeable, and many families cannot afford to send their children to school. All secondary schools charge tuition, in addition to charging for supplies and uniforms. University is currently beyond the reach of most Kenyans, Proceeds from the REDD+ project will be used to directly fund Kenyan students who require aid in affording school tuition as well as ensuring education equality for both girls and boys. All education levels will be supported, including primary, secondary and University-level students. Providing school fees is a crucial project activity as it directly addresses one on the major drivers of deforestation and other conversion activities, namely a need for income to pay these fees. In addition, indirectly it also provides the young generation, especially girls, with a chance for acquiring broader life skills and a means to escape the cycle that perpetuates direct harnessing of natural resources as the key livelihood means.

Strengthen Community Organization

The project will support capacity building for community groups and institutions directly involved in the management of natural resources. It will help to train local stakeholders in natural resource governance, land tenure and land rights, responsibilities, forest and fuel wood management and natural resource management education. This will include providing locations for meetings, materials, travel support, bringing in experts on specific subjects (such as conservation agriculture) and other logistical and organizational support. These project activities will work well with the Community Outreach Program and build on the FPIC exercise. These all will combine to raise awareness across the community and continually throughout the project lifetime on the links between the benefits from the REDD+ project and conservation.

Reducing Agricultural Impact

In the West, there is some commercial agriculture, especially around the springs. There are also lots of boreholes, both legal and illegal, that impact the water table and this is a major cause of deforestation in this area. One of the project activities will be to reduce agricultural impact by introducing activities that improve agricultural sustainability.

In the East, a major cause of conversion is subsistence agriculture. One of the primary goals of the project is to provide alternatives to destructive practices such as slash and burn agriculture and unsustainable planting and harvesting techniques. These practices often fail, and require vast amounts of land. Using the tenets of conservation agriculture, particularly increased cover cropping, zero tillage and an emphasis on soil health and moisture retention, the project aims to increase yields on existing farms and decrease dependence on the clearing of additional land for new fields. Additionally, the project will build and support produce storage facilities and value-added technologies to take advantage of market price fluctuations and aid in achieving high sale prices.

Tree Nurseries

Multiple tree nurseries will be established in key locations to act as growing points for seedlings purchased from community members in the seedling out-growing scheme. Seedling are nurtured until they are ready for out-planting, concentrating on high survival rates, and they are eventually out-planted in degraded areas and on farms. Nurseries not only support the enhancement of biodiversity, but also provide educational opportunities for horticultural management and agroforestry. They also create numerous skilled jobs for the community at large.

Establish Micro-financing schemes

Using best practice in micro-finance such as micro-loans, micro-insurance and other small and medium development practices (SME), the project aims to enhance access to capital and markets, thus providing more sustainable and valuable alternatives to current destructive forest practices.

Improve Health Facilities and Care

Proceeds from the Project will be used to enhance the delivery of health care through increased support to health care workers, hiring of additional health care employees and improvements of facilities such as rainwater collection, solar systems, sanitation and support for outreach (hand washing stands at local schools, HIV / AIDS training for professionals, truck drivers, etc.).

School Construction

Standing schools shall be renovated and facilities improved to support better education. New schools will be built in central locations using carbon revenue, and jobs will be created in all forms pertaining to school systems, including teachers, administrators, janitors, etc. Because school construction is often most important to local communities, this activity will be of high importance in indicating Project success.

Eco-charcoal Training

Wildlife Works has implemented a sustainable eco-charcoal program to support leakage mitigation and alternative livelihood creation for the Kasigau Corridor Projects, Phases I and II. This knowledge will be transferred in the form of training and education for local communities who will then be able to start their own eco-charcoal schemes. Charcoaling, as mentioned previously, represents a significant destructive practice, resulting in deforestation and degradation throughout Kenya and beyond. It is therefore important that revenues from the REDD+ project are placed directly toward the mitigation of unsustainable charcoal burning practices.

Income Generating Activities (IGAs)

The following Income Generation activities are either already functioning within the Project Zone or will be implemented once the Project receive carbon revenue.

Beekeeping

Beekeeping projects from which the honey is sold. This is already a large income-generating activity on the eastern side of the Project Area, and is commonly practiced as a trade in many areas in Kenya. Some groups have formed cooperatives for this trade, and additional ones may be formed in the future. These cooperatives are used to market honey, wax and other bi-products and it is envisioned that the Chyulu Hills REDD+ Project will support these. There is also an opportunity to create improved market-access, value-added technologies and processing.

Eco-tourism

There are ongoing eco-tourism activities within the area. However, access and marketing are not developed to their full potential. The Chyulu Hills REDD+ Project will seek to enhance promotional activities such as development of marketing materials, enhanced security, media / PR and other promotional items. Eco-tourism is a non-consumptive activity and can provide for a sustainable income source.

Crafts and Jewelry

Artisan crafts, traditional Maasai beaded jewelry and basket weaving are prominent amongst Kenyan women and can provide valuable means of income to local communities. The Chyulu Hills REDD+ Project will seek to improve quality, variety of products and ultimately market access and marketing channels.

High-value water product

The Umani and Kiboko springs could potentially provide a means to market high-value spring water product. This is seen as an activity that will create jobs and bring sustainable income into the local communities.

Seedling Buyback Program

The Chyulu Hills REDD+ Project will establish a network of out-grower schemes for which revenue from the Project will be used to buy high-quality indigenous seedlings from local growers. These seedlings will then be used to restore degraded areas within the Project Zone and restore biodiversity. This program will also help to adhere to the Government of Kenya's National Climate Change Response Strategy and Vision 2030, one of the tenets of which is to help increase the number of trees on farms.

Activity Area 1: Poverty Reduction and Livelihood Diversification

Defined Activities:
Training on income generating activities (IGAs) and direct employment
Provision of bursaries and scholarships, improving schooling infrastructure
Establishing micro-finance schemes
Stimulating investment in new businesses
Improving health facilities and care
Strengthening community organization and specific promotion of female education
Expected positive impacts
Reduced dependence on extractive forest resources
Increased employment and income from legal income generating activities (IGAs)
Increase in stability of income flow
Reduced risks through livelihood diversification
Improved community well-being

Activity Area 2: Food security

Defined Activities:
Training on agricultural methods and intensification
Training on IGAs and direct employment
Strengthening community organization
Establishing tree nurseries
Expected positive impacts

Increased productivity (crop and livestock) for subsistence and cash purposes
Increase in stability and amount of income
Increased capacity and knowledge
Reduced risk through livelihood diversification
Increased employment and income from IGAs
Improved community well-being

Activity Area 3: Improvement of Education

Defined Activities
Provision of bursaries and scholarships
Constructing and improving of school facilities
Employment of teachers and initiatives to increase their motivation
Raising awareness of and promoting female education
Expected positive impacts
Increased overall enrolment and transition rates
Increased enrolment of girls and support empowerment
Improved teaching standards
Strengthened local capacity and improved community well-being

Activity Area 4: Ecosystem enhancement

Defined Activities
Improved Livestock Management
Enhancement and Strengthening of Landscape Protection
Training on IGAs and direct employment
Improving education standards and increasing environmental awareness
Strengthening community organization
Establishing tree nurseries
Training and support for sustainable eco-charcoal techniques
Training on agricultural methods and intensification
Expected positive impacts
Reduced dependence on extractive resources
Enhanced ecosystem integrity and ability to provide for wildlife
Ensured maintenance of ecosystem services
Stabilization of water flow and quality for downstream producers
Increase in perception/ recognition of the value of forests resources

Activity Area 5: Biodiversity Conservation

Defined Areas
Improved Livestock Management
Enhancement and Strengthening of Landscape Protection
Improving education standards and raising environmental awareness

	Training on IGAs and direct employment
	Compensation schemes
	Establishing tree nurseries
	Strengthening community organization, esp. female involvement and empowerment
	Training on agricultural methods
Expected positive impacts	
	Reduced poaching activities and associated impacts
	Safeguarding High Conservation Value Species
	Enhanced ecosystem integrity and ability to provide for wildlife
	Increase in perception/ recognition of the value of forests and wildlife

2.3 Management of Risks to Project Benefits (G3)

2.3.1 Natural and Human-induced Risks to the Expected Climate, Community and Biodiversity Benefits, and Measures to Mitigate these Risks

2.3.1.1 Human induced risks

1. Slash and Burn / Unsustainable Agriculture:

   As described in Section 1.2.1 and parts of Section 1.3, the Project Zone is considered semi-arid to arid, with frequent / rampant crop failures. It is an extremely difficult area to sustain subsistence, rain-fed agriculture, which nevertheless continues to be the primary form of survival throughout the area. As such, farmers often expand their growing areas, in an attempt to find more fertile, moist soil, following a drought event. The prevailing practice, in the event of a failure, is to try to find a better area to grow crops. Unfortunately, these practices result in rapid expansion of degradation and deforestation. In this area, farmers typically degrade (extract hardwoods for fuel and charcoal), and those degraded areas are then entirely cleared for agricultural fields within a short period of time (often < 1 year). Therefore, slash and burn agriculture is a primary risk to project benefits and thus project sustainability.

   Mitigation for this risk is envisioned to be the advent of improvement policies, mainly in the form of agricultural intensification and/or conservation agricultural techniques as described above in Section 2.2. Additionally, alternative livelihoods such as employment in other sectors (rangers, plot sampling teams, IGAs like beekeeping and craft / woodcarving sales, etc.) are seen to be effective direct mitigation strategies. Local communities generally have a very difficult time as subsistence farmers in this area, and are therefore quite open to alternatives that offer them an easier way to make a living in subsistence agriculture, or to considering jobs in other areas that allow them to put food on the table.

2. Charcoal burning, wood carvings and firewood collection:

   Within the project area there are currently unregulated, extractive activities, including charcoal burning, firewood extraction and wood extraction for carvings. These are the main threats of deforestation and degradation in the Chyulu Hills National Park area and pose a significant risk to the project's climate benefits. Ranger teams patrol the area permanently and attempt to halt such activities early on. It has been recognized, however, that these law enforcement units lack resources and are consequently unable to effectively reduce the threat. The Chyulu Hills REDD+ Project therefore plans to provide support in terms of financial, political and human capacity. This

will be achieved through employing more rangers, increasing ranger motivation and providing rangers with more equipment.

3. Poaching:

   Subsistence bush meat hunting and commercial poaching represent a substantial risk to this project's biodiversity benefits. Subsistence hunters lay snares around the forest with the aim of catching small game. Poaching of rhinos and elephants is a more severe problem that has escalated in Africa in the recent years and has also affected the Chyulu Hills REDD+ Project Area. In 2013, a total of 3 elephants were poached in the Project Area and two died following a human-wildlife conflict in the Project Area. As outlined in 7.3., the Chyulu Hills also provide one of the last strongholds for the black rhino (*Diceros bicornis michaeli*). However, the 'Rhino Area', also known as Mukururo on Mbirikani/ CHNP, lost three black rhinos in 2013. KWS, BLF, DSWT and MWCT are putting all their efforts into maintaining high vigilance in the area and preventing further poaching incidents.

   The Chyulu Hills REDD+ Project will provide further support through ranger employment, increasing motivation and equipment, and providing IGAs. The project will also provide educational activities, workshops and jobs in wildlife conservation that will serve to raise awareness and increase wildlife tolerance / perception in local communities.

4. Anthropogenic fires:

   Another human induced threat are frequent fires: these occur multiple times annually in the area. Whilst some are set intentionally by pastoralists with the goal of allowing fresh pasture to grow, others may start accidentally from cooking fires set by herders or poachers. Irrespective of their origin, KWS, BLF and MWCT have well thought-out fire management regimes in place and a close collaboration exists to address fire events.

   The Project will continue to support the partners in their fire management efforts. In addition, the Project Office will aim to reduce illegal incursions of people into the Project Area, thus mitigating anthropogenic fire potential. Furthermore, the Project Proponent will monitor fire events and other potential contribution to reversals as part of their annual monitoring efforts, and will be required to report on and account for any major loss of carbon in the Project Area. Through collaboration with the communities, awareness will be enhanced in the area of carbon protection and forest stewardship. It is the goal of the Project to work with communities to understand the value of the forest, thus decreasing their willingness to destroy their forest resources, as they begin to realize tangible carbon benefits.

2.3.1.2 Natural Risks

1. Droughts:

   Droughts are frequent in the area and this century 2001, 2006-2007 and 2009 have all been severely dry years. The 2009 drought has been described as the worst drought in living memory (African Conservation Centre, retrieved 18 December 2013) and had devastating effects on humans, wildlife and livestock alike. During this period, studies indicate that 75% of migratory wildlife and 81% of livestock numbers were lost on a national scale (KWS, 2010). In eastern Kajiado, deaths to wildlife were severe, with an estimated 92% of wildebeest, 86% of zebra, 66% of Gant's gazelle lost (Worden *et al*., 2010). A study conducted on Kuku GR found that livestock

numbers also plummeted, and that pastoralists lost 84% of cattle, 77.8 % of goats and 72.8% sheep (Wangai *et al*., 2013). These losses had severe economic impacts on food security and livelihood strategies, and similar events in the future pose a risk to the Project's envisaged community and biodiversity benefits.

Droughts are naturally occurring phenomena and it is the Project's aim to mitigate the impacts of recurring droughts through promoting adaptive and drought-resistant livelihood strategies. Most of local flora and fauna are incredibly drought-resistant, yet crop failure due to extreme droughts poses a severe challenge to the human population. It is therefore the aim of the project to concentrate on agricultural practices that increase yield, and in particular increase moisture retention, so as to minimize the devastating affects of drought on subsistence agriculture.

2. Fires:

There is a possibility of natural fires occurring in the landscape. However, the frequency of these is very low and the majority of fires are caused by humans, either deliberately or accidental. The Chyulu Hills REDD+ Project will mitigate this risk via those strategies outlined above which refer to managing the risk of anthropogenic fires. Additionally, natural and anthropogenic fires alike shall be monitored and reported on. Any significant event that results in a loss of carbon will be included in the carbon accounting model.

2.3.1.3 Political Risks

1. Kenya's political stability:

In its 50 years of independence, Kenya has maintained notable political stability, despite changes in its political system and conflicts in neighboring countries. A new constitution was passed in 2010, which included provisions for the establishment of devolved governance structures. Known as "devolution" many formerly central government roles are being transitioned to the newly established county governments, which will have a greater sphere of influence. With Kenya's previous and current stability however, the political risks to the REDD+ project are considered minimal. The Chyulu Hills REDD+ Project aims to maintain open channels of communication and keep government entities informed of operations. There are two significant government organizations included as Project partners (KWS and KFS). It is envisioned that their involvement in the project will facilitate and augment country-level awareness and involvement in the Project, thus increasing the stability of not only this project, but also the national REDD+ strategy.

2. Legislative changes:

There always exists a slight risk of changing legislation or the potential of new policies that could potentially affect natural resource management and/or land tenure. Previously, there have been cases in which the government has expropriated lands through compulsory purchase for development schemes. That said, the likelihood of such changes occurring is considered to be extremely small, especially given that half of the Project Area is currently under government ownership and a large proportion is technically under protective status (although in practice, much of the area is not physically protected).

The Project will uphold open communication with the governmental entities and continue to be involved in political decisions that could potentially affect the Project Area, its natural resource management or tenure. The involvement of the aforementioned government organizations will provide lobbying support for the project and for the national REDD+ strategy. Unlike many

REDD+ projects, the Chyulu Hills REDD+ Project is not isolated from the national government. On the contrary, because the government possesses a stake in the project, its success is in the Government of Kenya's best interests, and therefore any changes in legislation will take the well-being of this and other REDD+ Projects in Kenya into account.

2.3.1.4 Policy risks

1. Risk of reversal:

   Risk of project reversal due to community unrest is considered minimal, as the landowners and communities alike have been heavily involved in the design of the project, and they have openly and widely been consulted through numerous FPIC meetings. As a Project governance policy, all stakeholders are always able to seek further information or air grievances if desired. The Group Ranches leadership are in the process of signing conservation easements with their designated landowner representative, affirming their endorsement of the project's intent to manage the landscape to enhance carbon related benefits and produce co-benefits. Other landowners have declared their support by acting directly as a Project Proponent. The Project will continue to engage the community in project implementation and involve them in all decision-making, including them perhaps most importantly in the Carbon benefit distribution scheme(s), thereby working to keep risk of reversal from stakeholder unrest at bay. The primary aim of the Chyulu Hills REDD+ Project is to create alternative livelihood options for stakeholders, thereby alleviating the pressure to extract forest resources in an unsustainable manner as well as alleviate human-wildlife conflict. Carbon revenues are envisioned to enhance such conservation activities. A major amount will be funneled directly back into the logistical operation of the project and/or directly into the community, so that they may improve their standard of living, and all the while conserve their forest and biodiversity.

2. Insufficient Revenues:

   The vast majority of REDD+ credits are currently sold on the voluntary market, posing a risk to recurring, sustainable income flow. If credits are not sold, there will be no revenue, and thus no monetary support for the project over its 30-year lifetime, save initial investment. Nevertheless, the uniqueness of this project, including the wonderful story surrounding the Chyulu Hills, the Mzima Springs area and the fabulous charismatic megafauna that can be observed throughout the Project Zone, provide a competitive advantage and a means to command higher credit prices from buyers that seek to invest in a high-end, additional and highly effective project that is managed by proven leaders in the industry. In particular, the internationally recognized project partners provide a great marketing advantage over other REDD+ credits. The Project Proponent's marketing team possesses substantial experience in credit sales, and important existing relationships with potential buyers. Finally, the Chyulu Hills REDD+ Project aims to be included in a jurisdictional REDD+ scheme, which will allow for the sale of large credit volumes, on a recurring, sustainable basis, to sovereign nations.

2.3.2 Measures Taken to Enhance CCB Benefits beyond the Project Lifetime

The Chyulu Hills REDD+ Project activities are all designed to enhance the CCB benefits beyond the project's lifetime. Implementing activities that address the drivers of deforestation, with a focus on education, poverty reduction and sustainable management of natural resources, will reduce the necessity of community members to cause deforestation and degradation. During the project lifetime, this will be achieved, for example, through training farmers in sustainable agriculture, facilitating better education,

creating alternative income generating activities and raising awareness of the value of the habitat and its biodiversity. These activities are outlined in more detail in section 2.2.

2.4 Measures to Maintain High Conservation Values (G3)

The following biodiversity and ecosystem related HCVs have been identified per the CCB indicators G1.8.1, 2 and 3 in section 1.3.6:

- G1.8.1 b) Five near threatened, six vulnerable, three endangered and one critically endangered species.
- G1.8.1 c) Nine endemic sub-species and races.
- G1.8.1 d) The Project Area is a wildlife corridor between the Tsavo and Amboseli ecosystem, thus supporting significant concentration of species during any time in their life cycle.
- G1.8.2 The Project Area is part of the Somali-Maasai biome and supports viable populations of plants and animals in their natural patterns of distribution and abundance.
- G1.8.3 Montane cloud forest that acts as a critical water catchment.

The Chyulu Hills REDD+ Project is designed to ensure the maintenance and enhancement of HCVs by maintaining the species, landscapes and ecotopes of the Project Area intact and non-fragmented. Close cooperation with the landowners and communities as well as active protection in terms of a larger and more effective ranger force are key to success here. Several of the project activities are also oriented toward further ensuring that the conservation related goals of the Chyulu Hills REDD+ Project are achieved, and HCVs maintained. These include increasing local awareness and capacity for conservation, generation of livelihood alternatives to reduce pressures on the land, and designing a zoning plan to allow for regeneration and sustainable, low-impact grazing.

The following community related HCVs have been identified per Section 1.3.6 (CCB indicators G1.8.4, 5 and 6):

- G1.8.4 Forests critical to water catchments, grasslands critical to the prevention of soil erosion.
- G1.8.5 Areas fundamental to meeting the basic needs of local communities, specifically food, medicines, fuel wood, and raw materials for building and crafts.
- G1.8.6 Areas critical for the traditional cultural identity of communities, specifically sacred sites, resources for artistic and traditional purposes, and importance to local worldview.

Similar to the measures outlined above for HCVs G1.8.1, 2 and 3, active protection and alternative livelihood options are intended to reduce pressure on the land and thereby ensure the maintenance of forests critical to water catchments. Zoning and sustainable grazing regimes are designed to protect grassland areas and avoid soil erosion. This will also ensure that areas fundamental for food, medicines, fuel wood, material for building and resources for artistic and traditional purposes are maintained. These values depend on the continued existence of an intact landscape and this is exactly what the Chyulu Hills REDD+ Project provides.

2.5 Project Financing (G3.11 & G4.7)

The Project Proponent features strong collective experience marketing REDD+ credits on the global market, and has used this applied experience to form conservative estimates for expected annual credit sales for the Chyulu Hills REDD+ Project. Additionally, the Project Proponent's combined REDD+ project development experience (6 total successful prior VCS/CCB validated & verified projects) have contributed to a detailed financial model for the development and management of the Chyulu Hills REDD+ Project. Predicted credit sales and an accurate estimated annual budget demonstrate sufficient cash flow from predicted contracted sales to sustain the project through the end of the crediting period. The Project Proponent has already received several grants and in-kind contributions from project partners, investors and donors to fund to project design and start-up costs. Documents supporting these investments can be produced to the project auditor for inspection.

The Project Proponent for the Chyulu Hills REDD+ Project is the Chyulu Hills Conservation Trust, which is comprised of 8 project partners. These project partners are all well-funded, sufficiently capitalized organizations, and include several major international NGOs (CI and AWF), local Kenyan trusts with impressive histories of financial sustainability (MWCT, DSWT and Big Life), Kenyan governmental organizations (KWS and KFS) and a private company with a responsible financial track record (WWC). Conservation International and the African Wildlife Foundation are both internationally recognized NGOs with broad donor bases, realizing funds from private and public sources. They both report annually on their financial health in a highly transparent fashion. MWCT, DSWT and Big Life are also non-profits, registered as Kenyan rusts and have received long-term support from a wide variety of donors, with proven track records of healthy financial status and experienced management. KWS and KFS are both state institutions with clear mandates from the Kenyan government, and receive their funding as such from the Government of Kenya, with additional funds from park entrance fees and grants. Wildlife Works Carbon LLC is a limited liability corporation in good standing. Wildlife Works Carbon LLC's largest member is Wildlife Works Inc., and also contains several other private members. Wildlife Works Inc. is a California registered US Corporation governed by corporation laws of California, which ensure the company remains constantly financially solvent.

2.6 Employment Opportunities and Worker Safety (G4)

2.6.1 Employee Orientation, Training and Capacity Building

The Chyulu Hills REDD+ Project considers local employment a priority and local sourcing is strongly encouraged at all levels of the project, from casual workers up to management positions. The Chyulu Hills REDD+ Project recognizes that local hiring is a major benefit to the implementation and operation of the project due to the knowledge and familiarity local people possess of the landscape, its communities and its biodiversity. Their involvement will also ensure the sustainability and continuity of the project throughout the projects' lifetime and beyond. Currently, the majority of the project partners' employees come from the local area. The Chyulu Hills REDD+ Project Office will continue employing and training local people in order to increase local participation in project design and implementation as well as build capacity, knowledge and a robust skills base.

Educating communities and employees in different areas related to the carbon project will also be on-going. Capacity building of aspects revolving around carbon measurement, accounting, climate change and carbon offsets will continue to take place in the form of meetings, workshops or training days. So far, local plot samplers, both male and female, have been selected and trained in biomass measurement and

forest inventory, thereby increasing their knowledge base and skill set. Furthermore, FPIC officers received an intensive 2-day training on REDD+ and climate change in an already established and successful REDD+ project, the Kasigau Corridor REDD+ Project, thus transferring knowledge from one location to another. It is anticipated that future training will no longer need external experts but will be carried out by locally-sourced employees who were trained in these initial stages.

2.6.2 Equal Opportunity for Employment

Future Chyulu Hills REDD+ Project job positions will be openly advertised through the Project Office and project partners. The selection of potential employees will be done on a democratic and neutral basis, allowing equal opportunity to all applicants. The Chyulu Hills REDD+ Project operates a strict non-discrimination policy such that women and vulnerable groups of people will receive equal chances regardless of the type of work. One example of this is that the project already employs a female plot sampler, a job that is physically demanding and usually only carried out by men.

Job applicants will be selected for an interview based on their skills and experienced required for the advertised positions. The HR department of the Project Office (to be formed) will be closely involved during the selection process in conjunction with a committee from the Project Office and the Head of the relevant department for which the vacancy is advertised. Employment vacancies will be publically advertised through the same channels that other Project news is publicized, such as through posters at local chiefs offices. Successful candidates will be selected in a democratic, non-discriminatory manner. Preference will be given to applicants who live in the local communities, if two applicants show the same capacity for a given position whereas one is local and the other one not. Unsuccessful candidates will be provided with an explanation for why they were not selected in order to assist them to improve if there is another vacancy in the future.

2.6.3 Employee Safety

The Chyulu Hills REDD+ Project will ensure that workers' health and safety are protected to the best of the project's ability at all times and across all sites. Risks will be identified, mitigation strategies produced and appropriate measures adopted in order to minimize any risks.

Given the nature of the project and its geographical surroundings, it is recognized that certain occupations inherently present a risk to the health and safety of workers', in particular occupations that require spending long periods walking in difficult environments. These include, though not exclusively, plot samplers and rangers, who are faced with challenging terrain as well as the risk of encountering wild animals or even poachers. In addition, forest fires may also be threatening if they spread rapidly and unexpectedly. Further similar situations and occupations will be identified and appropriate mitigation strategies implemented. The Project has created a comprehensive Health and Safety Plan ensures that all workers' health and safety is protected, and that all workers are informed about workplace risks. These will include training in safe working practices, first aid training for some staff members as well as the enforcement of requirements for safe handling of equipment and other materials. This health and safety plan additionally provides a comprehensive list of the measures that will be taken to inform employees of their rights, to assign roles and responsibilities to supervisors and workers and provide a safe workplace culture. This document will be revisited regularly and revised as needed to ensure that it contains current information and includes all job categories and potential risks. A copy of the plan has been provided to the validator and will be kept at the Project Office and be readily available for any consultation. In addition, the CHRP will ensure detailed orientation of newly recruited employee during their initial introduction at work and ensure that they are fully aware of their rights as well as responsibilities.

2.7 Stakeholders (G3)

2.7.1 Community and Stakeholder Identification and Involvement in Project Design (G3.8)

The process of Community and Stakeholder identification was conducted through a series of key informant/ Expert interviews, workshop discussions, an analysis of rights and a literature review. Through these methods it was possible to obtain a well-informed and comprehensive understanding of all communities and community groups in the Project Area.

Key informants

Key informants are of particular value for providing inside information of the area and its communities due to the fact that they have been based in the area for decades, and therefore possess substantial local knowledge and experience. Key informants consulted include:

- Mr. Richard Bonham: Co-founder of the Big Life Foundation and who has been running conservation operations on Mbirikani GR for nearly 30 years.
- Mr. Samson Parashina: Chairman of the MWCT Board who has been instrumental in setting up the Maasai Wilderness Conservation Trust on Kuku Group Ranch.
- Mr. Godfrey Wakaba: Senior Warden of Tsavo West National Park and who also provided significant insight into the local dynamics concerning habitat protection and local communities.

Mr. Daniel Woodley: the former Senior Warden of Tsavo West National Park, and former employee with Wildlife Works, was also widely consulted on the historical trends and natural resource use patterns in the area.

Table 8: Key Informant interviews were conducted on the following days:

Key Informant	Position	Date
Mr. Richard Bonham	Co-founder of BLF	20th November 2013
Mr. Godfrey Wakaba	Tsavo West Senior Warden	20 January 2014
Mr. Samson Parashina	Chair of MWCT	22nd January 2013

Group discussion at FPIC training

A FPIC workshop took place on the 25th of September 2013 at Wildlife Works in Maungu, in the Kasigau Corridor REDD+ Project. A total number of 16 FPIC Officers from the Chyulu Hills area attended. During this workshop, discussion focused on the agents and drivers of deforestation and native grassland conversion, as well as on the community and community groups. Through the expert knowledge provided by the FPIC officers in these discussions all of the stakeholders of the Chyulu Hills REDD+ Project and a comprehensive list of the categories of people expected to be affected by the project were identified. This provided valuable background information for subsequent investigations and research.

Analysis of rights

An analysis of user rights helped provide a straightforward insight into which communities, community groups and stakeholders are present in the area. The analysis focused on ownership rights to the land,

which included Group Ranches as well as government gazetted land and therefore aided in identifying communities and stakeholders. Furthermore, it took into account project partners that have had an operational presence in the area for multiple years and that have significant influence on resource use in the Project Area. This analysis was carried out using expert knowledge and also drew on Wildlife Works' experience in the Kasigau Corridor REDD Project.

Literature review

To provide a listing of all potential stakeholders in the Chyulu Hills REDD+ Project, a comprehensive review of the literature, including academic papers, published reports and any available open-source Internet resources was completed. This process provided further insight into local dynamics, cultural migration, and historic government land policy. These resources provided both specific information on local stakeholders in the project and general guidance for identifying and describing stakeholders in REDD+ projects.

Identified community groups and stakeholders

The following community groups and stakeholders have been identified in the project. Table 9 outlines their current impact on the land, the effects of the project on these activities and the relationship with other stakeholders. This analysis allows the Chyulu Hills REDD+ Project to understand the complexities within the social structure and generates insight into potential conflict areas. This in turn informs where special care is needed and helps to target project activities more directly.

Table 9: The Stakeholders in the Chyulu Hills REDD+ Project.

Stakeholder or stakeholder sub-group	Current impact/ activities in landscape	Effect of project on their activities	Relationship with other stakeholders (Partnership/conflict)
Pastoralists	Livestock herding, setting fire to allow fresh growth of pasture.	Reduced area of land for grazing and introduction of regulated grazing periods through zoning.	Potential conflict with farmers due to loss of grazing land and access to water. Conflict with ranger teams due to setting fires.
Agriculturalists	Land conversion, cultivation and irrigation.	No further land conversion allowed, loss of potential agricultural land.	Potential conflict with pastoralists due to livestock incursions.
Charcoal producers	Extraction of wood for charcoal making, often from protected areas.	Prohibition of charcoal making in the Project Area, loss of income generating activities, increased law enforcement and potential prosecution.	Conflict between charcoal burners and KWS, BLF, KFS, DS and MWCT's rangers if illegally trespassing into protected areas.
Firewood gatherers	Collection of firewood (sometimes obtained through intrusion into protected areas).	Regulated collection of firewood. Prohibition of collection from protected areas.	No conflict besides that resulting from intrusion into National Park. KFS allows firewood collection in Kibwezi forest under a regularized scheme.
Wood carvers	Intrusion into protected areas to obtain hardwoods for carvings causing deforestation and degradation.	Prohibition to extracting wood from protected areas, potential temporary loss of income.	Potential conflict between wood carvers and ranger teams.
Subsistence hunters	Intrusion into protected areas, killing of wildlife, igniting anthropogenic fires.	Greater law enforcement and abatement of hunting activities, persecution.	Potential conflict between hunters and ranger teams.
Commercial poachers	Poaching of elephants and rhinos.	Greater law enforcement to stop poaching.	Conflict between poachers and ranger forces. Potential threat within the communities.
Women	In charge of firewood collection, increasingly involved in charcoal production.	Regulation of firewood collection, stopping of charcoal production potentially leading to some loss of income.	Underrepresentation in decision-making, which could lead to conflicts.
Youth	Providing assistance for extractive activities, transportation of charcoal bags, khat (miraa) collection from protected area.	Stopping of illegally produced charcoal therefore reducing demand for transportation, preventing intrusion	Potential conflict between youth and ranger teams. Underrepresentation in decision-making due to seniority being main precedent for involvement.

		into protected areas for khat collection.	
Landless	Living on land without secure land titles, often practicing subsistence agriculture.	Cooperation to engage in agricultural training activities, though legal titles needed.	Potential conflict between landless and rightful landowners, such as KARI.

Stakeholder Involvement

The Chyulu Hills REDD+ Project has been designed through engagement of all communities and stakeholders, and has involved them in decision-making and implementation from the outset. Collaboration amongst the project partners with the goal of initiating a carbon-crediting scheme began in 2012. The role of the project partners is central to the Chyulu Hills REDD+ Project, due to their close relationship with the communities. Through long-standing ties, these communities are already familiar with the project partners and open communication channels were already established prior to the start of the REDD+ project design phase. The Chyulu Hills REDD+ Project builds on these structures, which makes it possible to disseminate information to the communities in a quick and timely manner as well as to encourage their involvement in the project. This structure also allows timely and efficient feedback, and questions and grievances are quickly forwarded to the Project Office.

Each project partner went through their existing channels to communicate with and publicize information meetings with the respective communities in their area. Meetings were mainly announced through phone calls or by informing the leader of a specific community group (women's groups, youth groups, etc.) in a timely fashion, who in turn would communicate the information to the members of that group. Project partners have been kept up to date with project documentation upon completion of the Project Design Document (PDD), each project partner will be provided with a hard and soft copy at their respective headquarters. Community members are encouraged to pay a visit to these headquarters in order to read and have full access to any such material, including an executive summary of the PDD in Swahili and Maa. Additionally all of the documents will be disseminated to the Chief's offices, and the Local Administration offices. An information poster was translated into Swahili and Maa in order to accommodate the non-English speaking members of the communities. These, too, were displayed at each project partner's headquarters and chiefs' offices.

FPIC Activities

Information regarding the Chyulu Hills REDD+ Project was communicated through a series of community meetings that took place in a culturally-appropriate setting. Meetings were conducted by appointed FPIC officers, and were called at public locations, such as a schools or churches. It is common in Kenya to provide a meal after the formal meetings, and this custom was also adhered to at these community consultations. The FPIC officers used a standard PowerPoint presentation to explain the concept of REDD+ and describe the project's anticipated benefits as well as costs and risks. An open discussion and question time followed, which often revolved around costs and benefits. FPIC officers tended to alternate between English and Swahili. This ensured that the information was communicated to and understood by the largest possible audience. In the Maasai areas, the FPIC officers spoke in the vernacular of the Maasai, Maa.

In addition to the community meetings, information was also disseminated through a local radio program (Table 10). The date and time was selected according to the highest listener rate. Nosim FM is a Maasai channel, thus capturing the communities on the western side of the Chyulu Hills.

Table 10: FPIC on local radio shows

Show	Date	Time	Duration	Audience
Nosim FM	14 November 2013	6 PM	1 hour	Mainly Maasai

Initial community FPIC meetings took place from September 2013 to January 2014. Details of all FPIC meetings including the dates, locations and number of attendants, are provided in Table 11. Significant time was given between the initial consultation and the time that any formal decision-making was expected.

Table 11. Location, date and attendance of FPIC meetings.

Location	FPIC Officers	Attendants	Date	Number of attendants
Kuku GR, Nyati	MWCT	Leaders	21 October 2013	66
Kuku GR, Iltilal	MWCT	Community	23 October 2013	45
Kuku GR, Samai	MWCT	Community	24 October 2013	81
Kuku GR, Loolepo	MWCT	Community	25 October 2013	27
Kuku GR, Oyaratta	MWCT	Community	28 October 2013	74
Kuku GR, Noolasiti	MWCT	Community	29 October 2013	29
Kuku GR, Olkaria	MWCT	Community	31 October 2013	56
Kuku GR, Enkutoto	MWCT	Community	1 November 2013	113
Kuku GR, Enkusero	MWCT	Community	2 November 2013	44
Rombo GR, Rombo	MWCT	Leaders	4 November 2013	44
Kuku GR, Enkii	MWCT	Community	7 November 2013	47
Kuku GR, Olorika	MWCT	Community	8 November 2013	53
Kuku GR. Ilchalai	MWCT	Community	9 November 2013	38
Kuku GR, Ikisanjani	MWCT	Community	11 November 2013	53
Kuku GR, Oltiasika	MWCT	Community	13 November 2013	61
Kuku GR, Oltiasika	MWCT	Community	14 November 2013	47
Kuku GR, Langatta	MWCT	Community	15 November 2013	29
Rombo GR, Matepes	MWCT	Community	19 November 2013	120
Rombo GR, Orgira	MWCT	Community	20 November 2013	96
Rombo GR, Olmapina	MWCT	Community	21 November 2013	87
Rombo GR, Oloshonyokie	MWCT	Community	26 November 2013	26
Rombo GR, Oloyapasei	MWCT	Community	27 November 2013	27
Rombo GR, Lemongo	MWCT	Community	27 November 2013	48
Rombo GR, Nasipa	MWCT	Community	28 November 2013	43
Rombo GR, Njukini	MWCT	Community	3 December 2013	20
Rombo GR, Oravalt	MWCT	Community	4 December 2013	30
Kuku GR, Kuku	MWCT	Community	13 January 2013	74
Kuku GR, HQ	MWCT	Ranger force	22 January 2013	35
Mtito Andei	KWS	Prov. Admin.	10 October 2013	27

Kathekakai CHNP	KWS	Women group	11 October 2013	33
Mwitasyano	KWS	Youth groups	12 October 2013	28
Kambu	KWS	Religious Leaders	28 October 2013	26
Mbukoni	KWS	Women group	30 October 2013	33
Kiboko/Makindu	KWS	Prov. Admin.	5 November 2013	39
Oltukai	KWS	Women group	6 November 2013	42
Oltukai	KWS	Religious Leaders	7 November 2013	35
Mbirikani, HQ	BLF	Leaders	18 October 2013	20
Mbirikani, Nkariak Naasila	BLF	Community	21 October 2013	65
Mbirikani, Nasipa	BLF	Community	24 October 2013	62
Mbirikani, Kalesirua	BLF	Community	25 October 2013	72
Mbirikani, Olchalai	BLF	Community	30 October 2013	121
Mbirikani, Namelok	BLF	Community	1 November 2013	75
Mbirikani, Shilishili	BLF	Community	11 November 2013	85
Mbirikani, Oltiasika	BLF	Community	13 November 2013	90
Mbirikani, Nabulaa	BLF	Community	25 November 2013	117
Mbirikani, Oldoinyo Wuas	BLF	Community	28 November 2013	58
Mbirikani, Olbili	BLF	Community	13 January 2014	67

Advisory committees

Proposed project activities have been shaped by the experience and input of project partners and their advisory committees. As outlined above, FPIC activities were undertaken by BLF, MWCT and KWS. Each of these organizations has been collaborating with their respective, designated local advisory committees on a regular basis in order to establish the most desirable and culturally-appropriate project activities for their corresponding areas. This allows the design and implementation of the project activities to be in accordance with the varying needs across the Project Zone. Consultation with these advisory groups is carried out by representatives chosen by the community who are considered best placed for their needs. The different advisory groups are described in more detail below.

Big Life Foundation - Advisory Committee

BLF works with an Advisory Committee of 17 members, who normally meet on a bi-monthly basis unless a special meeting is required outside of this schedule. The members comprise a cross-section of the local communities around Mbirikani Group Ranch. Each zone on the ranch votes in their representative. Due to the traditional cultural background, where women do not have any say, women are never voted in directly. To ensure female representation however, BLF enforces a policy in which two (2) women are nominated.

The current committee includes:

1. 10 member zonal representatives
2. Women representatives
3. 2 chiefs who are ex-officio
4. Group Ranch leaders who are ex-officio (Chairman, Secretary & Treasurer).

During these meetings, the members are able to propose new activities and shape already existing projects according to the views expressed in the communities they represent. Decisions are made jointly and minutes of each meeting are available upon request. In addition, there is an education sub-committee

derived from the Advisory Committee, which has five members. The education sub-committee meets quarterly.

MWCT

MWCT's Development Committee meets bi-annually. Members come from the 10 major villages in the area and were appointed by the villages themselves. The appointment of women is encouraged, and currently the gender ratio is 4 women to 6 men. During the meetings, they are able to identify the most needed community projects.

In addition, MWCT meets with the Group Ranch Advisory Committee, made up of 6 Group Ranch officials, who are also part of the Development Committee. In order to harmonize the requests raised by each committee, and since some of the members are the same, the committees usually convene together.

KWS – County Development Committee

KWS welcomes proposals for community projects from a number of registered entities, such as a school or dispensaries. Proposals are submitted to the Tsavo West Senior Warden, and passed on to the County Development Committee, which is chaired by the County Commissioner. It is at the discretion of this committee whether to endorse the request or not. Projects are endorsed on the conditions that they must serve the larger community, and are mainly focused on schools, water projects and dispensaries. After endorsing the proposal, it is passed on to the KWS headquarters' Project Committee, alongside a request for approval and funding. If approved, the Tsavo West Senior Warden will receive the funding and a Project Implementation Committee is set up, which is mainly composed of community members. The County Development Committee meets on a regular basis, and are best placed to judge the needs of the community.

A combination of Advisory Committee meetings and FPIC meetings have thus enabled the communities to be directly involved in the Chyulu Hills REDD+ Project design. Communities have been consulted and their views represented at this stage. Furthermore, anticipated project activities are designed according to the needs of the stakeholders as outlined by them.

In the future, the Chyulu Hills REDD+ Project will continue these dialogues on a regular basis. Advisory committees will convene and discuss any new project activities during their scheduled meetings. Communication with the communities will be upheld during the partners' usual community outreach meetings and through the open door policy, any community member is able to consult or ask clarification from the Project Office or any of the project partners.

2.7.2 Steps to Communicate and Publicize the CCB Public Comment Period (G3.9)

The following steps will be taken to ensure all stakeholders have access to the PDD and are aware of and provided a means to comment on the document for the public comment period:

- An executive summary of the PDD will be made available in English, Swahili and Maa at all project partners' headquarters in the landscape, as well as the main chief's offices.
- The project partners will actively communicate to community members the start of the Public Comment Period at all their community outreach meetings and encourage them to file any comments. FPIC Officers will also make note of any verbal comment and ensure that these are registered.

- A computer will be made available at MWCT, BLF and KWS for making comments directly on the CCB website. Public comments received in writing will be scanned and emailed to the project validator.

2.7.3 Process for Handling Unresolved Conflicts and Grievances (G3.10)

Project partners currently have their own respective grievance procedures in place. These vary from an open door and open dialogue policy, to formalized procedures. In the case of KWS, for example, written and verbal complaints are registered by the Community Warden and delivered to the Tsavo West Senior Warden. The complaints are then verified and a report written. Every quarter, these reports are sent to the KWS headquarters to be kept on file. In addition, KWS has a 24-hour hotline that community members can call any time of the day or night.

For the beginning of the REDD+ project, existing grievance procedures will be used until a formalized Feedback and Grievance Redress Procedure has been established for the project. Consultation with stakeholders about the most culturally-appropriate design for such a mechanism has begun during FPIC meetings.

A three-stage Feedback and Grievance Redress Procedure will be designed, with specified time limits and clear instructions at each stage. The first stage shall be on amicable grounds in which the Chyulu Hills REDD+ Project Office shall respond to grievances through a written letter or notice within 30 days of the registered complaint, in addition to directly communicating with the person if that person or group of people is known. In the case that no solution can be found on amicable grounds, a neutral third party shall need to be consulted. Community members will be involved in identifying a third party who they consider as the most culturally appropriate, respected and neutral person within their respective societies. If grievances are still not resolved through such a mediator, the procedure shall move to a third, more formal stage, including jurisdictional involvement. All grievances and project responses will be documented and kept at the Project Office for record.

2.8 Commercially Sensitive Information

Some annexes of this PD document contain commercially sensitive information. All efforts have been made by the Project Proponent to make as much information freely available to the public as conceivably possible. All necessary supporting information shall be provided to the validator, but may not be distributed publicly.

3 LEGAL STATUS

3.1 Compliance with Laws, Statues, Property Rights and Other Regulatory Frameworks (G4 & G5)

3.1.1 Employee Safety

The Chyulu Hills REDD+ Project abides by all worker's rights laws and regulations. Workers will be informed about their rights at the point of their employment. A hard copy of the relevant laws will be kept at the Chyulu Hills REDD+ Project Office once it is physically established and any worker is free to consult these any time during working hours. Below can be found a list of the relevant laws.

The Employment Act, 2007

Employment Act 2007 is- an Act of Parliament that, declare and define the fundamental rights of employees, to provide basic conditions of employment of employees, to regulate employment of children, and to provide for matters connected with the foregoing.

The Labour Institution Act, 2007

The Labour Institution Act 2007 is- AN ACT of Parliament to establish labour institutions, to provide for their functions, powers and duties and to provide for other matters connected thereto.

The Labour Relations Act, 2007

The Labour Relation Act 2007 is- An Act of Parliament to consolidate the law relating to trade unions and trade disputes, to provide for the registration, regulation, management and democratization of trade unions and employers organizations or federations, to promote sound labour relations through the protection and promotion of freedom of association, the encouragement of effective collective bargaining and promotion of orderly and expeditious dispute settlement, conducive to social justice and economic development and for connected purposes.

The Work Injury Benefits Act, 2007

The Work Injury Benefits Act 2007- An Act of Parliament to provide for compensation to employees for work related injuries and diseases contracted in the course of their employment and for connected.

The Retirement Benefits Act, 1997

The Retirement Benefits Act 1997 is- An Act of Parliament to establish a Retirement Benefits Authority for the regulation, supervision and promotion of retirement benefits schemes, the development of the retirement benefits sector and for connected purposes.

The National Social Security Fund Act, 1989

The National Social Security Act (the 1989 was revised in 2012) is- An Act of Parliament to establish a National Social Security Fund; to provide for contributions to and the payment of benefits out of the Fund; and for matters connected therewith and incidental thereto.

The Occupational Safety and Health Act, 2007

The Occupational Safety and Health Act 2007 is- An Act of Parliament to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes.

3.1.2 Compliance with Relevant National and Local Laws, Regulations, and International Agreements (G5.1)

The Chyulu Hills REDD+ Project meets all local, national and international laws, which relate to this project. These laws include the aforementioned Employment laws, as well as multiple laws outlined below:

The Land (Group Representatives Act), 2010

The Land (Group Representatives Act), 2010 is- An Act of Parliament to provide for the incorporation of representatives of groups who have been recorded as owners of land under the Land Adjudication Act, and for purposes connected therewith and purposes incidental thereto.

The Forests Act, 2005

The Forests Act, 2005 is- An Act of Parliament to provide for the establishment, development and sustainable management, including conservation and rational utilization of forest resources for the socio-economic development of the country.

The Wildlife (Conservation and Management) Act (Cap. 376), revised 2009 and 2013

The Wildlife (Conservation and Management) Act 2013 is- An Act of Parliament to provide for the protection, conservation, sustainable use and management of wildlife in Kenya and for connected purposes.

The Forest (Conservation and Management) Bill, 2014

The Forest (Conservation and Management) Bill 2014 is- An Act of The National Assembly to provide for the establishment, development and sustainable management, including conservation and rational utilization of all forest resources for the socio-economic development of the country.

The Land Act (No. 6), 2012

The Land Act 2012 is- An Act of Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes.

The Environmental Management and Coordination Act, 1999

The Environmental Management and Coordination Act 1999 is- An Act of Parliament to provide for the establishment of an appropriate legal and institutional framework for the management of the environment and for matters connected therewith and incidental thereto.

The Water Act, 2002

The Water Act is- An Act of Parliament to provide for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water; to provide for the regulation and management of water supply and sewerage services; to repeal the Water Act (Cap. 372) and certain provisions of the Local Government Act; and for related purposes.

The Agriculture, Fisheries and Food Authority Act, 2013

The Agriculture, Fisheries and Food Authority Act is – An Act of Parliament to provide for the consolidation of the laws on the regulation and promotion of agriculture generally, to provide for the establishment of the Agriculture, Fisheries and Food Authority, to make provision for the respective roles of the national and county governments in agriculture excluding livestock and related matters in furtherance of the relevant provisions of the Fourth Schedule to the Constitution and for connected purposes.

The Constitution of Kenya, 2010

The Constitution of Kenya (2010) - The Kenyan Constitution is the supreme law of Kenya. It establishes the structure of the Kenyan government, and also defines the relationship between the government and the citizens of Kenya.

The National Climate Change Response Strategy, 2010

The National Climate Change Response Strategy - Kenya has developed its first National Climate Change Response Strategy (NCCRS) in order to put in place robust and thorough adaptation and mitigation measures to minimize risks and maximize opportunities. The Strategy is designed to enhance Kenya's participation in the global climate change (COP) Discussions.

International Treaties:

Kenya is a signatory to the following International Treaties.

Convention of Biological Diversity: Kenya ratified the convention on 26 July 1994, and signed its two related mandated, the **Cartagena and Nagoya Protocol** on 11 September 2003 and 2 of January 2012 respectively.

United Nation Framework Convention of Climate Change: Kenya signed this on 12 June 1992 and ratified the **Kyoto Protocol** on the 25 September 2005.

African Convention on Conservation Of Nature and Natural Resources: Kenya signed on 15 September 1968.

Convention on International Trade in species of Wild Fauna and Flora (CITES): Kenya ratified on 13 December 1978.

3.1.3 Approval from the Appropriate Authorities, Including Established Formal and/or Traditional Authorities Customarily Required by the Communities. (G5.2)

To be completed when conservation easements are signed and the Project Proponent has been drafted and agreed upon.

3.2 Evidence of Right of Use (G5)

Land tenure within the project area is divided between Kenya Wildlife Service, Kenya Forest Service and the four Maasai community owned Group Ranches. In addition, The David Sheldrick Wildlife Trust has a 30-year leasehold agreement for the management and protection of the Kibwezi Forest Reserve from KFS. Between them these partners hold title and/or control of all the land within the project area (Please refer to Figure1).

KWS has tenure over the Chyulu Hills National Park and the Southern Chyulu Extension, which falls within the much larger Tsavo West National Park. KFS has title over the Kibwezi Forest Reserve. The four group ranches (Kuku Group Ranch, Kuku A Group Ranch, Rombo Group Ranch and Mbirikani Group Ranch) have community title for their respective group ranches which are held on behalf of registered community members.

Current Kenyan law makes no specific provisions for carbon rights or GHG emissions reductions. However, title to land includes a bundle of associated rights, such as to minerals and timber. In addition, precedent has been set with two VCS verified REDD projects (Kasigau Corridor REDD Project Phases I and II), located within about 70 miles of the Chyulu Hills Project, both of which have asserted Right of Use linked to land tenure in Kenya.

Based on land tenure granted to KWS and KFS, by statute that also includes the right and responsibility to manage the vegetation and conservation and management process that generates GHG emission reductions on behalf of the people of Kenya, KWS and KFS claim the Right of Use to the GHG emissions

reductions for the land units under their respective jurisdiction (Chyulu Hills National Park, the Southern Chyulu Extension and the Kibwezi Forest Reserve). Similarly, the group ranches (Kuku A Group Ranch, Kuku Group Ranch, Rombo Group Ranch, and Mbirikani Group Ranch) have been granted statutory authority to tenure and to manage the lands within their respective Group Ranch parcels, including the vegetation and conservational management process that generates the GHG emissions. As such, they claim Right of Use to the emission reductions generated by the project for the land units under their respective jurisdictions.

All these entities with Right of Use to the GHG emissions are assigning their respective Rights of Use to the Project Proponent (Chyulu Hills Conservation Trust) through enforceable and irrevocable agreements with the holders of the statutory, property rights in the land, vegetation, conservational or management process that generate GHG emission reductions which vests the right of use in the project proponent.

3.3 Emissions Trading Programs and Other Binding Limits (CL1.5)

The Chyulu Hills REDD+ Project is not subject to any additional emission trading programs or other binding limits. The Chyulu Hills REDD+ project is being developed under the VCS and CCB standards. The VCS standard requires that all carbon credits (VCUs) generated by the project are listed on a third-party registry and are tracked from the time of initial verification until their eventual retirement. Unique serial numbers will be generated for each tonne of CO2e that is sequestered under this protocol and issued as VCUs, so as to ensure that no credits can be sold more than once (double-counted). This project area will not be involved with any other projects developed under another voluntary or regulatory carbon offset protocol.

3.4 Participation under Other GHG Programs (CL1)

This is the first and only application for the Chyulu Hills REDD+ Project to a GHG credit program.

3.5 Other Forms of Environmental Credit (CL1)

The Chyulu Hills REDD+ Project will also be validated under the Climate, Community, and Biodiversity (CCB) standards (Second Edition, Gold Level).

3.6 Projects Rejected by Other GHG Programs (CL1)

The Chyulu Hills REDD+ Project has neither applied nor been rejected by any other GHG program.

3.7 Respect for Rights and No Involuntary Relocation (G5)

3.7.1 Encroachment on Private, Community or Government Property without Free Prior and Informed Consent from those Affected by the Project (G5.3)

The project will not encroach uninvited on private property, community property or government property. Tenure of the Project Area is outlined in section 1.3.4. Furthermore, section 2.7.1. outlines the comprehensive procedure of FPIC activities which ensures that all stakeholders and communities are consulted.

3.7.2 Involuntary Relocation of People or Activities Important for Livelihood or Culture (G5.4.)

The project does not require involuntary removal or relocation of communities or any activities important for their livelihood and culture.

3.8 Illegal Activities and Project Benefits (G5.5)

There are some activities that, if carried out in a protected area, are illegal. These are being addressed by the project partners but need further attention once the Chyulu Hills REDD+ Project is established in order to reduce and eventually stop them. Activities that may impact the project's climate objectives include charcoal burning, wood extraction for carvings and some logging. Project partners have on-going security operations and ranger teams that patrol the area with the aim of stopping any such activities, particularly in the National Parks and the Forest Reserve (KWS and KFS). Selective logging and removal of poles for fencing is currently allowed on the Group Ranches with approval by the Board of Directors, but during negotiations with the stakeholders it was made clear that such activities should be stopped.

Poaching is a serious problem, both in terms of bush meat and elephant/ rhino poaching for tusks and horn products, and may affect the project's biodiversity impact. However, project partners, particularly BLF, MWCT and KWS, are dedicated to protecting these animals and have comprehensive security operations and vigilance in place in order to monitor any illegal activity. With the increasing demand of rhino horn and ivory, however, further security measures must be implemented in order to protect these species in the Project Area.

4 APPLICATION OF METHODOLOGY

4.1 Title and Reference of Methodology

The Chyulu Hills REDD+ Project employs the VCS VM0009 Methodology for Avoided Ecosystem Conversion, version 3.0. This methodology quantifies greenhouse gas emission reductions generated from avoiding either planned or unplanned (or both) deforestation as well as protection from native grassland conversion as initiated by a variety of agents and drivers.

4.2 Applicability of Methodology

PDR.1 For each applicability condition, a statement of whether it applies to the project. If the applicability condition does not apply to the project, justification for this conclusion.

PDR.2 Where applicability conditions apply, credible evidence in the forms of analysis, documentation or third-party reports to satisfy the condition.

1. *This methodology was developed for avoiding land use conversion of forest and native grassland ecosystems. The drivers and agents of conversion in the baseline scenario must be consistent with those described in section 6 of this methodology and the end land use in the baseline scenario is non-forest or converted native grassland. Accordingly, the project activity must be Avoided Planned Deforestation (APD) or Avoided Unplanned Deforestation and/or Degradation (AUDD) for forested project accounting areas and Avoided Planned Conversion (APC) or Avoiding Unplanned Conversion (AUC) for grassland project accounting areas.*

VM0009 version 3.0 “Methodology for Avoided Ecosystem Conversion” is applicable to this project because the baseline scenario includes agents of deforestation and native grassland conversion who carry out native ecosystem-clearing activities that result in land use conversion to a non-forest or non-native grassland state. The Project Proponent have documented significant evidence to show that the primary driver of conversion is agricultural land, and that substantial portions of the reference region have already undergone such conversion. In addition, agricultural conversion is already present in the Project Area. The primary agents of conversion are the native agro-pastoralists people on the western side of the Chyulu Hills and the predominantly agriculturalists on the eastern side of the hills. This conversion to agricultural land use is an unplanned native ecosystem conversion, and therefore falls under the AUDD baseline type for the Forest Project Accounting Area and AUC for the Grassland Project Accounting Area.

2. *All project accounting areas must have been in an unconverted state (i.e., forest or native grassland) for at least 10 years prior to the project start date, according to the following:*

    a. *Land in all forested project accounting areas has qualified as forest on average across the project accounting areas as defined by FAO 2010 or as defined by the residing Designated National Authority (DNA) for the project country for a minimum of 10 years prior to the project start date.*

All of the land within the Forest Project Accounting Area has been native tropical dryland or tropical moist upland forest for at least 20 years prior to the project start date. Additionally, this forest has been a native primary forest in its current state since recorded times. An analysis of canopy cover was performed to ensure that it met Kenya’s minimum requirements of canopy coverage and height on average across all forest strata. The definition of forest as set by the Kenyan Forest Service, who is the designated national authority (DNA) established by the FAO, is for an area greater than 0.5 hectares with 15% or greater canopy cover, with a canopy height of 2 m (Kenya Forest Service, 2010).

    b. *Land in all grassland project accounting areas has qualified as native grassland or shrub land for a minimum of 10 years prior to the project start date.*

All land in the Grassland Project Accounting Area has been native grassland or native shrub land for least 10 years prior to the project start date. The land within this Project Accounting Area was analyzed for tree canopy coverage, and found to not meet the Kenyan definition of forest. Local experts have documented that the Grassland Project Accounting Area is comprised primarily of native species in a native species composition. The Africover land cover dataset which was collected in approximately 2000 documents these lands as grasslands.

3. *For project accounting areas of baseline type U (unplanned), a conversion threat must exist for each project accounting area as demonstrated by one of the following two options:*

    a. *Imminent conversion as predicted by a survey (see definition of imminent conversion). Moderate risk is defined as when more than 60% of respondents predict the end land use identified in the baseline scenario. The survey must meet the requirements of Appendix E.*

    OR

    b. *As of the project start date, some point within 2 kilometers of the perimeter of the project accounting area has been converted to the end land use identified in the baseline scenario (Broadbent et al., 2008).*

There are two Project Accounting Areas with unplanned type baseline scenarios in this project. There is significant evidence of native ecosystem conversion within 2 km of the perimeter of each of these. These points have all been converted to agricultural, which is the identified baseline scenario. Additionally, there has already been ecosystem conversion to agriculture inside of the Project Area.

4. *In the case of baseline type F-U1, at least 25% of the project area boundary is within 120 meters of deforestation and at least 25% of the project area boundary is adjacent to the reference area (see VM0009 Methodology section 6.3).*

The Forest Project Accounting Area meets this definition for a baseline type of F-U1. More than 25% of the Project Area boundary is within 120 m of existing deforestation. Additionally, at least 25% of the Forest Project Accounting Area boundary is adjacent to the Reference Area.

5. *In the case of baseline type G-U1, at least 25% of the project area boundary is adjacent to the reference area (see section 6.3).*

The Grassland Project Accounting Area meets this definition for a baseline type of G-U1. More than 25% of the Project Area boundary is within 120 m of existing native grassland conversion. Additionally, at least 25% of the Grassland Project Accounting Area boundary is adjacent to the Reference Area.

6. *In the case of baseline type F-U2, at least 25% of the project area boundary is within 120 meters of deforestation (see section 6.3).*

The Forest Project Accounting Area has a baseline type of F-U1.

7. The project accounting area(s) must not contain peat soil.

The Forest Project Accounting Area and the Grassland Project Accounting Area both do not contain any peat or organic soils. Please refer to the soil map in Appendix E that shows all of the soil types present in the two Project Accounting Areas.

8. *For each project accounting area, a reference area can be delineated for each baseline type in the baseline scenario that meets the requirements, including the minimum size requirement, of section 6.8.1 of the VM0009 methodology.*

A Reference Area was selected for each the Forest Project Accounting Area and the Grassland Project Accounting Area that meets of all the requirements in section 6.8.1 of the methodology VM0009. Please refer to Section 4.5.8.1 regarding the selection of the reference area for the Forest Project Accounting Area and the Grassland Project Accounting Area. In the section referenced there is the results of the spatial analysis demonstrating that the Forest Reference Area contained as much forest as the Forest Project Accounting Area at the onset of the historic reference period. The section also documents that the Grassland Reference Area contained as much grassland as the Grassland Project Accounting Area at the beginning of the historic reference period.

9. *As of the project start date, historic imagery of the Reference Area(s) exists with sufficient coverage to meet the requirements of section 6.8.4 of the VM0009 methodology.*

As of the start of the historic reference period there is sufficient historic imagery available to ensure that the reference areas have coverage that meets all requirements of section 6.8.4 of the methodology VM009. Additionally, all of this imagery meets all minimum requirements for imagery in section 6.8.4 in the methodology VM0009.

10. *Project activities are planned or implemented to mitigate ecosystem conversion by addressing the agents and drivers of conversion as described in section 8.3.1 of the methodology VM0009.*

The Project Proponent of the Chyulu Hills REDD+ Project has already implemented a number of activities that will result in a reduction in ecosystem conversion. These activities are all designed to address the identified agents and drivers of conversion as documented in this document.

11. *The project proponent has access to the activity-shifting leakage area(s) and proxy area(s) to implement monitoring (see sections 8.3.2.1 and 6.4), or has access to monitoring data from these areas for every monitoring event.*

The Project Proponent has full access to activity-shifting leakage areas and proxy areas. This is demonstrated by the collection of data on the post-conversion residual carbon stock from the proxy area. Additionally, the 2 activity-shifting leakage areas in the project have been fully delineated and mapped to ensure that all lands within the areas are fully accessible by project staff.

12. *If logging is included in the baseline scenario and a market-effects leakage area is required per section 8.3, then the project proponent has access to (or monitoring data from) the market-effects leakage area if measurement is needed (see section 8.3.3).*

The Chyulu Hills REDD+ Project does not have any logging in the baseline scenario.

13. *This methodology is applicable to all geographies, however if SOC is a selected carbon pool and the default value from section 6.19.2 is selected then the project must be located in a tropical ecosystem.*

The Chyulu Hills REDD+ Project is located in a tropical ecosystem in Kenya. Therefore the default value for the determination of the decay of carbon in soil is applicable to this project.

14. *If livestock are being grazed within the project area in the project scenario, there must be no manure management taking place, as emissions from N2O as a result of manure management are not quantified or addressed in this methodology.*

There may be livestock grazing within the Project Area of this project. Many of the area communities are pastoralists, and have smallholdings of cattle, goats and sheep. These communities may continue grazing activities in the Project Area. These livestock grazing activities are not a component of the project, nor are they a project activity. There will be no manure management of any type occurring on in the Project Area.

15. *Project activities must not result in significant GHG emissions. All GHG emissions from project activities must be shown to be de minimis (see section 8.3.1of the methodology VM0009).*

All project activities in the Chyulu Hills REDD+ Project will not result in any significant GHG emissions. The project activities have been designed to be low carbon in nature and do not include any industrial scale agricultural, large uses of fertilizer or other industrial type activity that may result in GHG emissions above the *de minimis* level.

PDR.3 Definition of forest used by the project proponent and its source.

The Project Proponent has used the definition of forest from the Kenyan Forest Service, who is the DNA from the FAO in Kenya. The Kenyan Forest Service defines forest as a minimum patch size of 0.5 hectares with at least 15% canopy coverage and a canopy height of 2 m (Kenya Forest Service, 2010).

Table 12. Kenyan Definition of Forest

Forest Definition of Kenya	
Item	**Value**
Minimum Crown Cover (%)	15%
Minimum Land Area (ha)	0.5
Minimum Tree Height (m)	2

4.3 Methodology Deviations

There are no deviations from the methodology.

4.4 Project Boundary (G1)

4.4.1 Gases

PDR.11 A list of the greenhouse gases considered.

Carbon dioxide (CO_2) was determined to be the primary source of greenhouse gas emissions in the project, given the threat of deforestation and native grassland conversion from the drivers listed in the baseline scenario. Methane (CH_4) and nitrous oxide (N_2O) are conservatively excluded from the project.

Table 13: Baseline and Project Greenhouse Gases Considered

Source		Gas	Included?	Justification/Explanation
Baseline	Source 1	CO_2	Yes	Major pool considered in the baseline scenario
		CH_4	No	Conservatively excluded
		N_2O	No	Conservatively excluded.
		Other	No	No other GHG gases
Project	Source 1	CO_2	Yes	Major pool considered in the project scenario
		CH_4	No	Conservatively excluded
		N_2O	No	Conservatively excluded.
		Other	**No**	**No other GHG gases**

4.4.2 Selected Carbon Pools

PDR.12 A list of the selected carbon pools and evidence for the conservative exclusion of any optional pools.

Table 14: Selected carbon pools in the Forest Project Accounting Area (REDD baseline type).

Pool		Required	Included in Project	Justification
AGMT	Above-ground merchantable tree	Yes, if baseline scenario or project activity(ies) include the	No	No commercial tree harvesting or production

		harvest of long-lived wood products. Otherwise, accounting for this carbon pool is not required		of long-lived wood products included in baseline
AGOT	Above-ground other (non-merchantable) tree	Yes	Yes	Major pool considered
AGNT	Above-ground non-tree	Yes, if the baseline scenario includes perennial tree crops. Otherwise, accounting for this carbon pool is optional.	Yes	Major pool considered
BGMT	Below-ground merchantable tree	Optional	No	No commercial tree harvesting or production of long-lived wood products included in baseline
BGOT	Below-ground other (non-merchantable) tree	Optional	Yes	Major pool considered
BGNT	Below-ground non-tree	Optional	Yes	Major pool considered
LTR	Litter	No	No	Conservatively excluded
DW	Dead wood	Yes, if AGMT is selected	No	Conservatively excluded
SD	Standing dead wood	Optional	Yes	Major pool considered
LD	Lying dead wood	Optional	No	Conservatively excluded
SOC	Soil organic carbon	Optional	Yes	Major pool considered
WP	Long-lived wood products	Yes, if AGMT is selected	No	Conservatively excluded

Table 15: Selected carbon pools in the Grassland Project Accounting Area (ACoGS baseline type).

Pool		Required	Included in Project	Justification
AGMT	Above-ground merchantable tree	Yes, if baseline scenario or project activity(ies) include the harvest of long-lived wood products. Otherwise, accounting for this carbon pool is not required	No	No commercial tree harvesting or production of long-lived wood products included in baseline
AGOT	Above-ground other (non-merchantable) tree	Yes	Yes	Major pool considered
AGNT	Above-ground non-tree	Yes, if the baseline scenario includes perennial tree crops.	Yes	Major pool considered

		Otherwise, accounting for this carbon pool is optional.		
BGMT	Below-ground merchantable tree	Optional	No	No commercial tree harvesting or production of long-lived wood products included in baseline
BGOT	Below-ground other (non-merchantable) tree	Optional	Yes	Major pool considered
BGNT	Below-ground non-tree	Optional	Yes	Major pool considered
LTR	Litter	No	No	Conservatively excluded
DW	Dead wood	Yes, if AGMT is selected	No	Conservatively excluded
SD	Standing dead wood	Optional	Yes	Major pool considered
LD	Lying dead wood	Optional	No	Conservatively excluded
SOC	Soil organic carbon	Optional	Yes	Major pool considered
WP	Long-lived wood products	Yes, if AGMT is selected	No	Conservatively excluded

4.5 Baseline Scenario (G2)

4.5.1 Most Likely Land Use Scenario in the Absence of the Project (G2.1)

PDR.17 Show that the identified baseline type is the most plausible baseline scenario identified in section 7.

The baseline scenario that has been identified is that of conversion of native ecosystems from a natural landcover to a non-forest or agricultural state.. The baseline scenario demonstrates that the lowland areas of the Project Area would be converted to subsistence agricultural, whereas the higher elevation areas of the Project Area would undergo complete deforestation through the unsustainable harvesting of trees for forest products. The VCS Additionality tool was used by the Project Proponent to demonstrate that this is the most likely baseline scenario for both the Forest Project Accounting Area and Grassland Project Accounting Area. Please refer to Section 4.6 for the VCS Additionality Tool.

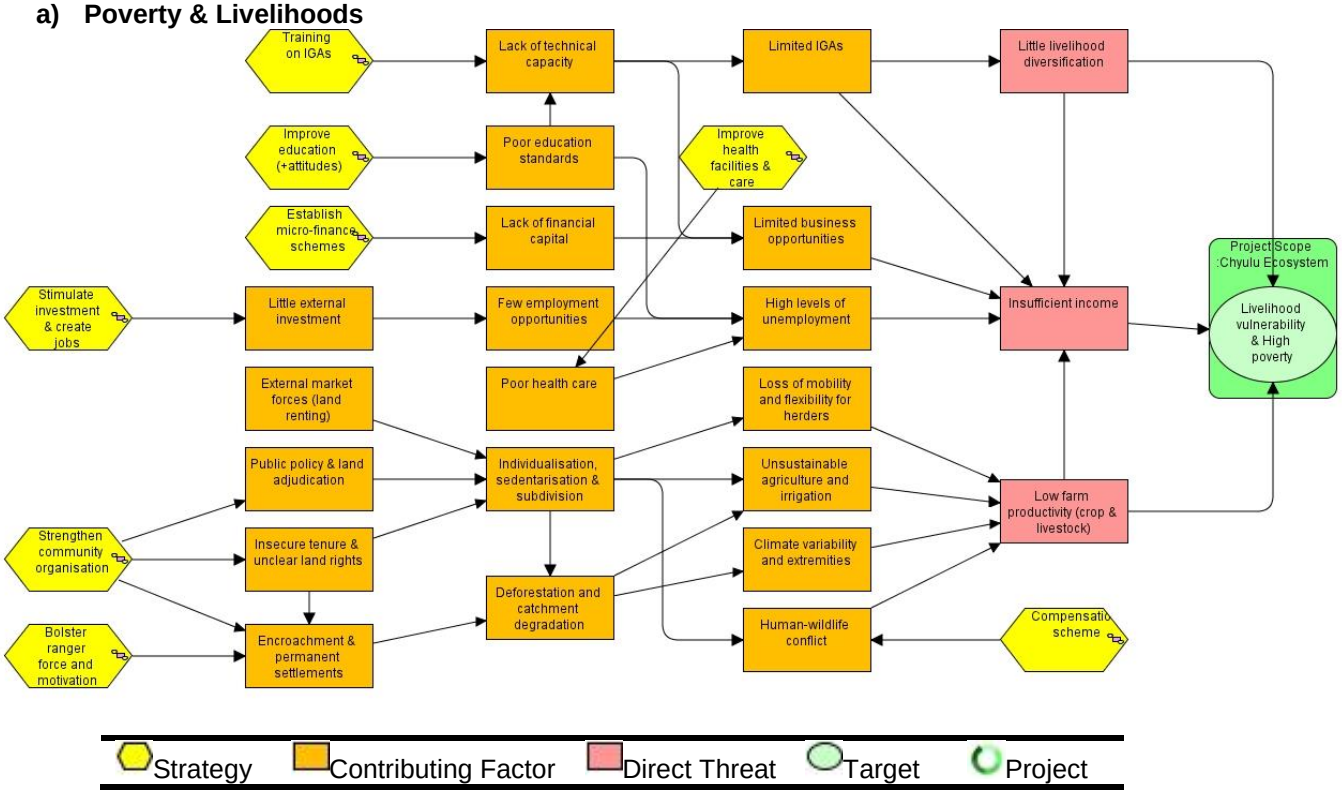
4.5.2 How the 'Without Project' Scenario (baseline) would Affect Communities in the Project Zone (G2.4)

The Without-Project land-use scenario would affect the communities in the Project Zone in myriad ways. In order to analyze these potential impacts systematically and pragmatically, we focused on several key issues, hereafter termed Focal Issues. Focal Issues are defined as the social and biodiversity factors or issues that are most important for the success of the REDD+ project (Richards & Panfil, 2011). These are issues or problems most associated with the deforestation and/or forest degradation process, which could prevent the project from achieving its (carbon) objectives. They could also be issues or problems in the project area that the REDD+ project could have most influence on (Richards & Panfil, 2011). Selection of the most relevant social and biodiversity variables requires a strong understanding of local social and ecological processes, including, *inter alia* local social structures and governance mechanisms, and the

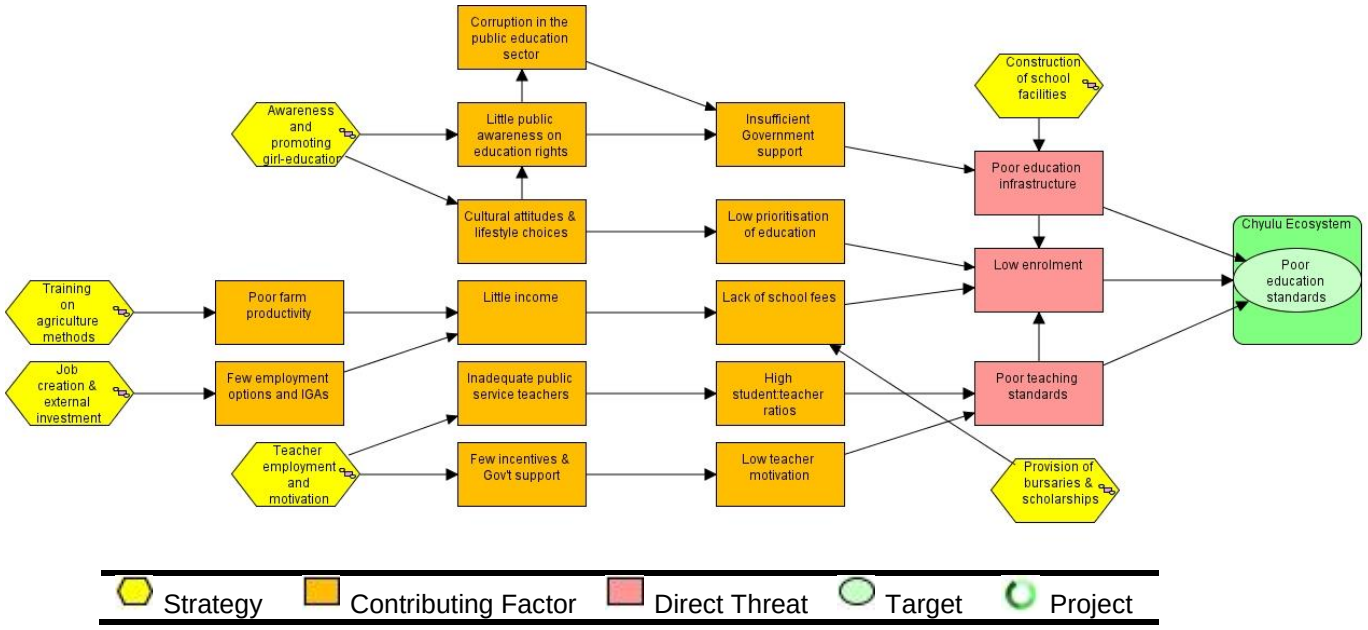
likely response of target species to changes in forest cover. In order to select and prioritize potential social and biodiversity issues, we used a combination of the project partners' experience of the project area, the local community (environment) advisory committees they work with, information from the FPIC meetings, and literature.

For the community component of this project, three focal issues were prioritized from a pool of potential issues as key to reducing deforestation, forest degradation and avoiding conversion of grasslands. These were: high levels of poverty and livelihood vulnerability; food insecurity; and poor education standards. (NB: water scarcity and poor health standards featured highly too, but were deemed cross-cutting and/or contributing factors and are thus already incorporated into these three main issues). A situational analysis of these three focal issues resulted in conceptual diagrams showing the root causes of the problems (also referred to as Problem Flow Diagrams by Richards and Panfil (2011)). From these diagrams, potential project entry points (or project strategies/activities) that would help address some key root causes were then identified.

a) Poverty & Livelihoods



b) Education



c) Food Security

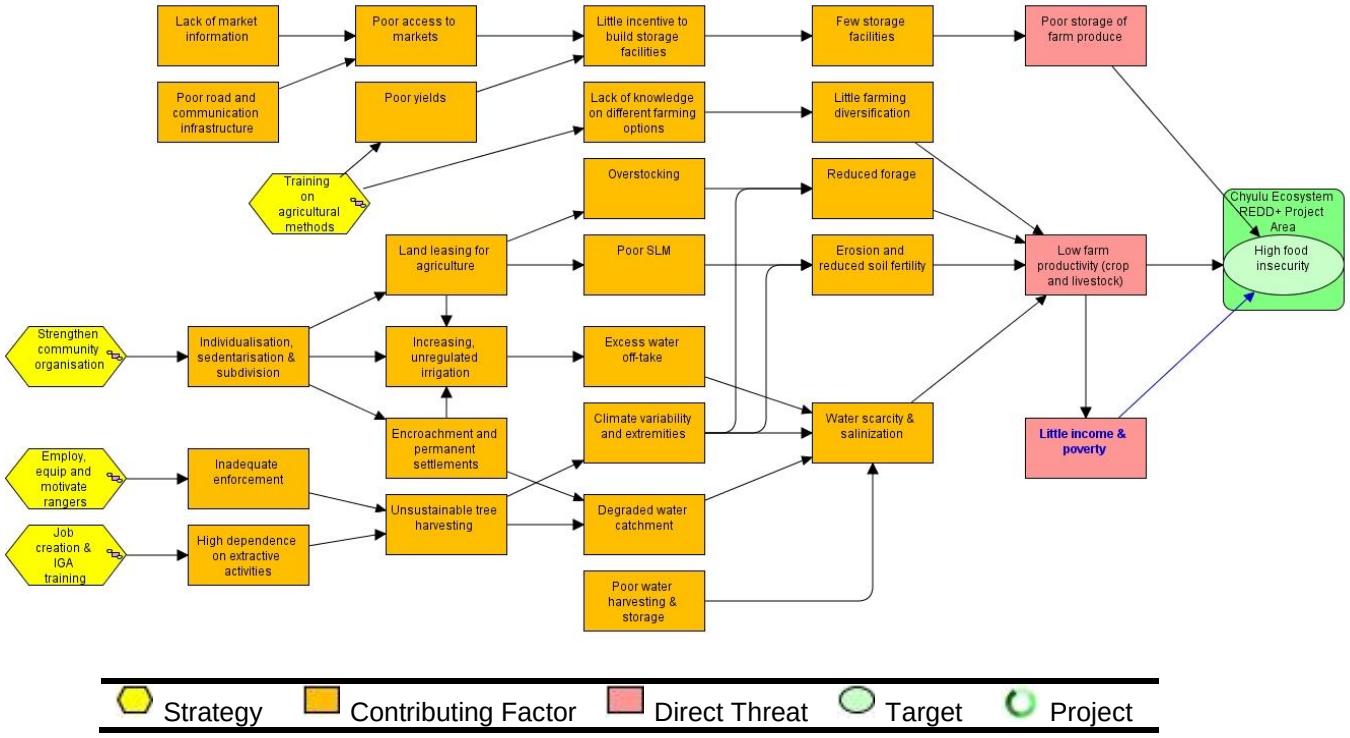


Figure 6: Conceptual diagram showing the root causes of the Social Focal Issues in the Chyulu Hills ecosystem

Next, we used these Problem Flow Diagrams to help analyze what would happen to the key community issues without the REDD+ project, assuming the baseline land use scenario (section 4.5.1) comes to pass. We focused on the Direct Threats (in pink on the Problem Flow Diagrams) and exploited the partners' wealth of experience in the landscape as well as literature to draw projections about the direction these Direct Threats will take over the short to medium term (5-10 years). Appropriate justification is provided for each projection as well as any additional supporting remarks (Table 16).

Table 16: Short-to-medium term Without-project projections for the major Direct Factors affecting the Social Focal Issues in the Chyulu Hills ecosystem

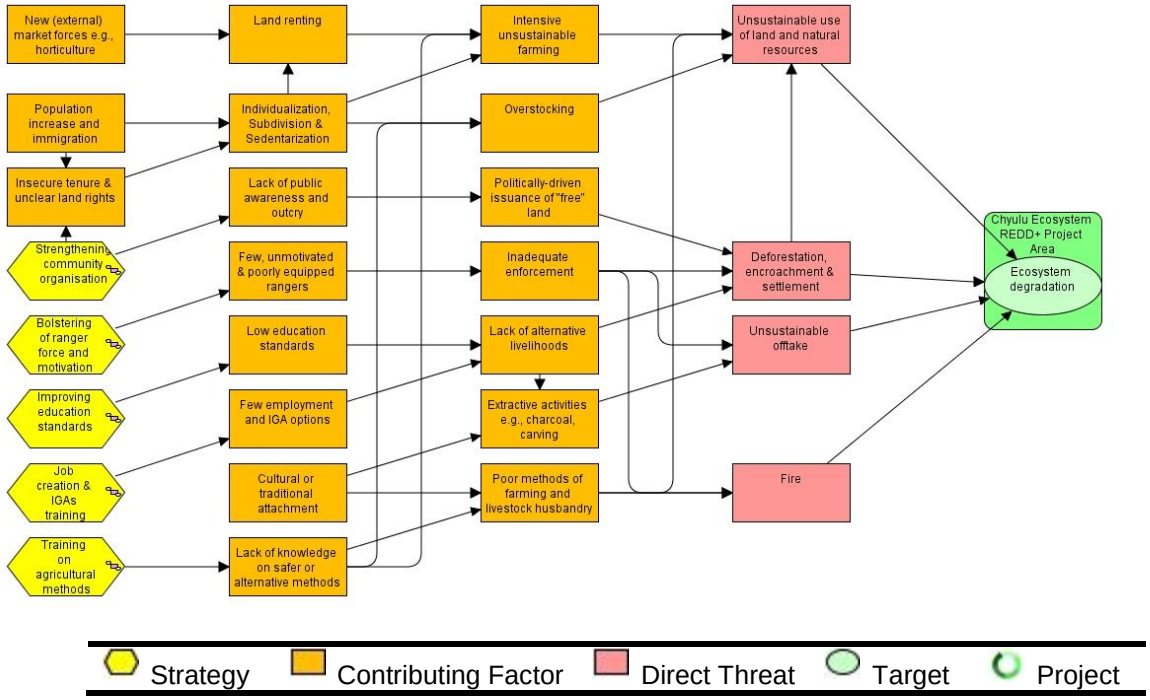
Direct Threat	Condition expected in 5-10 years, improve, worsen, or remain unchanged?	What will drive the change?	Remarks
Little livelihood diversification	Worsen	Few alternative Income-generating activities (IGAs); Lack of technical capacity & poor education	Ecosystem deterioration in turn means lesser support for IGAs

Insufficient incomes (poverty)	Worsen	Limited external investment creating limited employment opportunities; Lack of capital for businesses	Includes poor health limiting ability to utilize opportunities;
Low farm productivity: livestock	Worsen	Loss of grazing areas from subdivision; Overgrazing and pasture deterioration; Increasing human-carnivore conflicts; Climate extremes (droughts)	
Low farm productivity: crops	Worsen	Sedentarization and unsustainable agriculture (poor SLM, excessive irrigation); Increasing human-wildlife conflicts; Climate extremes (drought/floods)	
Poor education infrastructure	Improve	Growing community awareness; Increased County provision for education	
Low enrolment	Unchanged	Growing community awareness; Growing girl-child drive; Vs Insufficient income to support fees; Cultural priorities	
Poor teaching standards	Unchanged	Increased awareness and County provision for education; Vs Still lagging cultural attitudes and hardship area failing to attract top teachers	
Poor storage of farm produce	Worsen	Poor yields and Poor market access will reduce the incentive to build storage structures; Lack of income to invest in such structures	

4.5.3 How the 'Without Project' (Baseline) Scenario would Affect Biodiversity in the Project Zone (G2.5)

The Without-Project land-use scenario would affect the biodiversity in the Project Zone in several ways. Similar to the Community section above (G 2.4), we focused once more on Focal Issues, which are defined in this context here as the biodiversity factors or issues that are most important for the success of the REDD+ project (Richards & Panfil, 2011). Biodiversity Focal Issues were also selected and prioritized based on project partners' experience in the project area, the local advisory committees, information from the FPIC meetings, and literature. For the biodiversity component of this project, the following two critical Focal Issues were prioritized from a pool of potential issues: Ecosystem degradation and Biodiversity declines. A situational analysis of these two Focal Issues resulted in conceptual diagrams showing the root causes of the problems (also referred to as Problem Flow Diagrams by Richards and Panfil (2011)). From these diagrams, potential project entry points (or project strategies/activities) that would help address some key root causes were then identified.

a) Ecosystem Degradation



b) Biodiversity Declines

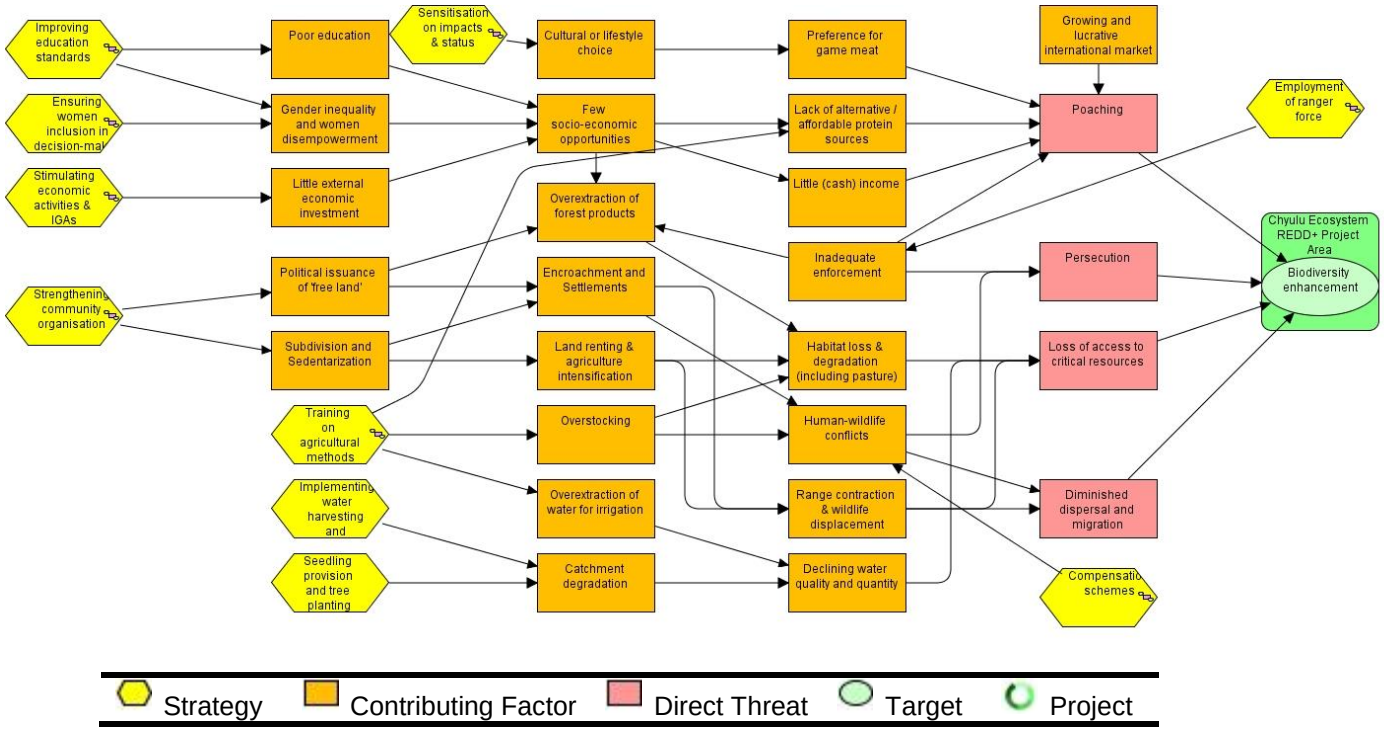


Figure 7: Conceptual diagram showing the root problems of the Biodiversity Focal Issues in the Chyulu Hills ecosystem

Next, we used these Problem Flow Diagrams to help analyze what would happen to these focal issues without the REDD+ project, assuming the baseline land use scenario (section 4.5.1.) happens. We focused on the Direct Threats (in pink on the Problem Flow Diagrams) and exploited the partners' combined wealth of experience in the landscape as well as literature to draw projections for the short to medium term (5-10 years) about the directions these Direct Threats will take. Appropriate justification is provided for each projection as well as any additional supporting remarks (Table 17).

Table 17: Short-to-medium term Without-project projections for the major Direct Factors affecting the Biodiversity Focal Issues in the Chyulu Hills ecosystem

Direct Threat	Condition expected in 5-10 years, improve, worsen, or remain unchanged?	What will drive the change?	Remarks
Unsustainable land use (overgrazing, poor SLM & excessive irrigation)	Worsen	Sedentarization and unsustainable agriculture intensification; Lack of technical knowledge or investment capacity for new agricultural methods e.g., agroforestry and livestock diversification	Individualization driven by population pressure and insecure tenure/rights
Deforestation, Encroachment, Settlement	Worsen	Poor security and enforcement; Lack of alternative livelihoods; Vs Increased community awareness precluding unregulated land issuance	
Unsustainable off-take (trees)	Worsen	Lack of alternative livelihoods will lead to greater dependence on extractive activities	
Fire	Worsen	Shrinking of grazing areas leading to elevated use of fire; Lack of technical knowledge on alternative techniques	Community stick to traditional techniques which will not work as well in this new landscape
Poaching	Worsen	Few economic opportunities; Lack of protein alternatives; Growing demand for game meat and other products; and Poor enforcement	Includes growing international markets for ivory
Wildlife persecution	Worsen	Inadequate enforcement; Increasing human-wildlife conflicts	From overstocking and farmlands in the wildlife dispersal areas
Wildlife displacement from critical resources	Worsen	Habitat degradation from over-extraction and overstocking; Unsustainable agricultural intensification; and	Also includes over-abstraction of water for agriculture and

		Encroachments and settlements	catchment degradation
Diminished migration and dispersal	Worsen	Range contraction from increasing encroachments and fenced settlements with the attendant escalation of human-wildlife conflicts	

4.5.4 Identifying the Agents and Drivers

PDR.18 A list of the agents and drivers of conversion, including quantitative descriptions of agent mobilities.

- Local members from the Maasai tribe converting natural lands for agricultural cropland and settlements. The mobility of the Maasai people is generally limited to that which can be walked on foot, which is one of the primary forms of transportation. This is assumed to be in the range of approximately 5-25 km. This is except in cases where products may be transported by vehicle to market, increasing the distance to approximately 100-500 km.
- Local members of the Kamba tribe deforesting and converting for agricultural cropland. The mobility of the Kamba people is generally limited to that which can be walked on foot, which is one of the primary forms of transportation. This is assumed to be in the range of approximately 5-25 km. This is except in cases where products may be transported by vehicle to market, increasing the distance to approximately 100-500 km.

PDR.19 A narrative describing the agents and drivers of conversion.

The primary agents of deforestation and native grassland conversion in the Chyulu Hills are identical to those in the general reference area. The primary agents of conversion are local community members who are part of several tribes present in the region performing subsistence agriculture. There exists clear evidence that the agents and drivers are present and active throughout the reference area and Project Area. The documented deforestation and grassland conversion in the reference area demonstrates that this type of conversion is common practice in the area, and occurs across all boundaries and land ownerships. There has been significant agricultural conversion in the Project Area before the arrival of the Project Proponent. The land ownership in the reference area and the Project Area is a similar mix of privately owned group ranches and government owned land that has official protection against settlement. Therefore the clear evidence of widespread conversion of the reference area provides strong evidence of the applicability of the identified baseline scenario and agents and drivers of conversion.

The drivers affecting both sets of agents include access to resources for livelihoods, proximity to major markets (allowing for access to healthcare, education, information and community), proximity to roads, and proximity to fresh water.

PDR.20 Descriptions of agents and drivers including any useful statistics and their sources.

The Maasai tribe is predominantly present on the western side of the project area. The Maasai has been present in this region for hundreds of years. Traditionally they have been a nomadic pastoralist society that has relied mainly on livestock for their food and livelihood, with only minimal agricultural activity. The Maasai, however, have been undergoing cultural shifts towards settling into larger sedentary communities and more permanent agriculture. This shift was hastened during a major drought in 2009, which killed a

significant amount of livestock in the region. The Maasai began to settle more permanently on the group ranches. However, this settlement is still happening in an unplanned manner, with no organization or pattern to the settlement.

On the eastern side of the Chyulu Hills the Kamba tribe is more dominant, with small numbers of Taita and Kikuyu. These tribes have been more traditionally agricultural communities, and the expansion of croplands is due to immigration into the areas along the Mombasa-Nairobi highway. On the eastern side the settlers generally do not have legal title to the lands, but are instead using slash and burn techniques to clear the land and farm until the soil is depleted of nutrients.

4.5.5 Delineating the Project Accounting Areas

PDR.22 A digital (GIS-based) map of the project accounting areas, including aerial or satellite imagery showing that they are forested as of the project start date and 10 years prior to the project start date.

The Project Area has been divided into two separate Project Accounting Areas based on the analysis of an AWF land cover dataset. This land cover data separates the Project Area into 7 different land cover classes based on vegetation type and canopy cover. From this dataset a Grassland Project Accounting Area and Forest Accounting Area were created. The areas in the Forest Project Accounting Area all meet the Kenyan definition of forest, whereas the Grassland Project Accounting is comprised of the remaining non-converted areas that did not meet the forest definition. The Forest Project Accounting Area and Grassland Project Accounting Area as seen in Figure 8.

PDR. 23 Justify the project accounting areas using the identified agents and drivers of conversion, constraints to conversion, and attributes listed above in the methodology VM0009 section 6.2.

There are 2 Project Accounting Areas in the Project Area, which were selected to conform to the selected baseline types. These were defined by the land cover in the area, as identified using a land cover/ land use remote sensing data set provided by AWF. This analysis stratified the Project Area into a number of areas based in relation to the land cover. Any areas identified as settlements, agriculture, surface water or any other non-native land covers were removed from the Project Accounting Areas. The remaining strata that met the Kenyan definition of forest were then placed into the Forest Project Accounting Area with the strata that did not meet the forest definition being placed into the Grassland Project Accounting Area. Forest inventory data was then used to confirm that all strata in the Forest Accounting Area met the Kenyan definition of forest.

High resolution imagery was then used to identify any areas within the Forest Project Accounting Area and Grassland Project Accounting Area that showed evidence of already being converted to settlements or agriculture. Additionally, to help support a good working relationship with the local communities that were located within the Project Accounting Areas at the project start date, and to support the project FPIC efforts of the Project Proponent, a community buffer was established around the communities. This 0.5 km buffer around the existing communities and agriculture will provide for future expansion and additional resources for these communities.

PDR.24 Selection of patch size for at which land conversion typically occurs.

For the Grassland Project Accounting Area the selected baseline is AUC type G-U1. The patch size in this project which conversion typically occurs is at least 250m by 250 m.

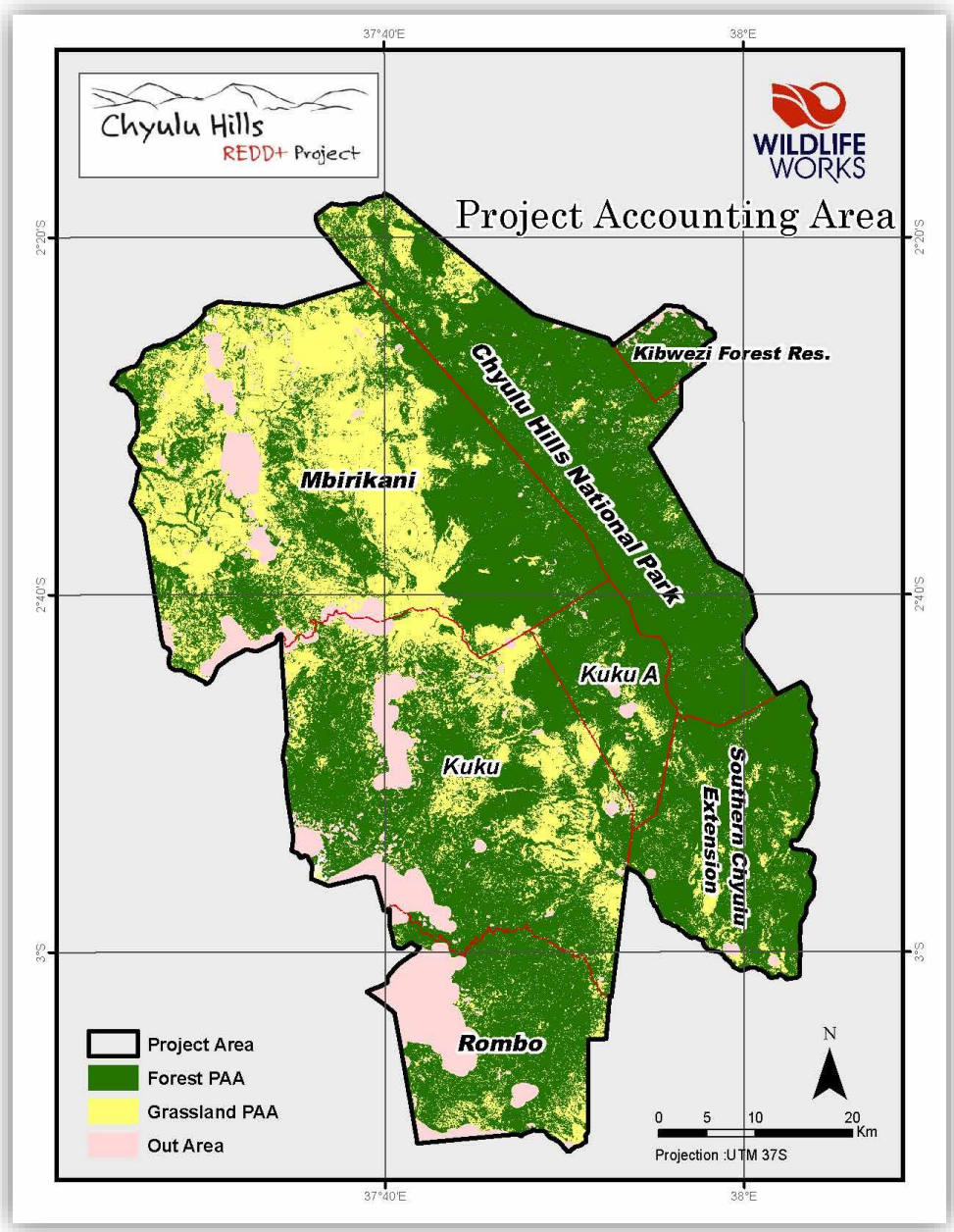


Figure 8: The Project Area, the Grassland Project Accounting Area and the Forest Accounting Area. “Out areas” are areas inside the Project Area that have been previously converted, and therefore removed from GHG accounting.

PDR.25 Justification of selection of patch size for delineation of Project Accounting Area.

In this area of small subsistence based agriculture the size of an agricultural patch may be relatively small. This is a result of the generally non-mechanized nature of the agriculture, which allows the conversion of small, irregular, or highly sloped land parcels. However, the conversion must also be able to be identified through remote sensing means so that it can be delineated with sufficient confidence.

Therefore the minimum patch size of 250 m x 250 m was selected in this project as the ideal patch size for conversion.

4.5.6 Baseline Types

4.5.6.1 Forest Project Accounting Area

PDR.30 If Type F-U1 is selected, a spatial analysis of the project area showing that at least 25% of the perimeter is within 120 meters of deforestation that occurred within 10 years prior to the project start date and showing that the reference area is adjacent to at least 25% of the project area.

PDR.32 If Types F-U1, F-U2 or F-U3 is selected, a spatial analysis of the project area showing that it is within 120 meters of deforestation that occurred within 10 years prior to the project start date.

Edge analysis was performed per VM0009 and VCS AFOLU Guidance and the percentage of deforestation within a period 10 years prior to the Project start date and within 120m of the Project perimeter was calculated as: 35.5%. Therefore, the Chyulu Hills REDD+ Project has been determined to be of type F-U1 (Avoided Unplanned Deforestation that meets the VCS definition of a Mosaic Deforestation Pattern and that Features an Adjacent Reference Area). Figure 9 below shows the results of the edge analysis, depicting deforestation both from the year 2003 (10 years prior to the project start date) and 2013 (the proposed Project start date).

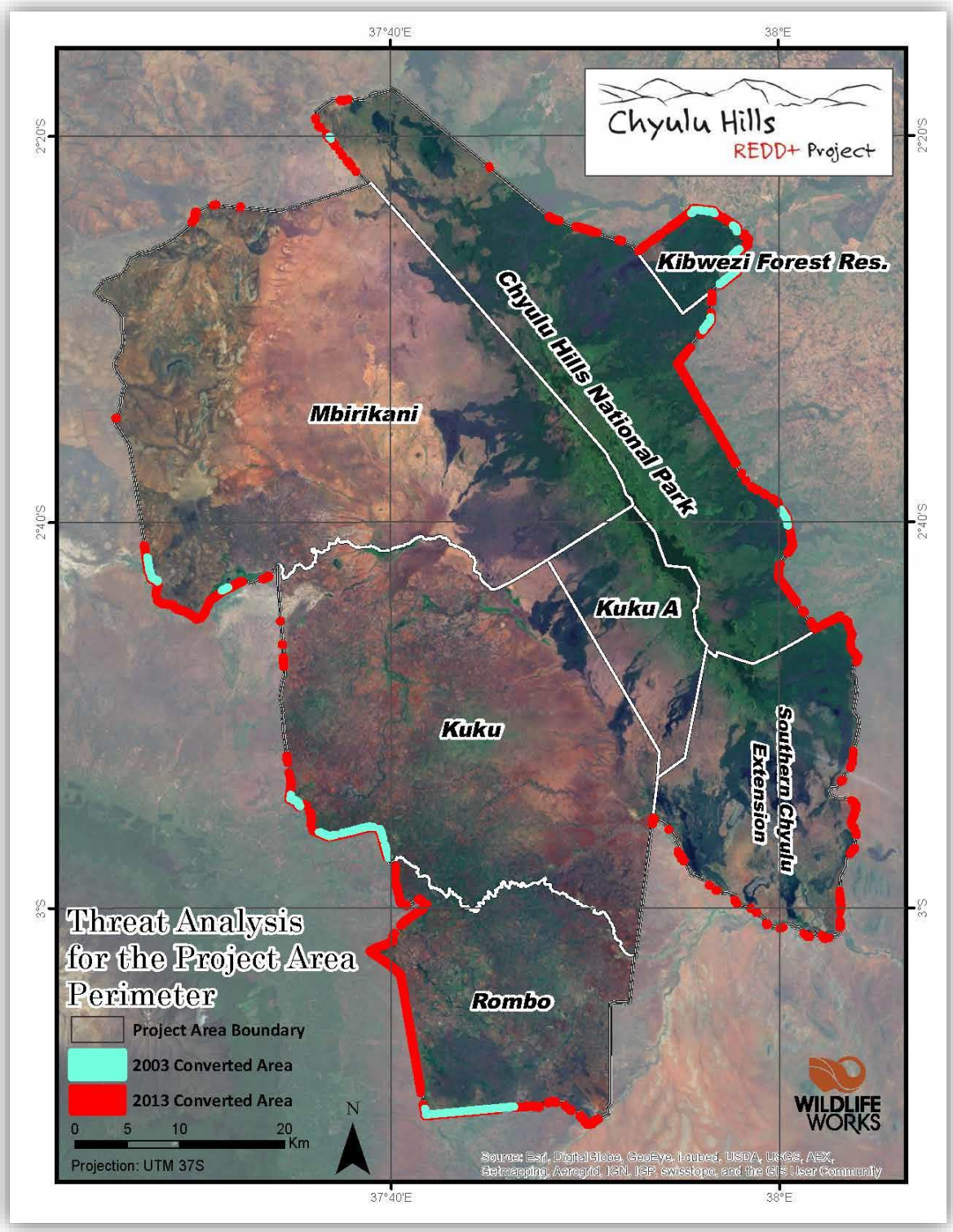
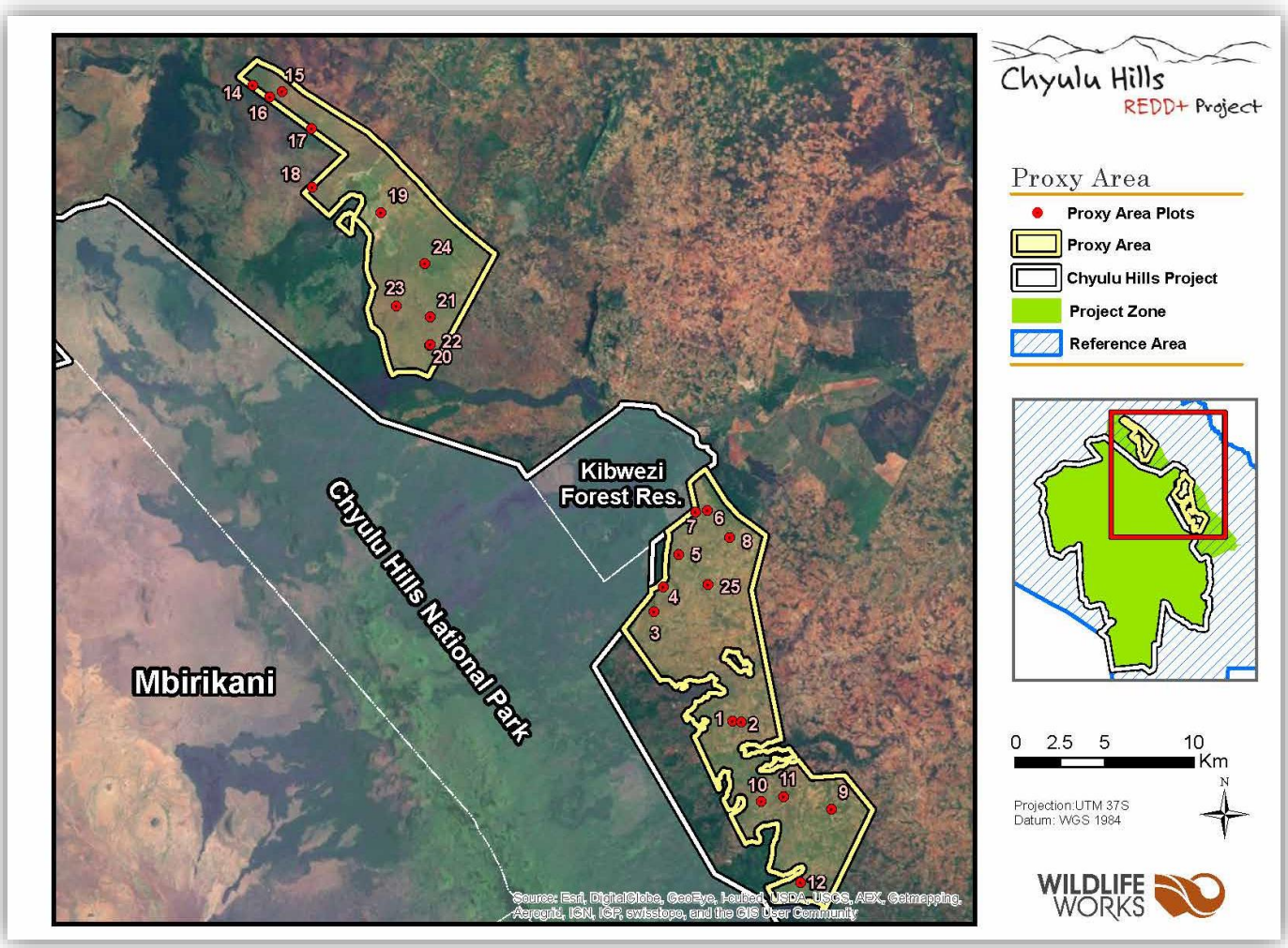


Figure 9: Edge threat analysis for the Project Area perimeter. Percentage deforested within 10 years prior to project start date and within 120m of the project boundary was calculated to be 35.5%.

4.5.6.2 Grassland Project Accounting Area

PDR.34 If Type G-U1 is selected, a spatial analysis of the project area showing that the reference area is adjacent to at least 25% of the project area.

The analysis shown above for the Forest Project Accounting Area (PAA) also applies to the Grassland PAA, because this analysis is performed at the Project Area boundary and thus applies to all PAAs within the Project Area. Figure 9 also applies to this PDR for the same reasons.



4.5.7 Delineating Proxy Areas

PDR.35 A map of the delineated boundaries.

Figure 10: Proxy Area and Proxy Area biomass plot locations

PDR.36 Maps or other evidence that the proxy area's site characteristics and landscape configuration is similar to its respective Project Accounting Area, including:

a. **Vegetation;**
b. **Climatic conditions (e.g. mean temperature, rainfall, etc.);**
c. **Topographic constraints to conversion (slope, aspect, elevation);**
d. **Land use and/or land cover;**
e. **Soil map (if available) or other soil information;**
f. **Applicable infrastructure (e.g. water ways, roads, railroad, airports, provision of electricity, and other access points); and**
g. **Ownership/tenure boundaries that influence conversion (e.g. government holdings, private holdings and reserves).**

Please see Appendix C for the above maps.

PDR.37 A narrative describing the rationale for selection of proxy area boundaries, including the proxy area's similarity to the corresponding project accounting area with respect to vegetation, soil and climatic conditions.

The Proxy Area was chosen primarily for its accurate representation of the most likely "end state" of the baseline scenario that has been identified for the Project Area. Local expertise suggests that the chosen area, adjacent to the Project Area is emblematic of the Project Area, and of the types of land use on deforested and converted native grasslands that are typical in this region. The proxy area is also required to be accessible to the project proponents, providing the ability to install permanent plots that can be re-visited for monitoring of the carbon stocks for the lifetime of the project. The proxy area delineated for this project meets this requirement. The proxy area was delineated using Africover land cover data, so as to identify areas that are classified as having a land use of agriculture. The delineated area was then confirmed using high-resolution imagery and through on the ground verification.

PDR.38 Results of a spatial analysis to demonstrate the proxy area is converted, on average, as of the project start date.

Please see a map demonstrating that the proxy area has all been converted to an agricultural land use as of the project start date in Appendix C.

4.5.8 Estimating the Deforestation Parameters

4.5.8.1 Delineating Reference Areas

PDR.40 A map of the delineated boundaries, demonstrating that the reference area was held by the identified baseline agent or agents and does not include the project area.

The combined reference area selected for the Chyulu Hills REDD+ Project is shown in Figure 11 below. However, VM0009 stipulates that there shall be a reference area for each PAA that contains the same distinct characteristics of each. The Chyulu Hills REDD+ Project has delineated 2 reference areas, 1 each for the two Project Accounting areas (see Figure 12 below). The reference areas were delineated to represent the region in which the Project Area is located. Therefore, these reference areas contain the same agents of conversion as have been identified in the baseline scenario. Neither of the reference areas overlap with the Project Area.

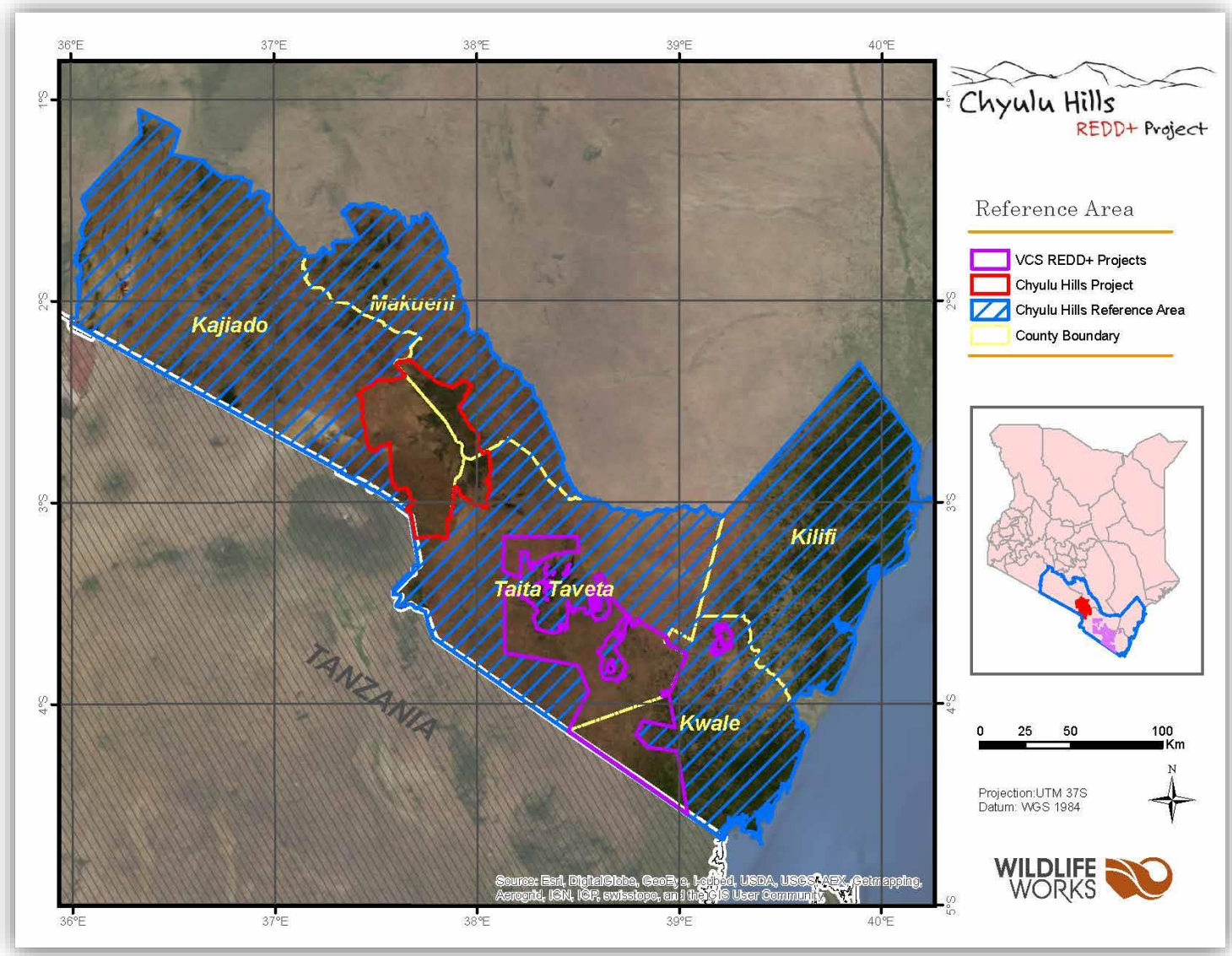


Figure 11: The reference area is shown in relation to the Project Area and the Kenyan national boundaries.

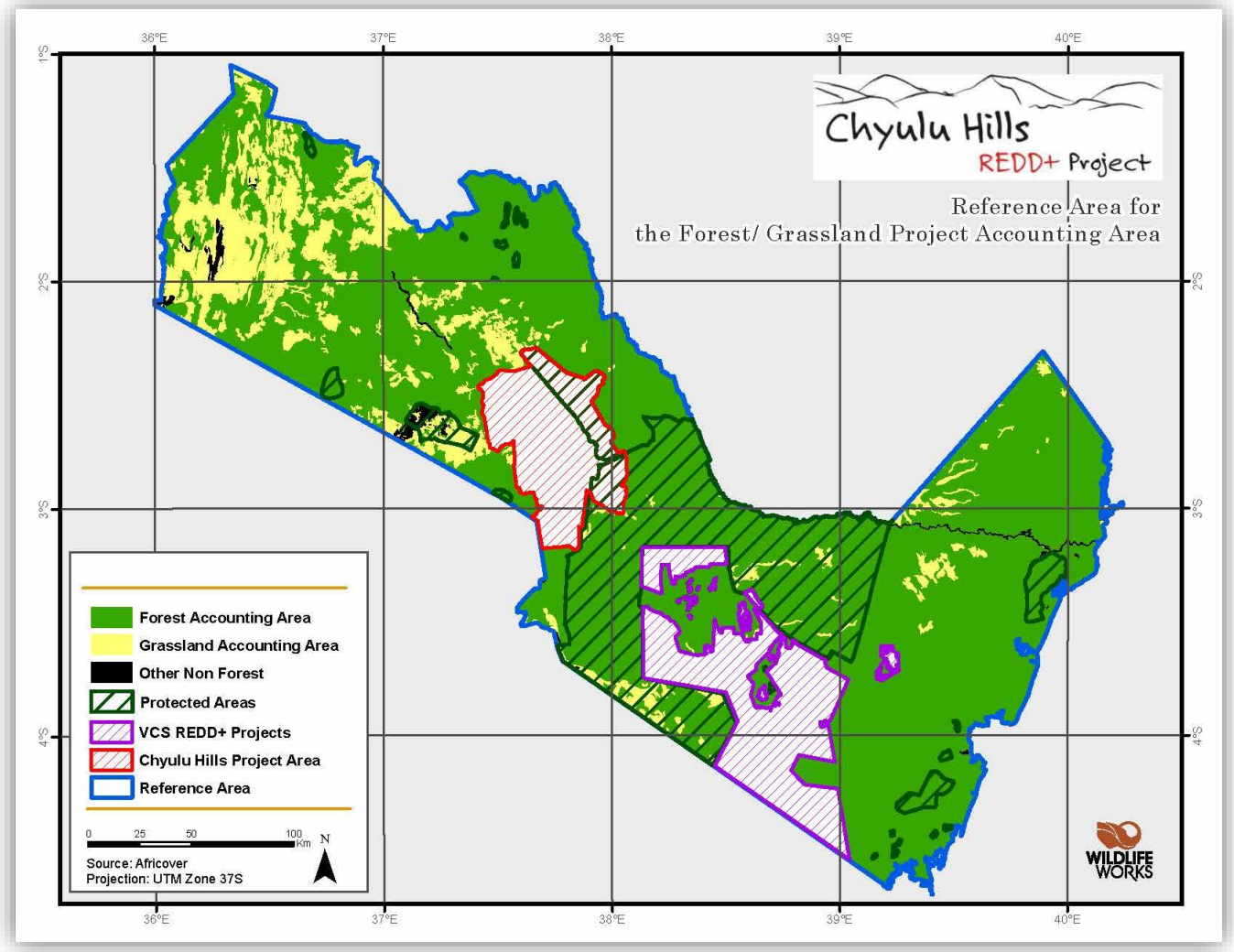
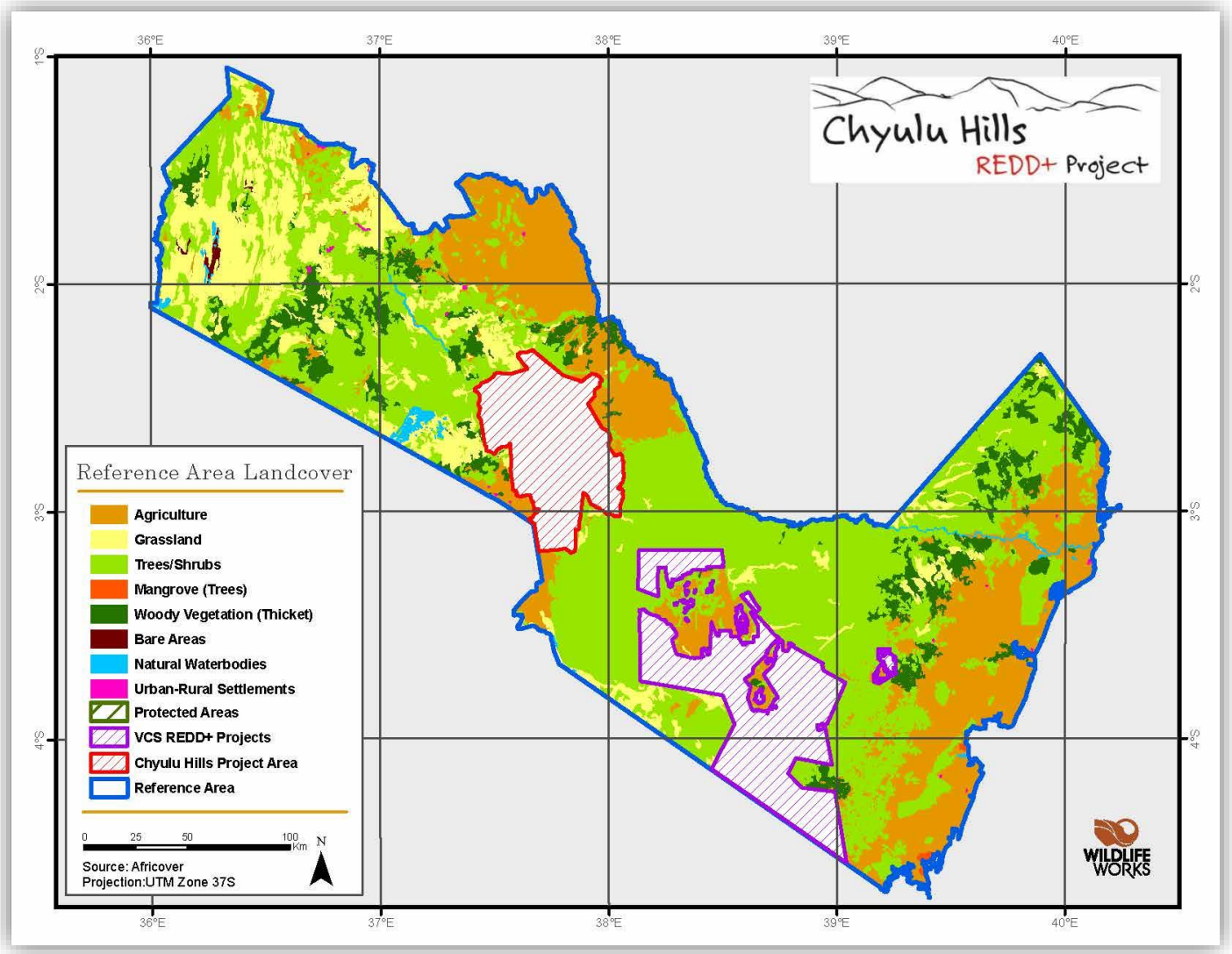


Figure 12: The reference area for the Grassland Project Accounting Area and Forest Project Accounting Area is shown in relation to the Project Area and the 5 county region

PDR.41 Results of a spatial analysis to demonstrate the reference area had as much forest or native grassland as the project area at some point in time during the historic reference period.

Based on the spatial analysis of Africover land cover data (http://www.glcn.org/activities/africover_en.jsp, 2000-2001 imagery), the reference areas contained more forest or native grassland than the Forest PAA or the Grassland PAA. Figure 13 below shows the results of this analysis. The numerical results of this analysis are shown below in table 18, and clearly indicate that the reference area contains as much native vegetated area as each respective PAA. VM0009 requires that this criterion is met “at some point within

the historical reference period". Because the Africover dataset was published in the year 2000, the



calculations are valid for the historical reference period (1984-2013).

Figure 13: Vegetation in the reference area for the year 2000.

Table 18: Results of spatial analysis to demonstrate validity of the reference area(s)

Metric	PAA area (ha)	Reference area native area (ha)	Reference area % of PAA
Forest PAA	265,547	5,107,550	1923%

Grassland PAA	109,131	622,766	571%

PDR.42 Evidence that the management practices of the baseline agents in the reference area are similar to those that would have been applied to the Project Accounting Area or areas in the baseline.

The two reference areas delineated for the project are located in the same landscape as the Project Area, and contain the same cultural mix of tribes and socio-economic factors. The reference areas were chosen as a 5-county region of Southeastern Kenya, excluding any valid VCS Project Areas, per VM0009 Section 6.8.1.2. Firstly, the same tribes are prevalent in the reference area that live in the PAAs. As tribes tend to hold very strict farming characteristics, it is assumed the presence of the same tribes in the PAAs and reference areas indicates similar subsistence farming practices. This region of Kenya is dominated by subsistence agriculture on small land holdings. The local communities in the reference areas have performed their characteristic agricultural management practices for several generations. As agriculture is still generally non-mechanized with minimal external inputs, farming techniques have by and large been constant throughout the historical reference period. Additionally, forested and/or native grassland areas are cleared the same way they have been for generations, with the clearing generally done by hand, and in an unplanned fashion to meet immediate familial nourishment requirements (subsistence farming). This is the same agricultural land clearing management practices that have been identified in the baseline scenario.

PDR.43 A description of the rationale for selection of reference area boundaries.

We elected to use county borders for the administrative boundaries describing the reference areas for the Chyulu Hills REDD+ Project. We have made the assumption that a future Kenyan Jurisdictional and Nested REDD+ (JNR) approach may opt to use similar boundaries, but we have no further insight into this process. Because the Project Area crosses the boundaries of three different countries, and the additional two adjacent countries share highly similar ecological characteristics and agents / drivers of conversion, a five-county area was selected to comprise the reference areas for the project. These five counties are Kajiado, Makueni, Kilifi, Taita Taveta and Kwale. Land cover data from the Africover dataset was used to identify land cover classes within the reference area, delineating them as either forested, native grassland, already converted (e.g. agriculture, settlements, roads, etc.) or other (e.g. surface water, unidentified areas, wetlands, etc.). The lands within this five-county area that were identified as forest were then delineated as the reference area for the Forest PAA, and the areas identified as native grassland as the reference area for the Grassland PAA.

VCS AFOLU rules require that a reference area must contain similar attributes to their respective project areas. As such, VM0009 requires that a minimum list of criteria are met that support this similarity. This list of criteria is satisfied with maps that show similarity, as required for PDR 44 below.

The primary source of similarity between Project and Reference Areas is implicitly assumed by virtue of the Project Area (Zone) being in the middle of the reference area. Although VM0009 does not allow overlap between Project and Reference Areas, the Project Ares is surrounded on all sides by the chosen reference area. It is therefore assumed evident that the reference areas incorporate all of the agents and drivers of deforestation identified in the baseline scenario, and that the Project Area contains similar cultural, socioeconomic and physical/geographic characteristics of the reference area. These characteristics are required to be mapped and/ or described by VM0009 as part of the reference area selection criteria, listed below.

The Reference Area was chosen due to the same tribes living in both the Project and Reference Areas, including the Maasai, Kamba, Taita and others (See section 1.3.3 for further detail). This portends similar socio-economic and cultural characteristics in both Project and Reference Areas. Written descriptions of some of these Reference Area selection criteria are required.

In general, all physical / geographic similarity criteria are met with the selection of the Reference Areas for this project. However, because physical / geographic characteristics cannot be implicitly assumed as readily as socio-economic or cultural similarities, maps are required to empirically prove physical / natural similarities. These maps are listed below and can be found in Appendix D at full size / resolution.

The delineation of the Reference Area for the Chyulu Hills REDD+ Project was made under the assumption that the Government of Kenya will opt to participate in a JNR approach in the coming years Therefore, a Reference Area was selected that the Project Proponent feels approximates a probable selection for a REDD+ jurisdiction, with the intent to ensure as smooth a crediting transition between pure project-based REDD+ and JNR REDD+ as possible.

PDR.44 The documentation required in the Reference Area selection requirements that the selected reference area meets the Reference Area Selection Requirements.

Documentation for the Reference Area selection requirements for the Chyulu Hills REDD+ Project is dispersed throughout various sections of this document. In the interest of brevity, references to these descriptions and maps are included below:

1. The location and size of the Reference Area relative to the PAA:
    a. A pair of maps showing the boundaries and size of the Reference Area and the PAA, including an indication of their locations relative to each other. (See section 4.5.8.1, Table 18 above)
    b. Written justification for the selection of the location of the Reference Area. (See PDRs 42 and 43 above)

2. A description of the drivers of conversion, including the following, relative to the Project Area:
    a. Written description of the socio-economic conditions in the Reference Area and PAA including the following data, where available:
        i. Census data depicting relevant demographics and socioeconomic conditions
        ii. PRA data
        iii. Economic studies
        iv. Maps depicting demographic data and socio-economic conditions (See PDRs 19 and 20, Section 4.5.4 above)

    b. Written description of the cultural conditions, such as historical events, cultural shifts, migration patterns, tribal traits and characteristics, and current cultural patterns including the following data, where available:
        i. Participatory Rural Appraisal data
        ii. Publications relevant to the cultural conditions in the area
        iii. Maps depicting cultural data (See Section 1.3.3 above)

3. The location(s) of the agents of conversion relative to the PAA and surrounding region including the following:
    a. A paired comparison of maps of the Reference Area and PAA, including locations of settlements or other population centers. For subsequent use in determining the mobility of the agents of conversion. (See maps in Appendix D below)

4. The mobility of the agents of conversion relative to the PAA, including the following:
    a. Written description of the mobility of all primary and secondary agents in the PAA and Reference Area. Acceptable data sources should be used to demonstrate mobility, including geographic and/or anthropogenic factors that may influence their movement or access. (See PDR 18, Section 4.5.4 above)

5. Landscape configuration of the Reference Area and the PAA including all of the following factors:
    a. A paired comparison of maps of the Reference Area and PAA, which must include the following criteria:
        i. Topographic constraints to conversion (slope, aspect, elevation);
        ii. Land use and/or land cover;
        iii. Soil map (if available) or other soil information;
        iv. Applicable infrastructure (e.g. water ways, roads, railroad, airports, provision of electricity, and other access points); and
        v. Ownership/ tenure boundaries that influence conversion (e.g. government holdings, private holdings and reserves). (See maps in Appendix D below)

4.5.8.2 Defining the Historic Reference Period

PDR.48 Established reference period boundaries.

The reference period for the Chyulu Hills REDD+ Project is 5 September 1984 to 18 September 2013.

PDR.49 A list of available historic imagery for the reference area.

As stated above for PDR 48, the historical reference period for the Chyulu Hills REDD+ Project is 5 September 1984 to 18 September 2013, a 29 year period. The dates of the historic images used are spread as evenly throughout the historical reference period as available, adhering to the stationarity requirements of VM0009 (see PDR 54, Section 4.5.8.3). Seven (7) dates were used for analysis. Multiple tiles were required to cover the Reference Area as listed below in Table 18. The image years selected for use were: **1984, 1987, 1992, 2001, 2003, 2009 and 2013**.

1984 Imagery

Image Number	Imagery date	Satellite/sensor	Tile / record	Identifier
1	1984-05-09	LANDSAT_5 TM	166/62	LT51660621984130XXX03
2	1984-05-09	LANDSAT_5 TM	166/63	LT51660631984130XXX03
3	1984-11-08	LANDSAT_5 TM	167/63	LT51670631984313XXX02
4	1984-12-17	LANDSAT_5 TM	168/61	LT51680611984352XXX13
5	1984-12-17	LANDSAT_5 TM	168/62	LT51680621984352XXX08
6	1984-11-22	LANDSAT_5 TM	169/61	LT51690611984327XXX02

Image Number	Imagery date	Satellite/sensor	Tile / record	Identifier
1	1987-06-19	LANDSAT_5 TM	166/62	LT51660621987170XXX01
2	1986-06-16	LANDSAT_5 TM	166/63	LT51660631986167XXX01
3	1986-08-26	LANDSAT_5 TM	167/63	LT51670611986238AAA04

4	1987-02-18	LANDSAT_5 TM	167/62	LT51670621987049AAA01	
5	1987-02-02	LANDSAT_5 TM	167/63	LT51670631987033AAA02	1987
6	1987-02-25	LANDSAT_5 TM	168/61	LT51680611987056XXX01	
7	1987-02-25	LANDSAT_5 TM	168/62	LT51680621987056XXX01	
8	1987-07-10	LANDSAT_5 TM	169/61	LT51690611987191XXX01	

Imagery

1992 Imagery

Image Number	Imagery date	Satellite/sensor	Tile / record	Identifier
1	1992-06-24	LANDSAT_4 TM	166/62	LT41660621992176AAA02
2	1992-06-24	LANDSAT_4 TM	166/63	LT41660631992176AAA02
3	1994-09-17	LANDSAT_5 TM	167/63	LT51670631994260JSA00
4	1993-02-17	LANDSAT_4 TM	168/61	LT41680611993048XXX02
5	1993-02-17	LANDSAT_4 TM	168/62	LT41680621993048XXX02
6	1994-12-04	LANDSAT_5 TM	169/61	LT51690611994338XXX02

2000 Imagery

Image Number	Imagery date	Satellite/sensor	Tile / record	Identifier
1	2000-01-22	LANDSAT 7 ETM	166/62	LE71660622000022EDC01
2	2000-01-22	LANDSAT 7 ETM	166/63	LE71660632000022EDC01
3	1999-10-25	LANDSAT 7 ETM	167/61	LE71670611999298SGS00
4	2001-05-07	LANDSAT 7 ETM	167/62	LE71670622001127SGS00
5	1999-10-25	LANDSAT 7 ETM	167/63	LE71670631999298SGS00
6	2000-02-21	LANDSAT 7 ETM	168/61	LE71680612000052EDC00
7	1999-11-01	LANDSAT 7 ETM	168/62	LE71680621999305EDC00
8	2000-08-22	LANDSAT 7 ETM	169/61	LE71690612000235SGS00

2003 Imagery

Image Number	Imagery date	Satellite/sensor	Tile / record	Identifier
1	2002-07-13	LANDSAT 7 ETM	167/61	LE71670612002194SGS00
2	2003-02-06	LANDSAT 7 ETM+	167/62	L72167062_06220030206
3	2003-02-06	LANDSAT 7 ETM+	167/63	L71167063_06320030206
4	2002-06-02	LANDSAT 7 ETM	168/61	LE71680612002153SGS00
5	2003-03-01	LANDSAT 7 ETM	168/62	LE71680622003060SGS00
6	2003-03-08	LANDSAT 7 ETM	169/61	LE71690612003067SGS00

2008 Imagery

Image Number	Imagery date	Satellite/sensor	Tile / record	Identifier
1	2009-12-08	LANDSAT_5 TM	166/62	LT51660622009342MLK00
2	2009-11-06	LANDSAT_5 TM	166/63	LT51660632009310MLK01
3	2008-09-07	LANDSAT_5 TM	167/61	LT51670612008251MLK00
4	2009-11-13	LANDSAT_5 TM	167/62	LT51670622009317MLK00
5	2009-11-13	LANDSAT_5 TM	167/63	LT51670632009317MLK01
6	2008-09-06	LANDSAT 7 ETM	168/61	LE71680612008250ASN01
7	2009-11-04	LANDSAT_5 TM	168/62	LT51680622009308MLK00
8	2008-09-21	LANDSAT_5 TM	169/61	LT51690612008265MLK00

2013 Imagery

Image Number	Imagery date	Satellite/sensor	Tile / record	Identifier
1	2013-06-10	LANDSAT_8	166/62	LC81660622013161LGN00
2	2013-05-25	LANDSAT_8	166/63	LC81660632013145LGN00
3	2013-04-14	LANDSAT_8	167/61	LC81670612013104LGN01
4	2013-04-14	LANDSAT_8	167/62	LC81670622013104LGN01
5	2013-04-14	LANDSAT_8	167/63	LC81670632013104LGN01
6	2013-06-08	LANDSAT_8	168/6	LC81680612013159LGN00
7	2013-06-08	LANDSAT_8	168/62	LC81680622013159LGN00
8	2013-07-01	LANDSAT_8	169/61	LC81690612013182LGN00

PDR.50 A timeline of important events as they relate to the agents and drivers of conversion.

The baseline type for both the Forest PAA and the Grassland PAA is described by unplanned conversion. In Southeastern Kenya, this type of ecosystem conversion has been occurring unabated for more than 30 years. The population in this region has been increasing significantly since the 1980s, exceeding the carrying capacity of the traditionally farmed fertile hilltops, forcing agriculture into lower dry areas and other less productive lands. Severe droughts in the 2000s have additionally caused traditionally pastoralist cultures, such as the Maasai, to adopt more sedentary lives with increased levels of agriculture. These events have resulted in tremendous pressures for new lands for settlement and agriculture.

PDR.51 Narrative rationale for the selection of the reference period.

1984 was selected as the beginning of the reference period because it is one of the earliest dates for which appropriate imagery was available for the Reference Area. The pattern of unplanned deforestation has been occurring from the same agents and drivers of deforestation since the early 1980s, therefore the reference period was defined to capture as accurate a conversion as possible.

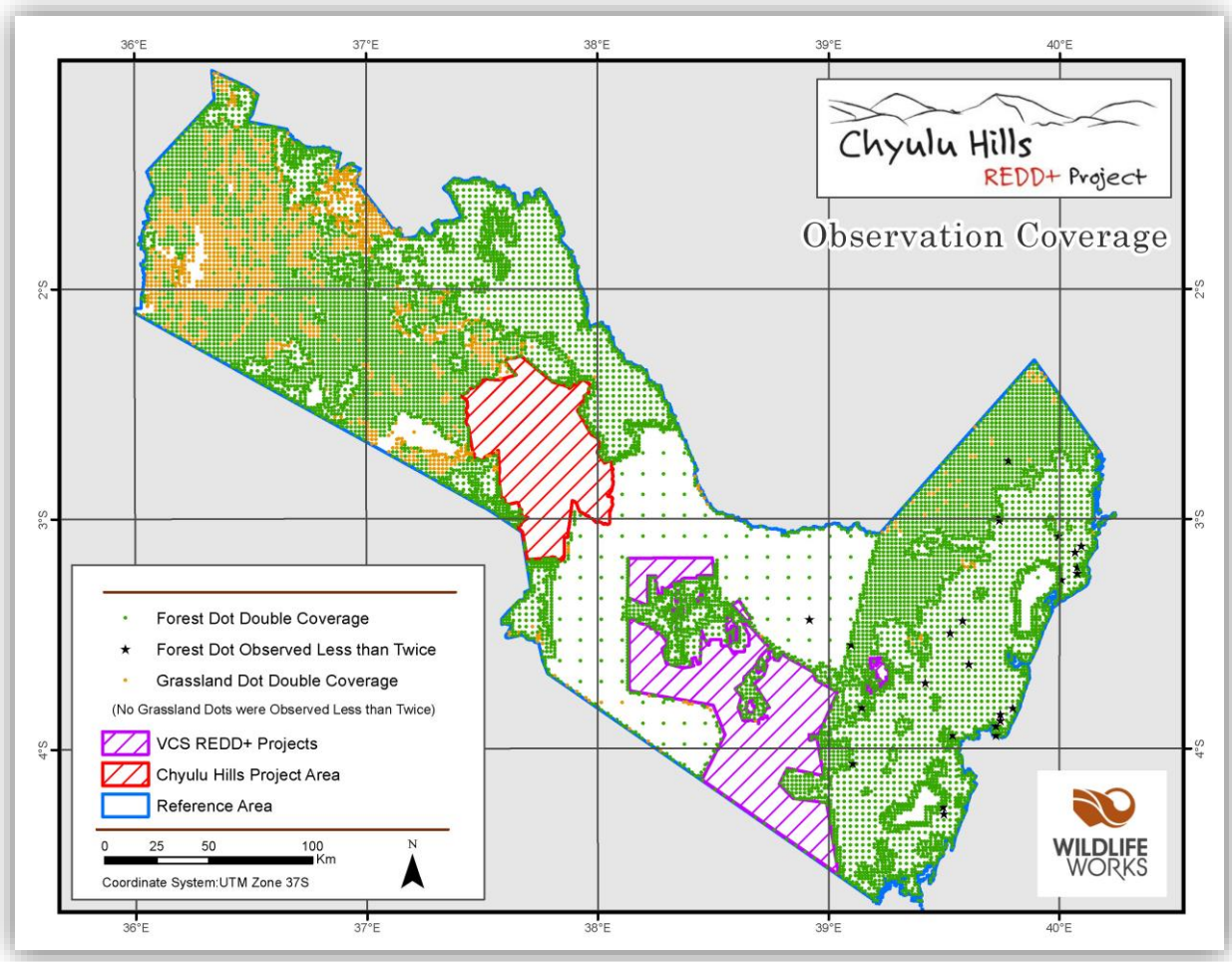
4.5.8.3 Selecting Historical Imagery

PDR.52 A map of the reference area showing the area of "double-coverage".

Please refer to Figure 14 and Appendix E for a map demonstrating double coverage of the Reference Area.

PDR.53 Quantification of "double coverage"(greater than 90%).

Double coverage analysis shows that 99.99% of the Reference Area met the double coverage requirement. 20 dots out of the 13,282 total of dots were observed less than 2 times (see figure 14



below). Please refer to Appendix D for a detailed map showing double coverage.

Figure 14: Double point coverage in the Reference Area for the Biomass Emissions Model (BEM).

PDR.54 A line plot of the historic image dates to confirm stationarity.

Imagery was collected and utilized to maximize temporal stationarity throughout the historical reference period as seen in the time-line plot below:

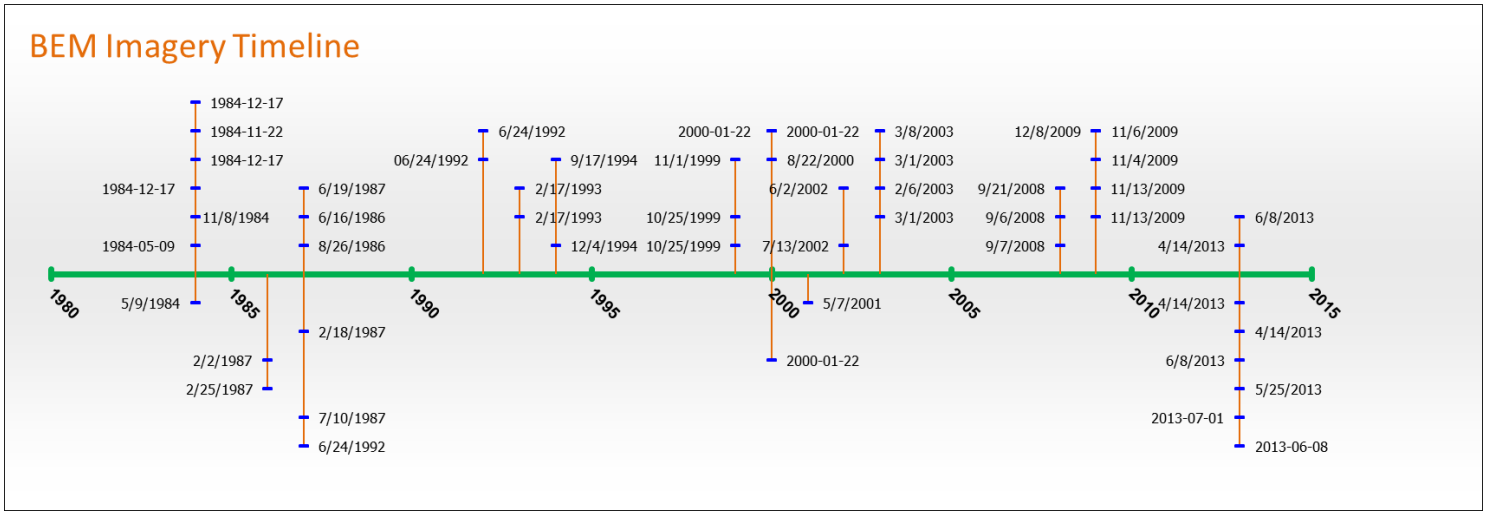


Figure 15: A timeline of the imagery used in the BEM is shown. This graph demonstrates the stationarity of the imagery.

PDR.55 Evidence that all image pixels are not more than 30m x 30m.

All of the imagery used for the analysis of the historic reference period is from the Landsat program, which features a spatial resolution of 30x30m.

PDR56 Empirical evidence that imagery is registered to within 10% RMSE, on average.

All of the imagery used for the analysis of the historic reference period is from the Landsat program. Additionally, each image was selected using (at least) the Level-1G Processing algorithm, which according to the USGS/NASA Website, passed a test in which two separate images were required to contain a maximum image to image error of 0.4-pixel (12m) at a 90% confidence interval (Storey *et al.*, USGS 2006).

No additional image-to-image geo-referencing was deemed necessary, as all images used were of the same type described above, originating from the same system and are therefore guaranteed to be of the accuracy described above as well.

4.5.8.4 Determining Sample Size

PDR.57 The sample size.

According to VM0009, the sample size of points used for the analysis of historical conversion in the reference area is determined based on the number of observations needed to achieve the required statistical precision to fit the logistic function for the Biomass Emissions Model (BEM), and estimate all conversion parameters therein. Typically, a pilot sample of 300 interpretation points is used to estimate the population variance and the sample size needed to estimate conversion parameters within the required 15% BEM error. However, due to the fact that the Reference Area emulates a Jurisdiction (in size and complexity), a stratified sampling approach was used, in which the following criteria was adhered to:

- For protected areas, it is assumed that less deforestation (i.e. temporal change) takes place in general, and we therefore use a sparser sampling grid
- For active agricultural areas, it is assumed that change has occurred, and continues to occur, at a higher rate. This area requires more samples, and therefore a “tighter” sampling grid.
- For all remaining land use strata, an appropriate grid spacing scheme was selected, the spacing falling in between the two (2) extremes described above.
- For each land use, relevant edges were identified for each land use stratum using a buffering technique, and each land use stratum was then separated into its “core” and “edge” components. This serves to account for the assumption that conversion tends to be most active within these edge-buffer areas (Bucki *et al*., 2012).

Table 19 lists the land use strata within the Reference Areas along with the grid spacing selected and the number of resulting samples. The total number of samples used for both forest and grassland BEMs was **11,929**.

Table 19: Land use grid spacing for the BEM(s)

Land use category	Area (ha)	Sample grid spacing (m)	# of samples
Agriculture Core	1,531,944	3,000	1,712
Agricultural buffer	798,648	1,500	3,574
Community land core	16,948	2,000	37
Community land buffer	9,668	1,500	15
Protected areas core	1,175,985	10,000	111
Protected areas buffer	219,273	1,500	912
Group ranch core	810,664	3,000	57
Group ranch buffer	237,225	1,500	559
Urban Core	4,228	2,000	15
Urban Buffer	25,070	1,500	96
Undefined land use	1,915,067	2,000	4,841
TOTAL			**11,929**

4.5.8.5 Sampling Deforestation

PDR.58 A map of the Reference Area showing the sample point locations.

A map depicting sample coverage for the Reference Area is shown above in Section 4.5.8.3. Please refer to Appendix E for a map showing all sample point locations in the Reference Area.

4.5.8.6 Discarded Sample Points

The BEM process began with 11,929 samples per year. 136 samples were removed because they fell within “urban” or “water” strata according to pre-stratification land cover mapping. An additional 25 samples were removed because they were observed only once throughout the historical reference period (i.e. they did not meet the double-coverage requirement). Additionally, points are removed during the modeling process if they are observed as converted the first year they are observed (i.e. those sample points could never represent “conversion” during the historical reference period).

4.5.8.7 Parameterizing α, β and θ

The deforestation parameters α and β were fit for each PAA using the conversion data from the Reference Area. When fit to a logistic function, sample deforestation data yielded the following values for α and β for the Forest PAA and the Grassland PAA. The parameter θ was not used in this analysis as no external covariates were employed. As a nominal part of the BEM modeling process, 20,596 samples were discarded throughout the various time periods because they were classified as “converted”, in the first year that they were observed.

Table 20: Alpha and Beta Parameters (linear predictor variables) from BEM.

Parameter	Forest Project Accounting Area	Grassland Project Accounting Area
$\boldsymbol{\alpha}$	-0.5673113	-1.139118
$\boldsymbol{\beta}$	0.0001032	0.0005784

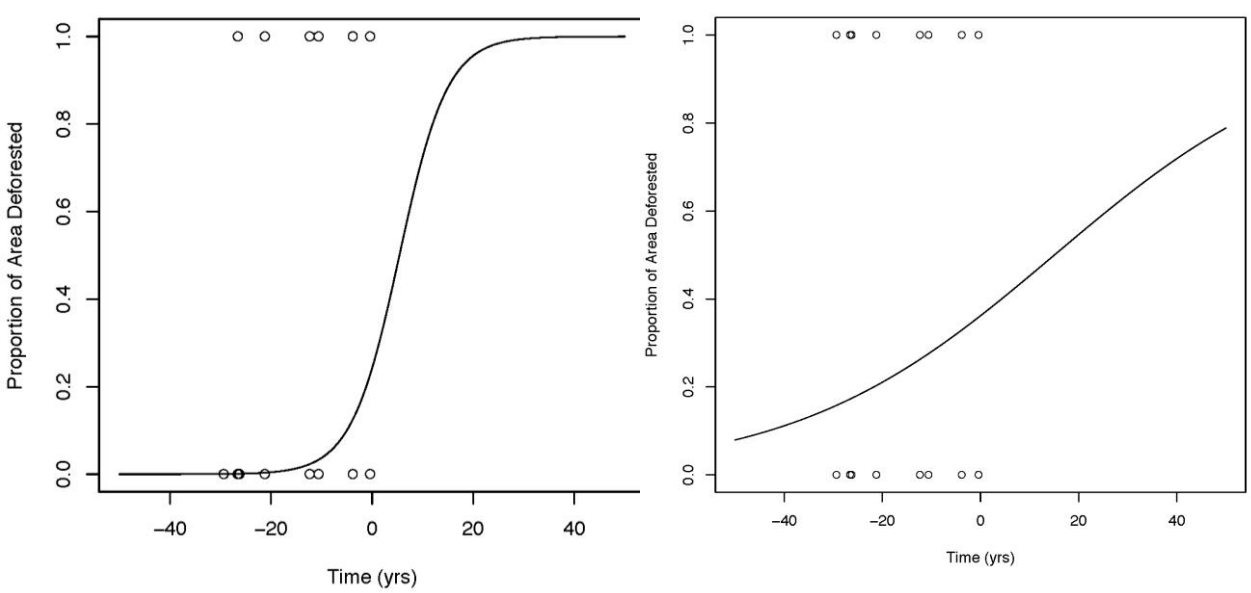


Figure 16: Graphical output of Grassland (left) and Forest (right) BEM models.

4.5.8.8 Minimizing Uncertainty

PDR.63 A protocol for interpreting land cover state from imagery, which must include guidance for interpreting the following:

a. Discerning conversion features using shape, texture and context in the reference area landscape

b. Addressing seasonal variation of vegetation (phenology) within imagery
c. Identifying and addressing the characteristics of specific landscape configurations (i.e. mosaic forest, grassland, etc.)

Imagery from the Landsat 4, 5 and 7 satellites were used to classify forest state in the Reference Area. Classification was performed using false color (5, 4, 3) (with band 5 being mid-range infrared, 4 near infrared, and 3 red). The point-grid classification process was performed using the Wildlife Works Toolbar, which is an add-in tool for ESRI's ArcGIS Desktop developed specifically for the BEM process. For more detailed information about the Wildlife Works Toolbar see the Wildlife Works Toolbar User Manual: http://www.wildlifeworks.com/redd/resources.php.

A pilot sample was used to determine the ultimate sample size (points) needed to meet the desired standard error amounts (VCS Methodology VM0009, Section 6.8.5). The Grid Generator tool was then used to place a random grid of 13,282 points over the first image and then the replicate the points over the subsequent images within the reference period. In the dot-grid modeling process, it is required that a minimum of 90% of the points are visible on at least two images (double-coverage). This is verified using the Double Coverage Analyzer, the results of which can be found in Section 4.5.8.3 as well as Appendix D. The Grid Classification tool is then used to classify each point into one of the following categories: Non-Converted, Converted, Cloud/Shadow, Built-up or No Image. The Identify Problem Points tool was then used to isolate points that have an unlikely conversion state change during the reference period. For example, this may include points that transition from a non-converted to converted state and back to a non-converted state within the reference period, which is assumed to be physically impossible. Each of these points is examined and updated, based on the most likely scenario by a separate technician. The process is repeated until there are zero problem points within in the model. The Export Data tool then summarizes the results from all of the grids on each image and calculates the observation weight for each point. The observation weight is dependent on the number of times each point is observed on the images and the total number of points in each grid (VCS Methodology VM0009, Section 6.8.5). Additionally, this tool removes points from the analysis that were classified as "converted" on the earliest image and points that do not have "double-coverage."

To ensure accurate and consistent classification of points Wildlife Works created a Standard Image Interpretation Protocol. (Refer to Annex 18 – Standard Image Interpretation Protocol.) All image interpreters received training using this protocol and followed its principles to determine ecosystem conversion state. The protocol describes the thematic land cover classes used to interpret the points, common types of land cover patterns, common features that are encountered and how to use recognize thematic classes using context. Often, ecosystem conversion state is easily discerned on the image, either by the color of the feature or patterns in the land cover. In cases where the conversion state could not be readily identified, the context of the surrounding area may be taken into account, or other sources of imagery, such as Google Earth, are used to inform the interpreter of the ecosystem conversion state. When ecosystem conversion state was still unable to be determined, photographs of different land cover types from the project area and reference area that were geo-tagged with the coordinates of the photograph's position were utilized. The geo-tagged photos were used to inform the image interpreters of the actual ecosystem conversion state at each coordinate to assist in the interpretation process.

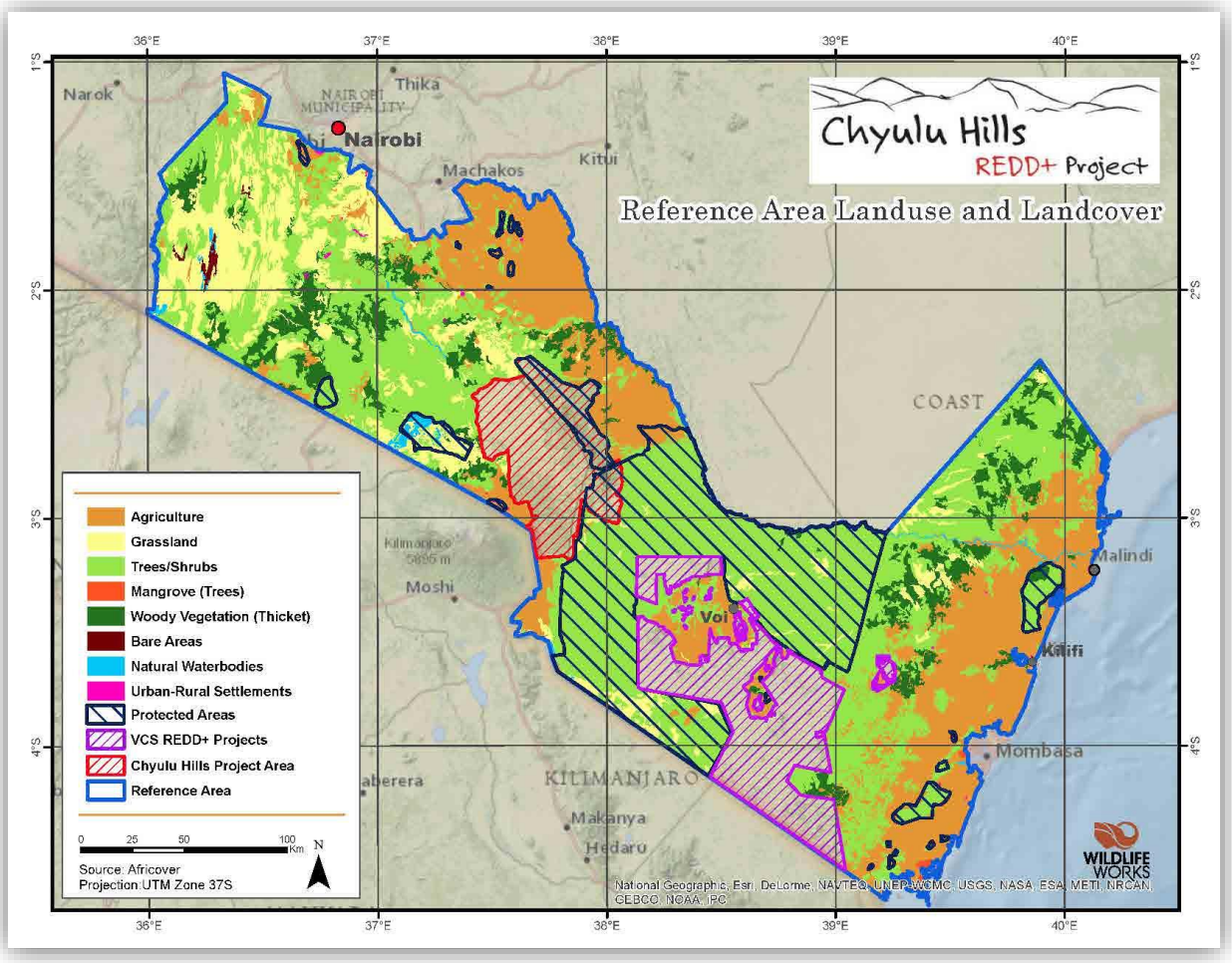
UCSB Analyst Program

To account for the extremely large extent of the chosen Reference Areas, the inherent land use and land cover complexities as well as to support the idea of capacity building as an integral feature of the BEM model concept, Wildlife Works designed, managed and successfully completed a BEM Analyst Program

in partnership with the University of California Santa Barbara's (UCSB) Climate Hazards Group. Seven (7) interns were recruited from the Department of Geography (and/or other geospatial department) and ushered through a detailed training program developed by Wildlife Works' Yuni Nunokawa. This training program involved firstly the location / purchasing of hardware and software for the task at hand (if an analyst required assistance in this area, Wildlife Works provided funds for this effort), and then rigorous and specific training re: the BEM (including background and history on the development of the model), the REDD+ Project's overall goals, and the analysts' specific role within the process. Analysts were required to have strong remote sensing and GIS experience before being accepted into the program, and their skills were verified a priori. Each student was furnished with the Wildlife Works analyst handbook described above and also guided through a hands-on training session that lasted approximately one week to familiarize each individual with the nuances of manually classifying land cover. Students were allowed (encouraged) to ask questions and field concerns about the modeling process, and allowed to practice classifying samples using both high and low resolution imagery until their demonstrated skill and identification accuracy was deemed sufficient by Wildlife Works management. All program activities took place on the UCSB campus.

Sample interpretation

Before starting the data collection process, the Reference Areas were stratified both by land use and land cover, creating a host of "strata-pairs" to be analysed (See Figure 17 below as well as section 4.5.8.1 for



a detailed description of the reference area(s) stratification):

Figure 17: Land use / Land cover strata pair for the reference areas.

12 strata, or "Areas" (A – L) were identified for the study area (Reference Areas) and each was assigned to the analysis on a rotating, yearly basis to ensure strict adherence to anti-bias and random data collection principles. Table 21 below depicts an example of organization of analyst data collection, complete with analyst assignments and a coding system for overall progress. Each analyst was thereby given a chance to experience conversion in each of the delineated areas and also to switch areas often to avoid bias due to over-repetitiveness. Over 93,000 samples were collected over a period of four (4) weeks in December 2103 by these seven (7) analysts.

Table 21: Example of analyst assignment matrix for BEM data collection program at UCSB.

Area	Land use	# samples	1984	1987	1993	2000	2003	2008	2013
A	Not Defined	4784	● Will	● Adam	Δ Raymond	● Spencer	● Raymond	● Omar	O
B	Agriculture Buffer	3575	● Will	● Omar	● Collin	● Spencer	O	Δ Kevin	O
C	Agriculture Core	1712	● Will	● Adam	● Collin	Δ Will	O	O	O
D	Ranch Buffer	1062	● Kevin	● Adam	Δ Adam	Δ Spencer	O	Δ Spencer	O
E	Protected Area Buffer	975	Δ Omar	● Collin	Δ Adam	Δ Omar	O	O	O
F	Ranch Core	895	Δ Omar	● Kevin	Δ Adams	Δ Omar	O	Δ Adam	O
G	Urban Buffer	98	O	● Will	Δ Adam	O	O	O	O
H	Other Non-Forest	60	Δ Omar	● Raymond	Δ Adam	O	O	O	O
I	Comm Land Buffer	44	Δ Omar	● Kevin	Δ Raymond	O	O	O	O
J	Comm Land Core	42	O	● Omar	Δ Raymond	O	O	O	O
K	Protected Area Core	121	O	● Collin	Δ Raymond	O	Δ Collin	O	Δ Collin
L	Urban Core	15	O	O	O	O	O	O	O

"Problem Point" Identification and Rectification

Additionally, the 'Identify Problem Points' tool in the Wildlife Works Toolbar lists points that have been classified as having unlikely land use transitions (e.g. a sample that transitioned from Forest to Non-forest to Forest and then back to Non-forest in historical reference period would be flagged as an unlikely transition). The identified problem points are always analyzed and updated by a different interpreter than that who performed the original interpretation. The identification and rectification of "problem points" serves to ensure an extremely high level of plausibility and accuracy for the BEM modeling process and is an integral part of the BEM QA/QC procedure. Results from this activity are shown below as PDR 64.

PDR.64 The results of an independent check of the interpretation.

The BEM model requires interpretation of samples overlaid on imagery from different years to be performed by different people. The Problem Points Tool identifies any inconsistencies or errors made in the forest state classification, as described above. A total of 1,279 points out of 13,282 were flagged as "problem points" for inconsistencies. A spreadsheet was used to evaluate and track the forest state change of the flagged points over the reference period (included as Annex 15). Each potentially problematic sample point was evaluated by an analyst, taking into account plausible and/or likely land cover transition characteristics for the local ecosystem. Any transitions deemed to be true errors were rectified, usually for quite obvious reasons (i.e. the rectification is typically quite evident, given common land cover conversion characteristics). Where rectification was not evident, or deemed a more difficult choice, another analyst was consulted. If the analyst pool could not make a decision, the problem point was escalated to Wildlife Works management. A decision was eventually made for all problem points, leaving only plausible natural / temporal transitions. All errors were documented, and following rectification the 'Problem Points Tool' was run once again to ensure that all flagged forest state transitions had in fact been corrected.

The following is a snippet of the list of "problem points" discovered for the Chyulu Hills REDD+ Project, depicting the "problem points" that were identified by the Problem Points Tool:

Table 22: An excerpt of Flagged "Problem Points" from the BEM. All points are checked and rectified before moving on to the logistic regression portion of the model. Highlighted states indicate questionable / implausible land use transitions.

PID / Sample Ident.	1984	1987	1992	2000	2003	2008	2013	Notes
1	Non-Forest	Forest	Non-Forest	Forest	Non-Forest	Non-Forest	Non-Forest	From Forest to Non Forest, less textures of fields in 1987 and at the edge in 2000
1	Forest	Non-Forest	Forest	Forest	Forest	Non-Forest	Non-Forest	1987 from Non Forest to Forest, close to clouds
1	Cloud/ Shado w	Non-Forest	Forest	Cloud/S hadow	Non-Forest	Non-Forest	Non-Forest	1992 from Forest to Non Forest, at the edge
2	Non-Forest	Forest	Forest	Non-Forest	Non-Forest	Non-Forest	Non-Forest	Non-forest to forest between 1984 & 1987, less textures of fields
2	Forest	Non-Forest	Non-Forest	Non-Forest	Forest	Cloud/S hadow	Non-Forest	2003 from Forest to Non Forest, less texture of fields
2	Cloud/ Shado w	Non-Forest	Forest	Forest	Forest	Non-Forest	Cloud / Shadow	1987 from Non Forest to Forest, between clouds
2	Non-Forest	Forest	Non-Forest	Cloud/S hadow	Forest	Non-Forest	Non-Forest	1984 and 2003 from Forest to Non Forest, less texture of field

PDR.65 Evidence that systematic errors, if any, from the independent check of the interpretation were corrected.

No systematic errors were identified. All inconsistencies identified in processes outlined above were rectified.

4.5.8.9 Estimating Uncertainty

PDR.66 The estimated uncertainty σ_{EM} from [F.13] and statistical summaries from model fitting software, if available.

Uncertainty from the BEM model is calculated per equation [F.13] in VM009, which is the standard deviation of conversion, derived from an estimate of variance from a Bernoulli random, categorical variable (See VM0009, Section 6.8.5 for more detail). Standard errors for α and β, the 2 constants associated with the BEM's logistic regression, are shown below in table 14, along with the BEM's respective standard deviations, $\hat{\sigma}_{EM}$, which is used in turn to calculate overall uncertainty in the BEM (Refer to Annex 14 – Deforestation Parameter Calculations.).

Table 23: Standard error for α and β BEM parameters.

Parameter	Forest Project Accounting Area	Grassland Project Accounting Area
$\boldsymbol{\alpha}$	3.9296	6.135
$\boldsymbol{\beta}$	0.0006	0.0028
$\hat{\boldsymbol{\sigma}}_{EM}$	0.43	0.22

PDR.67 Reference to uncertainty calculations.

Please refer to Annex 14 – Deforestation Parameter Calculations for all uncertainty calculations.

4.5.9 Determining γ

PDR.78 The project shift parameter γ as the number of days between the beginning of the historical reference period and the project start date.

A value of 10,725 was selected for the γ parameter. The historical reference period begins on 9 May 1984. The project start date is 19 September 2013. Therefore, the length of time from the beginning of the historical reference period to the project start date is **10,725 days**.

4.5.10 Determining q

PDR.79 The parameter q as the number of days between the onset of degradation and the beginning of conversion.

The default value of zero (0) was selected for this parameter, as we have conservatively assumed no lag between degradation and the onset of conversion.

4.5.11 The Decay Emissions Model

4.5.11.1 Determining λ_{soc}

The default value of 0.2 was used for the parameter λ_{SOC}, which characterizes the decay of soil organic carbon over time (Davidson & Ackerman, 1993). The project is located in a tropical climate; therefore the use of the default value from the methodology VM0009 for the λ_{SOC} parameter is allowed.

4.5.12 Baseline Scenario for Selected Carbon Pools

PDR.39 A qualitative description of the baseline scenario for each selected carbon pool.

4.5.12.1 Forest Project Accounting Area

Above-ground other tree (AGOT): The above-ground portion of the tree carbon pool is assumed to be completely removed from the forest ecosystem during the conversion process for the baseline scenario. The trees in this pool are assumed to have immediate loss to CO2e emissions, with no wood used for long-lived wood products. Conversion of this pool is carried out either in-situ via combustion or by removal and direct combustion for fuel wood. Any residual AGOT biomass that remains following conversion by the agents is determined using data collected from biomass sample plot measurement in the proxy area.

Above-ground non-tree (AGNT): The AGNT pool is assumed to be completely removed from the forest ecosystem during the conversion process for the baseline scenario. Plants and shrubs in this pool are assumed to have immediate loss to CO2e emissions, with no portion going to long-lived products. As this pool is comprised of generally low-density and small woody material, it is assumed in the baseline scenario that biomass from this pool is either combusted in-situ or entirely cleared and left to decay. This decay occurs very quickly due to the ecosystem climate and physical characteristics of the material. Any residual biomass from the AGNT pool that remains after conversion by the agents is determined using data collected from biomass sample plot measurement in the proxy area.

Below-ground other tree (BGOT): The below-ground component of the tree carbon pool is assumed to be minimally impacted by the activities of the agents of deforestation. Emission from this pool are determined using a root to shoot ratio of 0.4 (the IPCC default) of below-ground to above-ground biomass. The below-ground carbon pool is assumed to decay at a constant (linear) rate over a period of 10 years.

Soil organic carbon (SOC): SOC is assumed to be depleted to a significantly reduced residual carbon stock level following conversion. The residual (without-project scenario) SOC pool is empirically measured with soil plots nested in agricultural plots that have undergone conversion to an end state identified in the baseline scenario. The rate of SOC loss is determined by a decay function, whose rate is dependent on a decay factor, λ_{SOC}, which in this project takes the default value of 0.2 from VM0009.

4.5.12.1 Grassland Project Accounting Area

Above-ground other tree (AGOT): The above-ground portion of the tree carbon pool is assumed to be completely removed from the forest ecosystem during the conversion process for the baseline scenario. The trees in this pool are assumed to have immediate loss to CO2e emissions, with no wood used for long-lived wood products. Conversion of this pool is carried out either in-situ via combustion or by removal and direct combustion for fuel wood. Any residual AGOT biomass that remains following conversion by the agents is determined using data collected from biomass sample plot measurement in the proxy area.

Above-ground non-tree (AGNT): The AGNT pool is assumed to be completely removed from the forest ecosystem during the conversion process for the baseline scenario. Plants and shrubs in this pool are

assumed to have immediate loss to CO2e emissions, with no portion going to long-lived products. As this pool is comprised of generally low-density and small woody material, it is assumed in the baseline scenario that biomass from this pool is either combusted in-situ or entirely cleared and left to decay. This decay occurs very quickly due to the ecosystem climate and physical characteristics of the material. Any residual biomass from the AGNT pool that remains after conversion by the agents is determined using data collected from biomass sample plot measurement in the proxy area.

Below-ground other tree (BGOT): The below-ground component of the tree carbon pool is assumed to be minimally impacted by the activities of the agents of deforestation. Emission from this pool are determined using a root to shoot ratio of 0.4 (the IPCC default) of below-ground to above-ground biomass. The below-ground carbon pool is assumed to decay at a constant (linear) rate over a period of 10 years.

Soil organic carbon (SOC): SOC is assumed to be depleted to a significantly reduced residual carbon stock level following conversion. The residual (without-project scenario) SOC pool is empirically measured with soil plots nested in agricultural plots that have undergone conversion to an end state identified in the baseline scenario. The rate of SOC loss is determined by a decay function, whose rate is dependent on a decay factor, λ_{SOC}, which in this project takes the default value of 0.2 from VM0009.

4.6 Additionality (G2)

Step 1. Identification of alternative land use scenarios to the proposed VCS AFOLU project activity

Sub-step 1a. Identify credible alternative land use scenarios to the proposed VCS AFOLU project activity.

PDR.99 A list of alternative land use scenarios to the project

a) Identify realistic and credible alternative land-use scenarios to the proposed REDD+ project activity.

i. Continuation of the pre-project land use;

The most likely alternative land-use scenario to the planned REDD+ Project is the continuation and proliferation of the historically observed unplanned deforestation, degradation and conversion of the Project Area. This ‘unplanned’ deforestation and conversion, as defined by the VCS methodology VM0009 v3, occurs across the Project Area both legally, with landowner permission in some land units, and illegally in other land units. This stems from lax enforcement of property tenure and resource planning, coupled with the communities’ economic need for resources and land. There are several different land ownership types existing within the Project Area. However, the general pattern of unplanned conversion, driven by the need for wood for building materials and charcoal production, and new agricultural land, is identical across all of the ownership types. The same mixture of drivers and agents of deforestation and conversion can be observed across both the privately owned group ranches and publicly owned land that comprises the REDD+ Project Area. This scenario occurs despite the publically owned areas in the project featuring official protection under Kenyan law.

End land-use in the greater Chyulu Hills ecosystem is generally observed as slash and burn agriculture. This is precipitated by several factors, the most prominent being immigration into the Project Area and the trend of traditional pastoralist cultures adopting more sedentary, agricultural-based livelihoods as described by Western *et al*., (2009).

Small-scale subsistence agricultural offers a crucial livelihood to communities in the Project Area, where there is limited access to other economic activities and export markets. Additionally, as current agricultural practices are based on unsustainable and inefficient land uses, the soil fertility of converted land is quickly depleted, necessitating the continual conversion of new lands to maintain crop yields. Slash and burn agriculture is an especially important driver of conversion for the grassland areas, where there exist few barriers to the rapid conversion of native grasslands into cultivated land.

For the majority of the prior ten years, the group ranches have experienced severe overgrazing which has led to ecological damage of the lowland dry forest areas. Cattle and shoat grazing results in deforestation through the clearing of forest by the herders to increase grazing lands and the cattle grazing down or trampling tree seedlings and saplings resulting in the suppression of the forests' natural regeneration. The areas managed by the group ranches are generally arid with little permanent water for sustainable cattle ranching. Traditionally, the cattle ranchers were transhumant pastoralists, moving across the landscape and limiting their ecological impact on any single location. However, due to cultural shifts, these communities have started settling (Western *et al*., 2009). This has led to increased ecological damage from overgrazing due cattle sedentarization. Cattle grazing may occur in parts of the Project Area with the sanction of the landowner, though in many cases the herders do not have permission, or graze significantly more cattle than permitted by the landowner. Additionally, through efforts to diversify income, many pastoralists have turned to small-scale agriculture, either by leasing land to a third-party or farming themselves, resulting in the conversion of areas that were formerly grazing areas, into farms.

Illegal charcoal production in Kenya is a significant driver of deforestation nationally and the Chyulu Hills REDD+ Project Area is no exception, particularly on the eastern boundaries of the Project Area. Charcoal is generally produced by local community members to supply urban demand, generally from Mombasa and Nairobi. The charcoal is produced either by targeted cutting of specific species across a larger area or clear-felling areas and burning the trees in earthen kilns built at the site of deforestation. This activity leads to significant forest degradation, and eventually can lead to deforestation.

Woodcarving is another significant driver of forest degradation and deforestation in the Project Area. Woodcarving is an important economic activity that is widely practiced by the communities and stakeholders of the Chyulu Hills REDD+ Project, especially on the eastern side of the Chyulu hills. Gathering or harvesting of wood for the production of carvings in Chyulu Hills and Tsavo West National Park is illegal and rangers periodically make arrests of wood carvers found in the protected areas. However, woodcarvers continue to trespass into the protected areas of Project Area. Historically, desirable carving species such as *Dalbergia melanoxylon* and *Olea africana* occurred widely across the area. However, due to over-extraction, woodcarvers now venture deep into the national parks and the forest reserve as these are the only remaining sources of the desired wood species remaining in the area. Often the carvers reside in Chyulu Hills and the Southern Chyulus Extension in Tsavo West National Park for weeks on end, where they perform the wood carving activity in-situ. The products are sold along the Nairobi-Mombasa highway to traders and to passing tourists. Though the activity is widespread

and well-known throughout the Chyulu Hills National Park and Southern Chyulus Extension, park rangers have had little overall impact on the curbing this activity.

In the absence of a REDD+ Project, the deforestation, degradation and conversion patterns described above, coupled with inadequate financial resources across the landscape, will continue unabated. It is clear that on both the privately owned group ranches and the state lands, that in the absence of funding from the sale of emission reductions, the Project Proponent will be unable fund project activities at a level significant enough to protect the Project Area from ecosystem conversion.

ii. Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project;

Conservation is a common practice in Kenya, with many run by non-governmental organizations. However many of these are smaller scale in nature than the Chyulu Hills REDD+ Project, and funded by governments or donor funds, not the financial return from Project Activities. There have been limited conservation activities over large portions of the privately owned group ranches in the Project Area prior to the initiation of the Chyulu Hills REDD+ Project. Three of the project partners, Maasai Wilderness Conservation Trust, Big Life and the David Sheldrick Wildlife Trust are conservation focused NGOs that have operated in portions of the Project Area prior to the onset of the Project. Existing activities include land patrolling by staff, collection of biological data and community education. There are also eco-tourism activities on sections of both Kuku A and Mbirikani group ranches. Visitors pay a conservation fee that is in turn used to fund some protection and conservation activities over very limited areas of the current Project Area resulting in only a proportion of the landscape being protected by the Chyulu Hills REDD+ Project. The lack of a consistent source of significant funding has limited the scope of these project activities and their effectiveness at reducing the widespread degradation and ecosystem conversion that has been occurring across the area. Furthermore, donor funding has been unsustainable and inconsistent over the long term, which has limited the ability of the Project Proponent to expand the project activities to the scale needed to stop the ecosystem degradation and conversion from occurring. The funds from the sale of emissions reductions provided garnered by the REDD+ Project will be instrumental in the development of an independent, and long-term sustainable revenue stream to support these project activities and expand their reach across the Project Area to additional communities.

iii. Activities similar to the proposed project activity on at least part of the land within the project boundary of the proposed VCS AFOLU project at a rate from legal requirements;

The state owned land in the Project Area includes land gazetted as National Parks (Chyulu Hills National Park and the Southern Chyulus Extension) through the Wildlife Act Cap. 376 and under the jurisdiction of Kenya Wildlife Service, and land gazetted as a Forest Reserve (Kibwezi Forest Reserve), through the Forest Act (2005), which falls under Kenya Forest Service (KFS) jurisdiction. On these land parcels there is a legal requirement to perform activities similar to the proposed project activities, such as conserve the forest and enforce the boundaries of the areas against deforestation and conversion activities. While this land is managed for conservation purposes and is protected under several articles of national legislation, it has undergone significant

degradation, deforestation and conversion over the last 10 years. This is largely due to a lack of funding at the aforementioned agencies, limiting their ability to enforce the national park and forest boundary rules / laws and patrol the areas to stop the activities that lead to conversation and deforestation. The primary source of revenue for the protection of national parks in Kenya is revenue generated through gate fees. This revenue is then remitted at the national level for re-allocation across a wide range of activities. Lesser-visited parks such as the Chyulu Hills National Park face significant shortfalls in funding, compared to the well-known parks such as Tsavo East, Tsavo West and Amboseli, due to their lower profile. Therefore, while some Kenyan National Parks do not face significant deforestation and conversion threat, the Chyulu Hills and Southern Chyulus Extension area of Tsavo West National Park have continued to suffer from insufficient levels of protection and therefore drastically higher levels of forest degradation, deforestation and conversion than these other parks. Deforestation activities inside of the national parks and forested areas in the Project Area include widespread "slash and burn" or swidden agriculture across these areas. Additionally, trees are harvested for woodcarvings, charcoal production and firewood.

Sub-step 1b. Consistency of credible land use scenarios with enforced mandatory applicable laws and regulations

The majority of the alternative land use scenarios listed in sub-step 1a represent illegal land uses, with the major exception of swidden agriculture. The obvious exception to this are the project land units that are nationally gazetted protected area such as the National Parks and the Forest Reserve, where all of the alternative land uses listed are illegal. However, local expert knowledge documents that all of these alternative scenarios have been commonly occurring in the project protected areas, despite being illegal. Much of the conversion to agriculture on the privately owned group ranches is done with the consent of the owners of the land. This conversion is primarily occurring by members of the communities that own the group ranches and who are shifting from traditional pastoralist livelihoods to more sedentary, agriculturally based existences. Despite the legal status of these activities, evidence of forest degradation, deforestation and conversion is present around the Project Zone as well as within the Project Area itself. It currently occurs in all project land units, irrespective of land ownership or management.

Forest degradation, grassland conversion and deforestation are major threats to all land units in the Project Area despite the presence of official legal protection. In addition to slash and burn agriculture, tree harvesting for charcoal production, firewood and woodcarving from the state owned protected areas is also clearly illegal under Kenyan Law. There is significant evidence that the boundaries of many Kenyan protected areas are not enforced, and that there is a substantial amount of uncontrolled access into protected areas that leads to their conversion. This gap in enforcement is largely caused by a lack of funding, limiting Kenyan Wildlife Service and Kenya Forest Service from the ability to patrol Chyulu Hills National Park, the Southern Chyulus Extension and Kibwezi Forest Reserve with enough frequency and efficacy to deter conversion activities, as detailed in the above section Sub-Step 1a. An analysis of the land cover / land use in the 5 counties (Kajiado, Kilifi, Kwale, Makueni, and Taita Taveta) in which the Project Area is located showed that greater than 30% of the land area has been converted to agriculture. This shows that conversion to Agriculture is a common and prevalent scenario in this area, and that laws and regulations on land use are systematically not enforced. The evidence of this analysis

was provided to the validator. Additional clear evidence in support of the land cover conversion assertions above is the Ngai Ndethya National Reserve, a Kenyan protected area adjacent to the Project Area. Despite this area being officially gazetted as a protected area, an analysis of recent satellite imagery (present day) demonstrates that a substantial amount of its area has undergone complete deforestation and conversion to agriculture (Figure 18). The Ngai Ndethya National Reserve exhibits extremely similar conditions to the protected areas within the Chyulu Hills REDD+ Project, including presence of, and ease of access by, the same agents of deforestation and conversion as well as the same drivers of deforestation and degradation.

Sub-step 1c. Selection of the baseline scenario:

PDR.100 Justification for the selected baseline scenario. This justification can include expert knowledge, results from the participatory rural appraisal and ex-ante estimates of avoided emissions

VM0009, 'Methodology for Avoided Ecosystem Conversion' v3 provides a step-wise approach for selecting the most plausible baseline scenario. For the Chyulu Hills REDD+ Project, the most plausible scenario was determined to be the continuation of pre-project land-use activity: namely, conversion to agriculture, as described in Step 1a above. There is evidence of significant encroachment into the Project Area already, including within the land units that are officially protected. Those areas that have already been converted to agriculture were excised from the Project Area according to VCS and VM0009 regulations. The surrounding areas, including other protected areas, have all seen significant levels of ecosystem conversion from forest or native grassland to agriculture, demonstrating that slash and burn agriculture is the primary driver of ecosystem conversion in this region, and it is also the most obvious scenario that would occur in the absence of a REDD+ project.

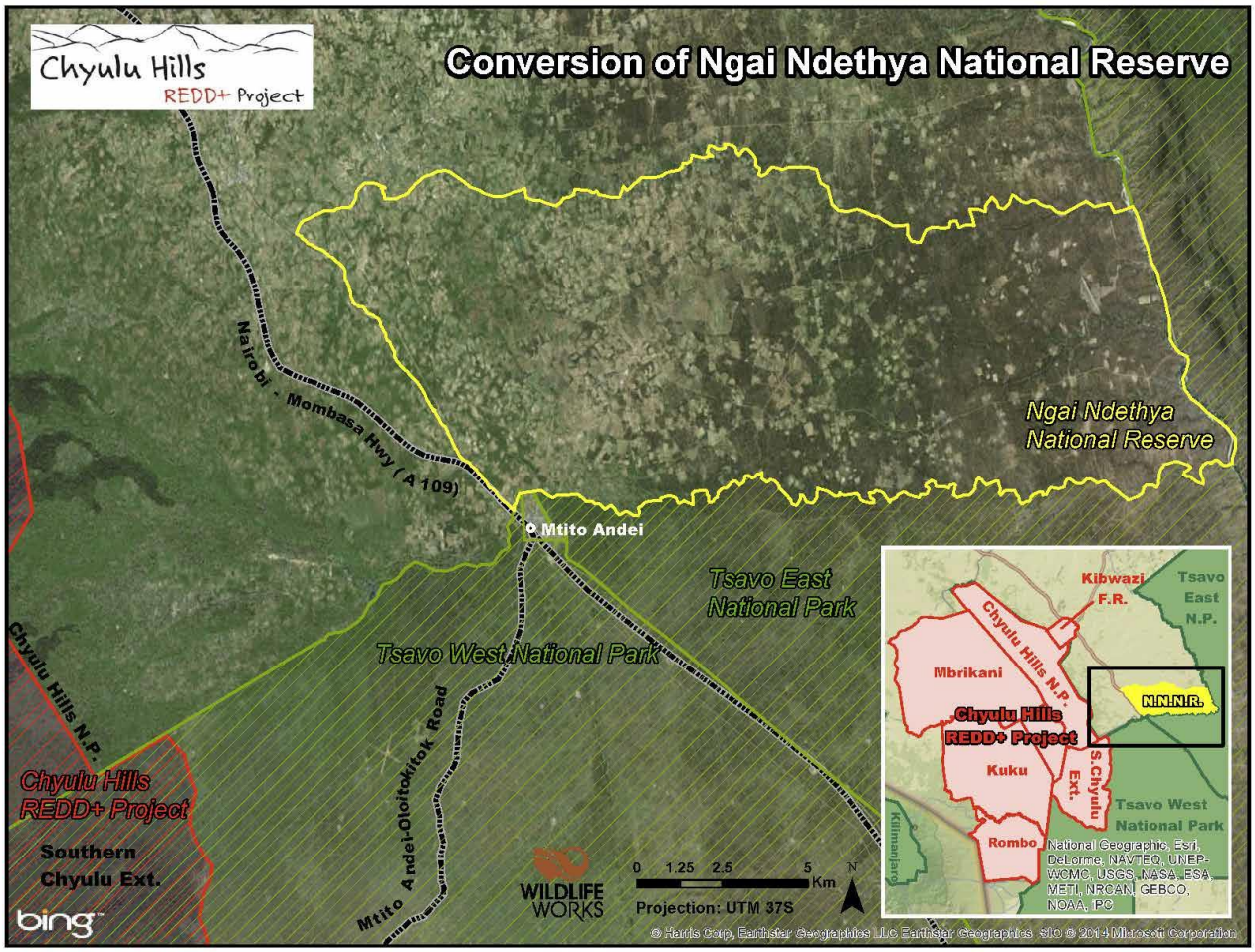


Figure 18: The Ngai Ndethya National Reserve is shown in relation to the Project Area. The Ngai Ndethya National Reserve has been mostly converted to agriculture despite being gazetted as a protected area.

Step 2. Investment analysis

PDR.101 An investment or barriers analysis proving that the project is not the most economical option.

Sub-step 2a. Determine appropriate analysis method

The VCS AFOLU project generates no financial or economic benefits other than VCS-related income derived from the sale of carbon credits. Therefore, simple cost analysis applies.

Sub-step 2b. Apply simple cost analysis

The proposed project activities are non-revenue generating (other than VCS-related carbon income) and the physical protection of the Project Area, and provision of deforestation mitigation activities are projected to cost the Project Proponent over $1,500,000 USD per annum. There

exists no significant income from other Project Activities or other sources from the land to offset these costs. In the absence of active protection, both physical, and that created by partnering with the communities to create new economic alternatives, it is clear the land in the Project Area would be cleared aggressively for subsistence agricultural purposes, as has already been observed in the Project Area currently. Slash and burn agriculture faces no economic barriers, and is therefore clearly identified as the most likely land use in the baseline (without-project) scenario.

Step 4. Common Practice Analysis

PDR.102 A common practice analysis including a list of project activities and the drivers of conversion that they address.

While several of the Project Activities in the Chyulu Hills REDD+ Project have already been attempted or in some cases implemented by some of the project partners on portions of the Project Area, they were all funded with charitable donations and/or grants. They have therefore been extremely limited in scope across the Project landscape. Most of these activities occurred independently, on isolated portions of the Project Area, thereby limiting their effectiveness in reducing overall threat from drivers of conversion that operate across the borders of the land units that comprise the Project Area. The Chyulu Hills REDD+ Project aims to utilize the revenue from emission reduction sales to significantly increase the number and size of project activities and the geographic area on which they are implemented. The project will additionally unite the individual land units into a single operating entity that will be better suited to coordinate efforts, engage communities and address the agents and drivers of deforestation and conversion across this incredibly important landscape. It is common practice to protect wilderness in Africa, and to provide sustainable development support for rural Kenyan communities, but that common practice is typically funded by governments or donor agencies, and not by financial return from Project activities. It is NOT common practice for a coalition of public entities, non-profits, NGOs and private companies, such as the project proponent, to unite in a large-scale effort to protect forested and native grassland wilderness in Africa for financial return, in the absence of carbon revenue. The Chyulu Hills REDD+ project will provide new, ecologically sustainable, economic alternatives for local communities, dramatically reducing their unsustainable reliance on the natural resources within the Project Area.

PDR.103 Evident compliance with the minimum requirements of the aforementioned VCS tool. This evidence may be the same as the evidence provided to meet reporting requirements listed in section 4.

The Project Proponent has demonstrated that the project complies with the applicability conditions of the methodology (see Section 4.2). Further, the Project Proponent has demonstrated that the REDD+ Project complies with all applicable local and National laws (see Section 3). Finally, the method for determining the baseline scenario (described in section 4.5) is consistent with that prescribed in VM0009 methodology version 3.0. Thus, the Project Proponent has fully complied with the minimum requirements of the VCS Additionality tool.

5 QUANTIFICATON OF GHG EMISSION REDUCTIONS AND REMOVALS (CLIMATE)

5.1 Project Scale and Estimated GHG Emission Reductions or Removals

Table 24: Project type

Project	
Large project	**X**

Table 25: Project estimated annual NERs

Year	Estimated GHG emission reductions or removals (tCO2e)
2014	1,128,485
2015	831,172
2016	916,396
2017	995,038
2018	1,153,454
2019	1,132,144
2020	1,191,836
2021	1,226,872
2022	1,258,641
2023	1,464,819
2024	1,287,787
2025	1,281,604
2026	1,271,327
2027	1,251,427
2028	1,495,892
2029	1,176,751
2030	1,140,664
2031	1,109,874
2032	1,067,120
2033	1,355,646
2034	990,403
2035	960,814
2036	937,763
2037	890,728
2038	1,217,146
2039	840,433
2040	810,277
2041	778,692
2042	753,599
2043	1,111,482
Total estimated ERs	**33,028,286**
Total number of crediting years	**30**
Average annual ERs	**1,100,943**

5.2 Leakage Management (CL2)

5.2.1 Leakage Mitigation Strategies

PDR.104 A list of project activities designed to mitigate leakage.

Risk of Project leakage will be minimized by a number of Project activities designed to provide improved agricultural methods and yields, diversification of and implementation of new income generating activities. These activities will reduce the potential risk of conversion shifting to areas outside of the Project Area. For a comprehensive and detailed list of all Project Activities please refer to Section 2.2. A brief overview of the significant Project Activities is provided below:

Table 26: Brief Overview of leakage mitigation strategies in the Chyulu Hills REDD+ Project.

Leakage Management Activity	Description
Improved and Intensified Agriculture	Training will be provided to the communities on the methods and best practices involved in conservation agriculture. This program will aim to increase yields on existing farms and decrease the rate of land conversion. It will also build and support produce storage facilities and value-added technologies to take advantage of market price fluctuations and aid in achieving high sale prices.
Employment of a Ranger Force	This Project will hire and equip a ranger force that provides direct protection of the land from conversion. This force acts as a deterrent to the conversion of the project area but also a powerful outreach tool to the local communities, providing assistance with wildlife issues and information.
Tree Nurseries	The Project will establish multiple tree nurseries in key locations. The nurseries buy seedlings from community members who participate in an out-growing scheme. The seedlings are nurtured in greenhouses, before being planted in degraded areas and on area farms.
Education	The Project will provide several programs to improve the access to and quality of education for youth in the communities. This includes providing school bursaries and scholarships and the construction of actual school buildings.
Alternative-Income Generation	The Project has several programs to help develop new income generating activities for members of the communities in the Project Area. This includes a variety of individual activities such as promoting and supporting beekeeping, crafts and jewellery, and
Micro-finance schemes	The Project will use best-practice in micro-finance to enhance community member's access to capital and markets. This will include micro-loans, micro insurance and other small and medium development practices (SME).
Eco-Charcoal Training	Wildlife Works will utilize its extensive experience in the establishment and operation of an eco-charcoal program to train local community members. These community members will then be supported in the establishment of their own eco-charcoal programs.

5.3 Baseline Emissions (G2)

The Baseline Emission Model (BEM) and the Soil Emissions Model (SEM) were used to calculate the emissions that would occur under the baseline scenario in the absence of a REDD+ Project. The BEM predicts the cumulative emissions from biomass as a result of ecosystem conversion and forest degradation. A separate BEM for the Forest Project Accounting Area and Grassland Project Accounting

Area was evaluated. The BEM is parameterized using observations of historic imagery from the reference area. The SEM is based on a logistic model of ecosystem conversion and assumes that soil organic carbon (SOC) begins to decay in the Project accounting area at the point which the patch is cleared to a converted state. This approach dramatically simplifies baseline accounting. Complete documentation is provided in sections 6.5-6.19 and 8.1 of the methodology VM0009, v3.0. Baseline emissions accounting for the Project is provided for monitoring event documentation, in the monitoring plan and monitoring report(s) associated with Project verification.

5.3.1 Calculating Baseline Emissions from Biomass

Cumulative baseline emissions from biomass $E_{B\ BM}^{[m]}$ are estimated for both the Forest PAA and Grassland PAA using equation [F.22] of the VCS methodology VM0009 v3:

$$E_{B\ BM}^{[m]} = BEM_{U1}\left(c_{P\ BM}^{[m=0]}, c_{B\ BM}^{[m]}, t^{[m]}, x^{[m]}\right)$$

This estimate employs a Biomass Emissions Model (BEM) for baseline type F-U1 and G-U1 using equation [F.5] of the VCS Methodology VM0009 v3:

$$BEM_{U1}(c_P, c_B, t, x) = \frac{A_{PAA}(c_P - c_B)}{1 + e^{-\beta(t+0.5q-t_{PAI})-\boldsymbol{\theta}(\boldsymbol{x}-\boldsymbol{x_{PAI}})^T-\alpha}}$$

5.3.2 Calculating Baseline Emissions from SOC for Baseline Types F-U1 and G-U1

Cumulative baseline emissions from SOC $E_{B\ SOC}^{[m]}$ for baseline types F-U1 and G-U1 are estimated using equation [F.28] of the VCS Methodology VM0009 v3:

$$E_{B\ SOC}^{[m]} = SEM_{U1}\left(c_{P\ SOC}^{[m=0]} c_{B\ SOC}^{[m]}, t^{[m]}, x^{[m]}\right)$$

The estimate employs the Soil Emissions Model (SEM) for baseline type F-U1 and G-U1 using equation [F.8] of the VCS Methodology VM0009 v3:

$$SEM_{U1}(c_P, c_B, t, x) = \frac{A_{PAA}(c_P - c_B)}{1 + e^{-\beta(t-t_{PAI})-\boldsymbol{\theta}(\boldsymbol{x}-\boldsymbol{x_{PAI}})^T-\alpha}}\left[1 + \frac{1}{1 + e^{-\alpha-\boldsymbol{\theta}(\boldsymbol{x_0}-\boldsymbol{x_{PAI}})^T-\beta t_{PAI}}}\right] - \frac{A_{PAA}(c_P - c_B)}{1 + e^{-\alpha-\boldsymbol{\theta}(\boldsymbol{x_0}-\boldsymbol{x_{PAI}})^T-\beta t_{PAI}}}$$

5.3.3 Calculating Carbon Not Decayed in DW

The Chyulu Hills REDD+ Project does not include planned forest harvesting in the baseline scenario. Therefore, the deadwood carbon pool has been conservatively excluded from Project carbon accounting.

5.3.4 Calculating Carbon Not Decayed in BGB

Carbon that has not yet decayed in the below ground biomass (BGB) carbon pool is estimated using equation [F.10] of the VCS Methodology VM0009 v3:

$$DEM_{DW,BGB}\left(E_{B\ \Delta}^{[m]}, t, t^{[m-1]}\right) = \frac{E_{B\ \Delta}^{[m]}}{1 + e^{t-t^{[m-1]}-3650}}\left[1 - \frac{t - t^{[m-1]}}{3650}\right]$$

The Decay Emissions Model (DEM) for carbon in the BGB and deadwood carbon pools is based on the default VCS decay models for those pools.

5.3.5 Calculating Carbon Not Decayed in SOC

Carbon that has not yet decayed in the SOC carbon pool is estimated using equation [F.33] of the VCS Methodology VM0009 v3:

$$C_{B\,SOC}^{[m]} = \sum_{i \in \mathcal{M}} DEM_{SOC}\left(E_{B\,\Delta\,SOC}^{[i]}, t^{[m]}, t^{[i-1]}\right)$$

This estimate employs the Decay Emissions Model (DEM) for carbon in the SOC for baseline type F-U1 and G-U1 using equation [F.9] of the VCS Methodology VM0009 v3:

$$DEM_{SOC}\left(E_{B\,\Delta}^{[m]}, t, t^{[m-1]}\right) = E_{B\,\Delta}^{[m]} - \frac{365 E_{B\,\Delta}^{[m]}}{\lambda_{SOC}(t - t^{[m-1]})}\left[\frac{\lambda_{SOC}\left(t - t^{[m-1]}\right)}{365} + e^{-\frac{-\lambda_{SOC}(t - t^{[m-1]})}{365}} - 1\right]$$

5.4 Project Emissions (CL1)

5.4.1 Calculating Emissions from Changes in Project Stocks

Biomass plots must be re-measured at a minimum every five years. 20% of the biomass plots will be re-measured annually, achieving 100% sample plot coverage every five years. Biomass plot locations are depicted below in Figure 19, and soil sample plots in Figure 20. Changes in project carbon stocks are calculated as the difference in project stocks in each stratum for each PAA between the current and prior monitoring periods, as determined from in-situ measurement of biomass plots:

$$A_{PAA}\left(c_P^{[m-1]} - c_P^{[m]}\right)$$

Carbon stocks that are lost to burning, wood products, and leakage are accounted for using the procedures and equations listed below.

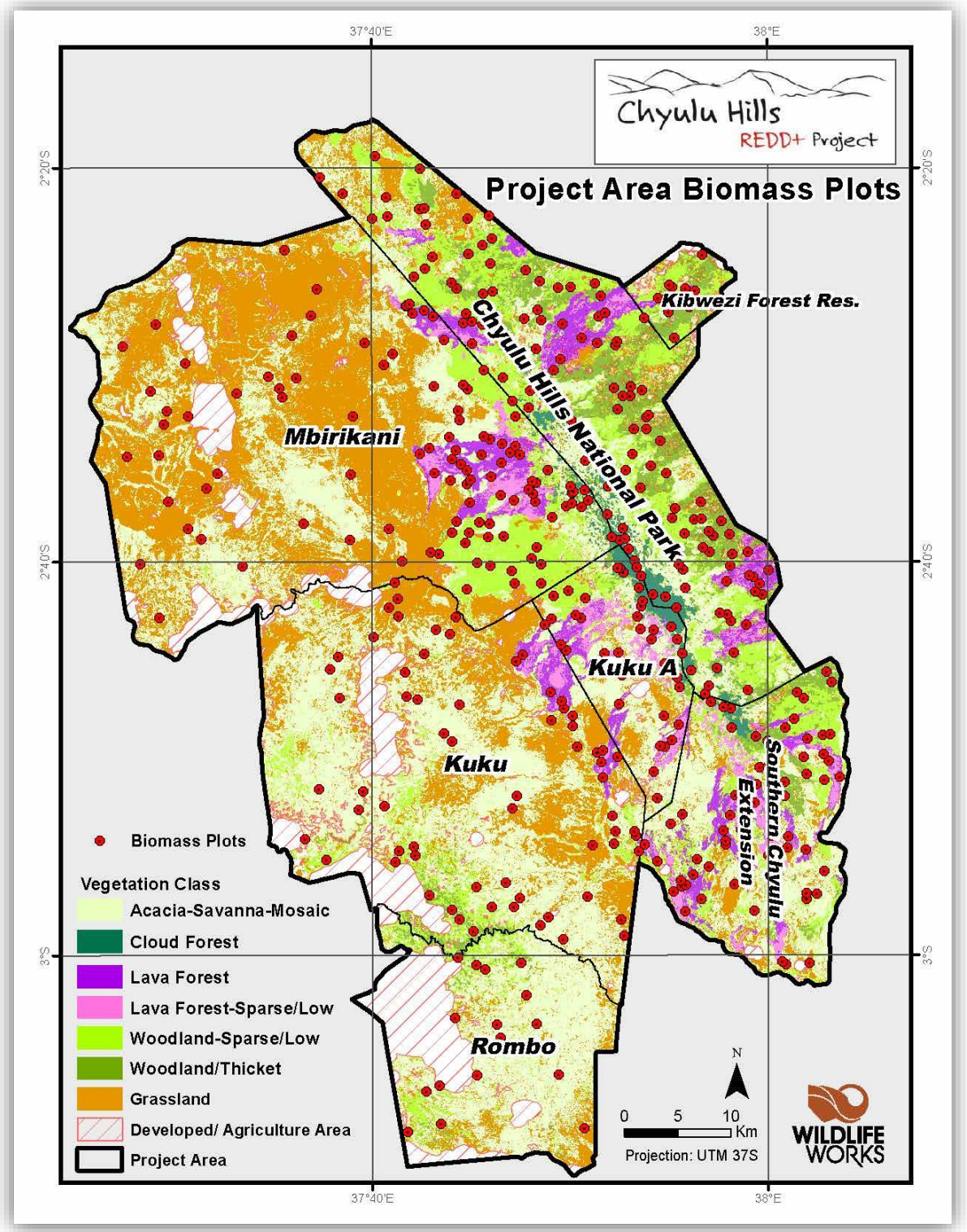


Figure 19: Biomass sample plot locations in the Chyulu Hills REDD+ Project

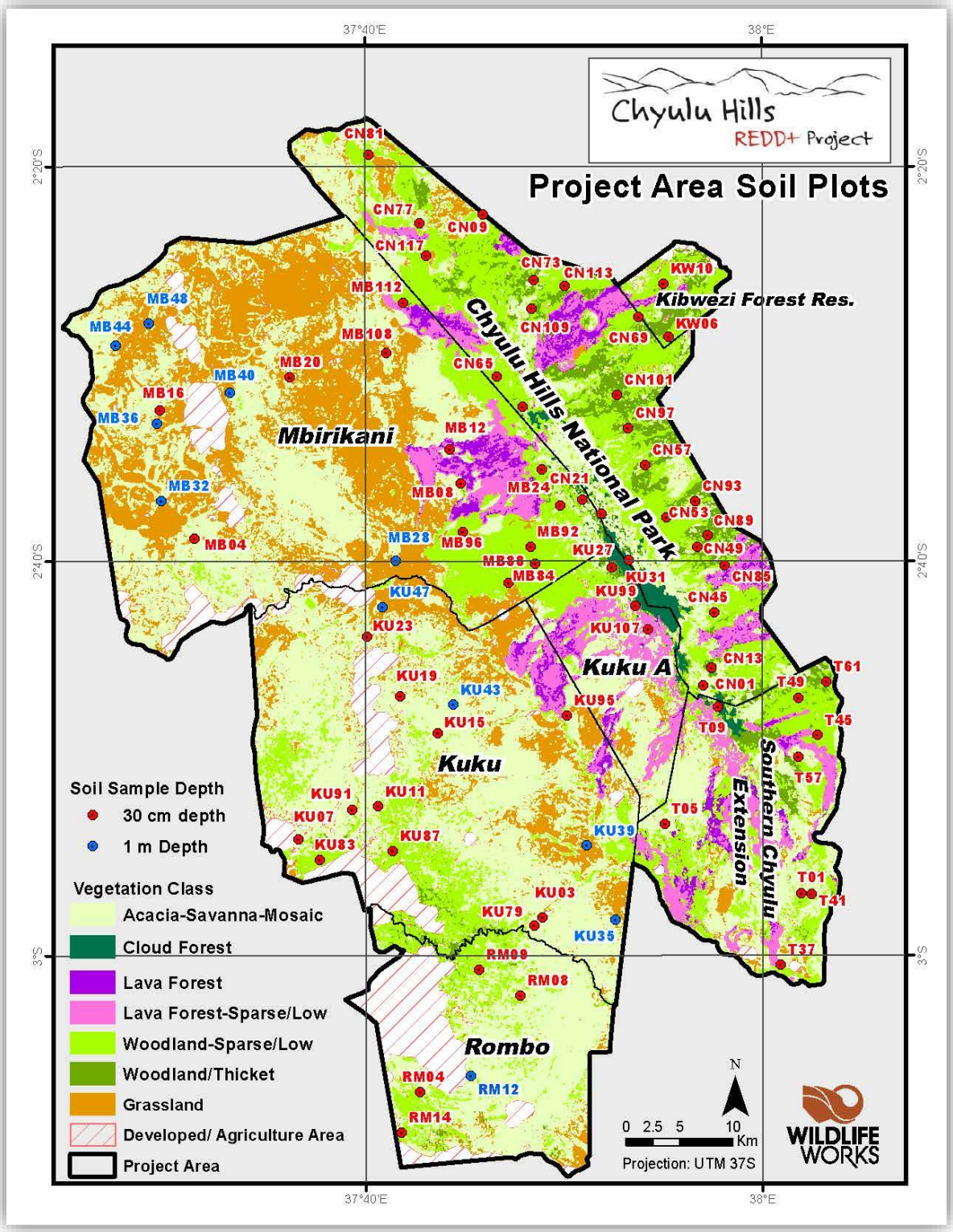


Figure 20: Soil sample plot locations in the Chyulu Hills REDD+ Project

5.4.2 Calculating Emissions from Burning

Currently, no planned project activities involve the burning of biomass burning in any manner. As such, emissions from burning are included in carbon accounting. However, if future project activities should include this emission type, project emissions from burning of biomass shall be calculated using equation [F.42] of the VM0009 methodology v3.0.

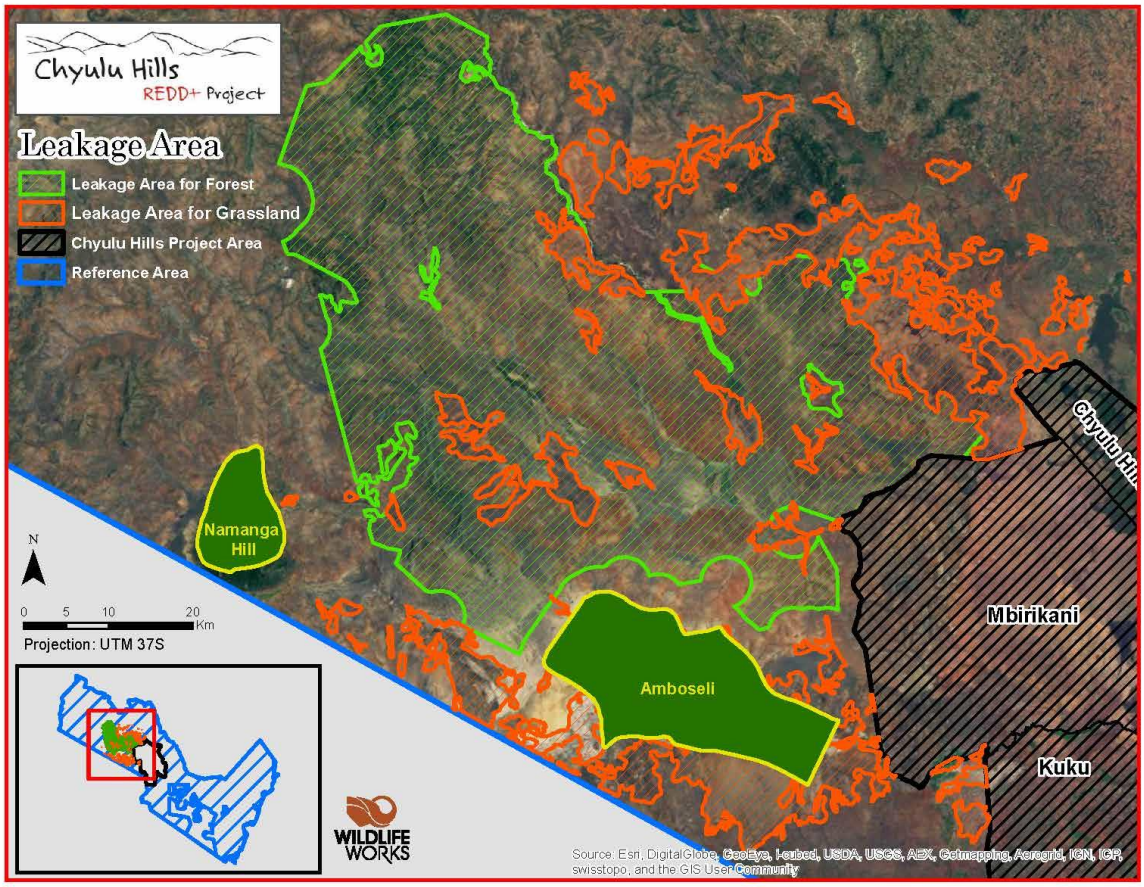
5.5 Leakage (CL2)

5.5.1 Activity-Shifting Leakage

5.5.1.1 Delineation of Activity-Shifting Leakage Area

PDR.105 A map of the delineated boundaries.

Activity shifting leakage, as described in detail by PDR 107 below, is measured in the activity shifting



leakage area, which is shown below:

Figure 21: Leakage areas for the Forest PAA and Grassland PAA

PDR.106 Maps of the landscape configuration, including:

a. Topography (elevation, slope, aspect);

Please see Appendix G. 'Map of Activity-Shifting Leakage Areas'. The maps of the two leakage areas in this appendix depict a digital elevation map of the leakage areas (DEM), a map of the leakage areas slopes' and a map of the leakage areas' aspects.

b. Recent land use and land cover (either a thematic map created by the project proponent or publicly available map);

Please see Appendix G. 'Map of Activity-Shifting Leakage Areas Land cover and Soil class'.

c. Access points;

Please see Appendix G. 'Map of Activity-Shifting Leakage Area's Infrastructure' for a map of the primary points of access for the Leakage Areas.

d. Soil class maps (if available);

Please see Appendix G. 'Map of Activity-Shifting Leakage Areas Land cover and Soil class'.

e. Locations of important markets;

Please see Appendix G. 'Map of Activity-Shifting Leakage Area's Infrastructure' for a map of the important markets in the Leakage Areas.

f. Locations of important resources like waterways or roads; and

Please see Appendix G. 'Map of Activity-Shifting Leakage Area's Infrastructure' for a map of important resources in the Leakage Areas.

g. Land ownership/tenure boundaries.

Please see Appendix G. 'Map of Activity Shifting Leakage Area's Infrastructure' for a map of the landownership/land tenure boundaries in the Leakage Areas.

PDR.107 A narrative describing the rationale for selection of activity-shifting leakage area boundaries. If the activity-shifting leakage area is smaller than the project accounting area or cannot be defined, justification for the size of the area. If foreign agents have been identified as an agent of conversion, justification that they are unlikely to shift their activities outside the activity-shifting leakage area.

A separate activity shifting leakage area was selected for the Forest Accounting Area and Grassland Accounting Area. Areas near the Project Area were examined using recent high-resolution imagery from Google Earth and Bing Maps. The closest appropriate regions to the Project Area that met VCS activity shifting leakage area requirements were selected. In the interest of conservativeness, it was confirmed that the identified leakage areas were as readily accessible as the Project Area to the agents of conversion and also of similar land tenure. This is to ensure that any conversion that is potentially displaced from the Project Area is captured through the sampling of the activity-shifting leakage areas. A land cover stratification was then used to confirm that the selected grassland activity-shifting leakage area contains as much native grassland as the grassland PAA and that the forest activity-shifting leakage area contains as much forest as the forest PAA. It was additionally confirmed, using geospatial analysis, that the leakage areas are similar to the Project Area in landscape configuration such as elevation, slope and proximity to infrastructure and settlements.

PDR.108 Results of a spatial analysis to demonstrate the activity-shifting leakage area is entirely in a non-converted state (e.g. forested or native grassland) as of the project start date.

Two activity shifting areas have been delineated for this Project, one for the Forest Project Accounting Area and one for the Grassland Project Accounting Area. The leakage area for the Forest Project Accounting Area was selected to include only areas that are currently forested and the leakage area for the Grassland Project Accounting Area includes only areas that are non-converted native grassland. The Africover land cover dataset was first used to select areas that met the criteria for the two leakage areas. More recent medium and high-resolution imagery was then utilized to confirm that the two leakage areas do not contain any areas of conversion. Please refer to Appendix G for maps demonstrating and cover within the selected leakage areas.

PDR.109 Results of a spatial analysis to demonstrate the activity-shifting leakage area is no larger than the project accounting area.

The two leakage areas were selected to contain the same area of non-converted land (one with forest and a second with native grassland) as the each their respective Project Accounting Areas. The forest leakage area is 292,861.1 ha, while the Forest Project Accounting Area is 265,547.57 ha. While the grassland leakage area is 101,615.98 ha, and the Grassland Project Accounting Area is 109,130.57 ha.

Table 27: Results of spatial analysis to demonstrate validity of the leakage areas

Activity shifting leakage area	Leakage area (ha)	PAA area (ha)
Forest	292,861	265,548
Grassland	101,616	109,131

5.5.1.2 The Leakage Emissions Model

Activity shifting leakage is estimated by empirical, in-situ observation of sample points in the activity shifting leakage areas for evidence of conversion and forest degradation. These observations are used to estimate the cumulative emissions from activity shifting leakage for each monitoring period according to equations [F.46] and [F.47] (from the methodology VM0009) using the leakage emissions model. The leakage emissions model is parameterized using equations [F.48] and [F.49] in the VCS methodology VM0009 v3.

5.5.1.3 Sampling Conversion and Forest Degradation to Build the Leakage Model

PDR.124 Summary of sampling procedures for the activity-shifting leakage areas, with a copy of a sampling protocol used to carry out measurements.

Conversion and forest degradation is sampled in the activity shifting leakage area by empirical, in-situ observation of sample plots. The sample design utilized is a simple random sample of 35 forest leakage area plots and 35 grassland leakage area plots within the Forest and Grassland activity shifting leakage areas. Please see Figure 21 and 22 for a delineation of the leakage areas and the locations of the plots. The procedures used for locating and sampling the activity shifting leakage Areas are found in Annex 7 – 'Standard Operating Procedure Activity-Shifting Leakage Area'. Plot teams visited each leakage plot a priori to confirm that each plot begins in a non-converted state and that its location is appropriate with respect to the agents and drivers in the project baseline scenario.

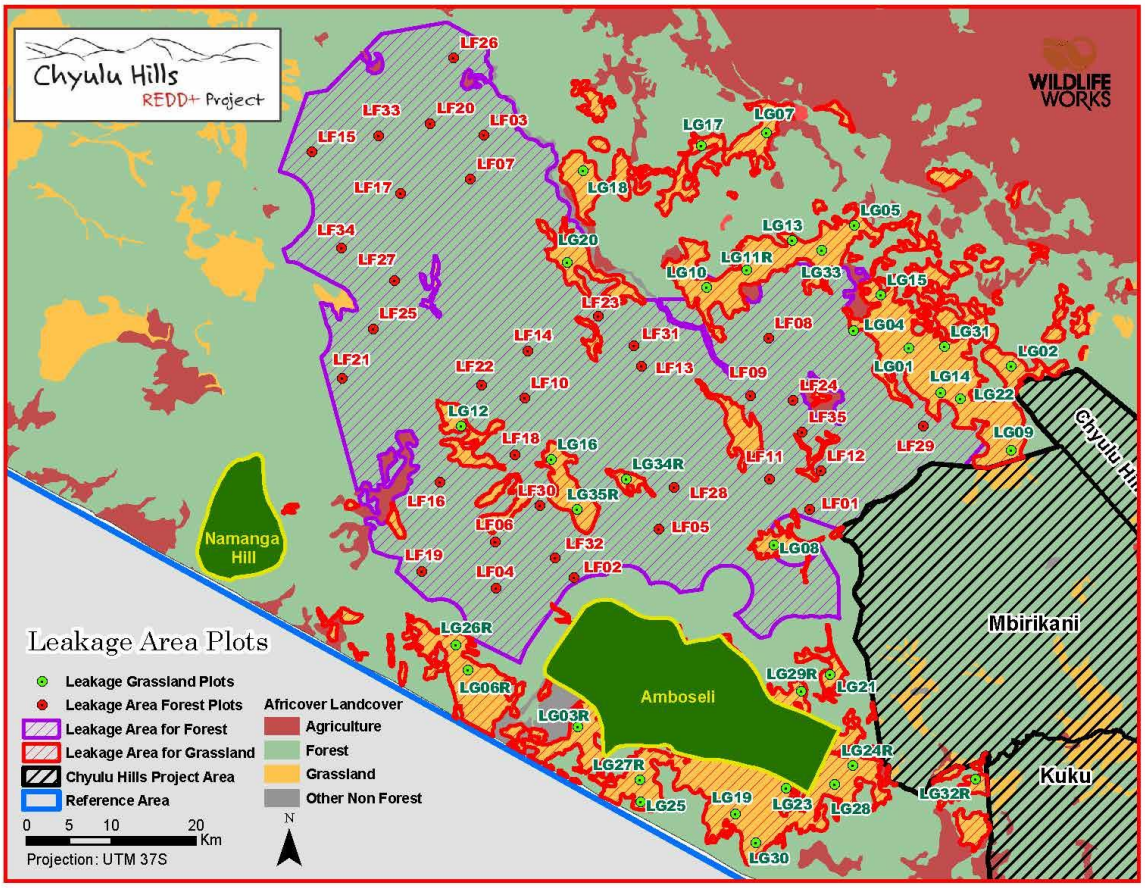


Figure 22: The sample plot locations in the Forest and Grassland leakage areas are shown.

5.5.1.4 Fitting the Leakage Model

The Leakage Emissions Model is dictated by the VCS methodology VM0009 v3 equation [F.48] for the Forest PAA and equation [F.49] for the Grassland PAA. These models estimate cumulative carbon emissions from activity shifting leakage based on the conversion parameters α, and β and field measurements in the leakage areas.

Where equation [F.48] is:

$$LEM_F(c_P, c_B, p_{L\,DEG}, t, x) = p_{L\,DEG}^{[m]} A_{AS}(c_P - c_B) - \frac{A_{AS}(c_P - c_B)}{1 + e^{\ln\left(\frac{1}{p_{L\,DEG}^{[m=0]}} - 1\right) - \beta t - \boldsymbol{\theta}(x_0 - x)^T}}$$

And, equation [F.49] is:

$$LEM_G(c_P, c_B, p_{L\,DEG}, t, x) = p_{L\,CON\,G}^{[m]} A_{AS}(c_P - c_B) - \frac{A_{AS}(c_P - c_B)}{1 + e^{\ln\left(\frac{1}{p_{L\,CON\,G}^{[m=0]}} - 1\right) - \beta t - \boldsymbol{\theta}(x_0 - x)^T}}$$

The parameter $p_{L\,DEG}^{[m]}$ is estimated at least once every five years from measurements taken in-situ within the Forest PAA Leakage area. The parameter $p_{L\,CON\,G}^{[m]}$ is estimated at least once every five years from measurements taken in the Grassland PAA Leakage area. The Standard Operating Procedure (SOP) used for estimating these parameters is given in Annex 7- SOP – 'Chyulu Hills - Forest Leakage 04-15-2014.pdf' and 'SOP - Chyulu Hills - Grassland Leakage 04-15-2014.pdf'.

5.5.2 Market Leakage

Market leakage can occur if a project reduces the supply of market goods, such as timber, relative to the baseline. Market leakage is assessed independently for the Forest Project Accounting Area and for the Grassland Project Accounting Area. As described in Section 4.5.1, the most likely baseline scenario is conversion of forest and native grassland to agriculture. This agriculture is primarily subsistence, with little production remaining beyond household consumption. Food security is a serious issue, as discussed in Section 4.5.2, in the Project Zone. Without the project there would be increasing demand for land and continued low productivity of agricultural production, crop failures from droughts, and few alternatives for income generating activities available to local communities. Given that the agents and drivers practice subsistence farming, and a key project activity is to work with local farmers to increase yields on land that is currently farmed, no net reduction in agricultural production due to the Project is anticipated.

5.6 Summary of GHG Emission Reductions and Removals (CL1 & CL2)

5.6.1 Determining Reversals

A Project reversal can occur if during any monitoring period throughout the project crediting period, quantified gross emission reductions (GERs) are negative (as a result of a carbon stock loss). The procedure for identifying Project reversals within the Chyulu Hills REDD+ Project meets all VCS procedures and requirements as listed in the VCS methodology VM0009 v3. Please refer to Annex 8 – 'Disturbance Monitoring Standard Operating Procedure' for a detailed description of the monitoring methods proposed to identify any potential significant conversion events within the Project Area, and subsequently quantify emissions from any potential Project disturbance / reversal.

5.6.2 Determining Reversals as a Result of Baseline Re-evaluation

In the event that a reversal occurs due to a baseline re-evaluation, the project proponent shall document the cause of reversal, quantify the emissions from the reversal and supply all supporting data for the in the respective monitoring report, following all guidance and requirements from section 8.4.2.1 in the VCS methodology VM0009 v3.0.

5.6.3 Quantifying Net Emission Reductions for a PAA

Annual net emission reductions (NERs) for the Project are calculated for each PAA by subtracting the VCS buffer pool allocation from the GERs using equation [F.55] from the methodology VM0009 v3.0.

$$E_{\Delta\,NER}^{[m]} = E_{\Delta\,GER}^{[m]} - E_{BA}^{[m]}$$

NERs are calculated both for the Forest Project Accounting Area and Grassland Project Accounting Area for each monitoring event.

5.6.3.1 Determining Deductions for Uncertainty

A potential confidence deduction is determined from NERs, based on a linear combination of the weighted standard errors associated with estimates from baseline emission models and carbon stock measurements from the Project Area and Proxy Area. Equation [F.57] from the methodology VCS VM0009 v3.0 is used to calculate the confidence deduction, if any, to be applied to Project NERs. Confidence deductions are documented for each monitoring event for each PAA.

$$E_U^{[m]} = E_{B\,\Delta}^{[m]} \left[\frac{1.64}{E_{B\,\Delta}^{[m]} + A_{PAA} c_P^{[m]} + A_{PX} c_B^{[m]}} \sqrt{\left(U_{EM}^{[M]}\right)^2 + \left(U_P^{[m]}\right)^2 + \left(U_B^{[m]}\right)^2} - 0.15 \right]$$

5.6.3.2 Determining Buffer Account Allocation

The quantity of NERs to be allocated to the VCS buffer account is determined annually for the Project using the VCS AFOLU Tool for Non-permanence Risk and Buffer Determination. The Project Proponent used this tool to assess all relevant risks to the Chyulu Hills REDD+ Project from natural, economic and management sources. It was determined that the overall risk level is moderate. Many risks can be minimized through the efficacy of Project Activities, community outreach, involvement in Project design and operation and experienced management. The Project Proponent has significant experience in the design and operation of REDD+ projects and Jurisdictional REDD+ approaches. These experiences will drawn upon to mitigate potential risks to the Chyulu Hills REDD+ Project throughout the Project lifetime.

Non-permanence risk assessment for the Chyulu Hills REDD+ Project was performed using the VCS Non-Permanence Risk Tool v3.2 and Risk Report Calculation Tool v3.0. Please refer to Annex 12 – 'Non-Permanence Risk Tool'.

5.6.4 Quantifying Net Emission Reductions Across PAAs

There are two PAAs in the Chyulu Hills REDD+ Project, a Forest Project Accounting Area and a Grassland Project Accounting Area. NERs are calculated separately for each PAA, and subsequently aggregated to arrive at total NERs for the Project, for each monitoring period.

5.6.5 *Ex-Ante* Estimation of NERs

Ex-Ante NERs are calculated for both the Grassland Project Accounting Area and the Forest Project Accounting Area according to the guidance and process detailed in various sections above. Please refer to Annex 10 – 'NER Worksheet-Forest PAA' and Annex 11 – 'NER Worksheet-Grassland PAA' for detailed NER calculations. The Ex-Ante NERs presented here are based on an initial ecosystem inventory performed on the two PAAs. All parameter values have been identified at the time of validation. Ex-ante estimates for NERs are assumed to be conservative, as they fail to consider additional emission reductions due to forest (or grassland) growth within the Project Accounting Areas or further degradation within the proxy area(s).

In the case when *ex-ante* estimates are used to prove the significance of emissions sources or estimate the quantity of NERs over the project crediting period, the project description must include the following:

PDR. 118 The projected avoided baseline emissions, project emissions and leakage for each monitoring period and vintage year over the lifetime of the project.

Table 28: *Ex-Ante* estimates for Baseline Emissions, Project Emissions, Leakage Emissions and Net Emission Reductions (NERs) for each monitoring period throughout the Project lifetime.

Monitoring Period	Monitoring Event Date	Estimated baseline emissions or removals (tCO2e)	Estimated project emissions or removals (tCO2e)	Estimated leakage emissions (tCO2e)	Estimated net GHG emission reductions or removals (tCO2e)
1	9/19/2014	1,253,872	0	0	1,128,485
2	9/19/2015	1,010,559	0	-78,331	831,172
3	9/19/2016	1,114,502	0	-86,656	916,396
4	9/19/2017	1,209,842	0	-93,819	995,038
5	9/19/2018	1,295,511	0	-100,770	1,153,454
6	9/19/2019	1,377,024	0	-107,177	1,132,144
7	9/19/2020	1,450,347	0	-113,477	1,191,836
8	9/19/2021	1,493,276	0	-117,076	1,226,872
9	9/19/2022	1,531,853	0	-120,027	1,258,641
10	9/19/2023	1,556,716	0	-122,388	1,464,819
11	9/19/2024	1,551,592	0	-108,646	1,287,787
12	9/19/2025	1,543,890	0	-107,898	1,281,604
13	9/19/2026	1,531,277	0	-106,822	1,271,327
14	9/19/2027	1,507,041	0	-104,910	1,251,427
15	9/19/2028	1,473,126	0	-102,263	1,495,892
16	9/19/2029	1,416,334	0	-97,950	1,176,751
17	9/19/2030	1,371,925	0	-94,068	1,140,664
18	9/19/2031	1,334,835	0	-91,477	1,109,874
19	9/19/2032	1,282,393	0	-87,033	1,067,120
20	9/19/2033	1,230,460	0	-82,799	1,355,646
21	9/19/2034	1,188,684	0	-79,412	990,403
22	9/19/2035	1,152,627	0	-76,551	960,814
23	9/19/2036	1,124,564	0	-74,344	937,763
24	9/19/2037	1,067,424	0	-69,954	890,728
25	9/19/2038	1,020,063	0	-65,587	1,217,146
26	9/19/2039	1,005,761	0	-64,752	840,433
27	9/19/2040	968,351	0	-61,239	810,277
28	9/19/2041	930,435	0	-58,699	778,692
29	9/19/2042	899,352	0	-55,818	753,599
30	9/19/2043	871,860	0	-53,302	1,111,482
	Total	**37,765,494**	**0**	**-2,583,245**	**33,028,286**

PDR.119 A narrative description of sources used to estimate the leakage rate and demonstration that the estimated rate is conservative.

Activity shifting leakage areas for both the Forest Project Accounting Area and Grassland Project Accounting Area were delineated as part of the Project development process. Additionally, no market leakage has been attributed to this REDD+ project. All Project activities detailed in the above sections are

designed to mitigate potential Project leakage. The Project Proponent contends that there will be little to no leakage associated with the Project, due to extensive, combined prior experience working with communities and Project stakeholders to mitigate leakage. However, in the absence of actual measurements of potential leakage or any precedent in this area for the estimation of ex-ante leakage emissions, a conservative estimate of an 8% annual leakage rate has been applied for the purposes of ex-ante NER estimates. The nearby Wildlife Works Kasigau Corridor Phase I and II REDD+ Projects, within their 4th monitoring period, have continually enjoyed leakage rates under 10%. We conclude that that an 8% Ex-ante estimate for leakage represents a fair and conservative estimate for the Chyulu Hills REDD+ Project.

5.6.6 Evaluating Project Performance

The Project Proponent will evaluate Project performance, including any deviations from the ex-ante NER estimates, during each monitoring event. The Project Proponent typically performs monitoring on an annual basis, although monitoring is required by VCS to be performed at least once every 5 years. Sources of deviation could include changes in data quality (i.e. estimates from literature vs. in-situ measurements), additional sampling and development of tree allometry, disturbance events in the Project Area, or inherent baseline re-evaluation deviations. At each verification event, the Project Proponent shall demonstrate comparisons between verification NERs and ex-ante NER estimates presented in this PDD. Any significant deviations will be documented and their causes explained in subsequent verification documents as well as at baseline re-evaluation.

5.7 Climate Change Adaptation Benefits (GL1)

5.7.1 Identify likely regional climate change and climate variability scenarios and impacts, and potential changes in the local land-use from these scenarios in the absence of the project (GL1.1)

Climate change scenarios and effects on land:

Global climate change models suggest a variety of scenarios for East Africa (Worden *et al.*, 2009), which are still subject to a high level of uncertainty. Overall rainfall in East Africa is expected to increase, particularly in the Kenyan and Tanzanian rangelands (IPCC, 2007, McSweeney *et al.*, 2008). Even though at first this may appear to be beneficial to land productivity and human livelihoods, changes in the spatial and temporal variability in rainfall, the timing of rainfall and a likely increase in extreme events, including both droughts and floods, may in fact exacerbate vulnerability in the region (Worden *et al.*, 2009). In addition, temperatures are expected to rise significantly, with an increase by up to 2.8°C until 2060 and up to 4.5°C by 2090 (IPCC, 2007). A combination of the above coupled with the current level of environmental degradation may cancel out any positive impacts of increased rainfall (Worden *et al.*, 2009.).

Droughts in particular have had a devastating impact on the pastoralists and farmers alike. As outlined several times previously, the 2009 drought had detrimental effects on pastoralists whereby loss of livestock was severe. On Kuku GR, for example, 84% of cattle, 77.8 % of goats and 72.8% sheep died due to the lack of water and pasture (Wangai *et al.*, 2013). As a result, many pastoralists turned to agriculture and have become increasingly sedentary. This trend is likely to continue, for it has been argued that pastoralism is no longer a viable livelihood strategy in Kenya (Thornton *et al.*, 2006). Settlements have sprung up around water points, making access for livestock increasingly difficult. The high risk of more frequent droughts and the loss of flexibility in terms of grazing land in dry periods due to

habitat fragmentation provides a high incentive to turn to farming. In the absence of the REDD+ project, agricultural expansion in the rangelands is assumed likely to occur in an unregulated manner.

At the same time, these expected climate change scenarios are likely to further exacerbate the agricultural potential, particularly for already existing farms on the eastern portions of the Project Zone. Unpredictable rain, water scarcity and higher temperatures will further limit crop production and inherently impact food security. In absence of the Chyulu Hills REDD+ project, this will force more people to revert to alternative income opportunities, such as increased charcoal burning, leading to increased environmental and forest degradation.

5.7.2 Identify any risks to the project's climate, community and biodiversity benefits and how these risks are being mitigated (GL1.2).

Due to uncertainties inherent in any climate change model, it is difficult to predict precise impacts of climate change on the landscapes and the communities. Nevertheless, given the above scenario, we assume a number of risks to the climate, community and biodiversity benefits, which are outlined below. Several mitigation methods are suggested.

Increased temperatures and risk of drought. This will have an impact on food security and water availability for both communities and wildlife. It will therefore be necessary to increase resilience in the community and landscape. This could be achieved, for example, by training communities in climate-smart agriculture. Droughts will put stress on the vegetation of the Project Zone. However, as this is an Avoided Deforestation project, with no climate benefits being claimed for net carbon stock increase from year to year in the with-Project scenario, we do not anticipate any negative impacts on the emissions benefits of this Project. Afforestation and reforestation projects would definitely face the risk of lower carbon stock increases if rainfall levels were further reduced as climate change continues. However, for this reason, the Chyulu Hills REDD+ Project will utilize solely indigenous species that have adapted to extreme dry weather conditions, and which therefore increases the chance of survival.

Low capacity of local population to adapt to more extreme weather patterns. Climate change studies are in accord that the people to be affected most by climate change will typically be the poorest and most vulnerable communities who may have little information about impending hazards and are often the least capable of rebuilding their lives and livelihoods after having suffered a setback (Omenda *et al.*, 1998). This is very much the case in the Chyulu Hills REDD+ Project and there is thus a great risk to community benefits if they fail to adapt to climate change induced stress, such as more frequent droughts, less available pasture for livestock, water scarcity etc. It is a primary Project priority to build capacity, diversify income generating activities and create a more sustainable income flow. This will allow local communities to build resilience to more extreme weather patterns.

A high degree of uncertainty is associated with predicting the effects of climate change on biodiversity. However, it is thought that climate change could have an impact on biodiversity and related species distributions. On a continent-wide scale, biodiversity of indigenous plants and animals in Africa is likely to be affected by all of the major environmental changes that constitute climate change. These include changes in ambient air temperature, rainfall and air vapor pressure deficit (which combine to cause altered water balance), rainfall variability and atmospheric CO2 (Desanker *et al.*, 2001). The IUCN rates climate change as one of the top five threats to biodiversity (IUCN, retrieved on 15 February 2014). These impacts could include changes in timing of life cycles, such as blooming and migration; changes in species distribution and abundance; changes in morphology and reproduction of organisms; and changes in ecosystem processes such as species interactions (IPCC, 2007). The primary manner in which climate

change impacts to the project's biodiversity benefits can be mitigated is through active protection measures, ensuring landscape connectivity, grazing area and increasing access to water sources.

5.7.3 Demonstrate that current or anticipated climate changes are having or are likely to have an impact on the well-being of communities *and/or* biodiversity in the project zone (GL1.3)

Africa is identified as the continent that will be struck most severely by the impacts of climate change (IPCC, 2007). Given its geographical position, the continent will be particularly vulnerable due to the considerably limited adaptive capacity, exacerbated by widespread poverty and the existing low levels of development (ibid). The IPCC report further predicts that by 2020, between 75 and 250 million people in Africa are projected to be exposed to increased water stress due to climate change. In addition, also by 2020, in some countries, yields from rain-fed agriculture could be reduced by up to 50%. Agricultural production, including access to food, in many African countries is projected to be severely compromised, which would further adversely affect food security and exacerbate malnutrition (ibid.). It is expected that these impacts hold true for the communities living in the Project Zone and would therefore severely impact the communities' well-being. This indicates a pressing need to focus on adaptation and climate change mitigation measures.

5.7.4 Demonstrate that the project activities will assist communities and/or biodiversity to adapt to the probable impacts of climate change (GL1.4).

The following are some examples of project activities that could assist communities and/or biodiversity to adapt to the probable impacts of climate change.

Table 29: Project climate change adaptation Benefits

Climate Change Risks	Potential Effects	Potential Mitigative/Adaptive Strategies
More intense and longer droughts	Low land productivity or complete crop failure, less pasture for livestock and wildlife, more severe fires	Reduce dependence on livestock and land through alternative IGAs, promote cultivation of drought resistant crops, improve storage facilities and management of crops, water harvesting and water storage, raise awareness of danger of fires,
Seasonal rivers drying out	Negative effects on water availability	Water harvesting methods could be implemented, construction of boreholes.
Low capacity of local populations to adapt to frequent natural disasters	Increase in periods of food insecurity, potential increase in disease and deaths with continuing very low health standards, potential for increasing inter-community conflict	Increase support of local institutional structures including the norms and rules of governance to help develop adaptive strategies, increase literacy levels, diversification of livelihood activities and income generation projects, involve women to a greater degree in decision making processes, increase general participation in decision making at the local level
Decreased biodiversity, loss of forest cover to drought, temperature change	Reduction in species, more species at risk	Help to maintain intact and interconnected ecosystems through protection of ecosystems, ensure landscape connectivity to allow migration, regeneration activities using indigenous, drought-resistant trees

6 COMMUNITY

6.1 Net Positive Community Impacts (CM1)

6.1.1 Estimated Impacts on Communities from Project Activities (CM1.1)

6.1.1.1 Result Chain Diagrams

Based on the extensive experience of the Project partners working on biodiversity and community projects in this landscape, a literature review, and from information obtained from the FPIC workshops held, we applied the theory of change approach to justify our project rationale and to produce indicators for the CCB monitoring plan. The theory of change is a hypothesis about how a project intends to achieve its stated objectives, or a roadmap of how it plans to get from project activities to project impacts (Richards & Panfil, 2011). As such, we developed a theory of change for each of the three key issues (hereafter referred to as **Focal Issues**) that we intend to address in the community component of this project. Addressing these focal issues will lead to reducing deforestation, forest degradation and avoiding conversion of grasslands, namely: high levels of poverty and livelihood vulnerability; Food insecurity; and Poor education standards. (NB: Water scarcity and Poor health standards were deemed cross-cutting and/or contributing factors and are incorporated into these three main issues). The assumptions we make about the cause-and-effect relationships are made explicit in the Result Chain diagrams below, from which the theories of change statements that follow are based. Indicators were developed for key results and assumptions; monitoring of assumptions was included to enable us identify points of deviation early enough. In sum, the indicators outlined in the Monitoring Plan will enable measuring progress towards achieving the desired project activity outcomes and impacts from project activities and strategies.

Chyulu Hills REDD+ Project's Social Focal Issues: Result Chain Diagrams

Poverty and Livelihoods

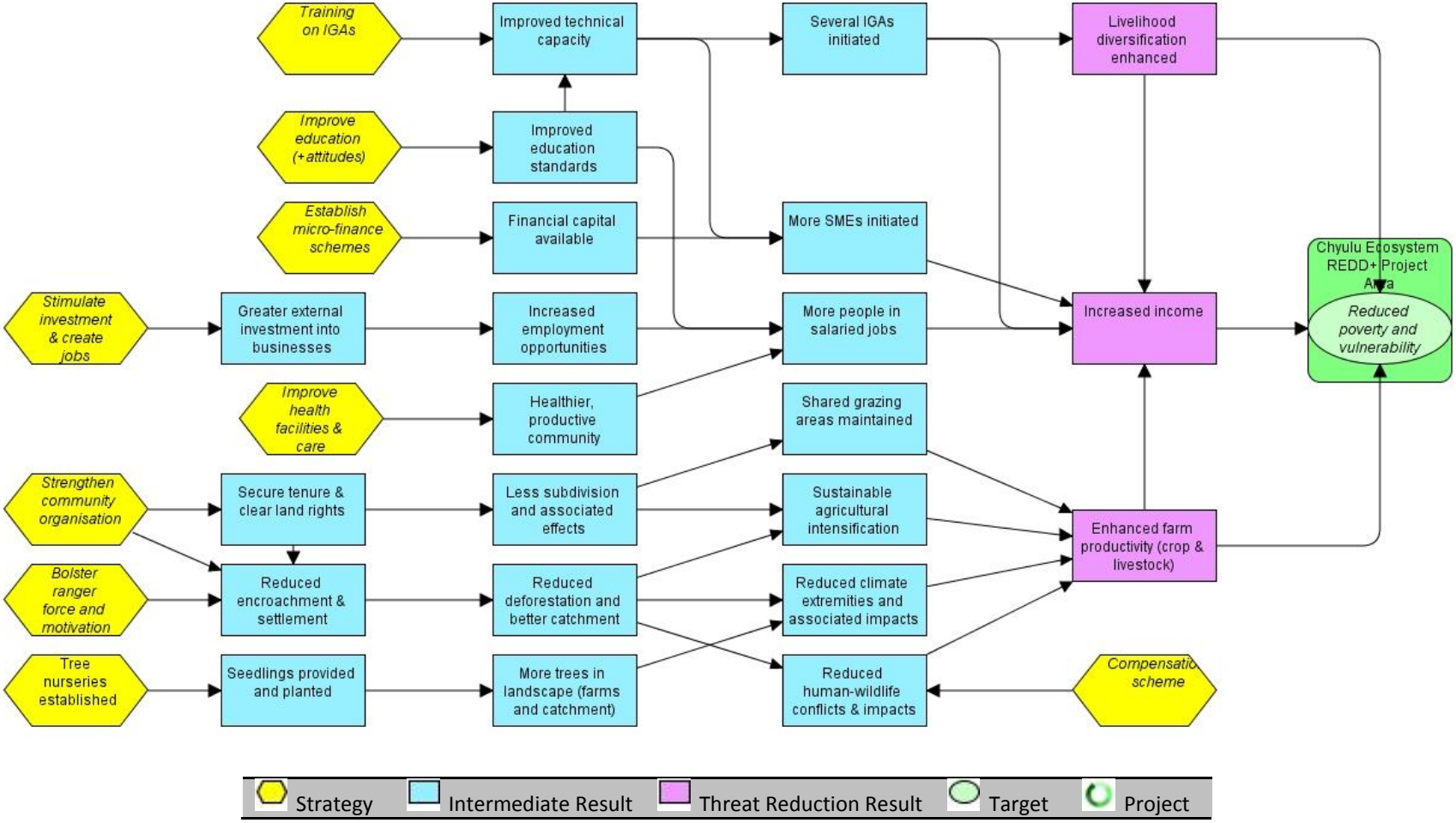


Figure 23: Reduced Poverty and livelihood diversification

Theory of Change Statement:

IF alternative livelihoods and jobs are created, IF farm and livestock production is improved and diversified, and IF losses of crops and livestock to wildlife are compensated, THEN poverty and livelihood vulnerability shall be reduced.

Comparison between the 'Without Project' and 'With Project' scenario

Section G2.4 outlines the 'Without Project' scenario. In summary, the direct threats to poverty and livelihoods are i) little livelihood diversification, ii) insufficient income, and iii) low farm productivity (crops and livestock). In the absence of the project, these are expected to worsen and thereby increase poverty and livelihood vulnerability.

The Result Chain Diagram depicts how the Chyulu Hills REDD+ Project aims to reduce poverty and improve overall livelihoods over the project's lifetime. Project activities (strategies) are designed to achieve intermediate results, which will lead to a threat reduction result that lead to an improved outcome. For example, it is believed that stimulating investment and creating jobs will lead to a greater external investment into businesses, thereby increasing employment opportunities. This in turn will lead to more people in salaried jobs resulting in increased income and hence reduced poverty.

Similar result chains from each other project activities regarding poverty are displayed in the above diagram, all of which support a net-positive impact of the 'With Project' scenario. Monitoring will confirm the ability of the project to achieve these positive impacts and provide information for adjusting activities and approaches over time to ensure these results are achieved.

Food security

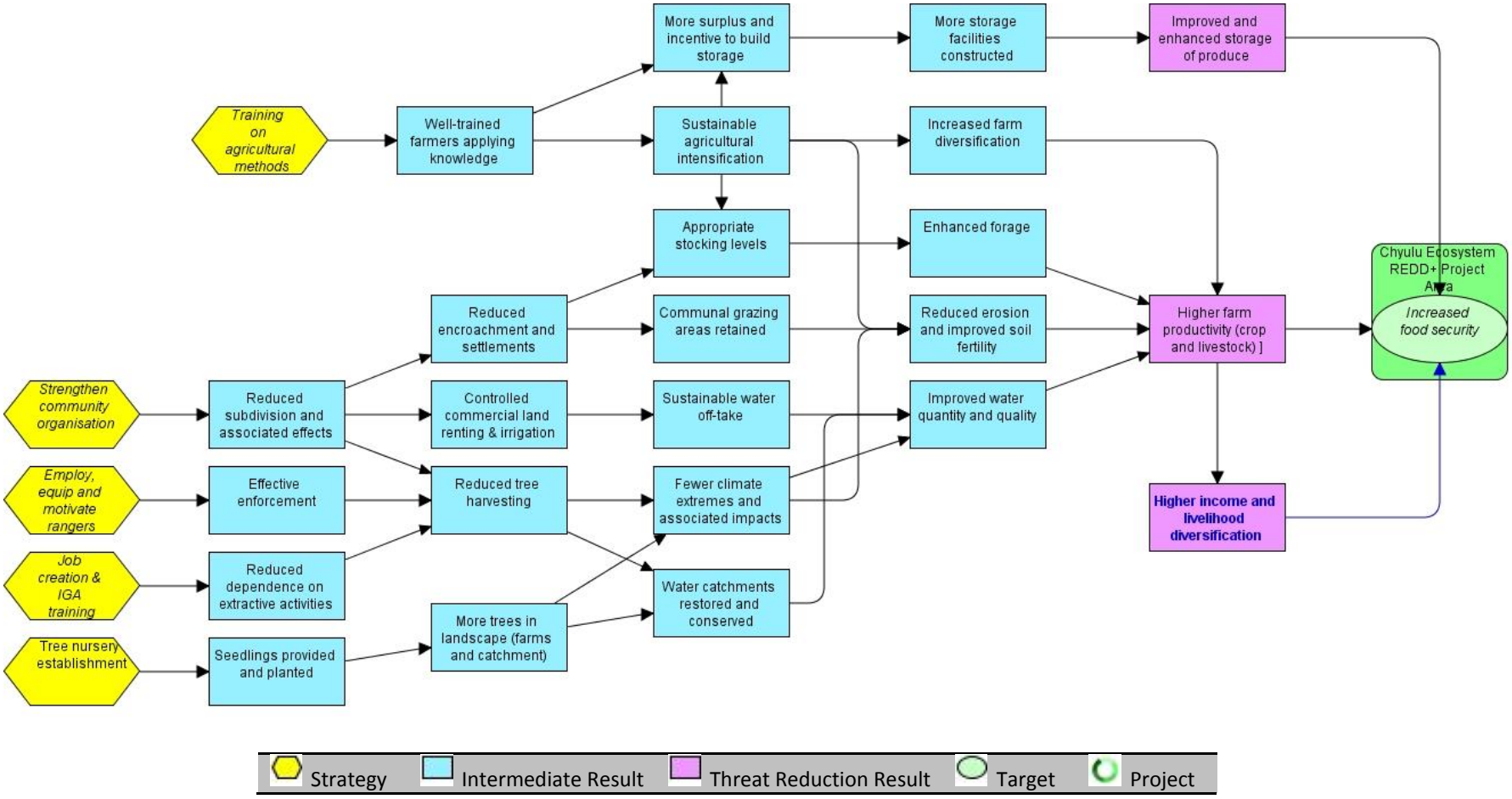


Figure 24: Food security

Theory of Change statement:

IF sustainable agricultural intensification is achieved, IF water catchments are restored and conserved, and IF communal grazing areas are not lost to subdivision and individualization, THEN there food security shall be enhanced.

Comparison between the 'Without Project' and 'With Project' scenario

Section G2.4 outlines the 'Without Project' scenario. In summary, the direct threats to food security are i) poor storage of farm produce, ii) low farm productivity both in terms of crops and livestock, and iii) little income and poverty. In the absence of the project, these are expected to worsen and thereby aggravate food insecurity.

The Result Chain Diagram depicts how the Chyulu Hills REDD+ Project aims to improve food security over the project's lifetime. Project activities (strategies) are designed to achieve intermediate results, which will lead to a threat reduction result that lead to an improved outcome. For example, it is believed that job creation and alternative income generation activities reduce the dependence on extractive resources, which in turn reduces tree harvesting. This in turn leads will result in fewer climate extremes and associated impacts, resulting in reduced erosion, improved soil fertility and improved water quality and quantity. The threat reduction result will be higher farm production, both of crops and livestock, which increases food security in the communities.

Similar result chains from each other project activities regarding food security are displayed in the above diagram, all of which support a net-positive impact of the 'With Project' scenario. Monitoring will confirm the ability of the project to achieve these positive impacts and provide information for adjusting activities and approaches over time to ensure these results are achieved.

Education

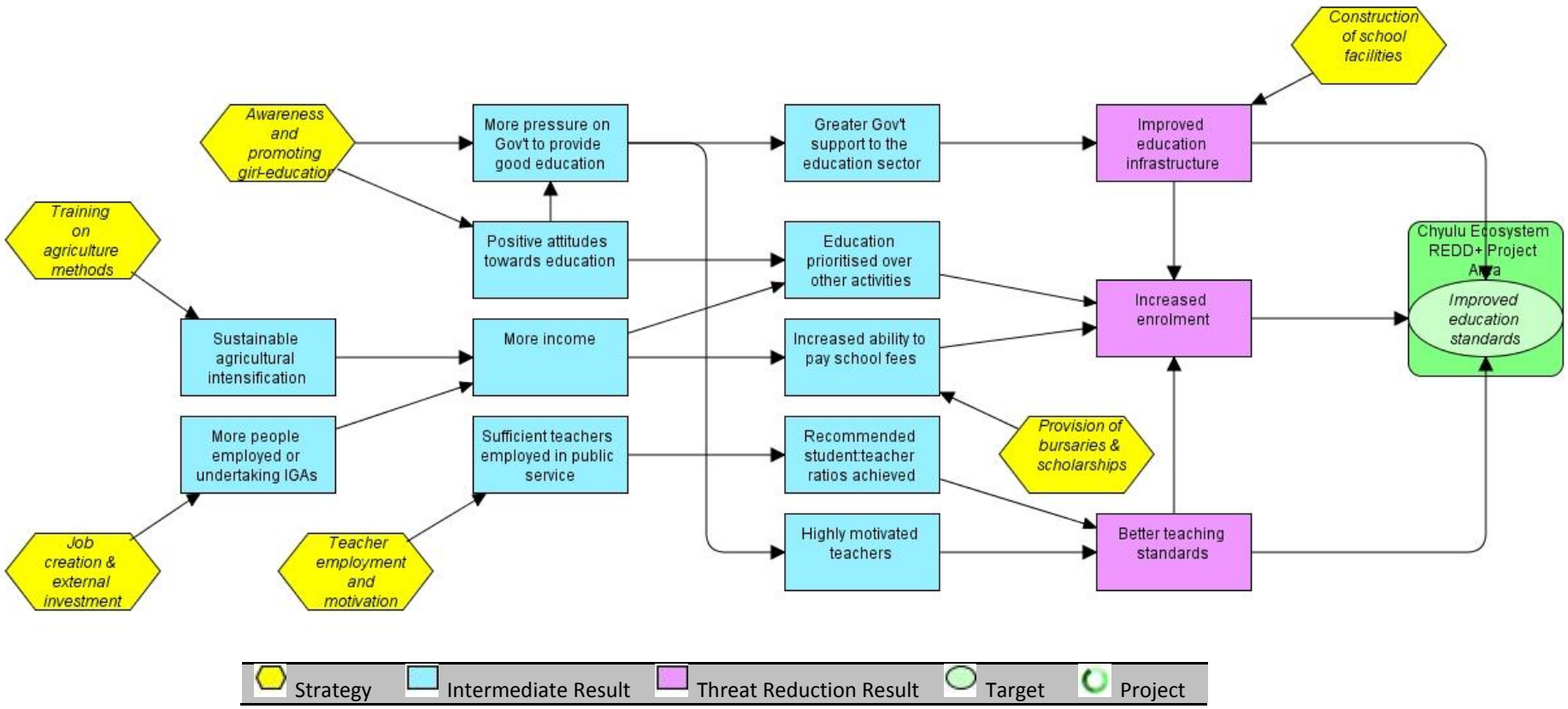


Figure 25: Education Improvement

Theory of Change Statement:

IF there are more finances for school fees payment, IF there are positive attitudes towards education, and IF education infrastructure and teaching are improved, THEN standards of education will improve.

Comparison between the 'Without Project' and 'With Project' scenario
Section G2.4 outlines the 'Without Project' scenario. In summary, the direct threats to poor education include i) poor education infrastructure, ii) low enrolment, and iii) poor teaching standards. It is unlikely that there will substantial improvement to this situation in the foreseeable future and thus the situation is expected to remain as is or worsen in the absence of the project.

The Result Chain Diagram depicts how the Chyulu Hills REDD+ Project aims to improve education over the project's lifetime. Project activities (strategies) are designed to achieve intermediate results, which will lead to a threat reduction result that lead to an improved outcome. Providing more bursaries will immediately allow parents to pay school fees, leading to increased enrolment and subsequent improved education. Likewise, employing teachers and raising their motivation will lead to more teachers employed in public schools, thus improving the teacher-student ratio, which leads to better teaching standards and ultimately improved education standards.

Providing school fees is a crucial project activity as it directly addresses one on the major drivers of deforestation and other conversion activities, namely a need for income to pay these fees. In addition, indirectly it also provides the young generation, especially girls, with a chance for acquiring broader life skills and a means to escape the cycle that perpetuates direct harnessing of natural resources as the key livelihood means.

Similar result chains from each other project activities regarding education are displayed in the above diagram, all of which support a net-positive impact of the 'With Project' scenario. Monitoring will confirm the ability of the project to achieve these positive impacts and provide information for adjusting activities and approaches over time to ensure these results are achieved.

6.1.1.2 Risks and negative impact analysis

As with any project (including REDD+ projects) that have impacts on communities and their surrounding environment, there is a possibility that negative, and/or unforeseen impacts may occur. According to CCB guidance (Richards & Panfil, 2011) it is recommended to identify any potential negative impacts, develop mitigation methods where necessary, and derive indicators to ensure that potential negative impacts are included within the monitoring program.

We used our theory of change rationale in the Result Chain diagrams to check for likely negative impacts and implementation risks. (NB: A negative impact is a negative side-effect of an otherwise successful result, while a risk is a threat to achieving key results in the results chain (Richards & Panfil 2011)). We focused on the key results and assessed the risks or assumptions in our logical framework analysis (Results Chains) that are outside the REDD+ project's control, e.g., policy or institutional reforms, and which would make it difficult to implement the desired project strategies. For all the Risks and Negative Impacts identified, we assessed their likelihoods and magnitudes (should they happen), as well as possible mitigation strategies.

Risks analysis

Table 30: Project community risk analysis

Result	Potential Risks to Result	Likelihood of risk	Magnitude of Impact of risk	Risk mitigation strategy	Explanation
Reduced subdivision	National or County Land Policy on adjudication	High	Medium	Reduce	Sensitization so that any such land policy does not affect land use and productivity negatively
	Corruption	Low	Medium	Resist	Sensitization to enable community to oppose corrupt land deals
Sustainable agricultural intensification	Low uptake	Low	High	Reduce	Work with the community to ensure recommendations are culturally acceptable
Compensation for human-wildlife conflicts	Cheating the system	Medium	High	Reduce	Have good checks, monitoring teams and strong punitive measures
Positive attitudes towards education	Resistance to change	Low	Medium	Remove	Work with community and Government to ensure right to education is respected
Greater Government support to education sector	Not prioritized in County Government and unpaid teachers	Low	High	Resist	Sensitize community to hold County leaders accountable to this Constitutional right

NB: **Likelihood** and **Magnitude**: Low, Medium, High; **Risk mitigation strategy**: Reduce, Remove, Resist, Do nothing

Negative impacts (NI) analysis

Table 31: Project potential community negative impacts

Result	Potential Negative Impacts	Likelihood	Magnitude	Duration	Stakeholders affected	Mitigation measure	Explanation
Reduced subdivision	Loss of land rent	Medium	Low	Short	Land owners	Compensate	They will gain revenue from carbon and other land uses

Effective enforcement	Loss of livelihoods	High	Low	Short	Charcoal burners; Wood carvers; Hunters	Minimize / Compensate	They will lose the illegal part but retain sustainable harvesting, NTFPs and other IGAs
More education, jobs and income	Social disruption	Medium	Medium	Medium	Entire community	Minimize	Ensure community sets up strong local institutions and structures to guard against this
Enhanced farm productivity	Price collapse from over-production	Low	Medium	Short	Agriculturists; Agro-pastoralists	Minimize	Diversify farm production; Develop storage and market access

NB: **Likelihood** and **Magnitude**: Low, Medium, High; **Duration**: Short, Medium, Long; **Mitigation measure**: Eliminate, Minimize, Compensate, Do nothing**.**

6.1.2 No Negative Project Effects on the High Conservation Values listed in CCB indicators G1.8.4-6 (CM1.2)

HCV G1.8.4. Areas that provide basic ecosystem services in critical situations
HCVs under this category include forests critical to water catchment and grassland for the prevention of soil erosion. Conservation of these services are the main priority of the project and its project partners, and activities are designed to ensure greater protection. This inherently provides positive effects on these high conservation values. No related negative effects are anticipated as a result of the project.

HCV G1.8.5 Areas that are fundamental to meeting the basic needs of local communities
HCVs under this category include provisioning services, such as poles for building material, fodder, fuel and medicinal plants. Through collaborative management with the communities and a development of a zoning plan, these services are not negatively affected by the project.

G1.8.6. Areas that are critical for the traditional cultural identity of communities
HCVs in this category are sacred sites within the project zone's forests, which have not been identified in the Project Area.

The Chyulu Hills REDD+ Project will monitor for negative impacts on HCVs.

6.2 Negative Offsite Stakeholder impacts (CM2)

6.2.1 Identify any Potential Negative Impacts on Offsite Stakeholders (CM2.1)

The Chyulu Hills REDD+ Project believes that there are no net negative impacts on legitimate offsite stakeholders. Potential offsite stakeholders may include charcoal traders along the Nairobi-Mombasa highway. Although we recognize that halting certain extractive activities from protected areas may affect the temporary income of such offsite stakeholder, such activities are a legal offence and therefore support law enforcement in the area. On the contrary, halting these activities may in fact lead to a positive impact on such offsite stakeholders as they may aim to generate their income in a more legal manner.

In addition, the Chyulu Hills REDD+ Project is aware that there is a heightened risk to a potential increase in human-wildlife conflict as wildlife numbers increase. This could be in the form of crop damage, loss of livestock or even personal injury of offsite stakeholders. The mitigation strategies are outlined in section 6.2.2.

6.2.2 Plans to Mitigate Negative Impacts on Offsite Stakeholders (CM2.2)

Human-wildlife conflict occurs quite regularly in the Project Area and subsequently affects offsite stakeholders as wildlife disperses. Mitigating any net negative impacts is achieved though conservation landscaping, where dams or water points may be scooped out at strategic places as to divert wildlife from populated areas. Furthermore there are comprehensive compensation schemes in place that reimburse any losses caused by wildlife in monetary terms. Finally, by encouraging offsite stakeholders to closely collaborate with the Project Office and its partners, particularly ranger teams, any negative result from wildlife intrusion may be stopped before leading to conflict.

6.2.3 Demonstrate no Net Negative Impacts on other Stakeholder Groups (CM2.3)

As outlined in section 6.2.1, the Chyulu Hills REDD+ Project does not expect any net negative impacts on other Stakeholder Groups. The comprehensive Monitoring Plan will monitor for any impacts on community groups. Once the plan has been implemented and data gathered, more concrete conclusions can be drawn.

6.3 Exceptional Community Benefits (GL2)

6.3.1 Project Zone is in a Low Human Development Country (GL2.1).

The Project Zone is located across three counties in Southeastern Kenya, which is characterized by high poverty level. Kenya itself is a low human development country (LHDV), which ranks at the 145th position worldwide (UNDP Human Development Report, 2013). Despite Kenya's promising economic potential, nearly half of the population (45.9%) lives below the poverty line (UN data, retrieved 14 February 2014). Moreover, more than three quarters of the population lives in rural areas, and rural households rely on agriculture for most of their income. The rural economy, in turn, depends mainly on smallholder farming, which produces the majority of Kenya's agricultural output (IFAD, retrieved 14 February 2014). As outlined in 1.3.3, poverty levels are higher in the Project Zone than Kenya's national average, with 67% in Loitokitok and 64.2% in Kibwezi County respectively. Kenya also has one of the world's highest rates of population growth. The population has tripled in the past 35 years, increasing pressure on the country's resources, leading to environmental degradation and leaving young people particularly vulnerable to poverty.

6.3.2 Demonstrate that at least 50% of the households within the lowest category of well-being of community are likely to benefit from the projects (GL2.2).

The Chyulu Hills REDD+ Project has designed the Project Activities to provide alternative income generating opportunities and economic benefits to marginalized and lower socio-economic households. The locations of where the Project Activities will be implemented are determined by need as identified by the communities. The school bursary program will provide funds to students that are identified as otherwise not being able to afford school fees or having access to other bursary or scholarship options. Additionally, the Project Activities focused on the provision of healthcare and public health education are also focused on households with no other access to healthcare due to their socio-economic positions. Other activities, such as water projects and agricultural intensification projects will be prioritized in communities that have the greatest need for such developments. The micro-finance program will be directed at households with limited resources so as to provide them with new opportunities to increase their economic well-being. The alternative income generating activities, such as craft and jewelry groups, will target marginalized groups, especially women, who have few other income generating activities available. Lastly, the Project will provide great benefits for those with the least access to education and resources through capacity building that will happen throughout the Project Zone and be open to community members. For example this may include workshops on land tenure, land rights, natural resource governance and community building activities.

6.3.3 Barriers or risks preventing benefits to go to poorer households (GL2.3).

Potential barriers or risks that prevent benefits from reaching the poorer households include elite capture, fewer chances of formal employment and no representation in decision-making processes. The Chyulu Hills REDD+ Project is taking measures to ensure these barriers and risks are mitigated and benefits reach poorer households. The benefit-sharing mechanism has been designed in a transparent and inclusive way and all finances are dispersed through the project partners. This prevents potential corruption in the communities. Furthermore, the Chyulu Hills REDD+ Project operates under a strict non-discrimination policy and offers the same chances for employment to all applicants. Finally, the advisory committees include representatives of all social groups, who represent the needs of their respective social class. The Chyulu Hills REDD+ Project will ensure that poorer households have a voice in decision-making of benefit sharing.

6.3.4 Measures to identify poorer and more vulnerable households and individuals whose well-being may be negatively affected by the project, and that the project design includes measures to avoid any such impacts (GL2.4).

Women

As highlighted previously, women are a marginalized group across the entire Project Zone, regardless of their ethnicity. They are considered vulnerable, as they do not have equal access to social and economic assets (IFAD, seen 14 February 2014, http://www.ruralpovertyportal.org/country/home/tags/kenya). Kipuri and Ridgewell (2008) outline the considerable inequality amongst pastoralist women in East Africa. They identify a lack of political participation leading to further marginalization, which is very much apparent in the Maasai communities in the Project Zone. As outlined in section 6.1.1., women, with the exception of widows, are not able to become a legal shareholder of the Group Ranches. There is also a large discrepancy between school attendance between boys and girls. Furthermore, the Kajiado District Development Plan (2008-2012) states that farmland is usually registered under the husband's name. On

a more cultural note, Maasai women are still brought up to respect and submit to male leadership and still undergo female genital mutilation (Kipuri and Ridgewell, 2008).

Poor households

There is also a discrepancy of wealth across the households in the Project Zone. As outlined by Thornton et al (2006), poorer pastoralist households are more susceptible to adverse impacts of land use changes and food insecurity. With fewer resources and less ability to diversify their income, poor households have to spend more money in absolute terms in order to satisfy their calorie requirements (ibid.). Political marginalization also exists. As Ntiati (2002) points out, it is the richer members of the community who are able, for example, to support the process of sub-division of Group Ranches and in return obtain first choice on the land. With most favorable land being located close to waterways often leaves the poorer households with less desirable land.

Many of the Project Activities of the Chyulu Hills REDD+ Project are focused at these two groups. This includes new income generating activities, such as micro finance and craft groups, healthcare and school fee bursaries, to name a few. Additionally, the Project will increase community organization to ensure that these groups have a strong voice and a established communication channel to the Project Management.

Demonstration of net-positive benefits to these groups, an analysis of barriers or risks that may prevent benefits reaching these groups as well as identifying marginalized/vulnerable groups whose well-being may be negatively affected by the project will be carried out post-validation.

6.3.5 Community Impact Monitoring will be able to identify positive and negative impacts on poorer and more vulnerable groups Biodiversity (GL2.5).

The Chyulu Hills REDD+ Project places great emphasis on women empowerment. Women have been involved in project design through their representation in various advisory committees, as outlined in section 2.7.1. It is also anticipated to encourage girls' enrollment in schools through the allocation of an equal number of school bursaries to boys as to girls. Finally, the Chyulu Hills REDD+ Project as developed Project Activities to engage with women groups and help promote financial independence as well as decision-making amongst these women.

7 NET POSITIVE BIODIVERSITY IMPACTS (B1)

7.1.1 Estimated Changes in Biodiversity in the Project Zone as a Result of the Project (B1.1)

7.1.1.1 Result Chain Diagrams

Based on the extensive experience of the project partners (both Government and NGOs) on the biodiversity of this landscape and conservation issues, and from information obtained from the FPIC workshops and literature, we applied the theory of change approach to justify our project rationale and produce indicators for the Biodiversity Monitoring Plan. The theory of change is a hypothesis about how a project intends to achieve its intended objectives, or a roadmap of how it plans to get from project activities to project impacts (Richards & Panfil, 2011). We developed a theory of change for each of the two key issues (hereafter referred to as Focal Issues) that we intend to address in the biodiversity component of this project so as to achieve the ultimate goal of reducing deforestation, forest degradation and avoid conversion of grasslands. The Focal Issues are: Ecosystem degradation and Biodiversity declines. The assumptions we make about the cause-and-effect relationships are made explicit in the Result Chain diagrams below, from which the theories of change statements that follow are based.

Indicators were developed for key results and assumptions; including assumptions will enable us monitor them in our causal chain analysis, which will help us identify points of deviation early enough. In sum, the indicators outlined in the Monitoring Plan will enable measuring progress towards achieving the desired project outcomes and impacts from project activities and strategies.

Chyulu Ecosystem REDD+ Project's Biodiversity Focal Issues: Result Chain Diagram

Ecosystem enhancement

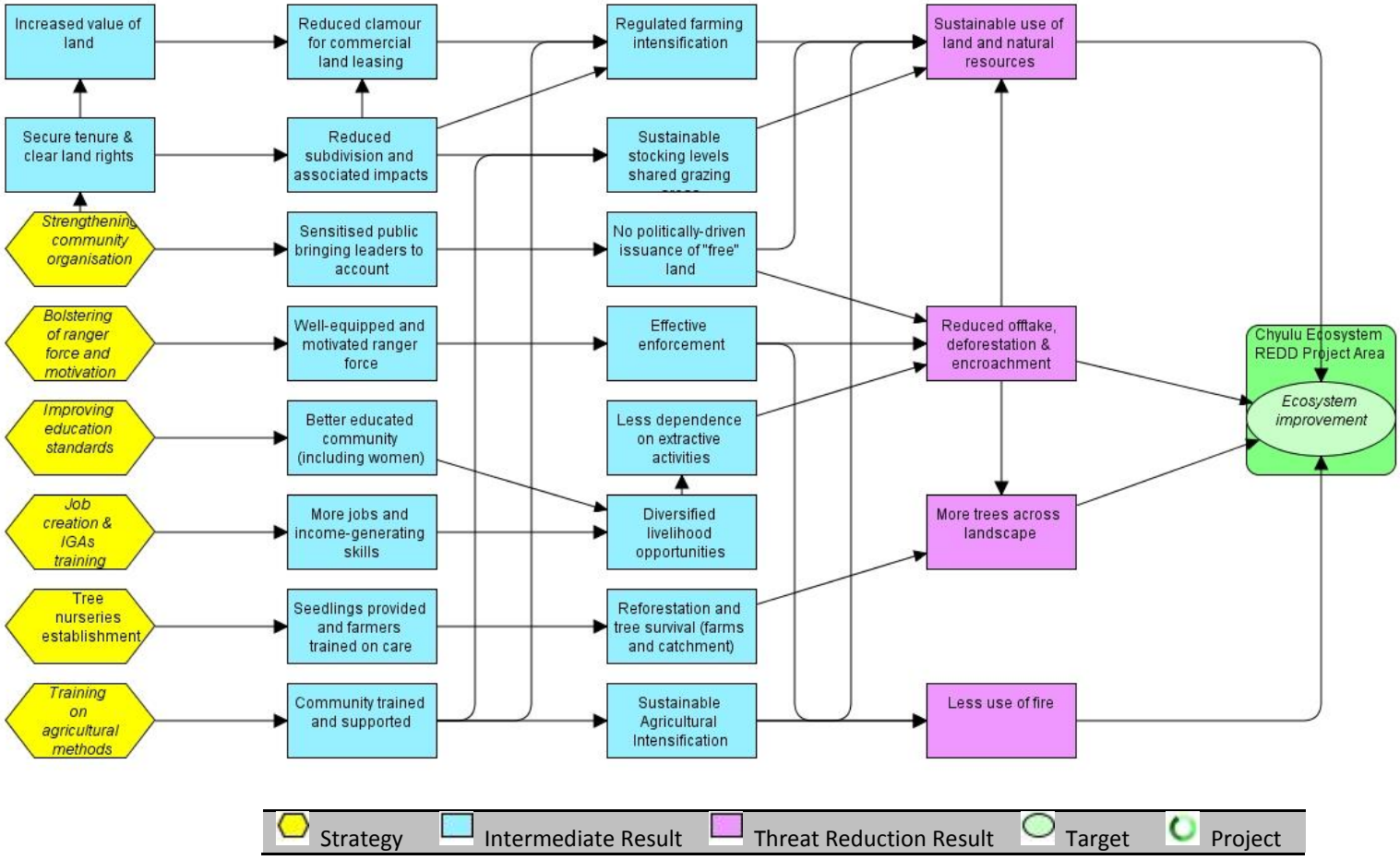


Figure 26: Ecosystem enhancement

Theory of Change Statement:

Ecosystem enhancement: IF there is sustainable agricultural intensification, IF there is sustained reforestation across the landscape, IF there is less dependence on extractive activities, and IF there is more effective enforcement, THEN there will be ecosystem improvement.

Comparison between the 'Without Project' and 'With Project' scenario

Section G2.5 outlines the 'Without Project' scenario. In summary, the direct threats to ecosystem degradation are i) unsustainable land use and low productivity, ii) encroachment, iii) unsustainable offtake and iv) fire. In the absence of the project, these are expected to worsen and thereby lead to a further degraded ecosystem.

The Result Chain Diagram depicts how the Chyulu Hills REDD+ Project aims to enhance the ecosystem over the project's lifetime. Project activities (strategies) are designed to achieve intermediate results, which will lead to a threat reduction result that lead to an improved outcome. Strategies include both directly conservation related activities (e.g. bolstering ranger force and motivation), whilst also approaching the problem from a socio-economic angel. It is anticipated, for example, that by strengthening community organization, land tenure and land rights will be clarified, which would reduce the demand for subdivision, which in return would allow regulated farming and organized grazing agreements leading to more sustainable use of land an natural resources. Thus, the 'With Project' scenario builds a clear case for being able to enhance the ecosystem for the benefit all communities as well as wildlife.

Similar result chains from each other project activities regarding ecosystem enhancement are displayed in the above diagram, all of which support a net-positive impact of the 'With Project' scenario. Monitoring will confirm the ability of the project to achieve these positive impacts and provide information for adjusting activities and approaches over time to ensure these results are achieved.

Biodiversity improvement

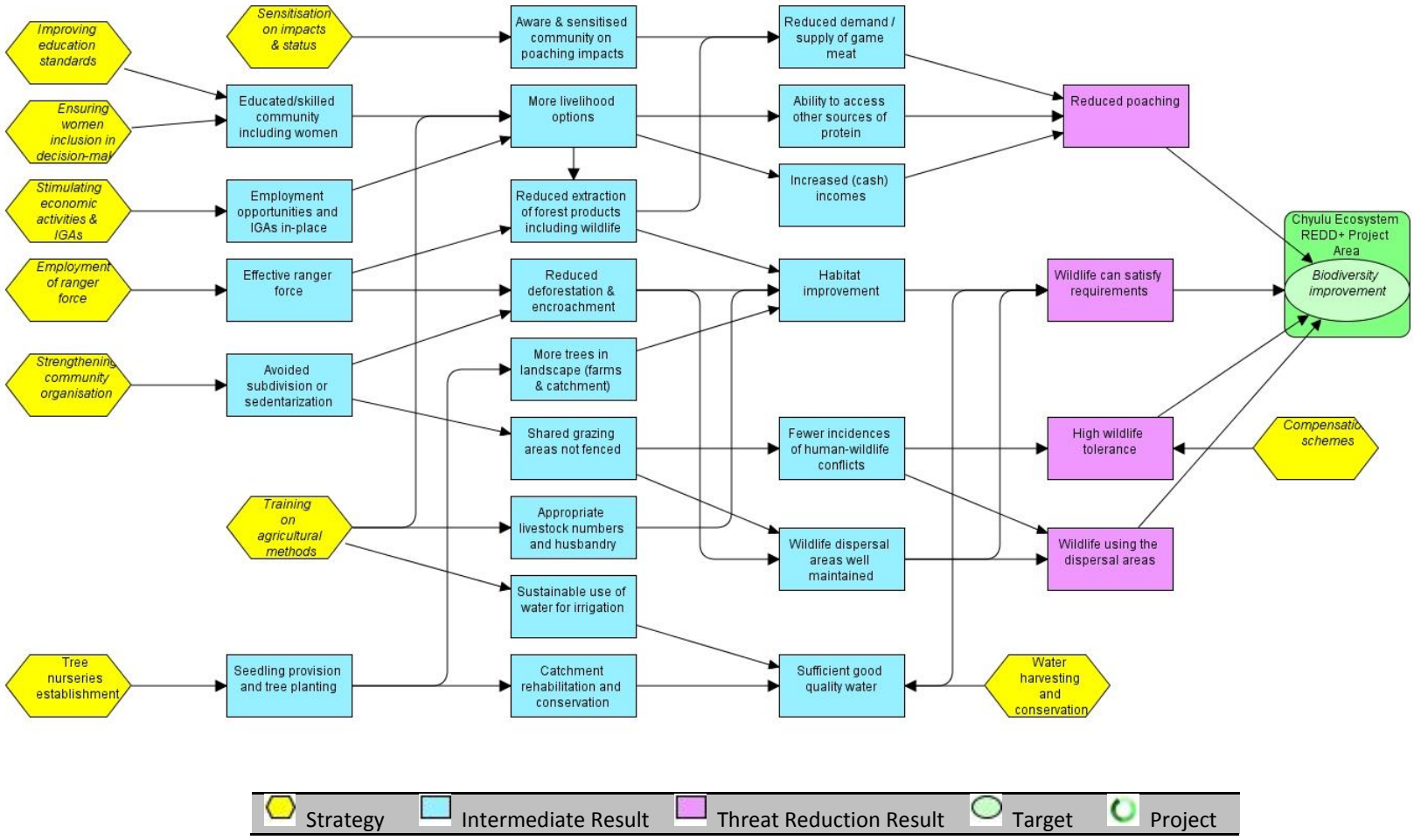


Figure 27: Biodiversity improvement

Theory of Change Statement:

Biodiversity improvement: IF livelihood diversification is achieved, IF wildlife habitat and dispersal areas are maintained, IF human-wildlife conflicts are reduced, and IF there is more effective enforcement, THEN biodiversity will flourish.

Comparison between the 'Without Project' and 'With Project' scenario

Section 4.5.3 outlines the 'Without Project' scenario. In summary, the direct threats to biodiversity include i) poaching, ii) persecution, iii) loss of access to critical resources and iv) diminished dispersal and migration. In the absence of the project, these conditions are expected to worsen and thereby lead to biodiversity decline.

The Result Chain Diagram depicts how the Chyulu Hills REDD+ Project aims to improve and safeguard biodiversity over the project's lifetime. Project activities (strategies) are designed to achieve intermediate results, which will lead to a threat reduction result that lead to an improved outcome. Strategies include both directly conservation related activities (e.g. bolstering ranger force and motivation), whilst also approaching the problem from a socio-economic angle. For example, employing more rangers will increase the effectiveness of the ranger force, which is expected to reduce deforestation and stop encroachment, which in turn result in habitat improvement. This in effect will result in a diverse habitat that is able to satisfy wildlife-use requirements, and consequently lead to improved biodiversity.

Similar result chains from each other project activities regarding biodiversity improvement are displayed in the above diagram, all of which support a net-positive impact of the 'With Project' scenario. Monitoring will confirm the ability of the project to achieve these positive impacts and provide information for adjusting activities and approaches over time to ensure these results are achieved.

7.1.1.2 Risk and Negative impact analysis

We used our theory of change rationale in the Result Chain diagrams to check for likely negative impacts and implementation risks. (NB: A negative impact is a negative side-effect of an otherwise successful result, while a risk is a threat to achieving key results in the results chain (Richards & Panfil 2011)). Focusing on the key results, we assessed the risks or assumptions in our logical framework analysis (Results Chains) that are outside the REDD+ project's control, e.g., policy or institutional reforms, which would make it difficult to implement the desired project strategies. For all the Risks and Negative Impacts identified, we assessed their likelihoods and magnitudes (should they happen), as well as possible mitigation strategies.

Risks analysis

Table 32: Risk analysis

Result	Potential Risks to Result	Likelihood of risk	Magnitude of Impact of risk	Risk mitigation strategy	Explanation
Secure tenure and reduced subdivision	National or County Land Policy	Medium	Medium	Reduce	Sensitization such that land policy & adjudication does not affect land use negatively
	Corruption	Low	Medium	Resist	Sensitization to enable community to oppose corrupt land deals
	External market forces adding pressure to sell land	Medium	High	Reduce	Strengthen land tenure to increase value; Sensitize and training to ensure agricultural intensification is done sustainably
Wildlife dispersal areas maintained thru shared grazing areas	Tragedy of the anti-commons	Low	Medium	Reduce	Strive to get the community to pass and endorse land-use associated issues collectively
Effective enforcement	Corruption	Medium	Medium	Reduce & Resist	Ranger vetting before employment; Employing technology including remote cameras and geo-spatial tools, and ensuring community is engaged in fighting poaching
Sustainable agricultural intensification	Low uptake	Low	High	Reduce	Work with the community to ensure recommendations are understood, culturally acceptable, practical and applied
Compensation for human-wildlife conflicts	Falsification of claims	Medium	High	Reduce	Have good checks, monitoring teams; Strong punitive measures
Reduced demand/supply of game meat	Resistance to change	Medium	Medium	Reduce / Remove	Work with community and relevant Government authorities to ensure subsistence poaching is reduced

					and illegal, commercial poaching severely punished
More jobs and IGAs	Stringent County laws and taxes making doing business difficult	Medium	High	Resist	Work with the County Government to support SMEs and environment-related project thru low taxation or rebates

NB: **Likelihood** and **Magnitude**: Low, Medium, High; **Risk mitigation strategy**: Reduce, Remove, Resist, Do nothing

Negative impacts (NI) analysis

Table 33: Negative impact analysis

Result	Potential NIs	Likelihood	Magnitude	Duration	Stakeholders affected	Mitigation measure	Explanation
Reduced subdivision	Loss of land rent	Medium	Low	Short	Land owners	Compensate	They will gain revenue from carbon and other land uses
Effective enforcement	Loss of income	High	Medium	Short	Charcoal burners and wood carvers	Minimize	They will lose the illegal component but have sustainable harvesting including NTFPs and gain other IGAs
	Loss of livelihoods	High	Medium	Short	Women, Landless	Minimize / Compensate	Provide alternative sources of livelihood e.g., food and fuel & NTFPs
More education, jobs and income	Social disruption	Medium	Medium	Medium	Those receiving education, training and employment	Minimize	Ensure community sets up strong local

							institutions & structures (including cultural) to guard against this
	Increased consumption and new needs & tastes (e.g., game meat)	Low	Medium	Medium	Land owners and other beneficiaries	Minimize	Build community cohesion; Sensitize on impacts of such changes
Wildlife using the dispersal areas	Increased human-wildlife conflicts	Medium	Medium	Long	Agriculturists, Pastoralists	Minimize & Compensate	Improve wildlife habitats; Promote compatible land uses; Compensate unmitigated losses
	Increased competition for forage excluding livestock	Low	Medium	Long	Pastoralists	Minimize	Have corridors to facilitate wildlife movement in and out of the area

NB: **Likelihood** and **Magnitude**: Low, Medium, High; **Duration**: Short, Medium, Long; **Mitigation measure**: Eliminate, Minimize, Compensate, Do nothing

7.1.2 No Negative Affect on HCVs as a Result of the Project (B1.2)

The following biodiversity related HCVs have been identified per Section 1.3.6:

- G1.8.1 b) Endangered and Vulnerable plant and animal species
- G1.8.1 c) 9 Endemic subspecies and races
- G1.8.1 d) Significant concentrations of a species during any time in their life cycle
- G1.8.2 Viable populations of plants and animals in natural patterns of distribution and abundance
- G1.8.3 Threatened ecosystems

By protecting habitats, safeguarding water availability and ensuring landscape connectivity, these high conservation values will be much better in the 'With Project' versus 'Without Project' scenario for the reasons noted above.

7.1.3 Species Used by the Project, Including and Invasive Species (B1.3)

No non-native species will be used in the Project Accounting Areas. The Project does not include any planting in the Project Area as a Project Activity and does not intend to initiate any during the crediting period. All farms in the Project Zone have been excised from the Project Accounting Area a priori.

7.1.4 Potential Adverse Effects of Non-native Species, Including Impacts on Native Species and Disease Introduction or Facilitation, and Justification for their Use over Native Species (B1.4)

As discussed in Section 7.1.3 above, no non-native species will be used in this project.

7.1.5 Genetically Modified Organisms (B1.5)

No GMOs will be used to generate GHG reductions or removals.

7.2 Negative Offsite Biodiversity Impacts (B2)

7.2.1 Potential Negative Offsite Impacts on Biodiversity (B2.1)

There is little chance of having significant negative biodiversity impacts outside the Project Zone for two reasons. Firstly, the sources of threat to biodiversity are mainly local and they are unlikely to be transferred outside the Project Zone (e.g. fuel wood collection and subsistence poaching). Secondly, commercial poaching threats, which could be transferred further, are unlikely to be because of the national drive and commitment to reducing poaching and should show an overall decrease.

7.2.2 Mitigation of Potential Negative Offsite Impacts on Biodiversity (B2.2)

Due to the reasoning outlined in Section 7.2.1, mitigation strategies are non-applicable.

7.2.3 Evaluation of Unmitigated Negative Offsite Impacts against the Biodiversity Benefits of the Project within the Project Boundaries (B2.3)

As there are no anticipated negative offsite impacts to biodiversity, evaluation of unmitigated offsite impacts is not applicable.

7.3 Exceptional Biodiversity Benefits (GL3)

7.3.1 Vulnerability: Critically Endangered (CR) and Endangered (EN) species - presence of at least a single individual (GL3.1).

7.3.1.1 Vulnerability: Critically Endangered (CR) and Endangered (EN) species

There are a number of plant and animal species in the Project Area that are classified as either near threatened, vulnerable, endangered or critically endangered. The following lists threatened species according to the IUCN within the Project Area:

Critically endangered (CR):

i. Black rhinos *Diceros bicornis*

Endangered (EN):

ii. Wild dogs *Lycaon pictus*
iii. Basra reed warbler *Acrocephalus griseldis* (migrant)
iv. *Afrocarpus usambarensis* (tree)
v. White-backed Vulture *Gyps africanus*
vi. Rüppell's Vulture *Gyps rueppelli*
vii. Hooded Vulture *Necrosyrtes monachus*

Vulnerable (VU):

viii. African Elephant *Loxodonta Africana*
ix. Cheetah *Acinonyx jubatus*
x. Lion *Panthera leo*
xi. Abbott's Starling *Cinnyricinclus femoralis*
xii. Martial Eagle *Polemaetus bellicosus*
xiii. Lappet-faced Vulture *Torgos tracheliotos*
xiv. Red stinkwood *Prunus africana*

Near-Threatened (NT):

xv. Leopard *Panthera pardus*
xvi. Gerenuk *Litocranius walleri*
xvii. Lesser kudu *Tragelaphus imberbis*
xviii. Thompson's gazelle *Eudorcas thomsonii*

In addition, a Kenya has created a national species list that defines species' status using IUCN criteria, yet applies it to species at the national level. Although not independently validated, this National List of Species is found in the Sixth Schedule of the Wildlife Conservation and Management Bill, 2013. The following species thereby are identified nationally as Critically Endangered, Endangered, and Vulnerable.

Mammals:

Critically Endangered
- Black rhinoceros (*Diceros bicornis*)

Endangered
- African Wild Dog (*Lycaon pictus*)
- African Elephant (*Loxodonta Africana*)
- African Lion (*Panthera Leo*)
- Cheetah (*Acinonyx jubatus*)
- Striped hyaena (*Haeyna haeyena*)
- Leopard (*Panthera pardus*)

Vulnerable
- African Golden Cat (*Profelis aurata)*
- Kenyan big-eared free-tailed bat (*Tadarida lobata*)
- Red Bush Squirrel (*Paraxerus palliates*)
- Vermiculate shrew (*Crocidura Xantippe*)
- Spotted hyaena (*Crocuta crocuta*)
- Lesser Kudu (*Tragelaphus imerbis*)
- Greater Kudu (*Tragelaphus stripsiceros*)

Birds

Endangered
- Egyptian Vulture (*Neophron percnopterus*)

Vulnerable
- Lesser Kestrel (*Falco naumanni*)
- Lapped-faced Vulture (*Torgos tracheliotos*)
- White-headed Vulture (*Trigonoceps occipitalis*)
- Madagascar Pratincole (*Glareola ocularis*)
- Abott's Starling (*Cinnyricinclus femoralis*)

Reptiles

Endangered
- Rock python (*Python sebae*)

Trees

Endangered
- East African Sandalwood (*Osyris lanceolata*)

Vulnerable
- Red stinkwood (*Prunus Africana*)

7.3.1.2 Eastern Black Rhinos

The Project Zone contains a site of global significance for biodiversity conservation. As outlined in Section 1.3.6.3, the Project Zone is home to a small remaining population of the Eastern Black Rhino (*Diceros bicornis*) population, which is classified by the IUCN as Critically Endangered (CE), meaning they "face an extremely high risk of extinction in the wild". In total, there are c. 799 *Diceros bicornis michaeli* (as at 31 December 2012, figures provided by the IUCN SSC African Rhino Specialist Group), of which 631 are in Kenya, 100 in Tanzania and 68 are out-of-range in South Africa. The black rhino has been identified as a trigger species due to the fact that they occur naturally at the site. These rhinos represents one of the last wild populations in Kenya, as most rhino today are kept in fenced sanctuaries, and their survival is key if there is to be any hope for the future of this species in the wild. Globally, rhinos are under severe threat of poaching, which makes the sanctuary even more important.

The Rhino Area in the Project Zone extends from KARI Kiboko, the Chyulu Hills National Park to Mbirikani Group Ranch in the north of the Project Area and has been identified as a site of high biodiversity conservation priority. About 80% of the Chyulus' black rhinos' home range is inside the Chyulu Hills National Park, and the other 20% outside the park on community land (KWS, 2009). The total rhino area is 1,195km² or 119500 ha (Save the Rhino, retrieved 20 February 2014).

Rhino population trend

From 1970 to the early 1980s the numbers and range of black rhinos in Africa declined drastically. The black rhino population in Kenya underwent drastic decline from about 10,000 animals in the 1950s to less than 400 in the 1980s (KWS, 2009). To date, there are approximately 620 black rhinos in Kenya. A small number of these live in the Chyulu Hills. In 2009, a study undertaken by KWS established that the minimum number of individuals in the Chyulu Hills National Park is 14, with a sex ratio of 7 males, 6

females and 1 unsexed individual (KWS, 2009). This population was found to be inbred and there is a dire need for genetic rescue through introductions of new genes from other populations in Kenya (ibid.).

In 2013, the population was still estimated at 14. Three new calves were born in that year, though three further rhinos were also lost to poaching. Poaching for the international illegal trade in rhino horn is the main, and most obvious, threat to the Eastern black rhinos. Given the critical status of the black rhinos and risk to its continued existence, it is of vital importance to enhance security in the Chyulu Hills REDD+ Project Area. In the absence of the REDD+ project, it is likely that project partners will not be able to provide adequate protection due to shortage of resources and funds, which could lead to a decline and possibly extinction of the rhinos in the Chyulu Hills landscape.

Measures to enhance population status

In order to enhance the protection and population status of the black rhinos, KWS and BLF have identified a number of measures. These include increased anti-poaching and monitoring patrols, rhino dung DNA analysis, afforestation program, improved landscape management and water availability, as well as community involvement.

A key goal is to designate the northern end of the Chyulu Hills as an IPZ (Intensive Protection Zone), with increased manpower, a new waterhole and a fence on the eastern boundary, to allow the translocation of more black rhino into the park, bringing this important rhino population up to viable breeding levels (Save the Rhino, seen 24 February 2014).

7.3.1.3 Other species

There are a number of other threatened species in the Project Zone. The most obvious is the presence of African elephants (*Loxodonta Africana*) that use the Project Zone as a corridor between Tsavo West National Park and Amboseli National Park. As stated in section 1.3.6.3. African elephants are classified as vulnerable (VU). Presence of other species include lions (*Panthera leo*) and cheetah (*Acinonyx jubatus*), who are also both IUCN classified as vulnerable (VU). There have also been occasional sightings of the endangered (EN) wild dogs (*Lycaon pictus*), and despite the lack of further scientific information of their population, it is confirmed that wild dogs use the Project Zone as a dispersal area. Finally, a recent biodiversity assessment report recorded a number of species of conservation interest within the Project Zone, including the endangered (EN) white backed vulture (*Gyps africanus*) and Vulnerable (VU) Martial Eagle (*Polemaetus bellicosus*) (Githiru *et al.*, 2011). Other globally-threatened bird species mentioned as likely in the area although not recorded during that assessment include Abbott's Starling (*Cinnyricinclus femoralis*) and Lappet-faced Vulture (*Torgos tracheliotos*), both designated as VU.

Endemic Species

To our knowledge, there are no full species that are endemic to the Project Area; but there are a number of endemic sub-species (races) particularly in the Chyulu Hills National Park, perhaps reflecting the relatively young age (in evolutionary terms) of these hills. More research needs to be undertaken to investigate further endemism in the area. The following sub-species are known to be endemic:

- Birds: endemic races of:
    - Shelley's Francolin *Francolinus shelleyi*
    - White-starred Robin *Pogonocichla stellata*
    - Orange Ground Thrush *Zoothera gurneyi chyulu*
- Butterflies:

- *Pentila tropicalis chyulu*
- *Acraea anacreon chyulu*
- *Papilio desmondi desmondi*
- *Amauris echeria chyuluensis*

- Amphibians
  - *Afrixalus pygmaeus septentrionalis*

8 MONITORING

8.1 Description of the Monitoring Plan (CL3, CM3 & B3)

8.1.1 Develop Plan for Community Monitoring (CM3.1)

The selection of appropriate indicators is considered to be invaluable to the impact assessment process, as they respond to the basic question: "what should be measured in order to show that the claimed net social benefits are real and additional?" (Richards & Panfil 2011). An ideal indicator from the perspective of showing attribution is one that measures an 'intermediate state' or assumption between an output and outcome or an outcome and an impact, clearly showing progress along a causal chain. Again, our theory of change logic in the Result Chain diagrams (section 6.1.1.1.) provided us with a good basis for selecting indicators that factor in attribution. We determined a total of **34 indicators** in three categories: Output 18; Outcome 11; and Impact 5. We then decided on the best sampling methods to use to collect these data, keeping in mind the need to achieve acceptable levels accuracy, precision and cost effectiveness whilst retaining transparency and simplicity. From this, a monitoring plan was designed to collect information on the identified indicators. For the Chyulu Hills REDD+ project, we shall use two major data sources for these indicators: In-house reporting systems and Household interviews. In addition, Focal Group Discussions will be used to validate findings and obtain any further information/clarification, while Government departments will be visited for secondary data about the general community. In-house reporting will mainly follow input and output indicators (and some outcome too), while the other methods will mainly assess outcome and impact indicators.

Social Impact Assessment: Monitoring Plan

Table 34: Social impact assessment

Key results	Indicator	Indicator type	Data collection method	Who?	When?
Community organisation and sensitisation initiatives	Voluntary membership to Community Groups	Output	Household survey	Social Monitoring team	Annually
	Access to weather and market information	Output	Household survey	Social Monitoring team	Annually
Sustainable agricultural intensification	No. of farmers trained	Output	Internal report	Community Outreach; Min. of Agriculture	Quarterly

	No. of farms incorporating Conservation Agriculture (CA) or other methods	Output	Internal report	Community Outreach; Min. of Agriculture	Quarterly
	Level of productivity from farms undertaking CA or other methods	Outcome	Internal report	Community Outreach; Min. of Agriculture	Quarterly
	No. of different products derived from farms	Outcome	Household survey	Social Monitoring team	Annually
	Number of hunger months	Impact	Household survey	Social Monitoring team	Annually
Water catchments conserved	No. of trees planted & surviving on degraded catchments	Output	Internal report	Greenhouse team & KFS	Annually
	Other conservation activities on catchment	Output	Internal report	Greenhouse team & KFS	Annually
	No. of new or improved water harvesting initiatives implemented	Output	Internal report	Operations team	Annual
	Amount of water extracted from key catchments	Outcome	Survey of users including households	Social Monitoring team & M. of Water	Seasonally
	Water levels/flow from catchment	Impact	Hydrological assessment	Social Monitoring team & M. of Water	Seasonally
Soil erosion controlled	No. of trees planted & surviving outside Protected Areas	Output	Internal report	Greenhouse team & KFS	Annually
	Other SLM activities on agricultural areas	Outcome	Household survey	Social Monitoring team	Annually
Communal grazing areas retained	Proportion of ranch subdivided and under different land uses	Output	Ranch records	Community Outreach	Annually
	No. of settlements or individual fenced farms or size of areas fenced off	Output	Ranch records	Community Outreach	Annually
Livelihood diversification enhanced	No. of training event on IGAs and micro-finance schemes	Output	Internal report	Community Outreach	Annually

	No. of new IGAs established	Output	Internal report	Community Outreach	Quarterly
	No. of new local employment opportunities created	Outcome	Internal report	Human Resources team	Quarterly
	No. of new businesses (SMEs) initiated	Outcome	Internal report	Community Outreach	Annually
	Income levels and sources at household level	Impact	Household survey	Social Monitoring team	Annually
	No. of physical assets, structures & utilities in household	Impact	Household survey	Social Monitoring team	Annually
Reduced human-wildlife conflicts	No. of human-wildlife conflicts (crops, livestock, human, property)	Output	Internal report	Human-wildlife conflict monitoring team	Seasonally
	Amount of compensation paid out for wildlife-related losses	Outcome	Internal report	Human-wildlife conflict monitoring & Finance teams	Seasonally
Positive attitudes towards education	No. of education-related awareness raising meetings	Output	Internal report	Community Outreach	Annually
	No. of students and amount spent on bursaries and scholarships	Output	Internal report	Community Outreach & M. of Education	Annually
	No. of primary and secondary school students not in school	Outcome	Household survey	Social Monitoring team	Annually
	Highest level of education attained in household	Outcome	Household survey	Social Monitoring team	Annually
Improved education infrastructure	No. of schools in the area	Output	Internal report	Community Outreach & M. of Education	Annually
	Average distances to nearest Primary and Secondary schools	Outcome	Household survey	Social Monitoring team	Annually
	No. of schools built, renovated or supplied with furniture	Output	Internal report	Community Outreach & Operations teams	Annually
Better teaching standards	No. of teachers employed or incentivised	Output	Internal report	Community Outreach & M. of Education	Annually

	Average student:teacher ratios	Outcome	Internal report	Community Outreach & M. of Education	Annually
	School performances	Impact	Internal report	Community Outreach & M. of Education	Annually

8.1.2 Develop Plan for HCV Monitoring (CM3.2)

High Conservation Values related to CCB indicators G1.8.4-G1.8.5 (see section 1.3.6) are expected to be positively impacted by the increased conservation-focused activities. The major community-related HCV ecosystem services were water provisioning and erosion control, both of which are captured in the Monitoring Plan above.

8.1.3 Commit to Developing a Full Monitoring Plan (CM3.3)

The Chyulu Hills REDD+ Project will disseminate the monitoring plan and the results of the monitoring within 12 months of validation. These documents will be made publically available on the internet and communicated to the communities and other stakeholders.

8.1.4 Initial Plan for Selecting Biodiversity Variables to be Monitored, and Monitoring Frequency (B3.1)

Indicators are important in impact assessment because they respond to the basic question “what should be measured in order to show that the claimed net social benefits are real and additional” (Richards & Panfil 2011)? An ideal indicator from the perspective of showing attribution is one that measures an ‘intermediate state’ or assumption between an output and outcome or an outcome and an impact, clearly showing progress along a causal chain (Richards & Panfil, 2011). Thus, we used our theory of change logic in the Result Chain diagrams (section 7.1.1.1.) as the basis for selecting indicators that factor in attribution. We then decided on the best sampling methods to use to collect these data to acceptable levels accuracy, precision and cost effectiveness whilst retaining transparency and simplicity. From this, a Monitoring Plan was developed to guide data collection.

Further, the indicators will be analyzed based on the **Pressure-State-Response framework,** which also relies on a causal-chain logic, where threats negatively impact the status/condition of biodiversity, while responses or project interventions reduce pressure. Most **Response** indicators can be grouped under: Habitat improvement; Security enhancement; Employment of locals; Alternative sources of income; and Human-wildlife conflict alleviation efforts. **Pressure** indicators fall under: Human population size and dynamics; Human-wildlife conflict (HWC); and Incidences (OI) including poaching, grazing, encroachment, charcoal and firewood collection. Finally, **State** indicators are grouped into three categories: wildlife (including species presence, diversity, distribution and movement); vegetation (including species composition and diversity, distribution, disturbance and regeneration); and land-uses (including changes in various vegetation/habitat types, encroachment and fire). Twenty-two (22) of these indicators (especially response and pressure indicators) correspond to the 34 Social indicators developed in CM 4, and so data collection follows the protocols outlined therein. On top, we determined **14 indicators** not part of the Social indicator set, also classified into three categories: Output **3**; Outcome **7**; and Impact **4**. For these new indicators, two main strategies will be used to obtain the data: In-house reporting, mostly for response and pressure indicators, and Fieldwork for most state indicators. We

envision three main aspects of state indicators to measure, each with a fairly distinct set of monitoring protocols:

- Wildlife: wildlife surveys and monitoring for all species – with a focus on HCVs – will be done using several methods: permanent road transects, ranger patrols, camera traps, aerial surveys, daily logs, and information from other research projects.
- Vegetation: two main methods to be used here are carbon plot monitoring and vegetation transects surveys e.g., radiating away from waterholes.
- Land use: monitoring major land-use changes (e.g., fire effects, encroachment) shall done using remote sensing (based on LANDSAT imagery) and GIS techniques.

Biodiversity Impact Assessment: Monitoring Plan

vcsTable 35: Project biodiversity impact assessment for monitoring plan.

Key results	Indicator	Indicator type	Data collection method	Who?	When?
Sustainable agricultural intensification	*Five indicators included in the SIA Monitoring Plan*				
Water catchments conserved	*Five indicators included in the SIA Monitoring Plan*				
Soil erosion controlled	*Two indicators included in the SIA Monitoring Plan*				
Communal grazing areas retained	*Two indicators included in the SIA Monitoring Plan*				
	No. of livestock in the wildlife dispersal area	Output	Transect censuses	Biodiversity Monitoring team	Quarterly
	No., diversity and distribution of wildlife in the wildlife dispersal area	Impact	Transect censuses (mammals, birds & reptiles)	Biodiversity Monitoring team	Quarterly
	Evidence of movement in-and-out of the dispersal area	Impact	Transect censuses, Camera traps & Ranger patrols	Biodiversity Monitoring & Security teams	Quarterly
Livelihood diversification enhanced	*Six indicators included in the SIA Monitoring Plan*				
Reduced human-wildlife conflicts	*Two indicators included in the SIA Monitoring Plan*				

Effective enforcement	No. of rangers employed	Output	Internal Report	Human Resource team	Annually
	No. of patrols done (and distances covered)	Output	Internal Report	Security team	Quarterly
	No. of poachers arrested	Outcome	Ranger patrols	Security team, KWS & KFS	Quarterly
	No. of landless encroaching into Protected Areas	Outcome	Ranger patrols	Security team, KWS & KFS	Biannually
	No. of snares found	Outcome	Ranger patrols	Security team	Quarterly
	No. of significant fires recorded	Outcome	Ranger patrols	Security, RS/GIS teams & KFS	Annually
	No. of charcoal kilns/bags and firewood amounts recorded	Outcome	Ranger patrols	Security & Biodiversity Monitoring teams	Quarterly
	No. of carcasses recorded	Outcome	Ranger patrols & Transects	Security & Biodiversity Monitoring teams	Quarterly
Biodiversity improvement	No., diversity and distribution of wildlife in the Protected Areas	Impact	Transect censuses, Camera traps & Ranger patrols	Biodiversity Monitoring & Security teams	Quarterly
Ecosystem improvement	Rates of tree disturbance and regeneration	Outcome	Carbon plot monitoring; Transect surveys	Carbon sampling team	Annually
	Abundance and diversity of plants	Impact	Carbon plot monitoring; Transect surveys	Carbon sampling team	Annually

8.1.5 Initial Plan for Assessing the Effectiveness of Measures to Maintain or Enhance Biodiversity HCVs (B3.2)

Biodiversity HCVs, such as critically endangered species, key threatened ecosystems and ecosystem services, biome, corridor function, are captured in the Monitoring Plan above.

8.2 Data and Parameters Available at Validation (CL3)

PDR.121 The value for each variable in the Methodology VM0009 Appendix G

Data Unit / Parameter:	α
Data unit:	Unitless

Description:	Combined effects of β and θ at the start of the historic reference period for the Forest Project Accounting Area
Source of data:	Reference area and historic reference period
Value applied:	-0.56731
Justification of choice of data or description of measurement methods and procedures applied:	Time and place in which the logistic model is fit
Any comment:	

Data Unit / Parameter:	$\boldsymbol{\alpha}$
Data unit:	Unitless
Description:	Combined effects of β and θ at the start of the historic reference period for the Grassland Project Accounting Area
Source of data:	Reference area and historic reference period
Value applied:	-1.13912
Justification of choice of data or description of measurement methods and procedures applied:	Time and place in which the logistic model is fit
Any comment:	

Data Unit / Parameter:	$\boldsymbol{\beta}$
Data unit:	unitless
Description:	Effect of time on the cumulative proportion of conversion over time for Forest Project Accounting Area
Source of data:	Reference area and historic reference period
Value applied:	0.000103
Justification of choice of data or description of measurement methods and procedures applied:	Time and place in which the logistic model is fit
Any comment:	

Data Unit / Parameter:	$\boldsymbol{\beta}$
Data unit:	unitless
Description:	Effect of time on the cumulative proportion of conversion over time for Grassland Project Accounting Area
Source of data:	Reference area and historic reference period
Value applied:	0.000578

Justification of choice of data or description of measurement methods and procedures applied:	Time and place in which the logistic model is fit
Any comment:	

Data Unit / Parameter:	γ
Data unit:	days
Description:	Time shift from beginning of historic reference period to project start date
Source of data:	Historic reference period
Value applied:	10,725
Justification of choice of data or description of measurement methods and procedures applied:	Time in which the logistic model is fit. The start of the historic reference period is 9 May, 1984 and the project start date is 19 September, 2013.
Any comment:	

Data Unit / Parameter:	θ
Data unit:	unitless
Description:	Effect of certain covariates on the cumulative proportion of conversion over time
Source of data:	Reference area and historic reference period
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	Time and place in which the logistic model is fit
Any comment:	Parameter not used

Data Unit / Parameter:	λ_{soc}
Data unit:	proportion (unitless)
Description:	Exponential soil carbon decay parameter
Source of data:	Value from the literature. Davidson, E., and Ackerman, I. 1993. Changes in soil carbon inventories following cultivation of previously untilled soils. Biogeochemistry, 20(3), 161-193.
Value applied:	0.2
Justification of choice of data or description of measurement methods and procedures applied:	Default value from VCS methodology VM0009
Any comment:	

Data Unit / Parameter:	$\widehat{\sigma}_{EM}$
Data unit:	standard deviation (unitless)
Description:	The estimated standard deviation of the state observations used to fit the logistic function for the Forest Project Accounting Area BEM
Source of data:	Remote sensing image interpretation
Value applied:	0.43027
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	$\widehat{\sigma}_{EM}$
Data unit:	standard deviation (unitless)
Description:	The estimated standard deviation of the state observations used to fit the logistic function for the Grassland Project Accounting Area BEM
Source of data:	Remote sensing image interpretation
Value applied:	0.21912
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	$\mathcal{B}$
Data unit:	set
Description:	The set of all selected carbon pools in biomass. Is a subset of $\mathcal{C}$
Source of data:	PD
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	$\mathcal{C}$
Data unit:	set
Description:	The set of all selected carbon pools
Source of data:	Monitoring records
Value applied:	N/A

Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	$\mathcal{J}$
Data unit:	set
Description:	The set of all observations of conversion. When superscripted with a monitoring period, the conversion observations are taken for leakage analysis.
Source of data:	Remote sensing image interpretation or field observations in the leakage area.
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	$\mathcal{M}$
Data unit:	set
Description:	The set of all monitoring periods
Source of data:	Monitoring records
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	$\mathcal{T}$
Data unit:	ha
Description:	The set of all species/categories of livestock
Source of data:	Monitoring records
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	Parameter not used

Data Unit / Parameter:	A_{PAA}
Data unit:	ha

Description:	Area of Forest Project Accounting Area
Source of data:	GIS analysis prior to sampling
Value applied:	265,547.07
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	A_{PAA}
Data unit:	ha
Description:	Area of Grassland Project Accounting Area
Source of data:	GIS analysis prior to sampling
Value applied:	109,130.57
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	A_{PX}
Data unit:	ha
Description:	Area of proxy area for the Forest Project Accounting Area
Source of data:	GIS analysis prior to sampling
Value applied:	
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	A_{PX}
Data unit:	ha
Description:	Area of proxy area for the Grassland Project Accounting Area
Source of data:	GIS analysis prior to sampling
Value applied:	
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	$c_{L\,p}$
Data unit:	tCO2e/ha
Description:	Carbon stocks in project leakage area
Source of data:	Leakage area sampling
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	Direct measurement
Any comment:	Parameter not used

Data Unit / Parameter:	$f_{LS\,i}$
Data unit:	kg CH4 head-1 yr-1
Description:	Emission factor for the defined livestock population, i
Source of data:	IPCC default values
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	Obtained directly from IPCC default values
Any comment:	Parameter not used

Data Unit / Parameter:	m
Data unit:	tCO2e/ha
Description:	Average carbon in merchantable trees cut each year as a result of legally-sanctioned commercial logging
Source of data:	Timber harvest plans or measurement of carbon stocks in merchantable trees in the project accounting area.
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	Should use the most accurate of the two data sources if both are available
Any comment:	Parameter not used

Data Unit / Parameter:	n_d
Data unit:	unitless
Description:	Number of spatial points in the Forest Project Accounting Area reference area
Source of data:	Remote sensing image interpretation
Value applied:	10,285

Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	n_d
Data unit:	unitless
Description:	Number of spatial points in the Grassland Project Accounting Area reference area
Source of data:	Remote sensing image interpretation
Value applied:	1,508
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	o_i
Data unit:	unitless
Description:	State observation for the ith sample point in the Forest Project Accounting Area reference area
Source of data:	Remote sensing image interpretation
Value applied:	See Annex 14 – BEM Export Grid Forest PAA
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	o_i
Data unit:	unitless
Description:	State observation for the ith sample point in the Grassland Project Accounting Area reference area
Source of data:	Remote sensing image interpretation
Value applied:	See Annex 14 – BEM Export Grid Grassland PAA
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	$p_{L\,ME}$

Data unit:	unitless
Description:	Portion of leakage related to market
Source of data:	VCS methodology VM0009 Section 8.3.3
Value applied:	0
Justification of choice of data or description of measurement methods and procedures applied:	No market leakage from project
Any comment:	Parameter not used

Data Unit / Parameter:	q
Data unit:	days
Description:	Lag between start of degradation and conversion
Source of data:	Expert knowledge, results from the PRA or reports from peer-reviewed literature
Value applied:	0
Justification of choice of data or description of measurement methods and procedures applied:	Commonly accepted methods in the social sciences, choice determined and justified by Project Proponent
Any comment:	Parameter not used

Data Unit / Parameter:	$r_{CF\,b}$
Data unit:	unitless
Description:	Carbon fraction of biomass for burned wood or herbaceous material b
Source of data:	Literature estimates or direct measurement
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	No burning of wood or herbaceous material in project
Any comment:	Parameter not used

Data Unit / Parameter:	r_{RS}
Data unit:	unitless
Description:	Expansion factor for above-ground biomass to below-ground biomass (root/shoot ratio)
Source of data:	IPCC Guidelines for National Greenhouse Gas Inventories, 2006, Volume 4: Agriculture, Forestry and Other Land Use, Chapter 4: Forest Land, Table 4.4
Value applied:	0.4

Justification of choice of data or description of measurement methods and procedures applied:	IPCC default value for Tropical shrubland
Any comment:	

Data Unit / Parameter:	r_U
Data unit:	unitless
Description:	Onset proportion of conversion immediately adjacent to project area
Source of data:	GIS analysis and image interpretation
Value applied:	0.3965
Justification of choice of data or description of measurement methods and procedures applied:	Measured using GIS
Any comment:	

Data Unit / Parameter:	t
Data unit:	days
Description:	Time since project start date
Source of data:	Monitoring records
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	t_i
Data unit:	days
Description:	The point in time of the observation made at point i
Source of data:	Remote sensing image interpretation
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	t_{PA}
Data unit:	days

Description:	Time prior to the project start date when the primary agent began commercial logging in the Project Accounting Area.
Source of data:	Harvest plans prepared for the project accounting area, or by public record
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	Parameter not used

Data Unit / Parameter:	t_m
Data unit:	days
Description:	Length of project or logging in baseline scenario
Source of data:	PD
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	Parameter not used

Data Unit / Parameter:	t_{PL}
Data unit:	days
Description:	Length of project crediting period
Source of data:	PD
Value applied:	10,957
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	t_{PAI}
Data unit:	days
Description:	Number of days after the project start date for the start of a project activity instance in a grouped project
Source of data:	PD
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	w_i
Data unit:	unitless
Description:	weight applied to the ith sample point in the Forest Project Accounting Area reference area
Source of data:	Remote sensing image interpretation
Value applied:	See Annex 14 – BEM Export Grid Forest PAA
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	w_i
Data unit:	unitless
Description:	weight applied to the ith sample point in the Grassland Project Accounting Area reference area
Source of data:	Remote sensing image interpretation
Value applied:	See Annex 14 – BEM Export Grid Grassland PAA
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	x
Data unit:	unitless
Description:	Covariate values
Source of data:	Participatory Rural Appraisal, analysis of public records, and/or expert interpretation of inventory data or remotely sensed imagery
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	Should use the most accurate of the data sources if both are available
Any comment:	Parameter not used

Data Unit / Parameter:	x_i
Data unit:	geographic coordinates
Description:	Latitude of the ith sample point
Source of data:	Remote sensing image interpretation

Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	x_o
Data unit:	unitless
Description:	Covariate values as of the project start date
Source of data:	Participatory Rural Appraisal, analysis of public records, and/or expert interpretation of inventory data or remotely sensed imagery
Value applied:	
Justification of choice of data or description of measurement methods and procedures applied:	Should use the most accurate of the data sources if both are available
Any comment:	Parameter not used

Data Unit / Parameter:	x_{SA}
Data unit:	unitless
Description:	Covariate values as of the arrival of the secondary agents
Source of data:	Participatory Rural Appraisal, analysis of public records, and/or expert interpretation of inventory data or remotely sensed imagery
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	Should use the most accurate of the data sources if both are available
Any comment:	Parameter not used

Data Unit / Parameter:	y_i
Data unit:	geographic coordinates
Description:	Longitude of the ith sample point
Source of data:	Remote sensing image interpretation
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

8.3 Data and Parameters Monitored (CL3, CM3 & B3)

Data Unit / Parameter:	$w^{[m]}$
Data unit:	set
Description:	The set of all burned wood or herbaceous material
Source of data:	Monitoring records
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	N/A
Any comment:	Parameter not used

Data Unit / Parameter:	$A_{B\,\Delta\,PAA}^{[m]}$
Data unit:	ha
Description:	Area of avoided conversion
Source of data:	Generated from equation
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.3.3.4
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.52]
Any comment:	Parameter not used

Data Unit / Parameter:	$A_{P\,1}^{[m=0]}$
Data unit:	ha
Description:	Area of Forest Project Accounting Area stratum 1 prior to first verification event – Cloud Forest
Source of data:	GIS analysis prior to sampling
Description of measurement methods and procedures to be applied:	GIS analysis of best available data
Frequency of monitoring/recording:	First monitoring period
Value applied:	4,823
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Cross-check of GIS analysis

Calculation method:	GIS analysis
Any comment:	

Data Unit / Parameter:	$A_{P\,2}^{[m=0]}$
Data unit:	ha
Description:	Area of Forest Project Accounting Area stratum 2 prior to first verification event – Woodland/Thicket
Source of data:	GIS analysis prior to sampling
Description of measurement methods and procedures to be applied:	GIS analysis of best available data
Frequency of monitoring/recording:	First monitoring period
Value applied:	24,874
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Cross-check of GIS analysis
Calculation method:	GIS analysis
Any comment:	

Data Unit / Parameter:	$A_{P\,3}^{[m=0]}$
Data unit:	ha
Description:	Area of Forest Project Accounting Area stratum 3 prior to first verification event – Woodland-Sparse/Low
Source of data:	GIS analysis prior to sampling
Description of measurement methods and procedures to be applied:	GIS analysis of best available data
Frequency of monitoring/recording:	First monitoring period
Value applied:	53,075
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Cross-check of GIS analysis
Calculation method:	GIS analysis
Any comment:	

Data Unit / Parameter:	$A_{P\,4}^{[m=0]}$
Data unit:	ha
Description:	Area of Forest Project Accounting Area stratum 4 prior to first verification event – Lava Forest
Source of data:	GIS analysis prior to sampling
Description of measurement methods and procedures to be applied:	GIS analysis of best available data
Frequency of monitoring/recording:	First monitoring period

Value applied:	16,718
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Cross-check of GIS analysis
Calculation method:	GIS analysis
Any comment:	

Data Unit / Parameter:	$A_{P\,5}^{[m=0]}$
Data unit:	ha
Description:	Area of Forest Project Accounting Area stratum 5 prior to first verification event – Lava Forest-Sparse/Low
Source of data:	GIS analysis prior to sampling
Description of measurement methods and procedures to be applied:	GIS analysis of best available data
Frequency of monitoring/recording:	First monitoring period
Value applied:	14,558
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Cross-check of GIS analysis
Calculation method:	GIS analysis
Any comment:	

Data Unit / Parameter:	$A_{P\,6}^{[m=0]}$
Data unit:	ha
Description:	Area of Forest Project Accounting Area stratum 6 prior to first verification event – Acacia-Savannah-Mosaic
Source of data:	GIS analysis prior to sampling
Description of measurement methods and procedures to be applied:	GIS analysis of best available data
Frequency of monitoring/recording:	First monitoring period
Value applied:	151,499
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Cross-check of GIS analysis
Calculation method:	GIS analysis
Any comment:	

Data Unit / Parameter:	$A_{P\,1}^{[m=0]}$
Data unit:	ha

Description:	Area of Grassland Project Accounting Area stratum 1 prior to first verification event – Grassland
Source of data:	GIS analysis prior to sampling
Description of measurement methods and procedures to be applied:	GIS analysis of best available data
Frequency of monitoring/recording:	First monitoring period
Value applied:	109,130.57
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Cross-check of GIS analysis
Calculation method:	GIS analysis
Any comment:	

Data Unit / Parameter:	$B_b^{[m]}$
Data unit:	tonnes
Description:	Biomass in burned wood or herbaceous material b
Source of data:	Measurements of biomass
Description of measurement methods and procedures to be applied:	Scale
Frequency of monitoring/recording:	Every monitoring period
Value applied:	
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Summation
Any comment:	Parameter not Used

Data Unit / Parameter:	$c_B^{[m]}$
Data unit:	tCO2e/ha
Description:	Baseline carbon stocks at the end of the current monitoring period for the Forest Project Accounting Area
Source of data:	Proxy area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 v3 Section 6.4 and Appendix B.4
Frequency of monitoring/recording:	Every monitoring period
Value applied:	5
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [B.33]
Any comment:	

Data Unit / Parameter:	$c_B^{[m]}$
Data unit:	tCO2e/ha
Description:	Baseline carbon stocks at the end of the current monitoring period for the Grassland Project Accounting Area
Source of data:	Proxy area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 v3 Section 6.4 and Appendix B.4
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [B.33]
Any comment:	

Data Unit / Parameter:	$C_{B\,BGB}^{[m]}$
Data unit:	tCO2e
Description:	Carbon not decayed in BGB at the end of the current monitoring period
Source of data:	Proxy area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 v3 Section 8.1.7
Frequency of monitoring/recording:	Every monitoring period
Value applied:	1,700,056
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.32]
Any comment:	

Data Unit / Parameter:	$C_{B\,DW}^{[m]}$
Data unit:	tCO2e
Description:	Carbon not decayed in DW at the end of the current monitoring period
Source of data:	Proxy area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 v3 Section 8.1.6
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11

QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.36]
Any comment:	

Data Unit / Parameter:	$C_{B\ SOC}^{[m]}$
Data unit:	tCO2e
Description:	Carbon not decayed in SOC at the end of the current monitoring period
Source of data:	Proxy area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1.5
Frequency of monitoring/recording:	Every monitoring period
Value applied:	5,161,218
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Subtraction
Any comment:	

Data Unit / Parameter:	$C_{B\ WP}^{[m]}$
Data unit:	tCO2e
Description:	Carbon not decayed in WP at the end of the current monitoring period
Source of data:	Proxy area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix C
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [C.1]
Any comment:	

Data Unit / Parameter:	$C_{B\ AGMT}^{[m]}$
Data unit:	tCO2e/ha
Description:	Baseline carbon stocks in above-ground merchantable trees at the end of the current monitoring period
Source of data:	Proxy area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 v3 Appendix B.2.1

Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Weighted per ha average
Any comment:	

Data Unit / Parameter:	$C_{B\ BGMT}^{[m]}$
Data unit:	tCO2e/ha
Description:	Baseline carbon stocks in below-ground merchantable trees at the end of the current monitoring period
Source of data:	Proxy area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 v3 Appendix B.2.1
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Weighted per ha average
Any comment:	

Data Unit / Parameter:	$C_{P\ AGMT}^{[m=0]}$
Data unit:	tCO2e
Description:	Project carbon stocks in above-ground merchantable trees at project start
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 v3 Appendix B.2.1
Frequency of monitoring/recording:	At project start
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Summation across plots
Any comment:	

Data Unit / Parameter:	$C_{P\ BGMT}^{[m=0]}$
Data unit:	tCO2e
Description:	Project carbon stocks in below-ground merchantable trees at project start

Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 v3 Appendix B.2.3
Frequency of monitoring/recording:	At project start
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Summation across plots
Any comment:	

Data Unit / Parameter:	$c_{B\,b}^{[m]}$
Data unit:	tCO2e/ha
Description:	Baseline scenario average carbon stock in selected carbon pools
Source of data:	Proxy area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 v3 Appendix B.1.5
Frequency of monitoring/recording:	Every monitoring period
Value applied:	See Annex 16 – Proxy Area Carbon Model
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Weighted per ha average
Any comment:	

Data Unit / Parameter:	$c_{B\,BM}^{[m]}$
Data unit:	tCO2e/ha
Description:	Baseline carbon stocks in biomass at the end of the current monitoring period for the Forest Project Accounting Area
Source of data:	Proxy area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 v3 Appendix B.2
Frequency of monitoring/recording:	Every monitoring period
Value applied:	5
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.18]
Any comment:	

Data Unit / Parameter:	$c_{B\,BM}^{[m]}$

Data unit:	tCO2e/ha
Description:	Baseline carbon stocks in biomass at the end of the current monitoring period for the Grassland Project Accounting Area
Source of data:	Proxy area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 v3 Appendix B.2
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.18]
Any comment:	

Data Unit / Parameter:	$c_{B\,SOC}^{[m]}$
Data unit:	tCO2e/ha
Description:	Baseline soil carbon stocks at the end of the current monitoring period for the Forest Project Accounting Area
Source of data:	Proxy area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 v3 Appendix B.2.6
Frequency of monitoring/recording:	Every monitoring period
Value applied:	89.6
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.32]
Any comment:	

Data Unit / Parameter:	$c_{B\,SOC}^{[m]}$
Data unit:	tCO2e/ha
Description:	Baseline soil carbon stocks at the end of the current monitoring period for the Grassland Project Accounting Area
Source of data:	Proxy area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 v3 Appendix B.2.6
Frequency of monitoring/recording:	Every monitoring period
Value applied:	224.0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records

Calculation method:	Equation [F.32]
Any comment:	

Data Unit / Parameter:	$c_P^{[m]}$
Data unit:	tCO2e/ha
Description:	Project carbon stocks at the end of the current monitoring period for the Forest Project Accounting Area
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2
Frequency of monitoring/recording:	Every monitoring period
Value applied:	66.86
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [B.31]
Any comment:	

Data Unit / Parameter:	$c_P^{[m]}$
Data unit:	tCO2e/ha
Description:	Project carbon stocks at the end of the current monitoring period for the Grassland Project Accounting Area
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2
Frequency of monitoring/recording:	Every monitoring period
Value applied:	17.93
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [B.31]
Any comment:	

Data Unit / Parameter:	$c_P^{[m-1]}$
Data unit:	tCO2e/ha
Description:	Project carbon stocks at the beginning of the current monitoring period
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2

Frequency of monitoring/recording:	Prior monitoring period
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Already reviewed
Calculation method:	Equation [B.31]
Any comment:	

Data Unit / Parameter:	$c_P^{[m=0]}$
Data unit:	tCO2e/ha
Description:	Project carbon stocks prior to first verification event for the Forest Project Accounting Area
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2
Frequency of monitoring/recording:	Prior monitoring period
Value applied:	66.86
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Already reviewed
Calculation method:	Equation [B.31]
Any comment:	

Data Unit / Parameter:	$c_P^{[m=0]}$
Data unit:	tCO2e/ha
Description:	Project carbon stocks prior to first verification event for the Grassland Project Accounting Area
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2
Frequency of monitoring/recording:	Prior monitoring period
Value applied:	17.93
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Already reviewed
Calculation method:	Equation [B.31]
Any comment:	

Data Unit / Parameter:	$c_{P\,1\,BM}^{[m=0]}$
Data unit:	tCO2e/ha
Description:	Project carbon stocks in biomass in Forest Project Accounting Area stratum 1 at project start – Cloud Forest

Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2
Frequency of monitoring/recording:	Prior to first monitoring event
Value applied:	1,157.39
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Average of plot measurements in a given stratum
Any comment:	

Data Unit / Parameter:	$c_{P\,2\,BM}^{[m=0]}$
Data unit:	tCO2e/ha
Description:	Project carbon stocks in biomass in Forest Project Accounting Area stratum 2 at project start – Woodland/Thicket
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2
Frequency of monitoring/recording:	Prior to first monitoring event
Value applied:	116.00
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Average of plot measurements in a given stratum
Any comment:	

Data Unit / Parameter:	$c_{P\,3\,BM}^{[m=0]}$
Data unit:	tCO2e/ha
Description:	Project carbon stocks in biomass in Forest Project Accounting Area stratum 3 at project start – Woodland-Sparse/Low
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2
Frequency of monitoring/recording:	Prior to first monitoring event
Value applied:	77.31
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Average of plot measurements in a given stratum
Any comment:	

Data Unit / Parameter:	$c_{P\,4\,BM}^{[m=0]}$
Data unit:	tCO2e/ha
Description:	Project carbon stocks in biomass in Forest Project Accounting Area stratum 4 at project start – Lava Forest
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2
Frequency of monitoring/recording:	Prior to first monitoring event
Value applied:	79.38
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Average of plot measurements in a given stratum
Any comment:	

Data Unit / Parameter:	$c_{P\,5\,BM}^{[m=0]}$
Data unit:	tCO2e/ha
Description:	Project carbon stocks in biomass in Forest Project Accounting Area stratum 5 at project start – Lava Forest-Sparse/Low
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2
Frequency of monitoring/recording:	Prior to first monitoring event
Value applied:	57.65
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Average of plot measurements in a given stratum
Any comment:	

Data Unit / Parameter:	$c_{P\,6\,BM}^{[m=0]}$
Data unit:	tCO2e/ha
Description:	Project carbon stocks in biomass in Forest Project Accounting Area stratum 6 at project start – Acacia-Savanna-Mosaic
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2
Frequency of monitoring/recording:	Prior to first monitoring event
Value applied:	19.91
Monitoring equipment:	Equipment list in Annex 11

QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Average of plot measurements in a given stratum
Any comment:	

Data Unit / Parameter:	$c_{P\ 1\ BM}^{[m=0]}$
Data unit:	tCO2e/ha
Description:	Project carbon stocks in biomass in Grassland Project Accounting Area stratum 1 at project start – Grassland
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2
Frequency of monitoring/recording:	Prior to first monitoring event
Value applied:	17.93
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Average of plot measurements in a given stratum
Any comment:	

Data Unit / Parameter:	$c_{P\ AGMT}^{[m=0]}$
Data unit:	tCO2e/ha
Description:	Project carbon stocks in above-ground merchantable trees prior to first verification event
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2
Frequency of monitoring/recording:	Prior to first monitoring event
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Average of plot measurements in a given stratum
Any comment:	

Data Unit / Parameter:	$c_{P\ BM}^{[m=0]}$
Data unit:	tCO2e
Description:	Project carbon stocks in biomass prior to first verification event
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2

Frequency of monitoring/recording:	Prior to first monitoring event
Value applied:	19,710,032.19
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.17]
Any comment:	

Data Unit / Parameter:	$c_{P\,b}^{[m]}$
Data unit:	tCO2e/ha
Description:	Average carbon in biomass in the Forest project accounting area
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2
Frequency of monitoring/recording:	Prior to first monitoring event
Value applied:	66.86
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Average of plot measurements in a given stratum
Any comment:	

Data Unit / Parameter:	$c_{P\,b}^{[m]}$
Data unit:	tCO2e/ha
Description:	Average carbon in biomass in the Grassland project accounting area
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2
Frequency of monitoring/recording:	Prior to first monitoring event
Value applied:	17.93
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Average of plot measurements in a given stratum
Any comment:	

Data Unit / Parameter:	$c_{P\,SOC}^{[m=0]}$
Data unit:	tCO2e/ha
Description:	Project soil carbon stocks prior to first verification event in the Forest Project Accounting Area

Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2.6
Frequency of monitoring/recording:	At project start
Value applied:	181.2
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Average of plot measurements in a given stratum
Any comment:	

Data Unit / Parameter:	$c_{P\,SOC}^{[m=0]}$
Data unit:	tCO2e/ha
Description:	Project soil carbon stocks prior to first verification event in the Grassland Project Accounting Area
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2.6
Frequency of monitoring/recording:	At project start
Value applied:	445.6
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Average of plot measurements in a given stratum
Any comment:	

Data Unit / Parameter:	$C_{P\,\Delta\,WP}^{[m]}$
Data unit:	tCO2e
Description:	Project carbon stocks in wood products at the end of the current monitoring period
Source of data:	Project accounting area sampling
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix C
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [C.2]
Any comment:	

Data Unit / Parameter:	$E_{\Delta\,GER}^{[m]}$

Data unit:	tCO2e
Description:	GERs for the current monitoring period
Source of data:	Area measurements
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.4.1
Frequency of monitoring/recording:	Every monitoring period
Value applied:	1,253,755
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of GER calculations
Calculation method:	Equation F.53

Data Unit / Parameter:	$E_{\Delta GER}^{[i]}$
Data unit:	tCO2e
Description:	GERs for monitoring period i
Source of data:	Area measurements
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.4.1
Frequency of monitoring/recording:	Prior monitoring period
Value applied:	1,253,872
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of GER calculations
Calculation method:	Equation [F.53]
Any comment:	

Data Unit / Parameter:	$E_{\Delta NER}^{[i]}$
Data unit:	tCO2e
Description:	NERs for monitoring period i
Source of data:	Area measurements
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.4.3
Frequency of monitoring/recording:	prior monitoring period
Value applied:	1,128,872
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of GER calculations
Calculation method:	Equation [F.55]
Any comment:	

Data Unit / Parameter:	$E_{B}^{[m]}$

Data unit:	tCO2e
Description:	Cumulative baseline emissions at the end of the current monitoring period
Source of data:	Proxy area measurements
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1
Frequency of monitoring/recording:	Every monitoring period
Value applied:	1,253,872
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.16]
Any comment:	

Data Unit / Parameter:	$E_B^{[m-1]}$
Data unit:	tCO2e
Description:	Cumulative baseline emissions at the beginning of the current monitoring period
Source of data:	Proxy area measurements
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1
Frequency of monitoring/recording:	Prior monitoring period
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.16]
Any comment:	

Data Unit / Parameter:	$E_{B\,\Delta}^{[m]}$
Data unit:	tCO2e
Description:	Change in baseline emissions
Source of data:	Proxy area measurements
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1
Frequency of monitoring/recording:	Every monitoring period
Value applied:	1,253,872
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.15]
Any comment:	

Data Unit / Parameter:	$E_{B\,\Delta\,BGB}^{[i]}$
Data unit:	tCO2e
Description:	Change in baseline emissions from below-ground biomass during monitoring period i
Source of data:	Monitoring the proxy area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2.3
Frequency of monitoring/recording:	Already Monitored
Value applied:	3,200,470
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.30]
Any comment:	

Data Unit / Parameter:	$E_{B\,\Delta\,DW}^{[i]}$
Data unit:	tCO2e
Description:	Baseline emissions from dead wood in monitoring period i
Source of data:	Measurements in the proxy area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.2.4 and B.2.5
Frequency of monitoring/recording:	Already Monitored
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.34]
Any comment:	

Data Unit / Parameter:	$E_{B\,\Delta\,SOC}^{[m]}$
Data unit:	tCO2e
Description:	Baseline change in emissions from soil carbon
Source of data:	Measurements in the proxy area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1.2.1, 8.1.2.2, 8.1.2.3 and Appendix B.2.6
Frequency of monitoring/recording:	Every monitoring period
Value applied:	6,467,504
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.26]
Any comment:	

Data Unit / Parameter:	$E_{B\,\Delta\,SOC}^{[i]}$
Data unit:	tCO2e
Description:	Baseline emissions from soil carbon in monitoring period i
Source of data:	Measurements in the proxy area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1.2.1, 8.1.2.2, 8.1.2.3 and Appendix B.2.6
Frequency of monitoring/recording:	Every monitoring period
Value applied:	6,467,504
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.26]
Any comment:	

Data Unit / Parameter:	$E_{B\,AGMT}^{[m]}$
Data unit:	tCO2e
Description:	Cumulative baseline emissions from above-ground commercial trees at the end of the current monitoring period
Source of data:	Measurements in the proxy area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1.6.1, 8.1.6.2, 8.1.6.3
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.37]
Any comment:	Parameter not used

Data Unit / Parameter:	$E_{B\,BGB}^{[m]}$
Data unit:	tCO2e
Description:	Cumulative baseline emissions from below-ground biomass at the end of the current monitoring period
Source of data:	Measurements in the proxy area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1.4
Frequency of monitoring/recording:	Every monitoring period
Value applied:	3,200,470

Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.30]
Any comment:	

Data Unit / Parameter:	$E_{B\,BGB}^{[m-1]}$
Data unit:	tCO2e
Description:	Cumulative baseline emissions from below-ground biomass at the beginning of the current monitoring period
Source of data:	Measurements in the proxy area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1.4
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.30]
Any comment:	

Data Unit / Parameter:	$E_{B\,BM}^{[m]}$
Data unit:	tCO2e
Description:	Cumulative baseline emissions from biomass at the end of the current monitoring period
Source of data:	Measurements in the proxy area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1.1, 8.1.1.5.1
Frequency of monitoring/recording:	Every monitoring period
Value applied:	1,253,872
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.22]
Any comment:	

Data Unit / Parameter:	$E_{B\,DW}^{[m]}$
Data unit:	tCO2e
Description:	Cumulative baseline emissions from dead wood at the end of the current monitoring period
Source of data:	Measurements in the proxy area

Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1.3
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.34]
Any comment:	

Data Unit / Parameter:	$E_{B\,DW}^{[m-1]}$
Data unit:	tCO2e
Description:	Cumulative baseline emissions from dead wood at the beginning of the current monitoring period
Source of data:	Measurements in the proxy area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1.3
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.34]
Any comment:	

Data Unit / Parameter:	$E_{B\,SOC}^{[m]}$
Data unit:	tCO2e
Description:	Cumulative baseline emissions from soil carbon at the end of the current monitoring period
Source of data:	Measurements in the proxy area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1.2.1, 8.1.2.2, 8.1.2.3
Frequency of monitoring/recording:	Every monitoring period
Value applied:	6,467,504
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.27]
Any comment:	

Data Unit / Parameter:	$E_{B\,SOC}^{[m-1]}$
Data unit:	tCO2e

Description:	Cumulative baseline emissions from soil carbon at the end of the current monitoring period
Source of data:	Measurements in the proxy area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1.2.1, 8.1.2.2, 8.1.2.3
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.27]
Any comment:	

Data Unit / Parameter:	$E_{BA}^{[m]}$
Data unit:	tCO2e
Description:	Cumulative emissions allocated to the buffer account at the end of the current monitoring period
Source of data:	N/A
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.4.4
Frequency of monitoring/recording:	Every monitoring period
Value applied:	125,387
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Multiplication
Any comment:	

Data Unit / Parameter:	$E_{L}^{[m]}$
Data unit:	tCO2e
Description:	Cumulative emissions from leakage at the end of the current monitoring period
Source of data:	Measurements in the leakage area(s)
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.3
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.45]
Any comment:	

Data Unit / Parameter:	$E_L^{[m-1]}$
Data unit:	tCO2e
Description:	Cumulative emissions from leakage at the beginning of the current monitoring period
Source of data:	Measurements in the leakage area(s)
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.3
Frequency of monitoring/recording:	Already monitored
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.45]
Any comment:	

Data Unit / Parameter:	$E_{L\,\Delta}^{[m]}$
Data unit:	tCO2e
Description:	Change in emissions due to leakage
Source of data:	N/A
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.3
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.44]
Any comment:	

Data Unit / Parameter:	$E_{L\,AS\,F}^{[m]}$
Data unit:	tCO2e
Description:	Cumulative emissions from activity-shifting leakage in forested strata at the end of the current monitoring period
Source of data:	Measurements in the activity-shifting leakage area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.3
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records

Calculation method:	Equation [F.46]
Any comment:	

Data Unit / Parameter:	$E_{L\ ASG}^{[m]}$
Data unit:	tCO2e
Description:	Cumulative emissions from activity-shifting leakage in native grassland strata at the end of the current monitoring period
Source of data:	Measurements in the activity-shifting leakage area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.3.3.4
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.47]
Any comment:	

Data Unit / Parameter:	$E_{L\ ME}^{[m]}$
Data unit:	tCO2e
Description:	Cumulative emissions from market leakage at the end of the current monitoring period
Source of data:	Measurements in the market leakage area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.3
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.51]
Any comment:	

Data Unit / Parameter:	$E_{P\ \Delta}^{[m]}$
Data unit:	tCO2e
Description:	Change in project emissions
Source of data:	Monitoring records for Forest Fire, Burning, logging, wood products, and natural disturbance events

Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.2
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.41]
Any comment:	

Data Unit / Parameter:	$E_{P\,\Delta BRN}^{[m]}$
Data unit:	tCO2e
Description:	Cumulative project emissions due to burning at the end of the current monitoring period
Source of data:	Monitoring plots in the project
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.2.2
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.42]
Any comment:	

Data Unit / Parameter:	$E_{P\,\Delta\,LS}^{[m]}$
Data unit:	tCO2e
Description:	Cumulative project emissions due to livestock grazing within the project area.
Source of data:	Monitoring in the project area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.2.4
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.43]
Any comment:	

Data Unit / Parameter:	$E_{P\,\Delta\,SF}^{[m]}$
Data unit:	tCO2e

Description:	Cumulative project emissions due to the use of synthetic fertilizers within the project area.
Source of data:	Monitoring in the project area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.2.5
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	CDM A/R methodological tool *Estimation of direct and indirect (e.g. leaching and runoff) nitrous oxide emission from nitrogen fertilization*
Any comment:	

Data Unit / Parameter:	$E_U^{[m]}$
Data unit:	tCO2e
Description:	Cumulative confidence deduction at the end of the current monitoring period
Source of data:	N/A
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.4.1.1
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.57]
Any comment:	

Data Unit / Parameter:	$n_{LS\,i}$
Data unit:	count
Description:	The number of head of livestock species/ category i in the project area
Source of data:	Monitoring in the project area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.2.4
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Use of literature or expert knowledge
Any comment:	

Data Unit / Parameter:	$p_{L\,DEG}^{[m]}$
Data unit:	proportion (unitless)
Description:	Portion of leakage due to degradation in forest at the end of the current monitoring period
Source of data:	Monitoring in the leakage area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.3.2.3
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Summation across leakage plots
Any comment:	

Data Unit / Parameter:	$p_{L\,DEG}^{[m=0]}$
Data unit:	tCO2e
Description:	proportion (unitless)
Source of data:	Portion of leakage due to degradation prior to first verification event
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.3.2.3
Frequency of monitoring/recording:	At project start
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Project verification
Calculation method:	Summation across leakage plots
Any comment:	

Data Unit / Parameter:	$p_{L\,CON\,G}^{[m]}$
Data unit:	proportion (unitless)
Description:	Portion of leakage due to native grasslands conversion at the beginning of the current monitoring period
Source of data:	Monitoring in the leakage area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.3.2.4
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11

QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Summation across leakage plots
Any comment:	

Data Unit / Parameter:	$p_{L\ CON\ G}^{[m=0]}$
Data unit:	proportion (unitless)
Description:	Portion of leakage due to native grasslands prior to the first verification event
Source of data:	Monitoring in the leakage area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.3.2.4
Frequency of monitoring/recording:	At project start
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Project verification
Calculation method:	Summation across leakage plots
Any comment:	

Data Unit / Parameter:	$p_{L\ CON\ G}^{[m-1]}$
Data unit:	proportion (unitless)
Description:	Portion of leakage due to native grasslands conversion at the end of the current monitoring period
Source of data:	Monitoring in the leakage area
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.3.2.4
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0
Monitoring equipment:	Equipment list in Annex 11
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Summation across leakage plots
Any comment:	

Data Unit / Parameter:	$p_{SL}^{[m]}$
Data unit:	proportion (unitless)
Description:	Proportion of AGMT that is not merchantable and goes into slash estimated from inventory
Source of data:	Estimated from inventory
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 8.1.6.3

Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Conservatively used volume of a cone
Any comment:	

Data Unit / Parameter:	$t^{[i-1]}$
Data unit:	days
Description:	Time from project start date to beginning of monitoring period i
Source of data:	Monitoring records
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	N/A
Value applied:	*N/A*
Monitoring equipment:	*N/A*
QA/QC procedures to be applied:	*N/A*
Calculation method:	Subtraction
Any comment:	

Data Unit / Parameter:	$t^{[m]}$
Data unit:	days
Description:	Time from project start date to end of current monitoring period
Source of data:	Monitoring records
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Subtraction
Any comment:	

Data Unit / Parameter:	$t^{[m-1]}$
Data unit:	days
Description:	Time from project start date to beginning of current monitoring period
Source of data:	Monitoring records

Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Every monitoring period
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Subtraction
Any comment:	

Data Unit / Parameter:	$U_B^{[m]}$
Data unit:	tCO2e
Description:	Total uncertainty in proxy area carbon stock estimate
Source of data:	N/A
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.1.5
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [B.34]
Any comment:	

Data Unit / Parameter:	$U_{EM}^{[M]}$
Data unit:	tCO2e / ha
Description:	Total uncertainty in Baseline Emissions Models for the Forest Project Accounting Area
Source of data:	N/A
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 6.8.10
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0.262
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.14]
Any comment:	

Data Unit / Parameter:	$U_{EM}^{[M]}$
Data unit:	tCO2e

Description:	Total uncertainty in Baseline Emissions Models for the Grassland Project Accounting Area
Source of data:	N/A
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Section 6.8.10
Frequency of monitoring/recording:	Every monitoring period
Value applied:	0.101
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [F.14]
Any comment:	

Data Unit / Parameter:	$U_P^{[m]}$
Data unit:	tCO2e / ha
Description:	Total uncertainty in the Forest Project Accounting Area carbon stock estimate
Source of data:	N/A
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.1.5
Frequency of monitoring/recording:	Every monitoring period
Value applied:	6.51
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [B.34]
Any comment:	

Data Unit / Parameter:	$U_P^{[m]}$
Data unit:	tCO2e / ha
Description:	Total uncertainty in Grassland Project Accounting Area carbon stock estimate
Source of data:	N/A
Description of measurement methods and procedures to be applied:	VCS Methodology VM0009 Appendix B.1.5
Frequency of monitoring/recording:	Every monitoring period
Value applied:	4.55
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	Equation [B.34]
Any comment:	

Data Unit / Parameter:	$wc_{Pi}^{[m=o]}$
Data unit:	tCO2e
Description:	Weighted average carbon stocks for biomass or SOC in the project for the set of selected strata
Source of data:	Biomass inventory
Description of measurement methods and procedures to be applied:	Inventory or GIS
Frequency of monitoring/recording:	Every monitoring period
Value applied:	See Annex 17 – Soil Carbon Model v2
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	N/A
Any comment:	

Data Unit / Parameter:	$x^{[m]}$
Data unit:	varies
Description:	Covariate values
Source of data:	Participatory Rural Appraisal, analysis of public records, and/or expert interpretation of inventory data or remotely sensed imagery
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Every monitoring period
Value applied:	
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Review of monitoring records
Calculation method:	N/A
Any comment:	

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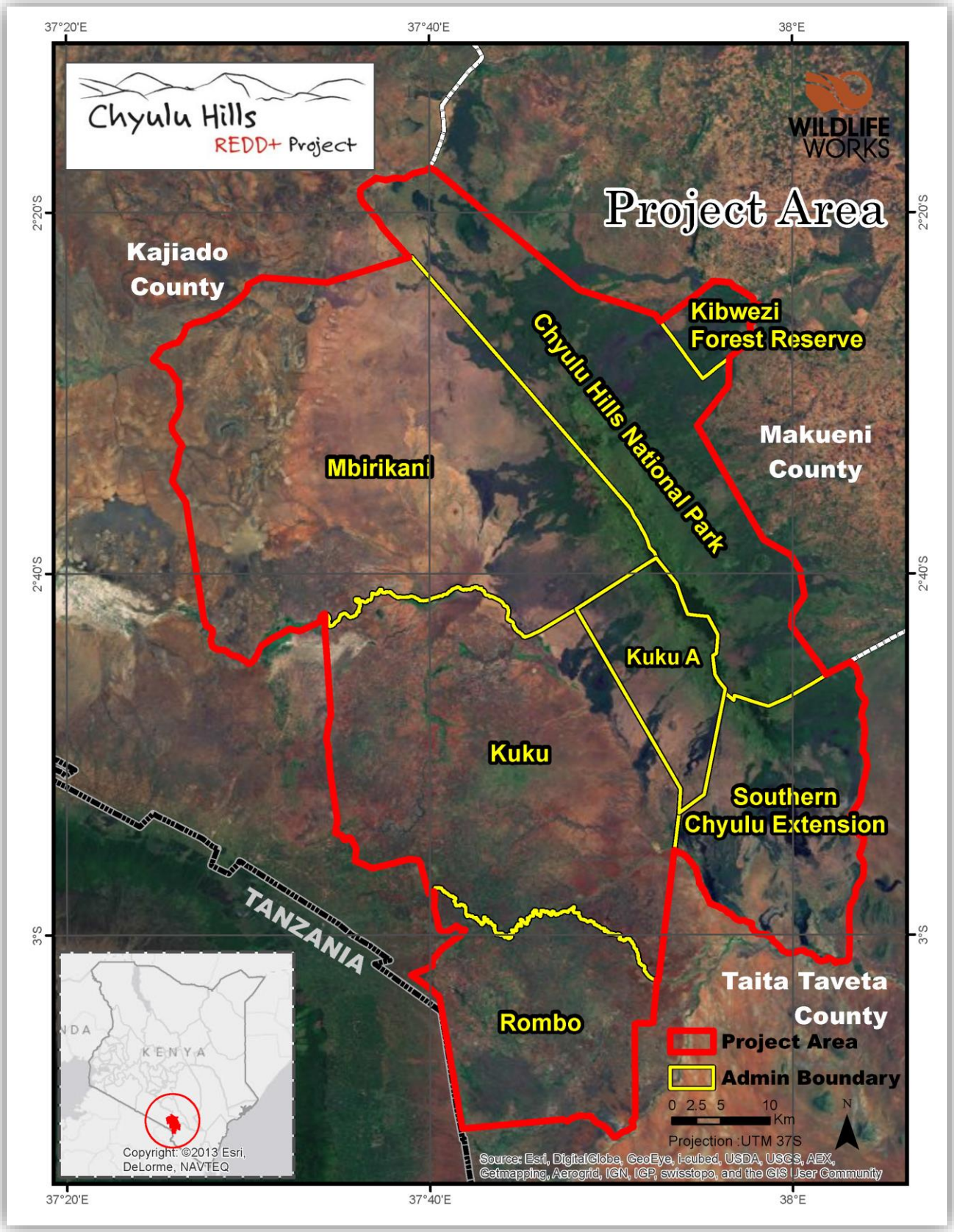
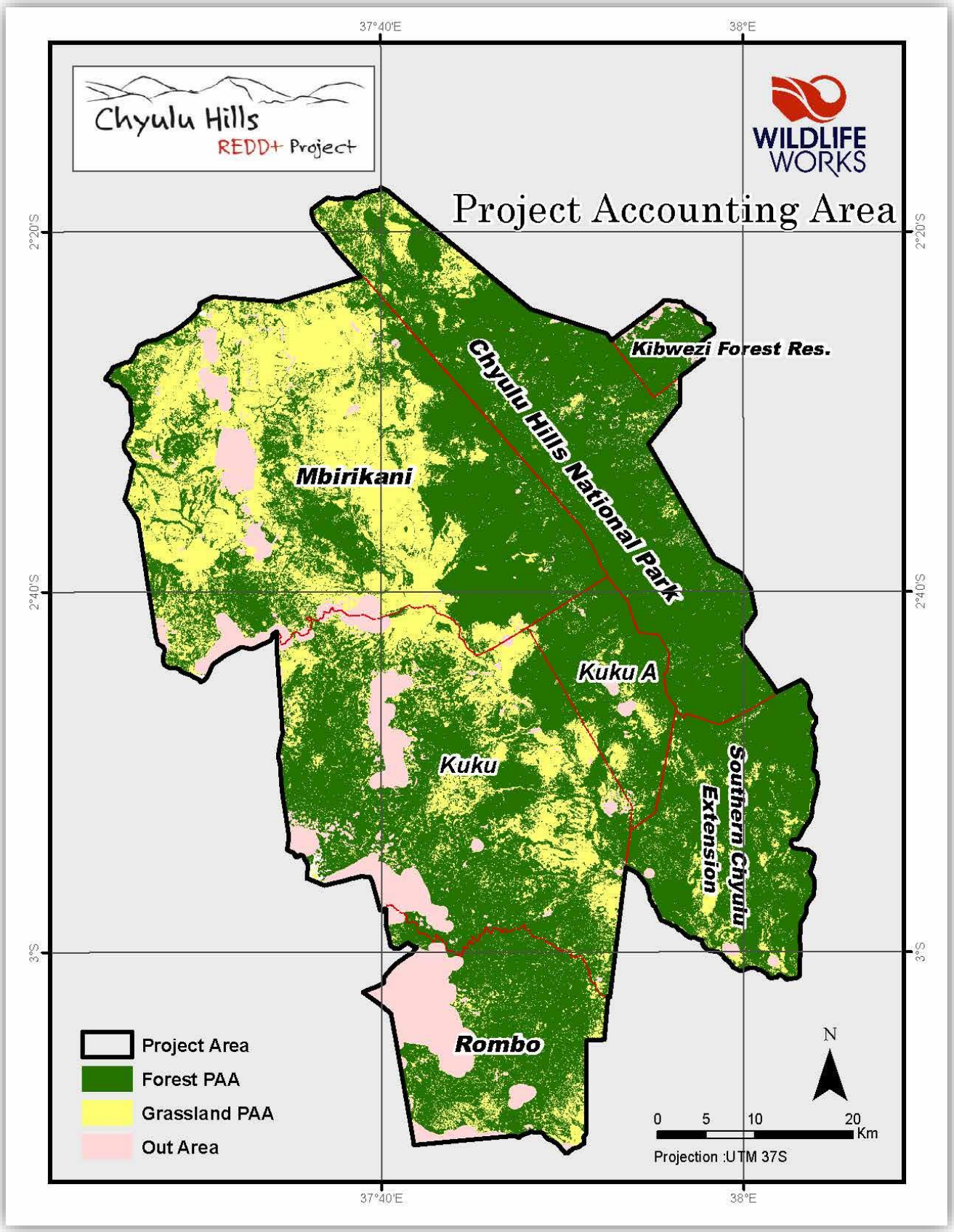
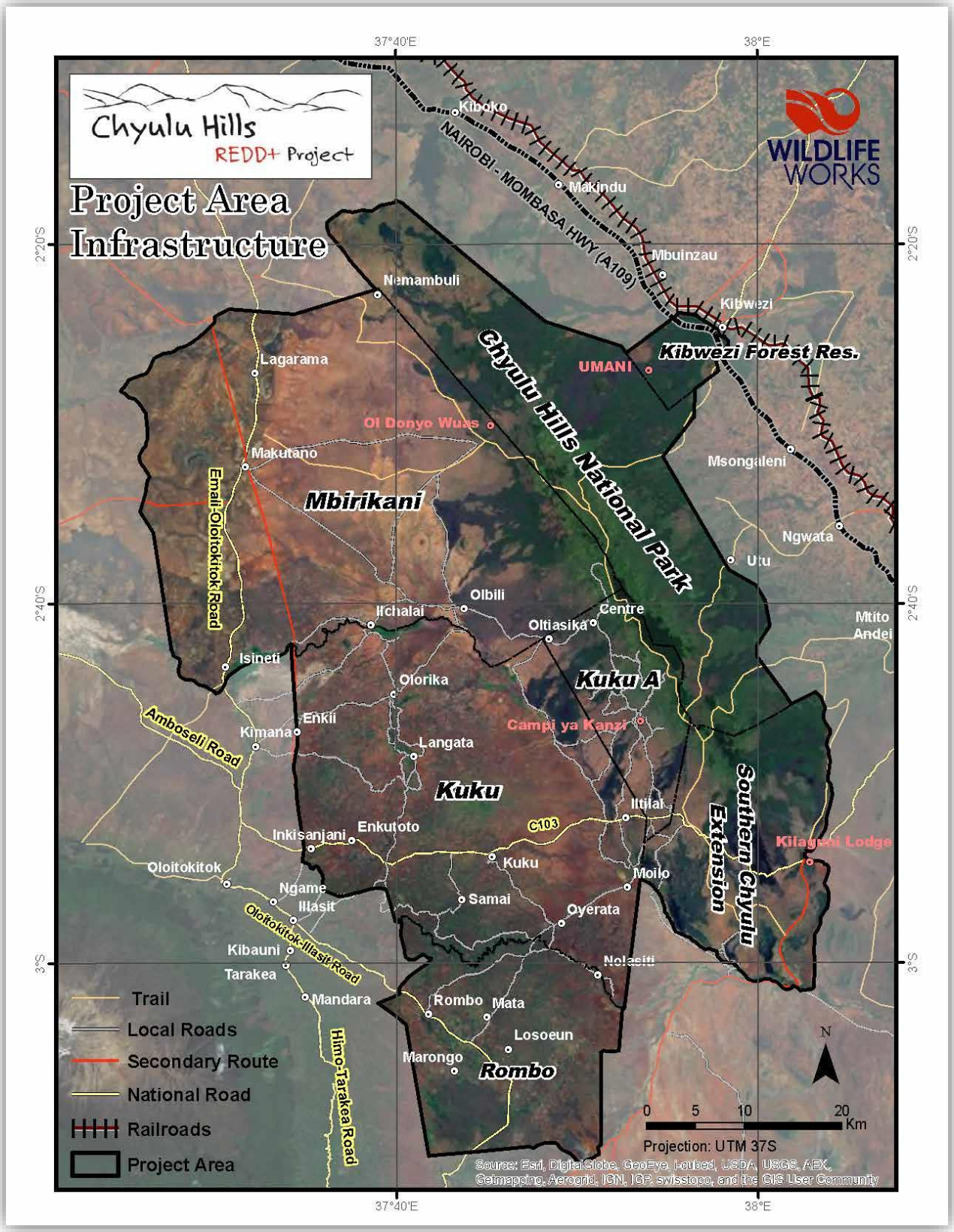
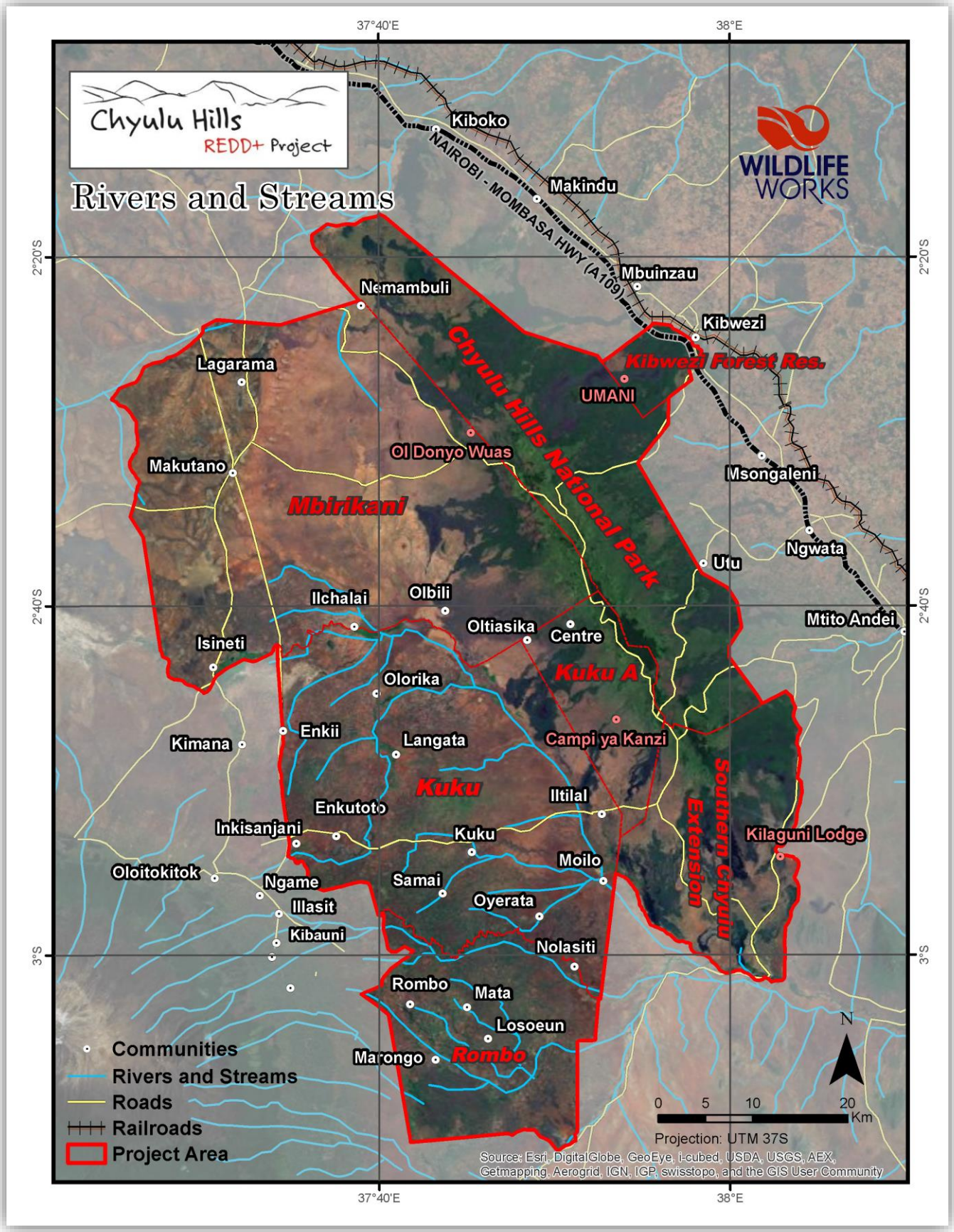
APPENDIX A. The Project Area and Project Accounting Areas

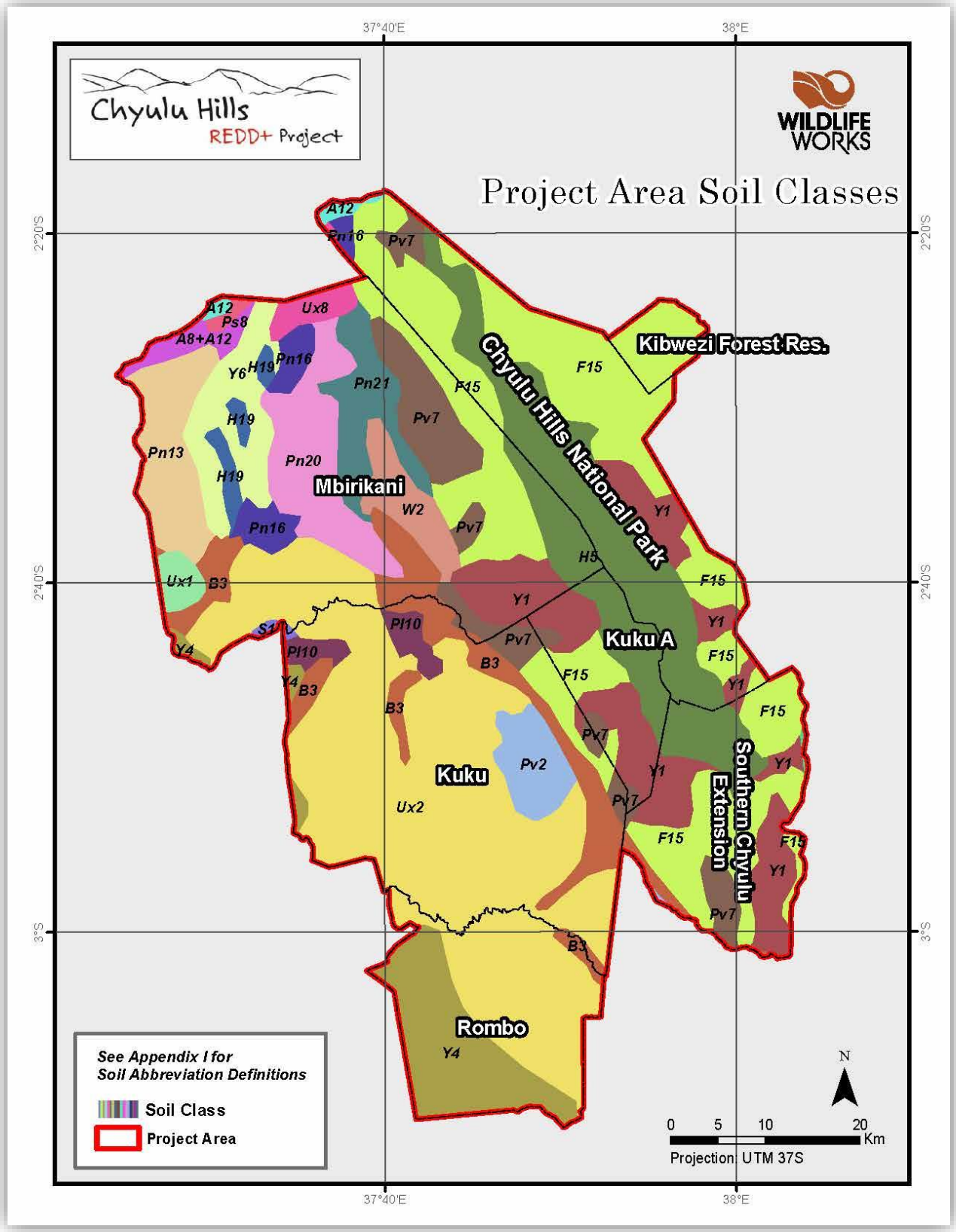



Chyulu Hills
REDD+ Project
WILDLIFE WORKS
Project Accounting Area
37°40'E
38°E
2°20'S
2°40'S
3°S
Kibwezi Forest Res.
Chyulu Hills National Park
Mbirikani
Kuku A
Kuku
Southern Chyulu Extension
Rombo
Project Area
Forest PAA
Grassland PAA
Out Area
N
0 5 10 20 Km
Projection :UTM 37S

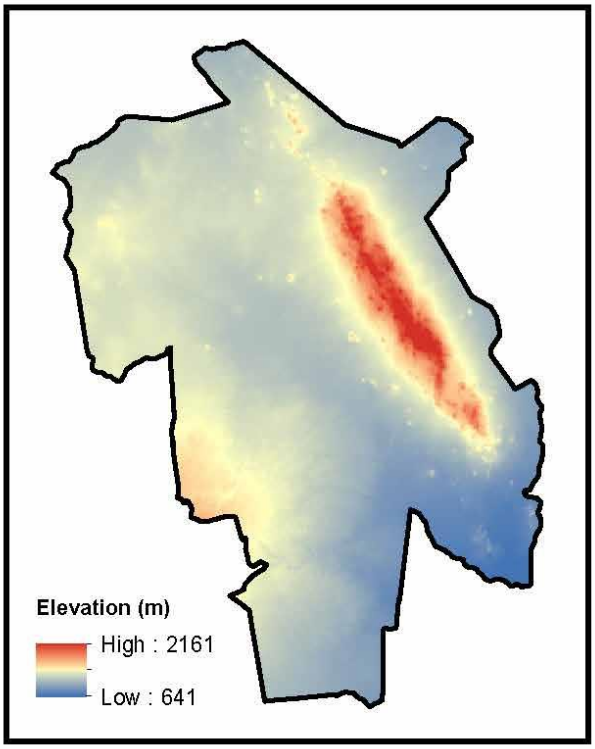
APPENDIX B. Project Area Vegetation, Rivers & Streams, Biomass and Soil Plots, Soil Types, Infrastructure, Communities and Landscape Configuration




Chyulu Hills
REDD+ Project
Rivers and Streams
WILDLIFE WORKS
37°40'E
38°E
2°20'S
2°40'S
3°S
Kiboko
NAIROBI - MOMBASA HWY (A109)
Makindu
Mbuinzau
Kibwezi
Nemambuli
Lagarama
Chyulu Hills National Park
Kibwezi Forest Res.
UMANI
Ol Donyo Wuas
Makutano
Msongaleni
Mbirikani
Ngwata
Ufu
Ilchalai
Olbili
Mtito Andei
Oltiasika
Centre
Isineti
Kuku A
Olorika
Enkii
Langata
Campi ya Kanzi
Kimana
Kuku
Southern Chyulu Extension
Iltilal
Enkutoto
Inkisanjani
Kuku
Kilaguni Lodge
Moilo
Oloitokitok
Ngame
Samai
Illasit
Oyerata
Kibauni
Nolasiti
Rombo
Mata
Losoeun
Marongo
Rombo
Communities
Rivers and Streams
Roads
Railroads
Project Area
N
0 5 10 20
Km
Projection: UTM 37S
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Please See Appendix H for the key for the Soil Class Abbreviations



Chyulu Hills
REDD+ Project

Project Area Topographic Maps

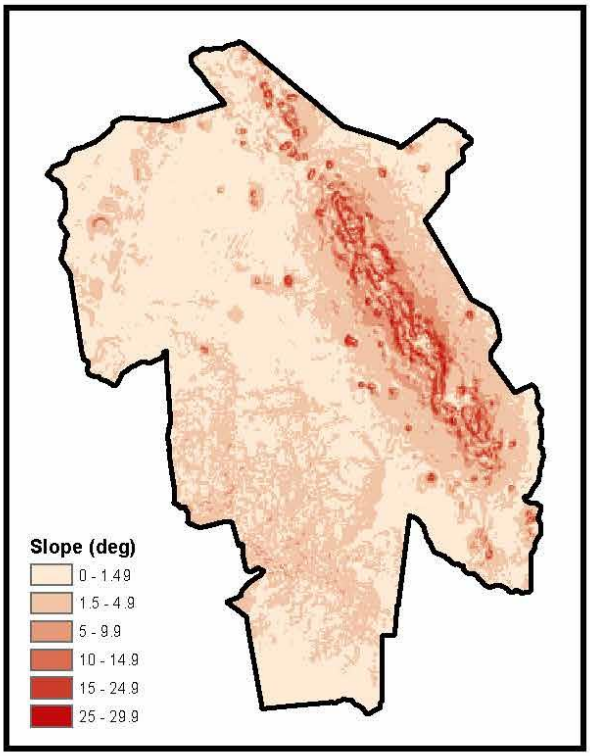
0 10 20 40 Km

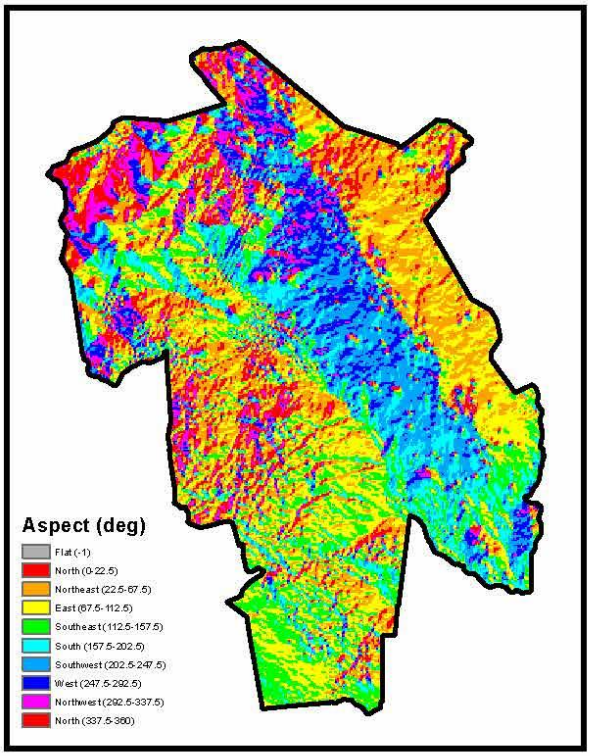
Source: SRTM 250m
Projection: UTM Zone 37S
Datum: WGS 1984

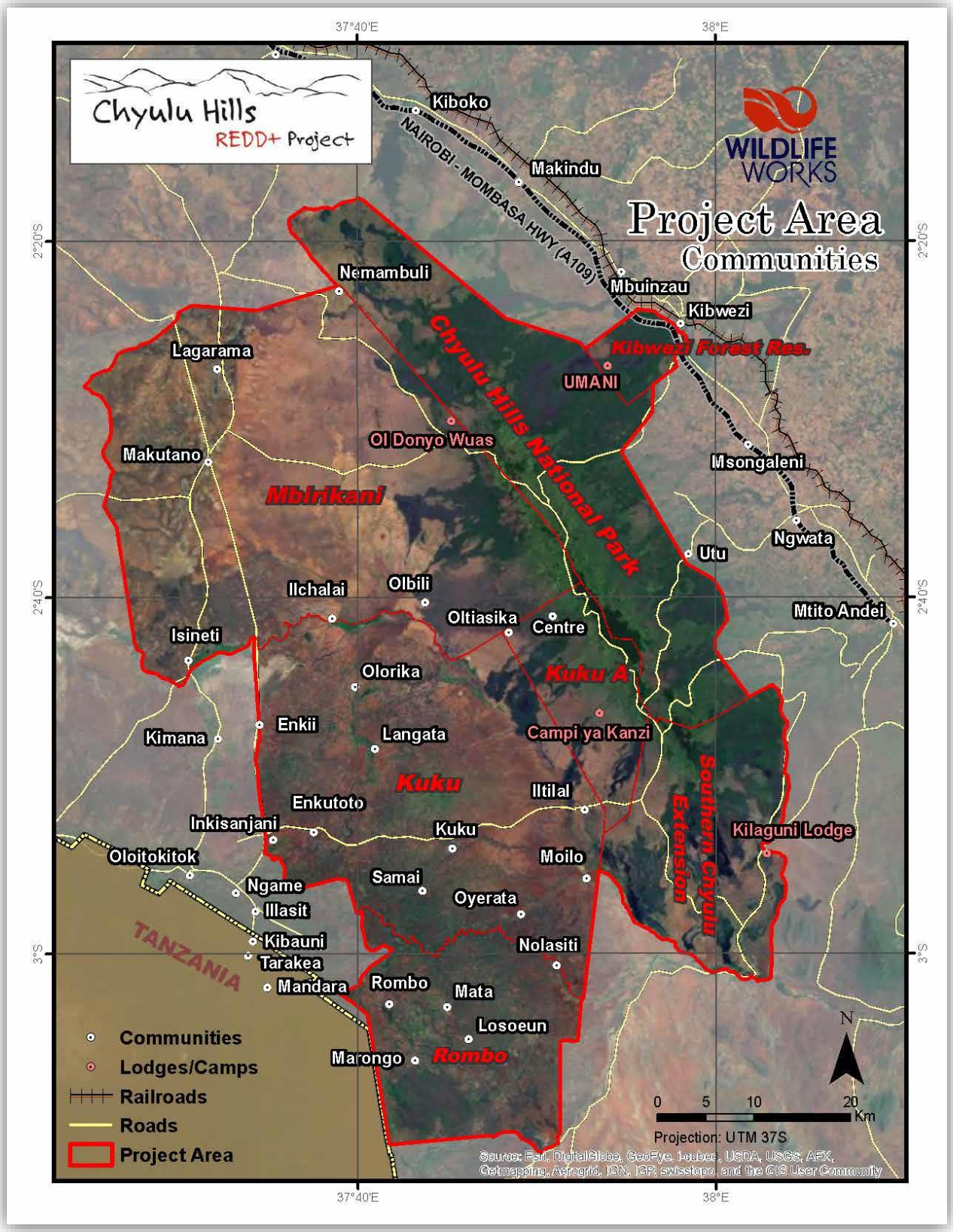
N W E S

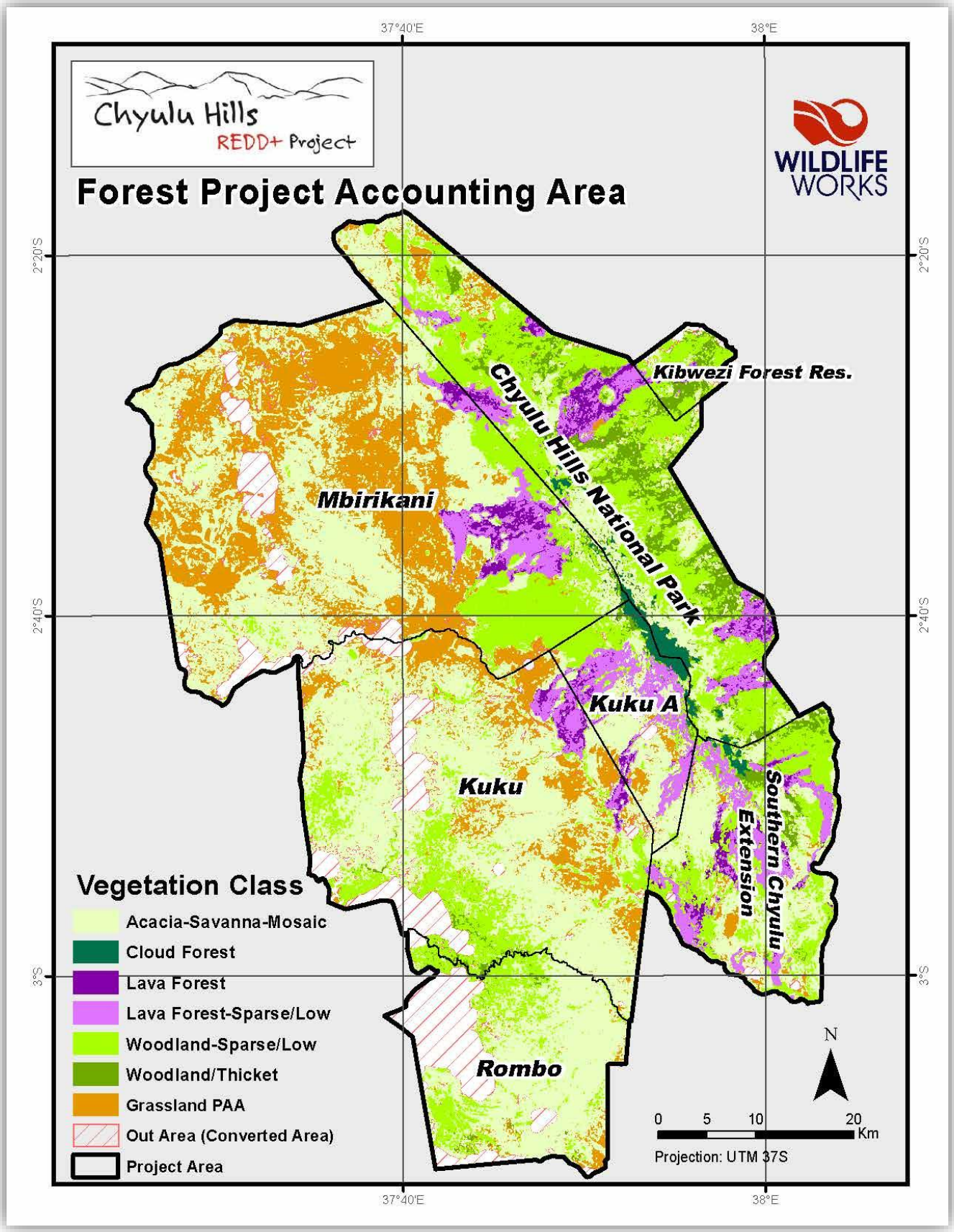
Chyulu Hills Project Area

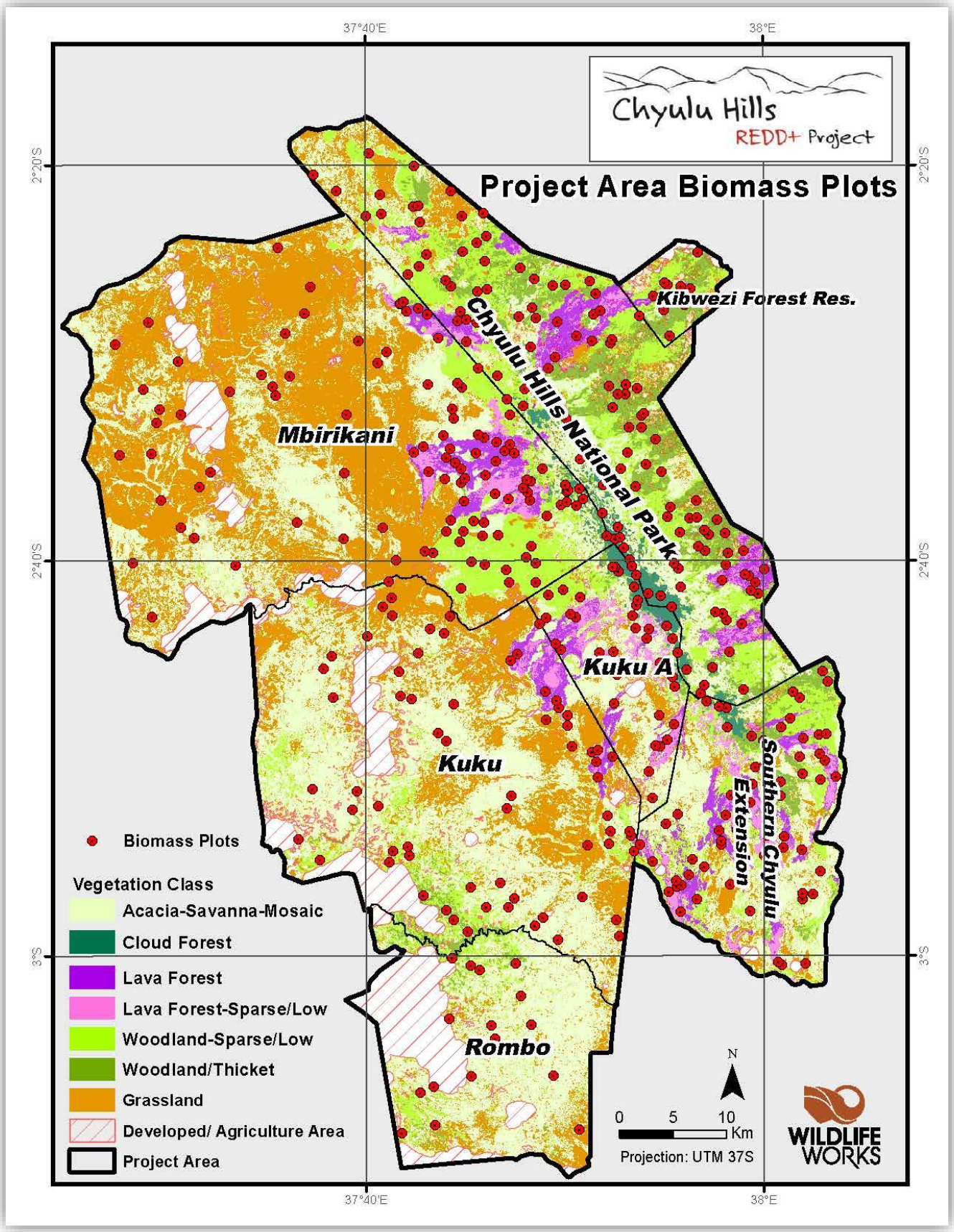
WILDLIFE WORKS

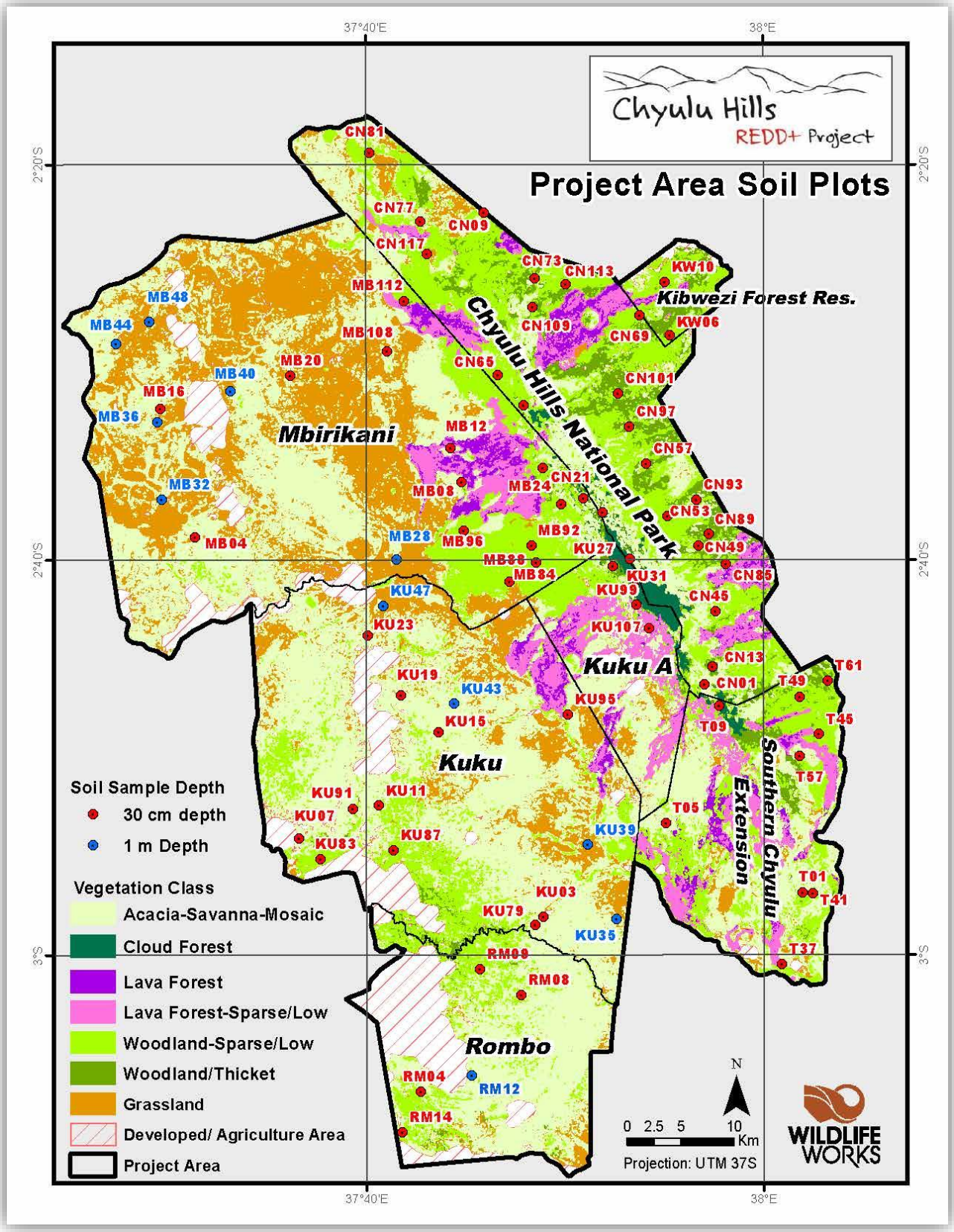




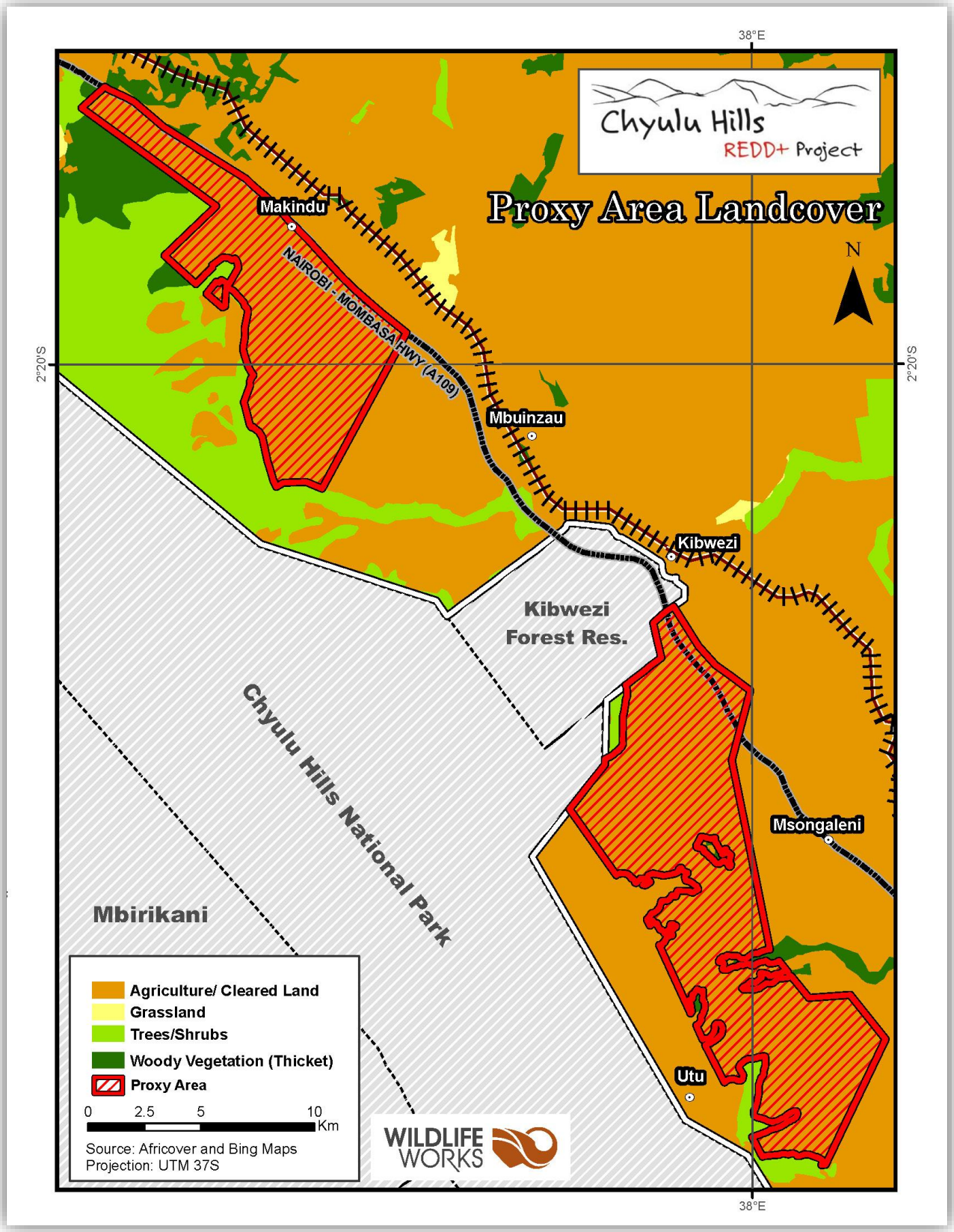

Chyulu Hills
REDD+ Project
WILDLIFE WORKS
Project Area
Communities
37°40'E
38°E
2°20'S
2°40'S
3°S
Kiboko
Makindu
NAIROBI - MOMBASA HWY (A109)
Nemambuli
Mbuinzau
Kibwezi
Kibwezi Forest Res.
UMANI
Chyulu Hills National Park
Lagarama
Ol Donyo Wuas
Makutano
Msongaleni
Mbirikani
Ngwata
Utu
Ilchalai
Olbili
Oltiasika
Centre
Mtito Andei
Isineti
Olorika
Kuku A
Enkii
Langata
Campi ya Kanzi
Kimana
Kuku
Iltilal
Southern Chyulu Extension
Enkutoto
Inkisanjani
Kuku
Kilaguni Lodge
Oloitokitok
Moilo
Samai
Ngame
Oyerata
Illasit
Kibauni
Nolasiti
TANZANIA
Tarakea
Mandara
Rombo
Mata
Losoeun
Marongo
Rombo
Communities
Lodges/Camps
Railroads
Roads
Project Area
N
0 5 10 20 Km
Projection: UTM 37S
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

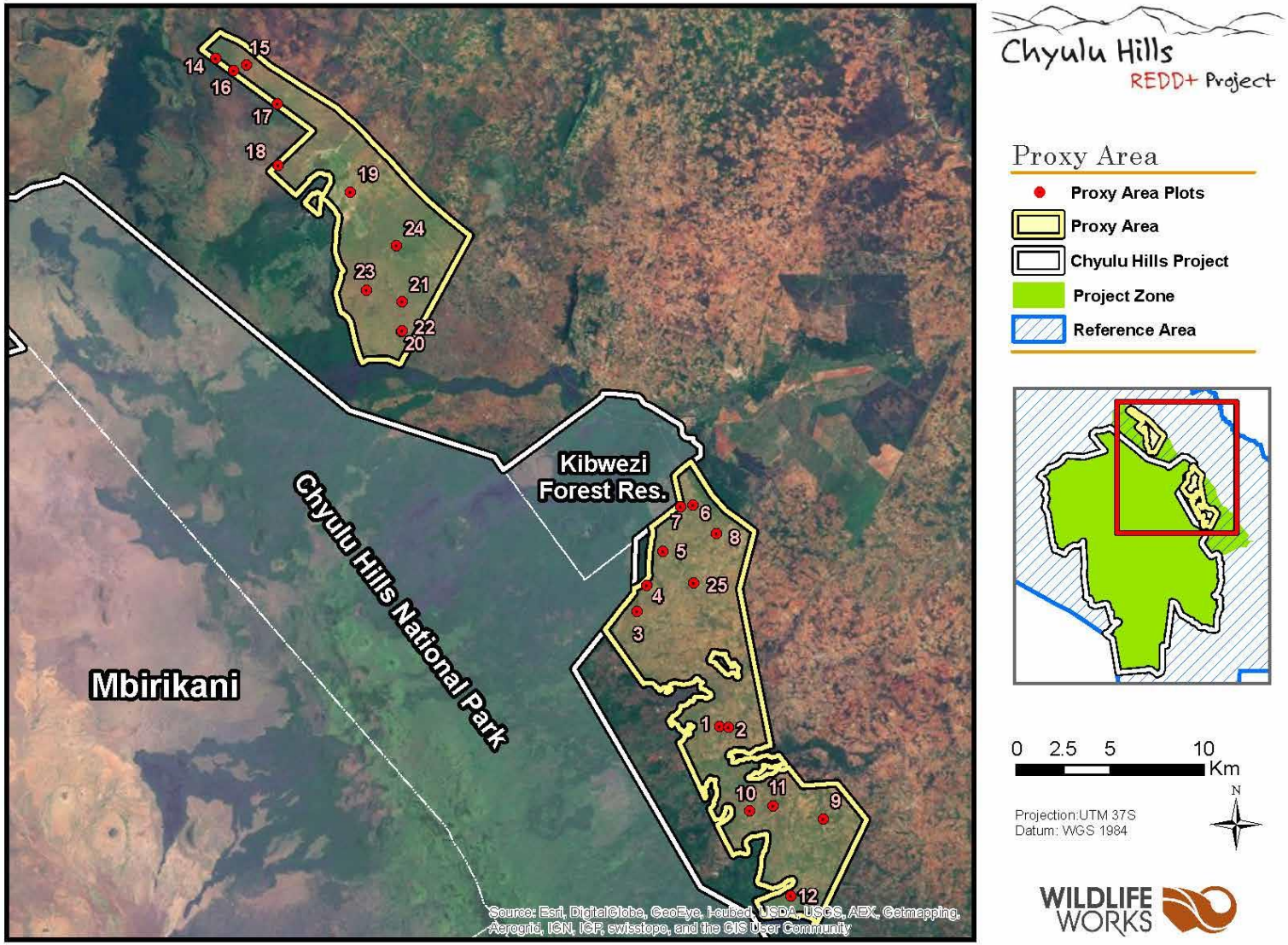

Chyulu Hills
REDD+ Project
WILDLIFE WORKS
Forest Project Accounting Area
37°40'E
38°E
2°20'S
2°40'S
3°S
Kibwezi Forest Res.
Chyulu Hills National Park
Mbirikani
Kuku A
Kuku
Southern Chyulu Extension
Rombo
Vegetation Class
Acacia-Savanna-Mosaic
Cloud Forest
Lava Forest
Lava Forest-Sparse/Low
Woodland-Sparse/Low
Woodland/Thicket
Grassland PAA
Out Area (Converted Area)
Project Area
N
0 5 10 20 Km
Projection: UTM 37S

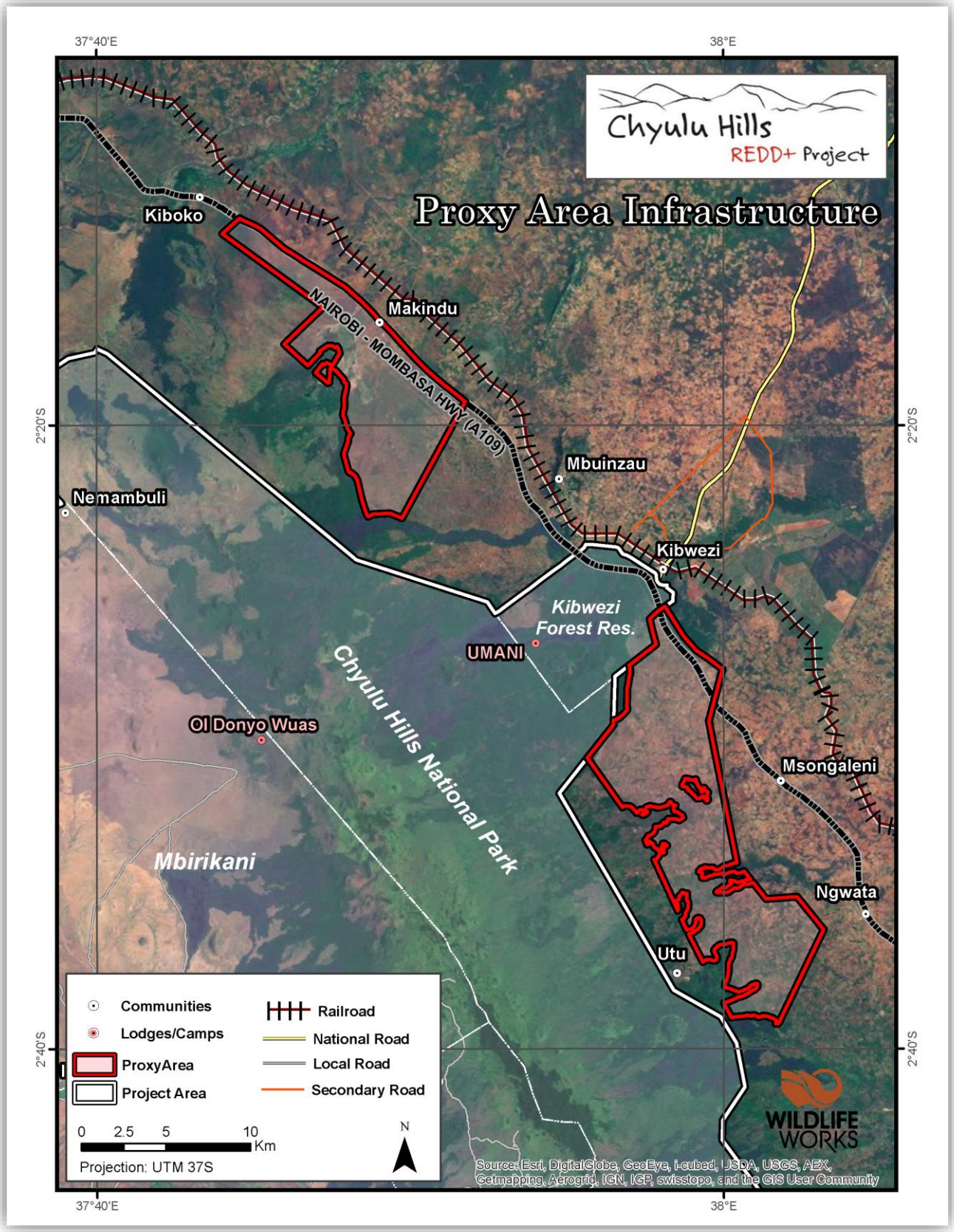

Chyulu Hills
REDD+ Project
Project Area Biomass Plots
37°40'E
38°E
2°20'S
2°40'S
3°S
Kibwezi Forest Res.
Chyulu Hills National Park
Mbirikani
Kuku A
Kuku
Southern Chyulu Extension
Rombo
Biomass Plots
Vegetation Class
Acacia-Savanna-Mosaic
Cloud Forest
Lava Forest
Lava Forest-Sparse/Low
Woodland-Sparse/Low
Woodland/Thicket
Grassland
Developed/ Agriculture Area
Project Area
N
0 5 10 Km
Projection: UTM 37S
WILDLIFE WORKS

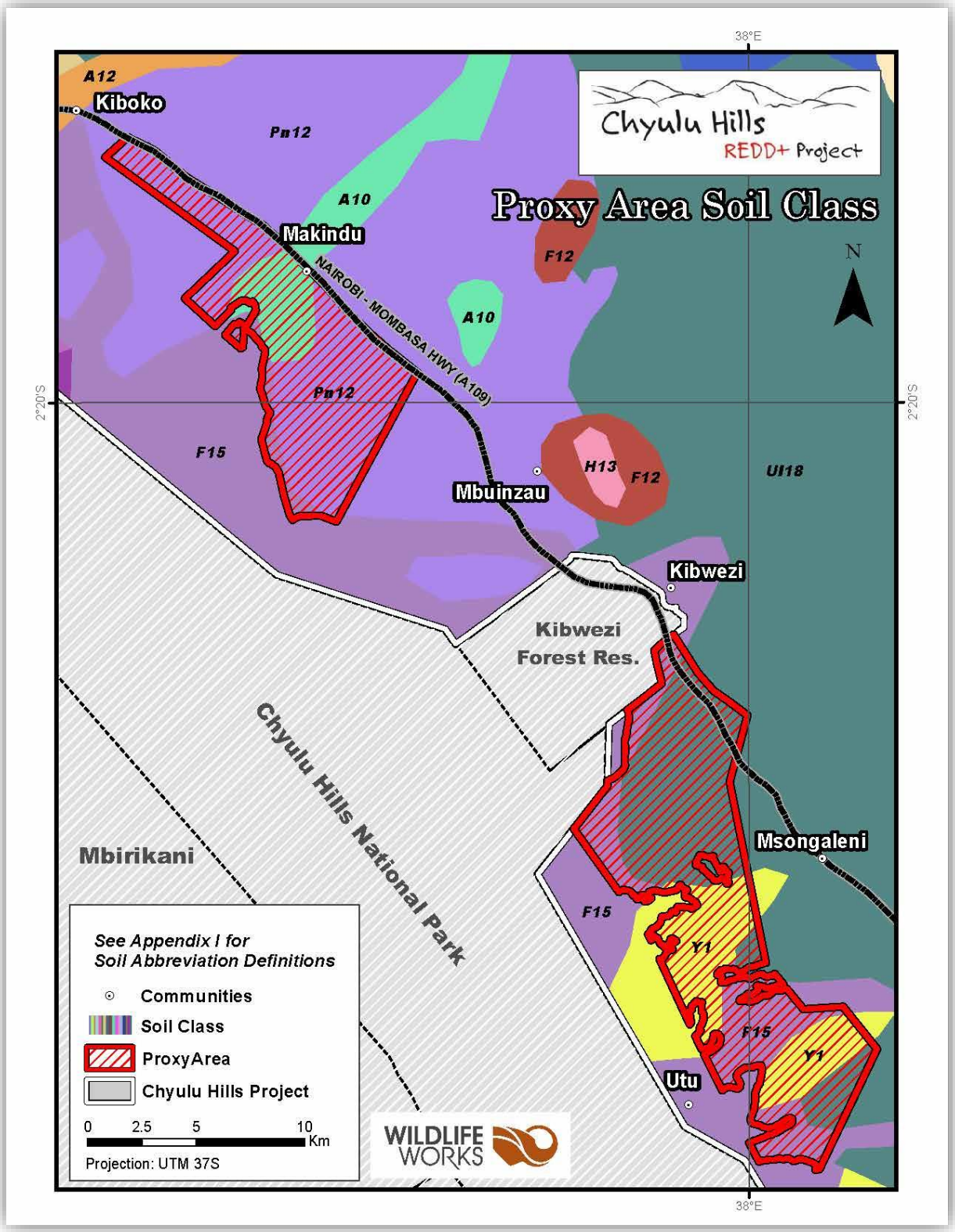

Chyulu Hills
REDD+ Project
Project Area Soil Plots
37°40'E
38°E
2°20'S
2°40'S
3°S
Chyulu Hills National Park
Kibwezi Forest Res.
Mbirikani
Kuku A
Kuku
Rombo
Southern Chyulu Extension
CN81
CN77
CN09
CN117
CN73
CN113
KW10
KW06
CN69
CN109
CN65
CN101
CN97
CN57
CN93
CN53
CN89
CN49
CN85
CN45
CN13
CN01
T61
T49
T45
T57
T09
T05
T01
T41
T37
MB112
MB108
MB20
MB48
MB44
MB40
MB16
MB36
MB32
MB04
MB12
MB08
MB24
MB92
MB28
MB96
MB88
MB84
KU27
KU31
KU99
KU107
KU47
KU23
KU19
KU43
KU15
KU95
KU91
KU11
KU07
KU83
KU87
KU39
KU03
KU79
KU35
RM09
RM08
RM04
RM12
RM14
Soil Sample Depth
30 cm depth
1 m Depth
Vegetation Class
Acacia-Savanna-Mosaic
Cloud Forest
Lava Forest
Lava Forest-Sparse/Low
Woodland-Sparse/Low
Woodland/Thicket
Grassland
Developed/ Agriculture Area
Project Area
N
0 2.5 5 10 Km
Projection: UTM 37S
WILDLIFE WORKS

APPENDIX C. Documentation Required for the Proxy Area Selection Criteria

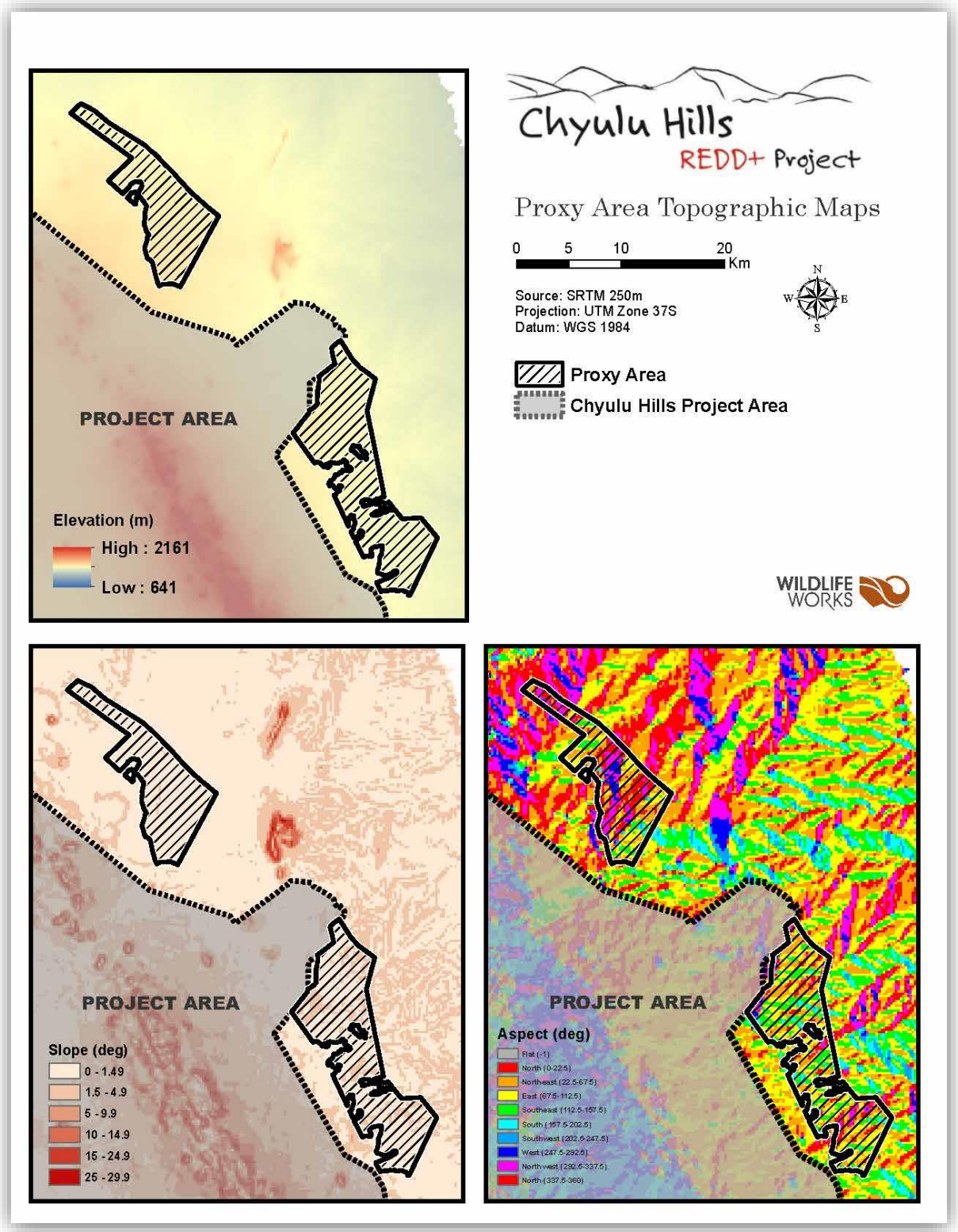



Chyulu Hills
REDD+ Project
Proxy Area
Proxy Area Plots
Proxy Area
Chyulu Hills Project
Project Zone
Reference Area
Kibwezi Forest Res.
Chyulu Hills National Park
Mbirikani
0 2.5 5 10 Km
N
Projection:UTM 37S
Datum: WGS 1984
WILDLIFE WORKS
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

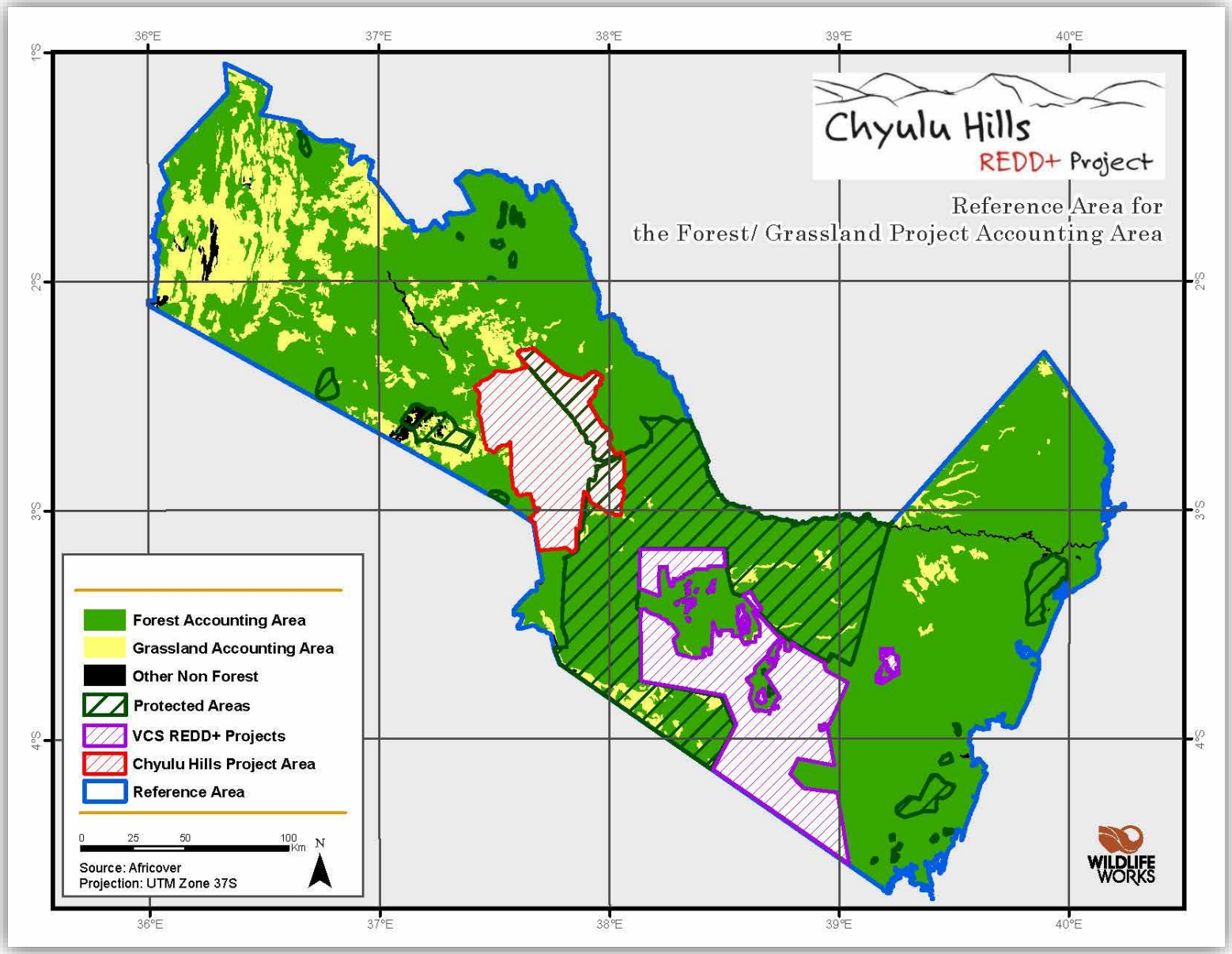

Chyulu Hills
REDD+ Project
Proxy Area Infrastructure
37°40'E
38°E
2°20'S
2°40'S
Kiboko
Makindu
NAIROBI - MOMBASA HWY (A109)
Mbuinzau
Nemambuli
Kibwezi
Kibwezi Forest Res.
UMANI
Chyulu Hills National Park
Ol Donyo Wuas
Msongaleni
Mbirikani
Ngwata
Utu
Communities
Lodges/Camps
ProxyArea
Project Area
Railroad
National Road
Local Road
Secondary Road
0 2.5 5 10 Km
Projection: UTM 37S
N
WILDLIFE WORKS
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

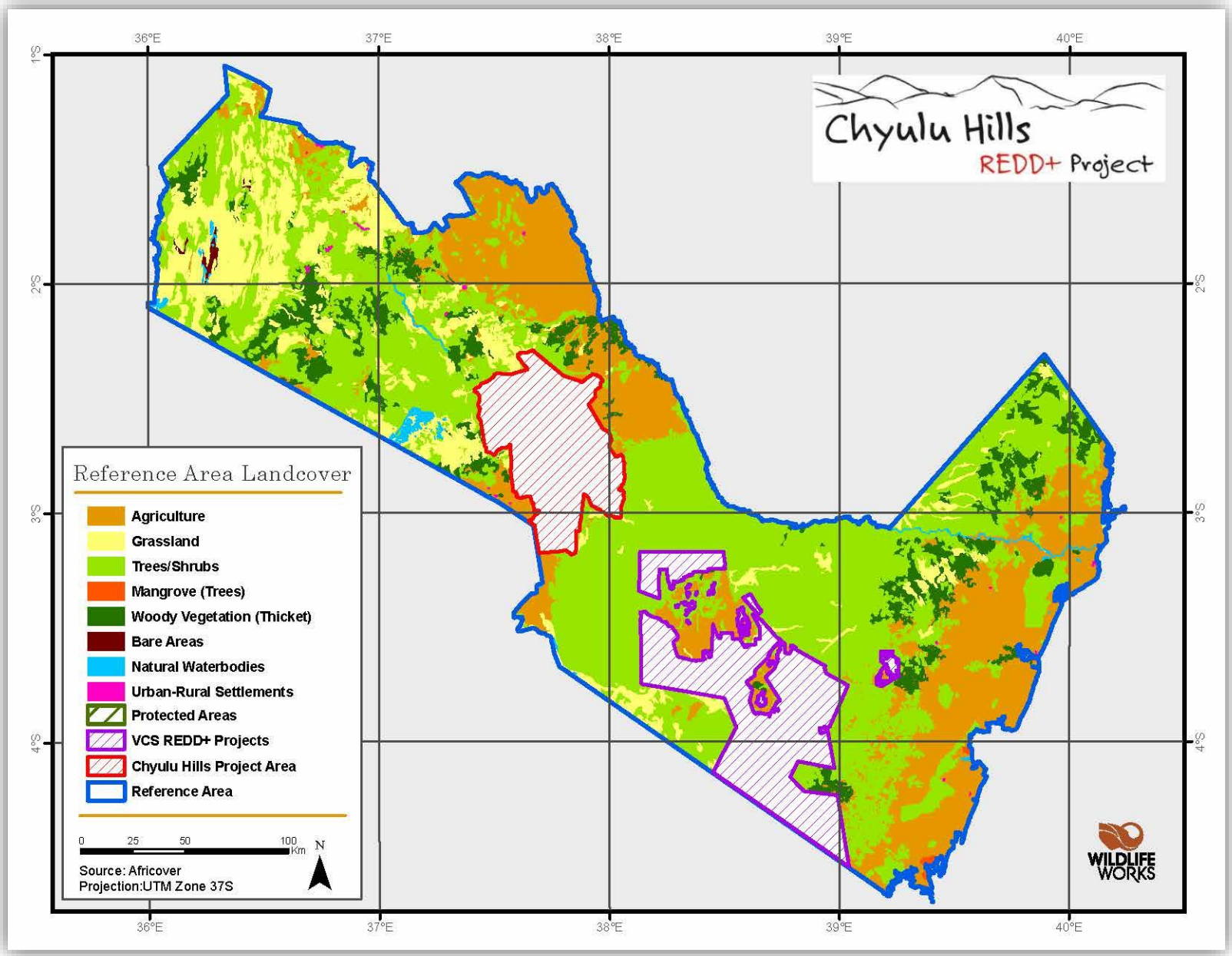


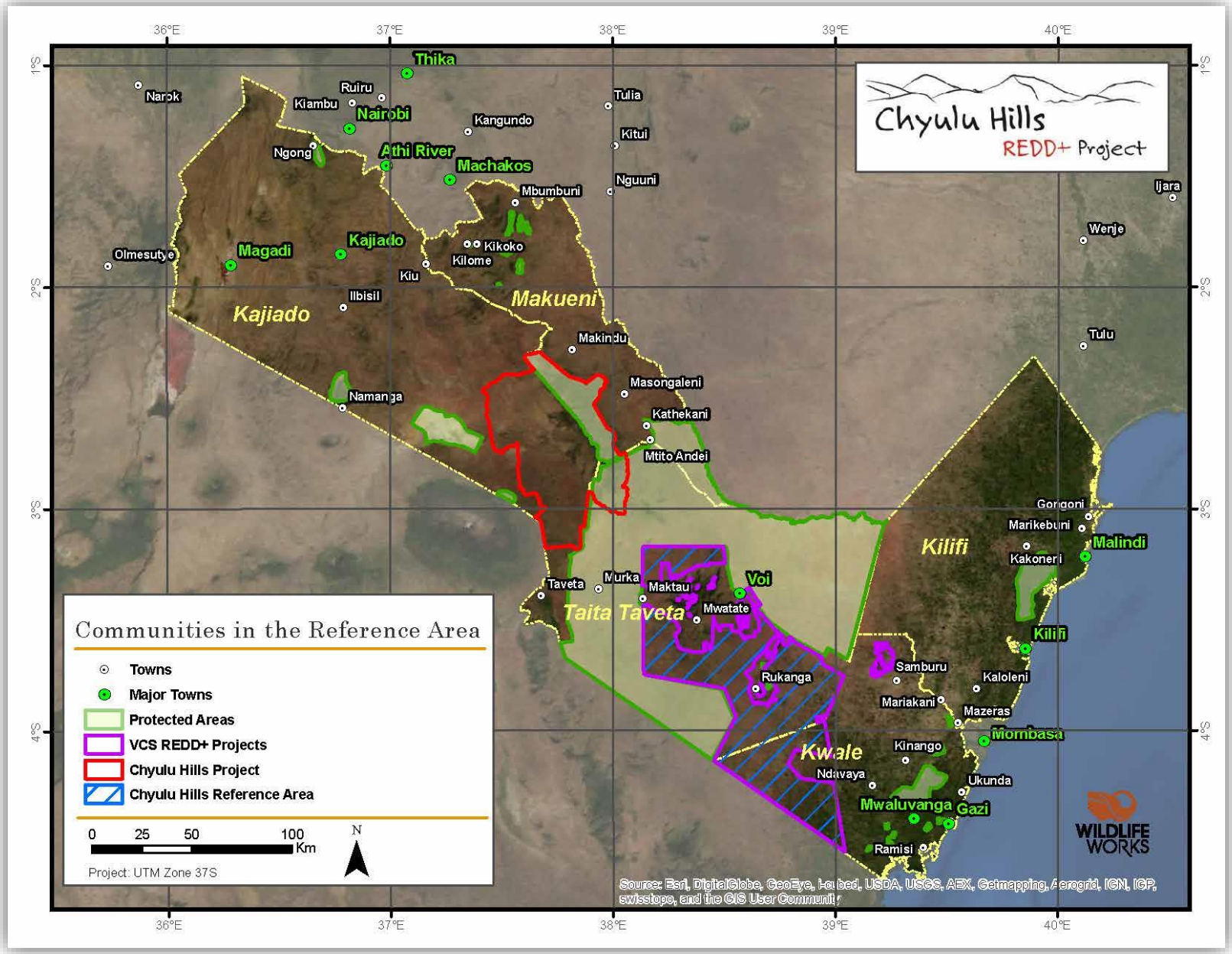
Please See Appendix H for the key for the Soil Class Abbreviations

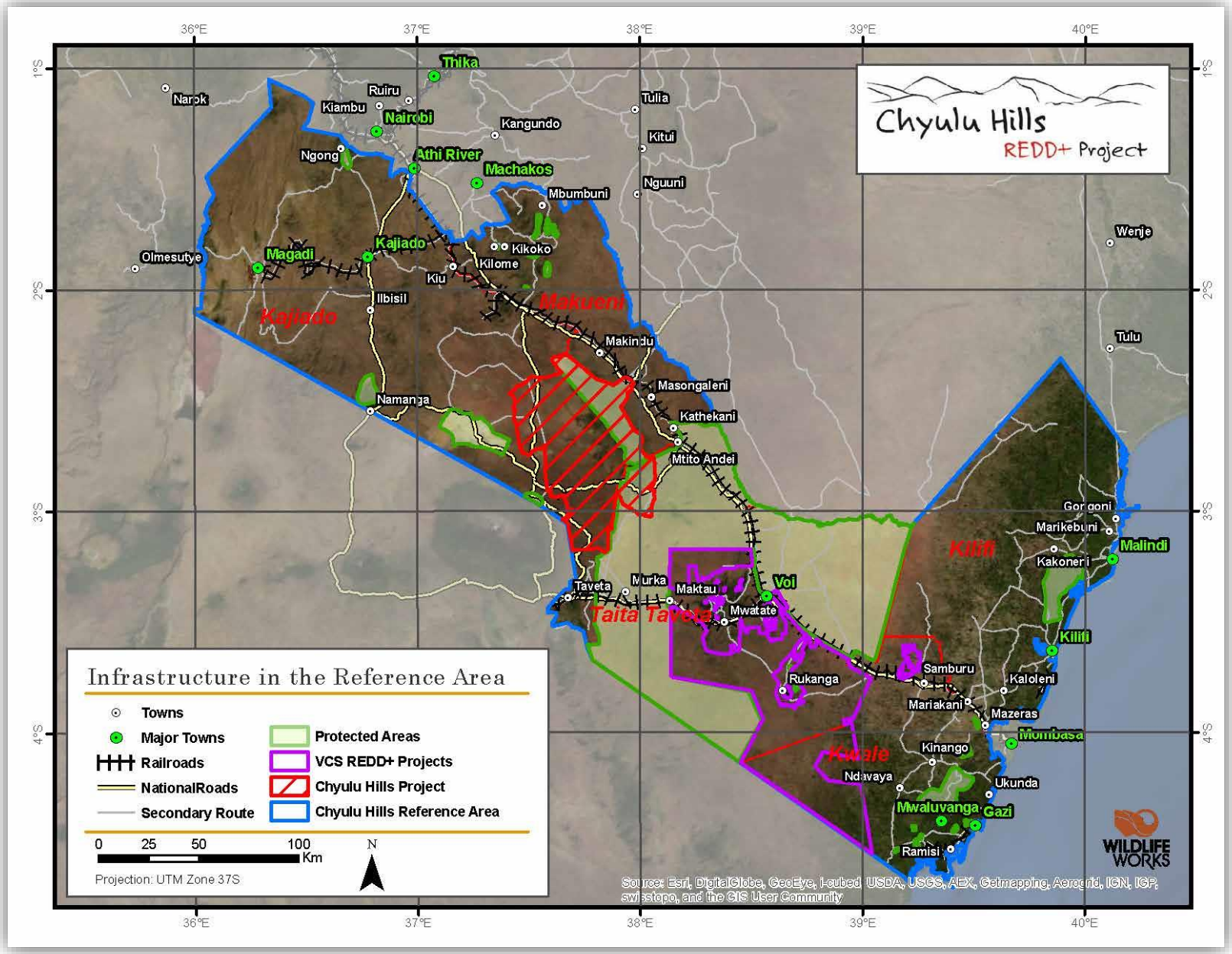

Chyulu Hills
REDD+ Project
Proxy Area Topographic Maps
0 5 10 20
Km
Source: SRTM 250m
Projection: UTM Zone 37S
Datum: WGS 1984
N
W
E
S
Proxy Area
Chyulu Hills Project Area
PROJECT AREA
Elevation (m)
High : 2161
Low : 641
WILDLIFE WORKS
PROJECT AREA
Slope (deg)
0 - 1.49
1.5 - 4.9
5 - 9.9
10 - 14.9
15 - 24.9
25 - 29.9
PROJECT AREA
Aspect (deg)
Flat (-1)
North (0-22.5)
Northeast (22.5-67.5)
East (67.5-112.5)
Southeast (112.5-157.5)
South (157.5-202.5)
Southwest (202.5-247.5)
West (247.5-292.5)
Northwest (292.5-337.5)
North (337.5-360)

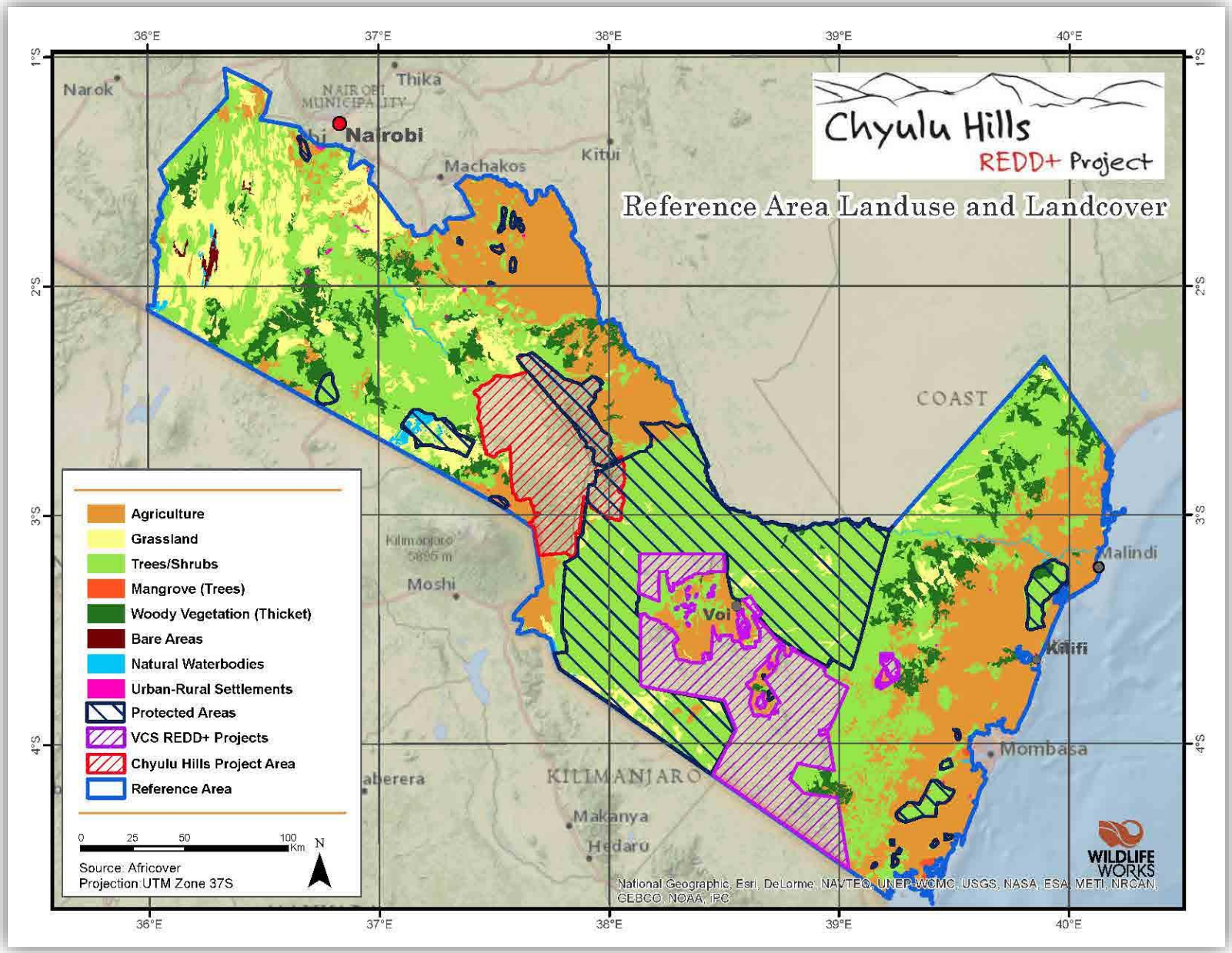
APPENDIX D. Documentation Required for the Reference Area Selection Criteria.

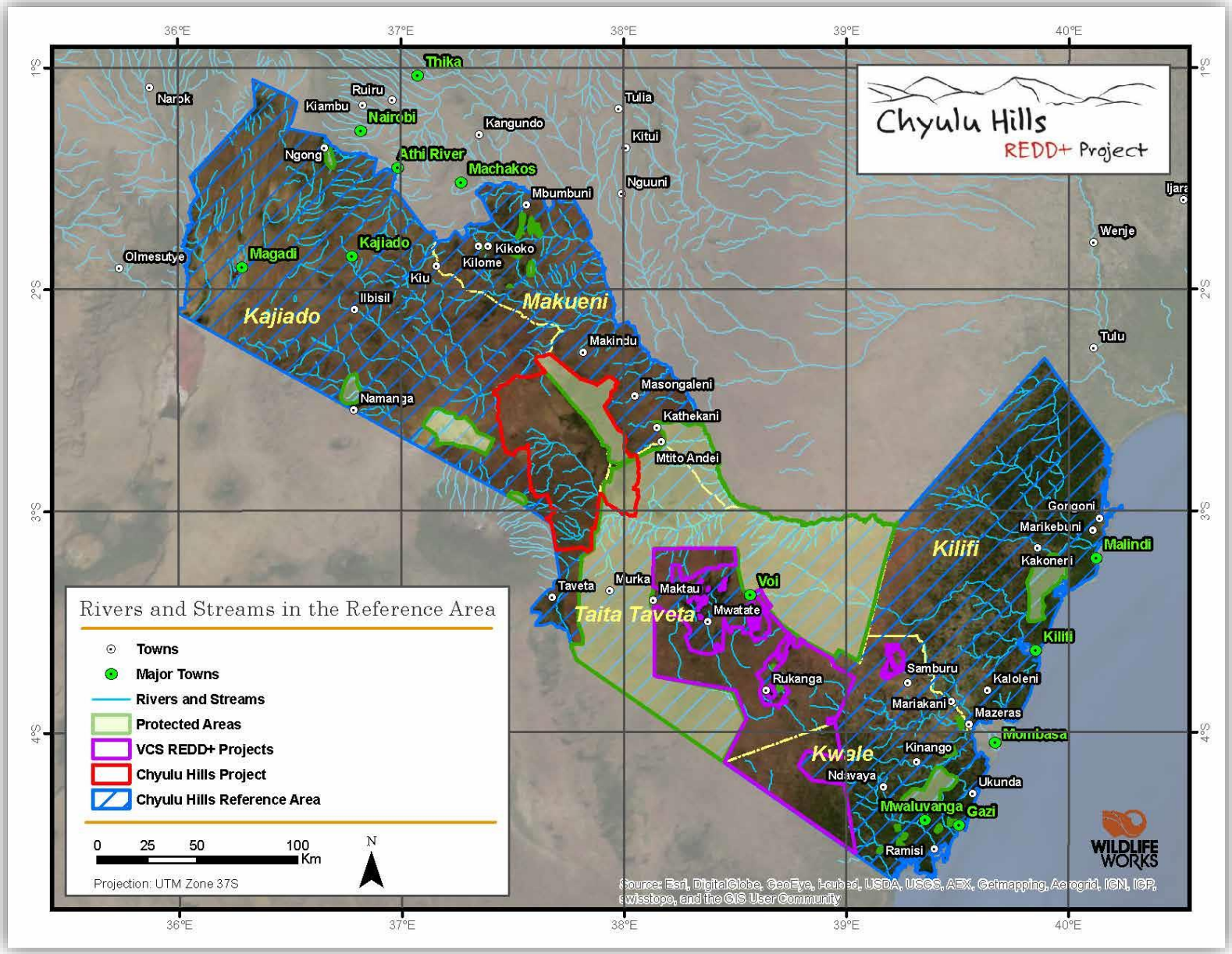


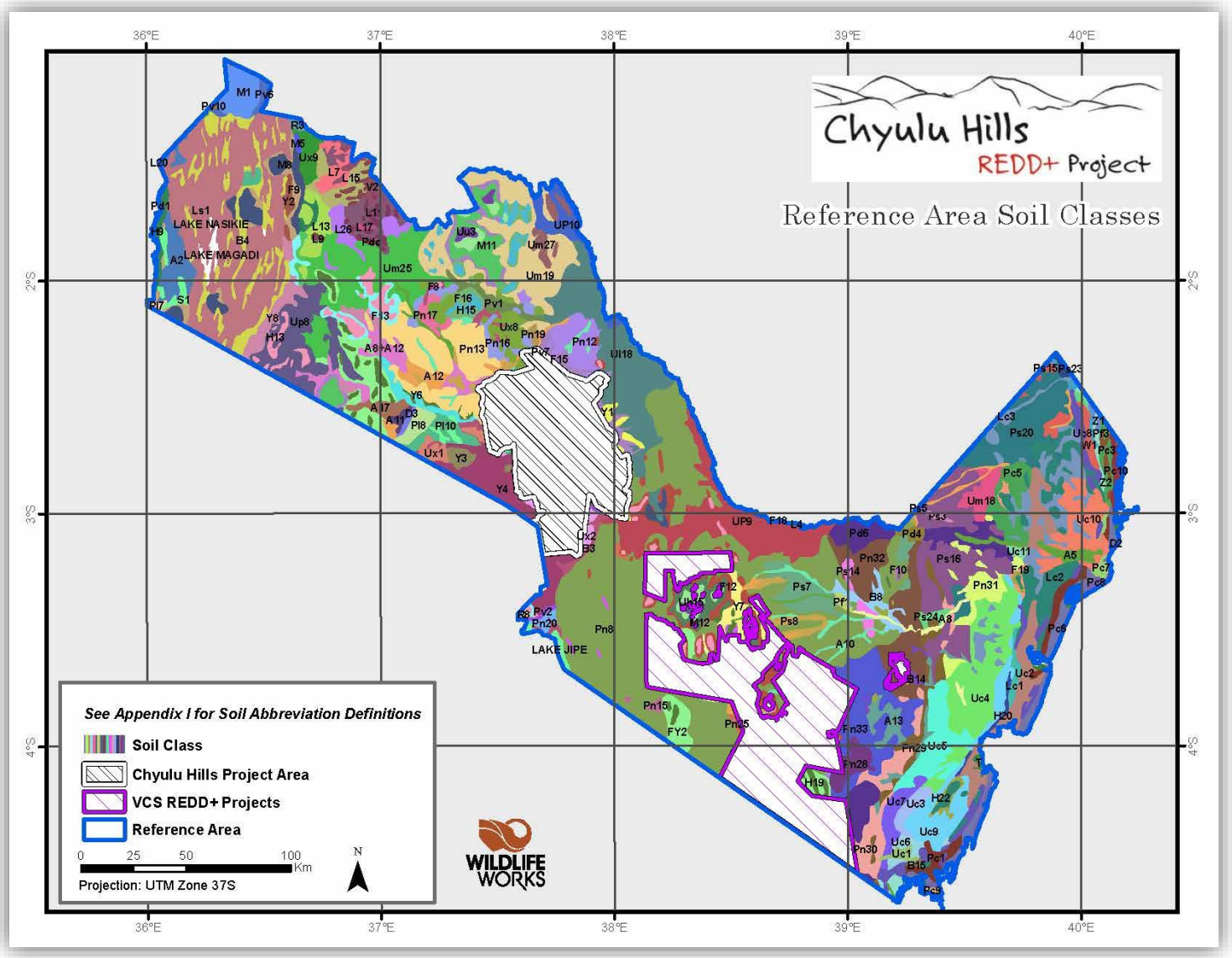

Chyulu Hills
REDD+ Project
36°E
37°E
38°E
39°E
40°E
1°S
2°S
3°S
4°S
Reference Area Landcover
Agriculture
Grassland
Trees/Shrubs
Mangrove (Trees)
Woody Vegetation (Thicket)
Bare Areas
Natural Waterbodies
Urban-Rural Settlements
Protected Areas
VCS REDD+ Projects
Chyulu Hills Project Area
Reference Area
0 25 50 100 Km
N
Source: Africover
Projection:UTM Zone 37S
WILDLIFE WORKS


Chyulu Hills
REDD+ Project
Communities in the Reference Area
Towns
Major Towns
Protected Areas
VCS REDD+ Projects
Chyulu Hills Project
Chyulu Hills Reference Area
0 25 50 100 Km
N
Project: UTM Zone 37S
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
WILDLIFE WORKS
Kajiado
Makueni
Taita Taveta
Kilifi
Kwale
Thika
Nairobi
Athi River
Machakos
Magadi
Kajiado
Voi
Malindi
Kilifi
Mombasa
Mwaluvanga
Gazi
Narok
Ruiru
Kiambu
Ngong
Kangundo
Tulia
Kitui
Nguuni
Mbumbuni
Kikoko
Kilome
Kiu
Olmesutye
Ilbisil
Makindu
Masongaleni
Kathekani
Mtito Andei
Namanga
Taveta
Murka
Maktau
Mwatate
Rukanga
Samburu
Kaloleni
Mariakani
Mazeras
Kinango
Ndavaya
Ukunda
Ramisi
Gongoni
Marikebuni
Kakoneni
Ijara
Wenje
Tulu
36°E
37°E
38°E
39°E
40°E
1°S
2°S
3°S
4°S

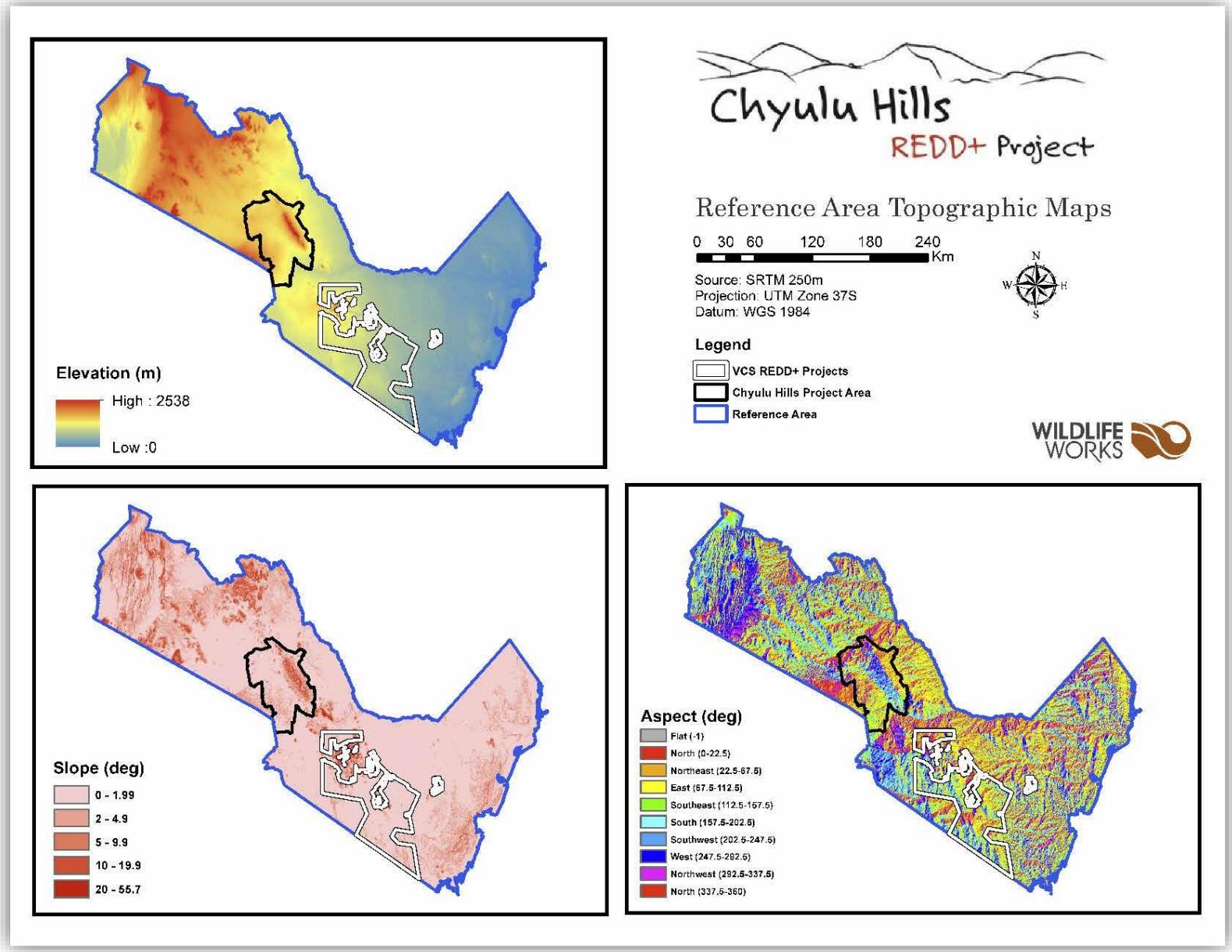

Chyulu Hills
REDD+ Project
Infrastructure in the Reference Area
Towns
Major Towns
Railroads
NationalRoads
Secondary Route
Protected Areas
VCS REDD+ Projects
Chyulu Hills Project
Chyulu Hills Reference Area
0 25 50 100 Km
Projection: UTM Zone 37S
N
36°E
37°E
38°E
39°E
40°E
1°S
2°S
3°S
4°S
Thika
Nairobi
Athi River
Machakos
Kajiado
Magadi
Narok
Ruiru
Kiambu
Ngong
Kangundo
Tulia
Kitui
Nguuni
Mbumbuni
Kikoko
Kilome
Kiu
Ilbisil
Olmesutye
Makueni
Makindu
Masongaleni
Kathekani
Mtito Andei
Namanga
Wenje
Tulu
Gorgoni
Marikebuni
Kakoneri
Malindi
Kilifi
Taveta
Murka
Maktau
Mwatate
Voi
Taita Taveta
Rukanga
Samburu
Kaloleni
Mariakani
Mazeras
Mombasa
Kwale
Kinango
Ndavaya
Ukunda
Mwaluvanga
Gazi
Ramisi
WILDLIFE WORKS
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


Chyulu Hills
REDD+ Project
Reference Area Landuse and Landcover
Agriculture
Grassland
Trees/Shrubs
Mangrove (Trees)
Woody Vegetation (Thicket)
Bare Areas
Natural Waterbodies
Urban-Rural Settlements
Protected Areas
VCS REDD+ Projects
Chyulu Hills Project Area
Reference Area
0 25 50 100 Km
N
Source: Africover
Projection:UTM Zone 37S
National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, PC
WILDLIFE WORKS
36°E
37°E
38°E
39°E
40°E
1°S
2°S
3°S
4°S
Narok
Thika
Nairobi
Machakos
Kitui
COAST
Malindi
Kilifi
Mombasa
Voi
Moshi
KILIMANJARO
Makanya
Hedaru

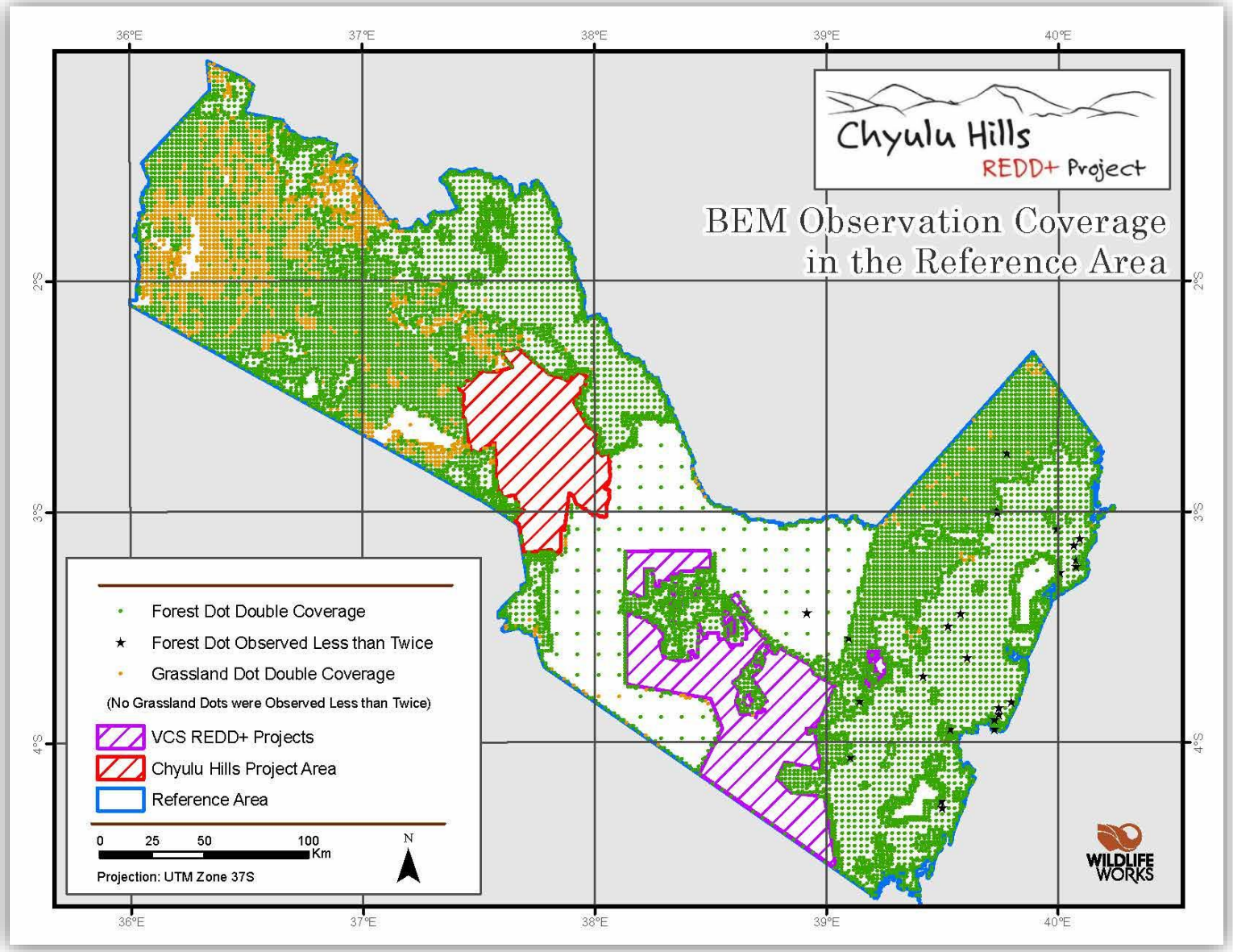

Chyulu Hills
REDD+ Project
Rivers and Streams in the Reference Area
Towns
Major Towns
Rivers and Streams
Protected Areas
VCS REDD+ Projects
Chyulu Hills Project
Chyulu Hills Reference Area
0 25 50 100 Km
N
Projection: UTM Zone 37S
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
WILDLIFE WORKS
36°E
37°E
38°E
39°E
40°E
1°S
2°S
3°S
4°S
Thika
Narok
Ruiru
Kiambu
Nairobi
Kangundo
Tulia
Kitui
Ngong
Athi River
Machakos
Nguuni
Mbumbuni
Ijara
Wenje
Olmesutye
Magadi
Kajiado
Kikoko
Kilome
Kiu
Ilbisil
Makueni
Makindu
Tulu
Masongaleni
Namanga
Kathekani
Mtito Andei
Gorigoni
Marikebuni
Kakoneri
Malindi
Kilifi
Taveta
Murka
Maktau
Voi
Mwatate
Taita Taveta
Kilifi
Samburu
Kaloleni
Rukanga
Mariakani
Mazeras
Mombasa
Kwale
Kinango
Ndavaya
Ukunda
Mwaluvanga
Gazi
Ramisi

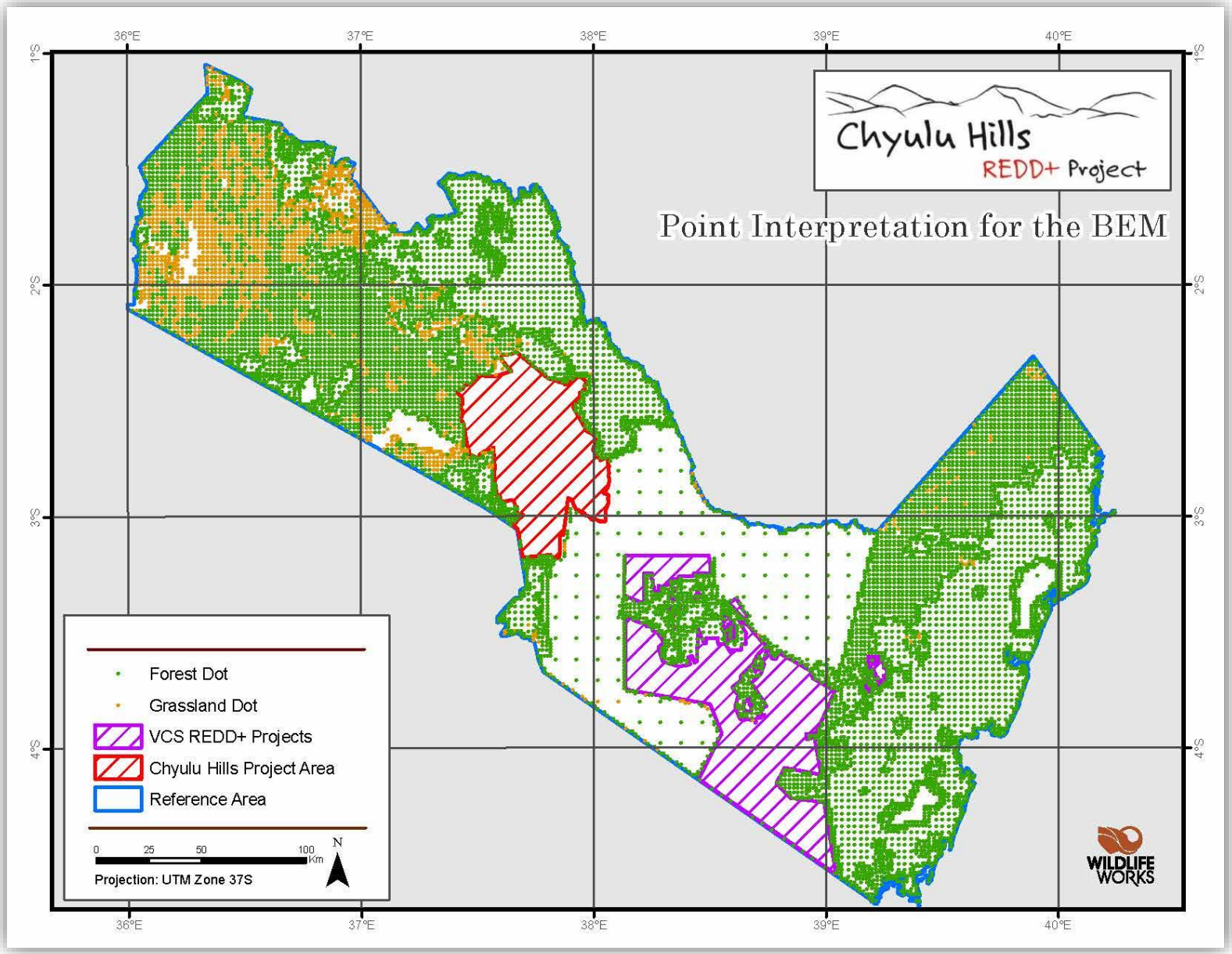


Please See Appendix H for the key for the Soil Class Abbreviations

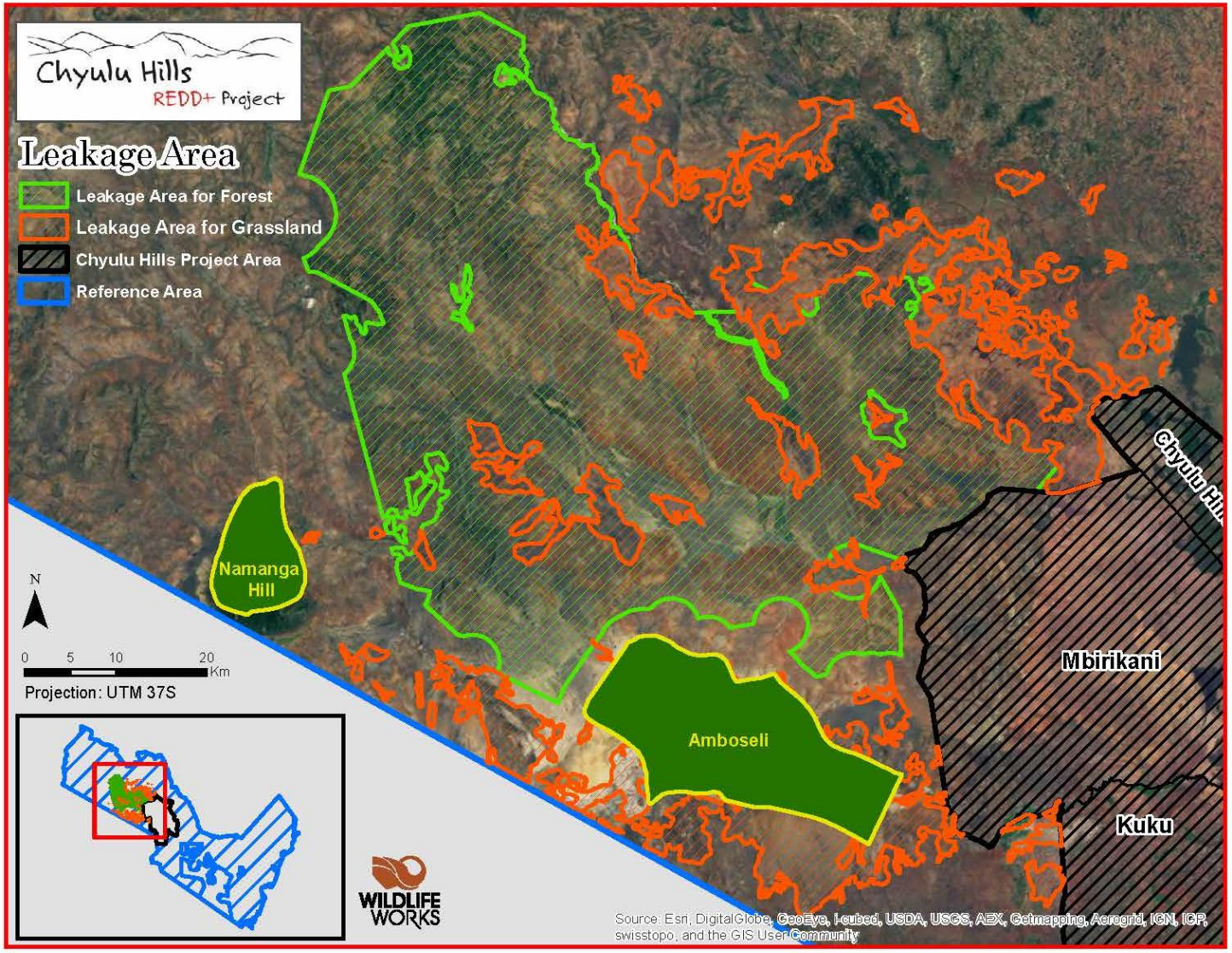

Chyulu Hills
REDD+ Project
Reference Area Topographic Maps
0 30 60 120 180 240
Km
Source: SRTM 250m
Projection: UTM Zone 37S
Datum: WGS 1984
N
W
E
S
Legend
VCS REDD+ Projects
Chyulu Hills Project Area
Reference Area
WILDLIFE WORKS
Elevation (m)
High : 2538
Low :0
Slope (deg)
0 - 1.99
2 - 4.9
5 - 9.9
10 - 19.9
20 - 55.7
Aspect (deg)
Flat (-1)
North (0-22.5)
Northeast (22.5-67.5)
East (67.5-112.5)
Southeast (112.5-157.5)
South (157.5-202.5)
Southwest (202.5-247.5)
West (247.5-292.5)
Northwest (292.5-337.5)
North (337.5-360)

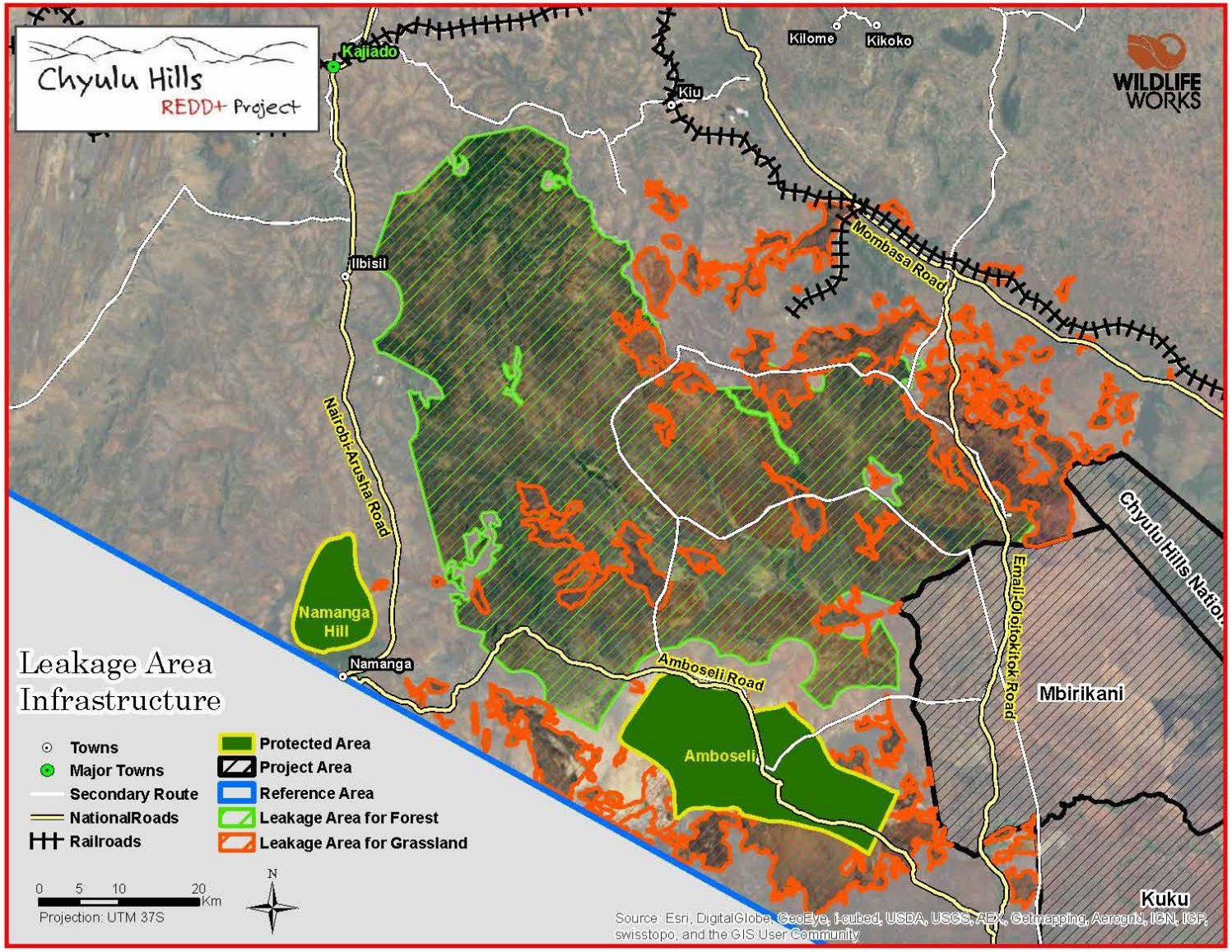
APPENDIX E. Map of the Reference Area Showing Double Coverage and Dot Interpretation

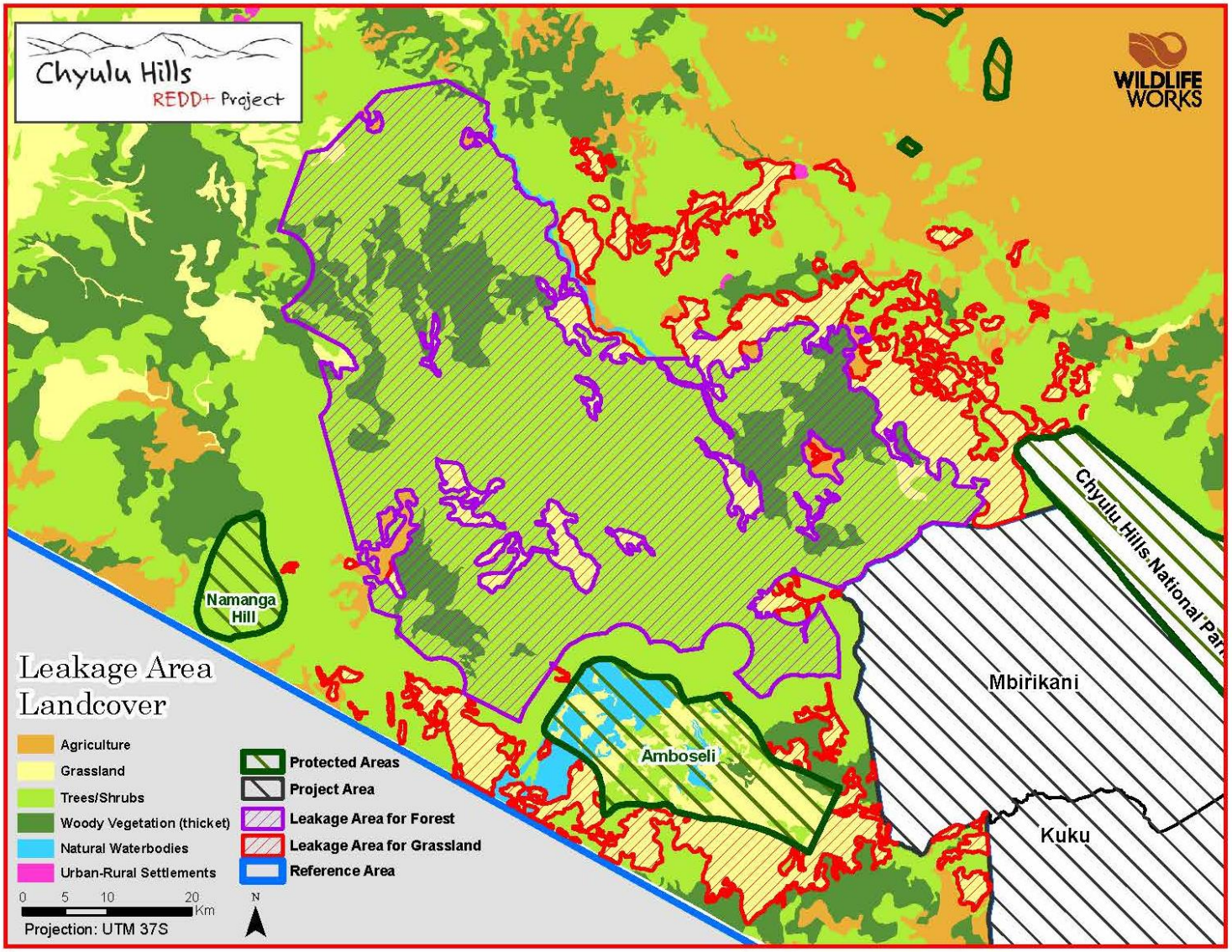


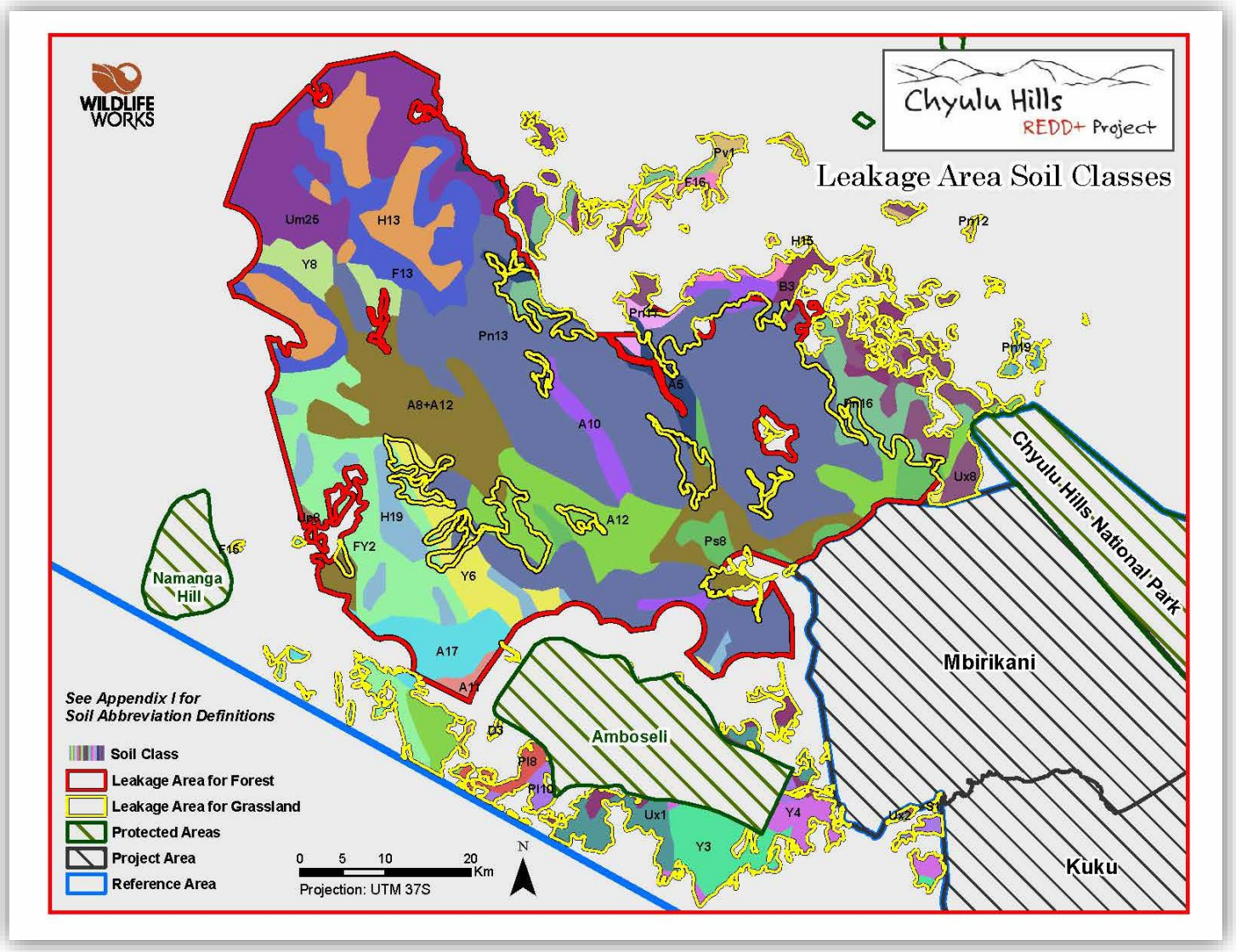

Chyulu Hills
REDD+ Project
Point Interpretation for the BEM
36°E
37°E
38°E
39°E
40°E
1°S
2°S
3°S
4°S
Forest Dot
Grassland Dot
VCS REDD+ Projects
Chyulu Hills Project Area
Reference Area
0 25 50 100 Km
N
Projection: UTM Zone 37S
WILDLIFE WORKS

APPENDIX F. Documentation Required for the Leakage Area Selection Criteria

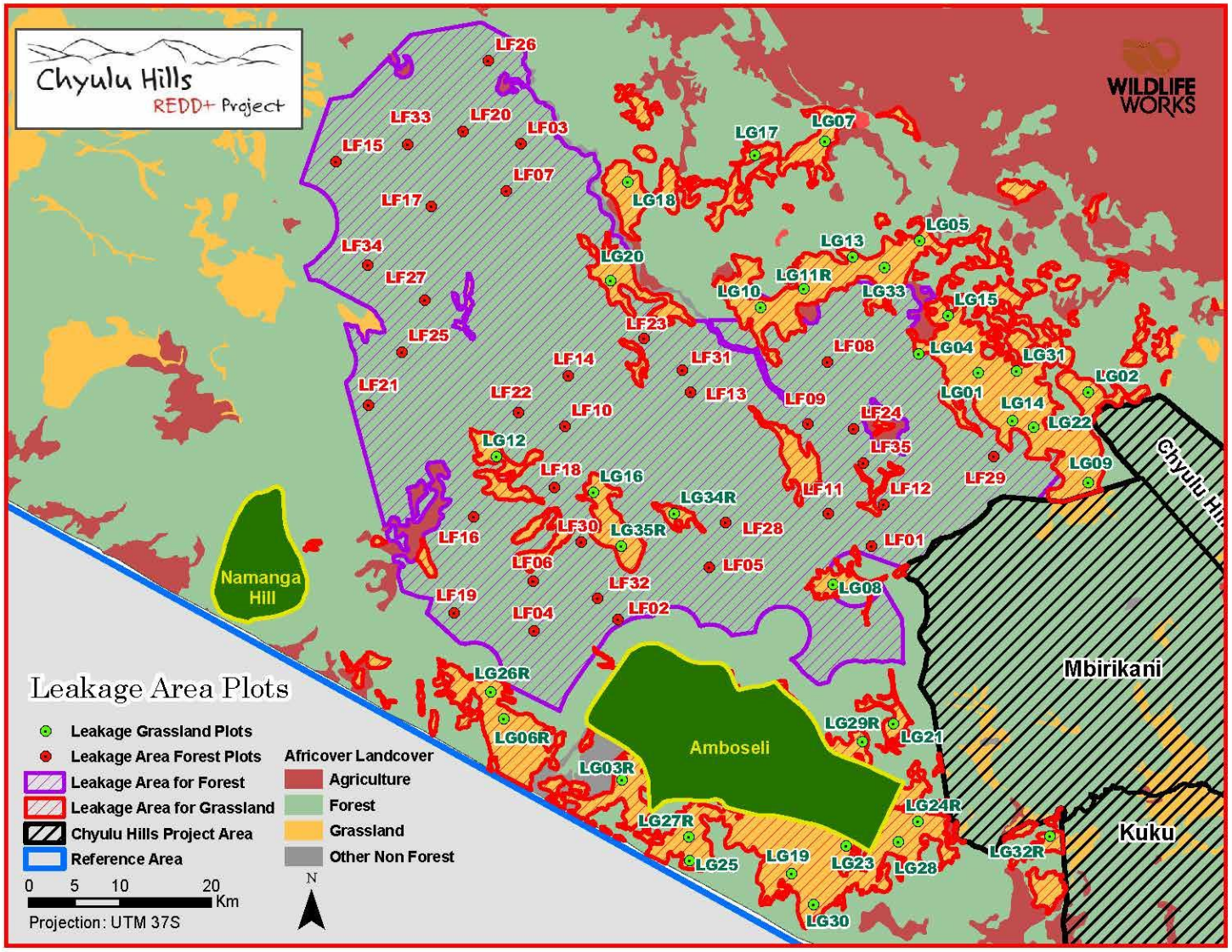


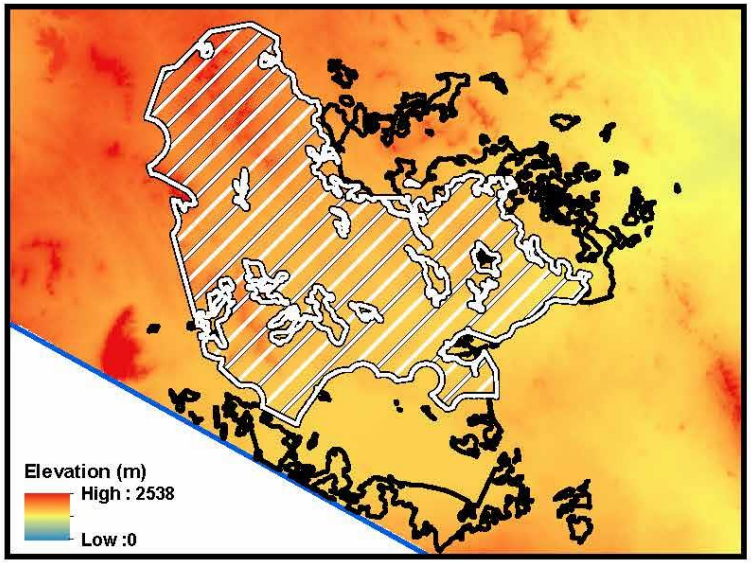

Chyulu Hills
REDD+ Project
Kajiado
Kilome
Kikoko
Kiu
WILDLIFE WORKS
Mombasa Road
Ilbisil
Nairobi-Arusha Road
Namanga Hill
Namanga
Amboseli Road
Amboseli
Emali-Oloitokitok Road
Chyulu Hills Nation
Mbirikani
Kuku
Leakage Area Infrastructure
Towns
Major Towns
Secondary Route
NationalRoads
Railroads
Protected Area
Project Area
Reference Area
Leakage Area for Forest
Leakage Area for Grassland
0 5 10 20 Km
Projection: UTM 37S
N
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


Chyulu Hills
REDD+ Project
WILDLIFE WORKS
Namanga Hill
Amboseli
Mbirikani
Kuku
Chyulu Hills National Park
Leakage Area Landcover
Agriculture
Grassland
Trees/Shrubs
Woody Vegetation (thicket)
Natural Waterbodies
Urban-Rural Settlements
Protected Areas
Project Area
Leakage Area for Forest
Leakage Area for Grassland
Reference Area
0 5 10 20 Km
N
Projection: UTM 37S



Please See Appendix H for the key for the Soil Class Abbreviations


Chyulu Hills
REDD+ Project
WILDLIFE WORKS
Leakage Area Plots
Leakage Grassland Plots
Leakage Area Forest Plots
Leakage Area for Forest
Leakage Area for Grassland
Chyulu Hills Project Area
Reference Area
Africover Landcover
Agriculture
Forest
Grassland
Other Non Forest
0 5 10 20 Km
Projection: UTM 37S
N
Namanga Hill
Amboseli
Mbirikani
Kuku
Chyulu Hi
LF26
LF33
LF20
LF03
LF15
LF07
LF17
LF34
LF27
LF25
LF21
LF22
LF14
LF10
LF23
LF31
LF13
LF09
LF08
LF24
LF35
LF11
LF12
LF29
LF28
LF05
LF01
LF16
LF18
LF30
LF06
LF19
LF04
LF32
LF02
LG12
LG16
LG34R
LG35R
LG26R
LG06R
LG03R
LG27R
LG25
LG19
LG23
LG30
LG28
LG24R
LG32R
LG29R
LG21
LG08
LG17
LG07
LG18
LG20
LG13
LG11R
LG10
LG33
LG05
LG15
LG04
LG31
LG01
LG14
LG22
LG02
LG09



Chyulu Hills
REDD+ Project

Leakage Area Topographic Maps

0 12.5 25 50 Km

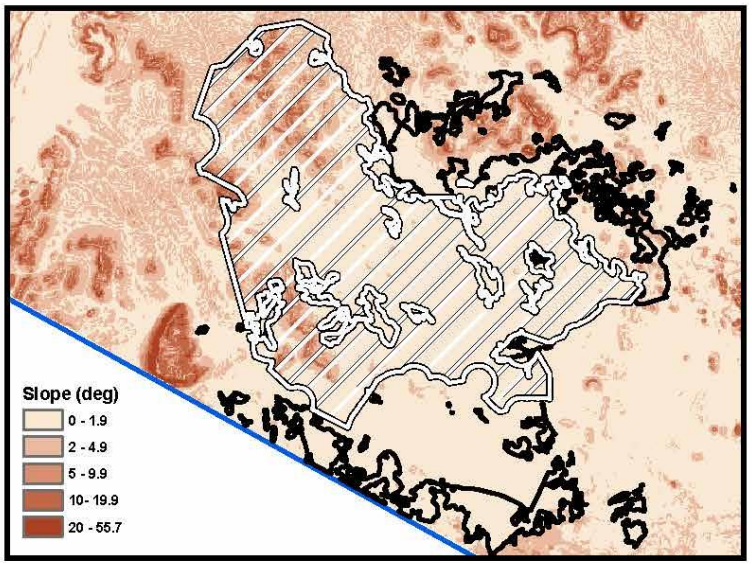
Source: SRTM 250m
Projection: UTM Zone 37S
Datum: WGS 1984

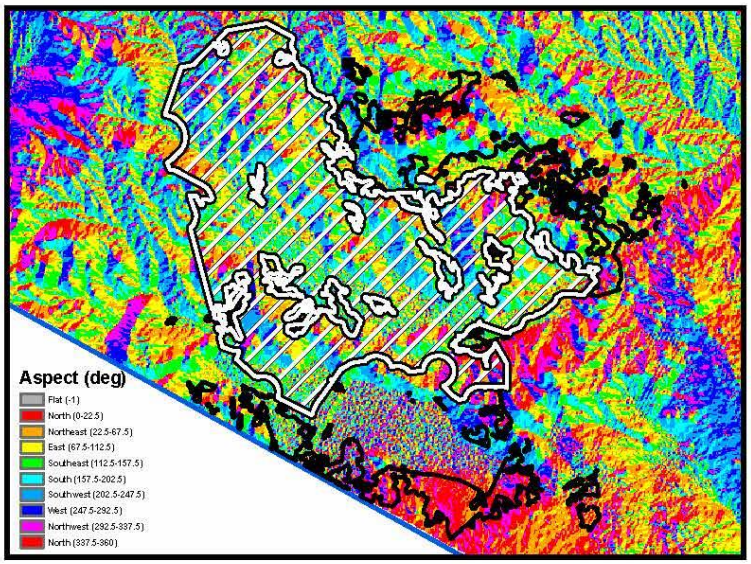
N
W E
S

Legend

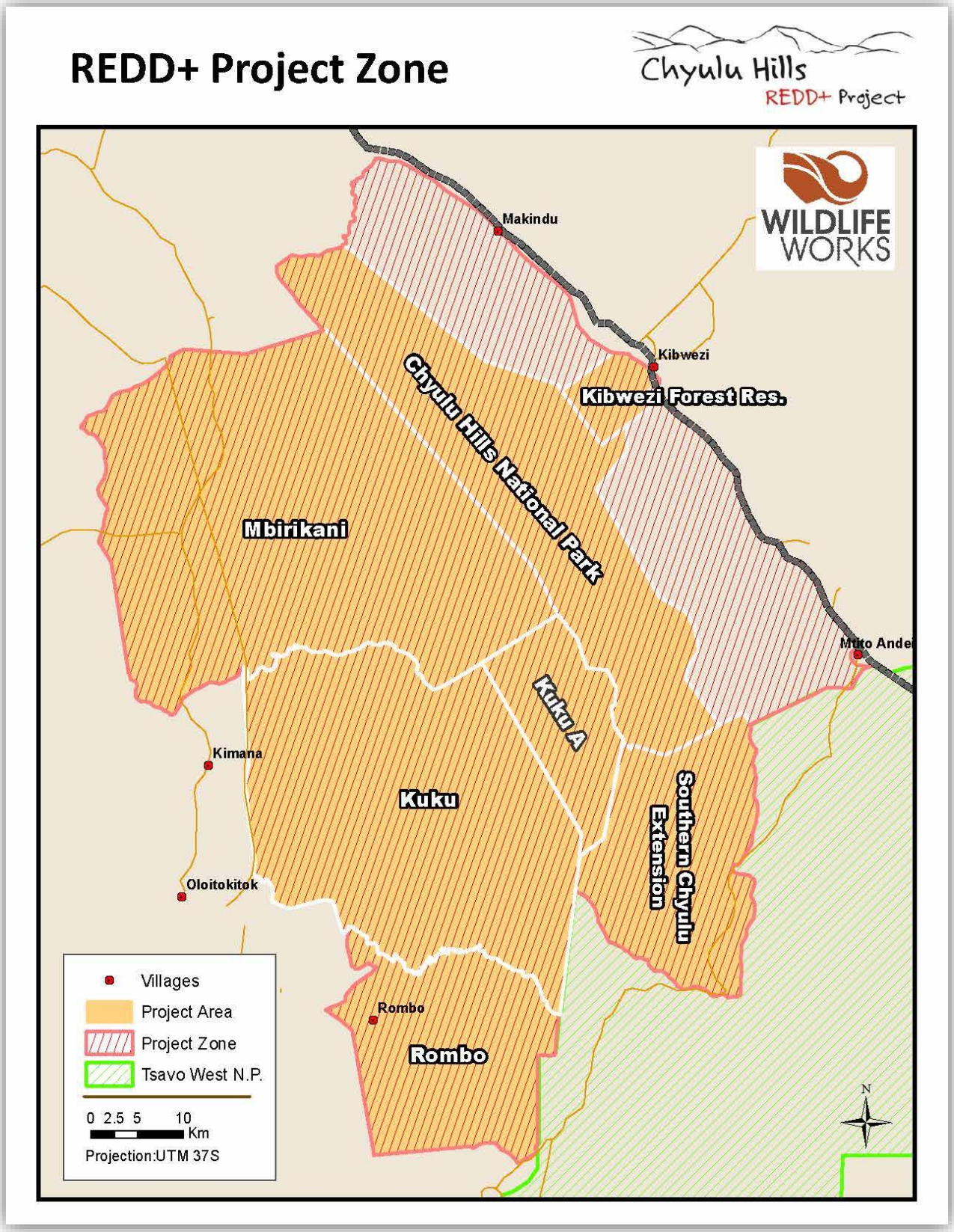
- Leakage Area for Forest
- Leakage Area for Grassland
- Reference Area

WILDLIFE WORKS





APPENDIX G. The Project Zone



Appendix H: Soil Class Key

Soil Abbreviation Definitions - *Source: International Livestock Research Institute / FAO*

Soil Class	Description
A10	100 % Calcic Cambisols
A11	100 % Calcic Luvisols
A12	100 % Chromic Vertisols
A13	100 % Pellic Vertisols
A17	50 % Calcic Luvisols + 50 % Pellic Vertisols
A2	100 % Eutric Fluvisols
A5	100 % Eutric Fluvisols
A8	100 % Calcaric Fluvisols
A8+A12	30 % Calcaric Fluvisols + 30 % Chromic Vertisols
B14	100 % Luvo-orthic Solonetz
B15	60 % Gleyic Phaeozems + 20 % Verto-luvic Phaeozems + 20 % Pellic Vertisols
B3	50 % Chromic Vertisols + 50 % Pellic Vertisols
B4	50 % Vertisols + 50 % Solonchaks
B8	100 % Orthic Solonetz
D2	100 % Cambic Arenosols
D3	100 % Calcic Cambisols
DC7	40 % Solodic Planosols
F10	100 % Chromic Luvisols
F12	50 % Rodic Ferralsols + 30 % Ferralic Arenosols + 20 % Ferralo-chromic Luvisols
F13	30 % Chromic Luvisols + 20 % Rodic Ferralsols + 15 % Luvic Arenosols + 15 % Ferralic Arenosols
F15	68 % Acrisols + 30 % Arenosols
F16	60 % Ferralic Arenosols + 20 % Ferralo-chromic Luvisols + 20 % Luvisols
F18	70 % Chromic Luvisols + 30 % Rodic Ferralsols
F19	60 % Luvic Arenosols + 20 % F Histosols + 20 % Albic Arenosols
F8	100 % Calcic Xerosols/Yermosols
F9	40 % Luvisols + 40 % Orthic-luvic Phaeozems + 20 % Chromic Vertisols
FY2	60 % Chromic Luvisols + 40 % Haplic Kastanozems
H13	60 % Eutric Regosols + 20 % K Podzoluvisols + 20 % Rock
H15	60 % Dystric Regosols + 15 % Lithosols + 13 % Humic Cambisols + 10 % Rock
H19	100 % Cambic Rendzinas
H20	100 % Cambic Rendzinas
H21	100 % Lithosols
H22	100 % Eutric Regosols
H5	100 % Mollic Andosols
H9	60 % Lithosols + 30 % Calcic Xerosols/Yermosols + 10 % Rock
L11	100 % Pellic Vertisols

L13	100 % Chromic Vertisols
L15	50 % Pellic Vertisols + 50 % Rendzinas
L17	45 % Ironstone soils + 15 % Lithosols + 20 % Vertisols + 20 % Vertic Gleysols
L20	100 % Ando-luvic Phaeozems
L26	60 % Pellic Vertisols + 40 % Humic Planosols
L4	60 % Nito-rodic Ferralsols + 40 % C Podzoluvisols
L7	100 % C Podzoluvisols
L9	70 % Verto-luvic Phaeozems + 30 % Humic Planosols
LC1	100 % Eutric Nitisols
LC2	46 % Acric Ferralsols + 46 % Rodic Ferralsols
LC3	70 % F Histosols + 30 % Gleysols
LS1	70 % Ando-chromic Cambisols + 30 % Calcic Xerosols/Yermosols
M1	72 % Ando-calcaric Regosols + 20 % Lava
M11	60 % Eutric Podzoluvisols + 20 % Lithosols + 10 % Eutric Regosols + 10 % Rock
M12	70 % Humic Cambisols + 20 % Dystric Regosols + 10 % Rock
M5	90 % Humic Cambisols + 50 % M Podzoluvisols
M8	80 % Eutric Regosols + 20 % Rock
PC1	40 % Albic Arenosols + 40 % Ferralic Arenosols + 20 % D Ferralsols
PC10	100 % Solodic Planosols
PC3	50 % Luvo-orthic Solonetz + 50 % Vertic Luvisols
PC5	70 % Gleyic Solonetz + 15 % Gleyic Phaeozems + 15 % Verto-luvic Phaeozems
PC6	20 % Albic Arenosols + 20 % Orthic Ferralsols + 20 % Gleyic Luvisols + 20 % Solodic Planosols + 20 % Pellic Vertisols
PC7	100 % Orthic Ferralsols
PC8	100 % Rodic Ferralsols
PC9	70 % Lithosols + 30 % Ferralic Cambisols
PD1	80 % Luvisols + 20 % Rock
PD4	70 % Calcic Cambisols + 30 % Chromic Luvisols
PD6	40 % Chromic Cambisols + 20 % Orthic Luvisols + 20 % Calcic Cambisols
PF1	100 % Luvisols
PF3	50 % Luvo-orthic Solonetz + 15 % Solodic Planosols + 15 % Chromic Vertisols + 20 % Cambic Arenosols
PL10	50 % Orthic Solonchaks + 50 % Orthic Solonetz
PL7	100 % Solonetz
PL8	100 % Gleyic Solonchaks
PN12	50 % Rodic Ferralsols + 50 % Orthic Ferralsols
PN13	50 % Ferric Luvisols + 50 % Chromic Luvisols
PN15	100 % Pellic Vertisols
PN16	50 % Ferric Luvisols + 50 % Nito-chromic Luvisols
PN17	50 % Vertic Luvisols + 50 % Chromic Luvisols
PN19	100 % Luvo-orthic Solonetz

PN20	100 % Vertic Luvisols
PN21	100 % Verto-luvic Phaeozems
PN25	100% 40 % C Podzoluvisols
PN28	100 % Pellic Vertisols
PN29	100 % Verto-luvic Phaeozems
PN30	70 % Eutric Cambisols + 30 % Lithosols
PN31	100 % Orthic Luvisols
PN32	100 % Chromic Luvisols
PN33	70 % Orthic Luvisols + 30 % Orthic Acrisols
PN8	100 % Rodic Ferralsols
PS14	100 % Calcic Luvisols
PS15	100 % Luvo-orthic Solonetz
PS16	100 % Gleyic Solonetz
PS20	100 % Solodic Planosols
PS23	100 % Luvo-orthic Solonetz
PS24	100 % Orthic Solonetz
PS3	60 % Ferralo-chromic Acrisols + 20 % Ferralic Arenosols + 20 % Ferric Luvisols
PS5	50 % Solodic Planosols + 50 % Luvo-orthic Solonetz
PS7	70 % Chromic Luvisols + 30 % Calcic Luvisols
PS8	100 % Ferric Luvisols
PV10	100 % Orthic Solonetz
PV2	100 % Chromic Luvisols
PV6	100 % Ando-calcaric Regosols
PV7	100 % Mollic Andosols
PVI	100 % Eutric Nitisols
R3	68 % Eutric Nitisols + 13 % Nito-chromic Cambisols + 13 % Chromic Acrisols
R8	50 % Nito-chromic Cambisols + 48 % Eutric Cambisols
S1	100 % Gleyic Solonchaks
T	50 % Thionic Fluvisols + 25 % Gleyic Solonchaks
UC1	100 % Eutric Nitisols
UC10	60 % Mollic Solonetz + 20 % D Rendzinas + 20 % Verto-luvic Phaeozems
UC11	70 % Luvisols + 30 % Verto-luvic Phaeozems
UC2	Unknown
UC3	50 % Albic Arenosols + 50 % Luvic Arenosols
UC4	70 % Orthic Luvisols + 30 % Solodic Planosols
UC5	60 % Eutric Cambisols + 40 % Orthic Luvisols
UC6	100 % Orthic Acrisols
UC7	100 % Solodic Planosols
UC8	50 % Rodic Ferralsols + 50 % D Ferralsols
UC9	20 % Ferralo-chromic Acrisols + 20 % Ferralo-orthic Acrisols + 20 % Gleyic Luvisols + 20 % Ferralic Arenosols + 20 % Luvic Arenosols

UH15	60 % Chromic Acrisols + 20 % Cambisols + 20 % Ferralsols
UH16	100 % Chromo-luvic Phaeozems
UL18	60 % Chromic Luvisols + 20 % Orthic Ferralsols + 20 % Xanthic Ferralsols
UM18	100 % Orthic Luvisols
UM19	20 % Ferralo-chromic Acrisols + 20 % Acrisols + 20 % Ferralo-ferric Acrisols + 20 % Luvisols + 20 % Ferralsols
UM25	50 % Chromic Luvisols + 50 % Dystric Cambisols
UM27	60 % F Histosols + 20 % Orthic Ferralsols + 20 % Acrisols
UP8	50 % Chromic Luvisols + 50 % Humic Planosols
UU3	50 % Rankers + 50 % H Podzoluvisols
UX1	100 % Calcic Cambisols
UX2	60 % Chromic Luvisols + 40 % Verto-luvic Phaeozems
UX8	40 % Eutric Nitisols + 15 % Chromic Cambisols + 10 % Vertisols + 10 % Rock + 25 % C Podzoluvisols
UX9	60 % Chromo-luvic Phaeozems + 40 % Chromic Vertisols
V2	25 % C Podzoluvisols + 25 % Chromic Luvisols + 30 % Humic Planosols + 20 % Pellic Vertisols
W1	100 % Solonetz
W2	60 % Solonetz + 10 % Calcic Xerosols/Yermosols + 10 % Lithosols
Y1	50 % Mollic Andosols + 50 % Haplic Chernozems
Y2	60 % Vertic Luvisols + 20 % Calcic Luvisols + 20 % Chromic Vertisols
Y3	100 % Eutric Podzoluvisols
Y4	100 % Calcic Cambisols
Y6	50 % Ferralo-ferric Luvisols + 50 % Vertic Luvisols
Y7	100 % Ferralo-chromic Luvisols
Y8	60 % Orthic Luvisols + 40 % Luvic Arenosols
Z1	100 % Rodic Ferralsols
Z2	35 % Ferralo-chromic Acrisols + 35 % Ferralo-orthic Acrisols + 30 % Solodic Planosols