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**AFRICAN DEVELOPMENT BANK  
GROUP**

**PROJECT : ADDAX BIOENERGY PROJECT**

**COUNTRY : SIERRA LEONE**

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**EXECUTIVE SUMMARY OF THE ENVIRONMENTAL, SOCIAL  
AND HEALTH IMPACT ASSESSMENT**

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# Environmental, Social and Health Impact Assessment Executive Summary

Project title: ADDAX BIOENERGY PROJECT

Country: SIERRA LEONE

Project reference : P-SL-AAG-002

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## List of acronyms

AOG	Addax & Oryx Group	IWMP	Integrated Waste Management Plan
ABC	Agricultural Business Center	LCA	Life Cycle Assessment
AfDB	African Development Bank	m <sup>3</sup>	metres cubed
BMP	Best Management Practice	m <sup>3</sup> /s	metres cubed per second
BSI	Better Sugarcane Initiative	MHI	Major Hazard Installations
CER	Certified Emission Reduction	MSDS	Materials Safety Data Sheet
CDM	Clean Development Mechanism		
CRPF	Comprehensive Resettlement Policy Framework	MW	Mega Watt
EHS	Environment, Health and Safety	NCD	Non-Communicable Disease
EMS	Environmental and Quality Management System	NPA	National Power Authority
ESHIA	Environmental, Social and Health Impact Assessment	NSADP	National Sustainable Agriculture Development Plan
ESMP	Environmental and Social Management Plan	PAPs	Project Affected Persons
EU	European Union	PHU	Primary Health Care Units
EU RED	European Union Renewable Energy Directive	PPE	Personal Protection Equipment
FAO	Food and Agriculture Organization	RAP	Resettlement Action Plan
FBO	Farmer Based Organization		
FDP	Farmer Development Programme	RSB	Roundtable on Sustainable Biofuels
FFLS	Farmer Field and Life Schools	SCP	Smallholder Commercialisation Programme
GHG	Green House Gas	SEMP	Social and Environmental Management Programme
GIS	Geographic Information System	STI	Sexually Transmitted Infection
ha	Hectare	t/ha	tonnes per hectare
HAZOP	Hazard Operability Study	TB	Tuberculosis
HSSE	Health, Safety, Security and Environment	UN	United Nations
IEC	Information, Education and Communication	UNFCCC	United Nations Framework Convention on Climate Change
IFC	International Finance Corporation	VLC	Village Liaison Committee
IITA	International Institute of Tropical Agriculture		
ILO	International Labour Organization Conventions		
IPM	Integrated Pest Management		

## 1. INTRODUCTION

1.1 Addax Bioenergy, a division of the Swiss-based energy corporation Addax & Oryx Group (AOG), intends to develop a Greenfield integrated agricultural and renewable energy project in Sierra Leone to produce fuel ethanol and electricity. The project will produce about 90,000m<sup>3</sup> of ethanol per annum, primarily for export to the European Union (EU) market and 15MW of power will be fed into the national grid. This report summarises the findings of the Environmental, Social and Health Impact Assessment (ESHIA).

1.2 The project area is located approximately 15km west of the town of Makeni in the Chiefdoms of Makari Gbanti and Bombali Shebora in the Bombali District and in the Chiefdom Malal Mara in the Tonkolili District, in the Northern Province of Sierra Leone. The project area is a large, gently undulating plain limited to the north by the Freetown-Lunsar-Makeni highway and to the south by the Rokel River.

1.3 This summary presents details regarding the legal and policy framework, the location of the project, a description of the project activities, an outline of project alternatives and the primary mitigation measures and recommendations of 14 specialist studies commissioned to determine the impacts associated with the project. An overview of the management systems to deal with environmental and social impacts and risks, together with a summary of the monitoring programme is presented. A summary of stakeholder engagement activities undertaken to date and an analysis of the environmental and social acceptability of the project is provided.

1.4 The Addax project is to a large extent financed by European Development Finance Institutions and the African Development Bank and applies IFC Performance Standards, Equator Principles and the African Development Bank policies. In order to meet EU sustainability criteria, the project will also adopt international best practices for the sugar and biofuels industry as defined by the Roundtable on Sustainable Biofuels (RSB) and the Better Sugarcane Initiative (BSI), of which Addax is a member.

## 2. PROJECT DESCRIPTION AND JUSTIFICATION

### Project Description

2.1 The project will consist of 10,100ha of irrigated sugarcane estates and an ethanol factory capable of producing 90,000m<sup>3</sup> of ethanol per annum and 32MW of nominal electrical power capacity, of which 15MW will be available for sale to the national grid.

2.2 The project will cover about 14,300ha of land comprising approximately 10,100ha of irrigated sugarcane estates, land for the project's infrastructure including an ethanol factory, a power plant, resettlement areas, roads and irrigation infrastructure and supporting infrastructure (including a power line connection the power plant to the national grid). Included in this is an estimated 2,000ha developed as part of the project's Farmer Development Programme (FDP). This surface will be divided into about 60 community fields established and sown by Addax and dedicated to staple food production (mainly rice and cassava) to the benefit of the local population. The FDP programme was developed with the support of the UN Food and Agriculture Organization (FAO) with the aim of securing the per capita food baseline in the project area. The program will significantly boost food production well beyond current levels. Another 1,800ha are required for ecological corridors and buffer areas to protect existing pockets of biodiversity. The sugarcane estates comprise circular fields under pivot irrigation, the location of which have been selected on criteria of agricultural suitability, proximity to factory and water sources, and various sustainability criteria including the avoidance of villages, forests and food-producing areas thereby minimising economic and physical displacement.

2.3 The factory feedstock of sugarcane will be sourced from the company plantation, over the sugarcane season of about 220 days. The estates will require partial irrigation (using centre pivots) during the dry season (November to May). The quantity of water required for the project peaks at up to 7m<sup>3</sup>/s in the driest months (February to April) and the total demand of about 80 million m<sup>3</sup> per annum will be drawn from the Rokel River which flows adjacent to the site and is Sierra Leone's third largest river with a an annual flow of about 3.8 billion m<sup>3</sup>. Therefore the water abstraction is only about 2% of the river water flow. As the Rokel river flow is now regulated by the upstream Bumbuna dam, the project does not cause changes to the natural base flow profile.

2.4 The sugarcane stalks will be mechanically harvested, crushed to extract juice and distilled

into fuel ethanol at the onsite factory, designed to be capable of processing up to 4,800 tonnes of cane per day and producing sugar juice for the 350m<sup>3</sup> per day fermentation distillery. A co-product from this process, known as bagasse, will be used to fuel steam turbines to generate 32MW of electricity, with about 15MW sold to the domestic power grid through a Power Purchase Agreement with the National Power Authority (NPA) backed by the Government of Sierra Leone. The factory, distillery and the sugarcane estates irrigation system will be powered by the factory's own power-plant. Another co-product from the distillation process, Vinasse, is rich in nutrients and will be returned to the fields through the irrigation system and a dedicated pipeline network to replace fossil fertilizer. The final product (de-natured anhydrous ethanol) will be transported to the Kissy terminal in Freetown by road, primarily for export to Europe. The ethanol will be stored and loaded on ocean-going tankers from the terminal.

2.5 The reduction of carbon emissions achieved by the electric power generated from residual sugarcane fibres (bagasse) will earn Addax Certified Emission Reduction certificates (CER), also known as carbon credits, after Addax certifies the high carbon savings of its ethanol production under the EU certification schemes. A greenhouse gas life-cycle assessment has estimated the CO<sub>2</sub> savings of Addax' ethanol production versus gasoline at 71%, i.e. well above the EU RED floor of 50%. Addax is developing the co-generation part of its project under the Clean Development Mechanism (CDM) of the United Nations Framework Convention on Climate Change (UNFCCC).

2.6 Addax has leased a total 57,000 hectares of land for its project. This amount exceeds the net needs of the project. This is due to Greenfield nature of the project and the very large and non-contiguous development area which requires a degree of flexibility to address some layout changes in the implementation phase. Therefore, the land leases include a relinquishment option which allows Addax to surrender lands that are not needed for its operations within a 5 year period. Until lands are either developed or relinquished, farmers are free to continue their operations.

In application of the Provinces Land Act Cap 122, the land leases were signed with the statutory authorities which are the Chiefdom Councils of the three Chiefdoms in the project area. The legal requirement is that if a third party intends to lease land, a surface rent payment needs to be made to local authorities in compensation for the loss. The rent stated in the land lease will be US\$3.60 per acre per year. The rent will be paid to the Chief Administrative Officer and requires this to be split in 20% to the District Council, 20% to the Chiefdom Administrator and 10% to the National Government, and 50% to the Landowners on the Leased Area which has not been surrendered.

According to the law, traditional landowners are not party to the land leases and no rent is payable to the landowner directly. This situation was not judged satisfactory to Addax and therefore it entered into direct discussions with traditional landowners and their communities. A reputed law firm was selected by the communities to represent them in the land lease negotiations with Addax. Over a period from June 2009 to March 2010, many information and consultation meetings were held between the communities and their lawyers and the land lease drafts were turned several times between the law firms until mutually acceptable drafts were finalized and signed in April 2010. Furthermore, Addax is giving landowners a status as project parties through Acknowledgment Agreements whereby the landowner acknowledges the rights and obligations of the parties to the lease agreements and receives an additional direct rent payment of US\$1.40 per acre per annum during the remainder of the Lease Period. Every community's and/or landowner's land boundaries are surveyed and payments are made on the basis of the surface of the land. Thus, the traditional landowner who acknowledges the lease will receive 50% of US\$3.60 plus US\$1.40 = US\$3.20 (or 64%) for the actual land that the project will lease. The total amount paid for land per acre is therefore US\$5.00 (US\$12 per hectare) which conforms to the recommendations issued by the Ministry of Agriculture in 2009.

The status of the landowners and their protection is at the heart of the lease agreement setup (which would not be guaranteed by the Provinces Land Act only). Addax fully complies with the Act but has introduced a major innovation through the Acknowledgment Agreements which are now suggested by the Government and resident international organizations for incoming investors in the agricultural sector.

### **Project Justification**

2.7 The Addax project builds on the opportunity presented by a growing market for biofuels in Europe as well as preferential trade agreements and suitable climate and lands in Sierra Leone. Sierra Leone is a functioning democracy but as a post-conflict country still suffers from the consequences of the civil war and has been hovering at the bottom of the UN human development index ever since the end of hostilities in 2002. The large-scale job creation and infrastructure and services development associated with the Addax project will therefore have a significant positive impact. The project is

considered a priority investment by the Government and Development Partners of Sierra Leone as it contributes to diversifying its economy and attracting more foreign direct investment. The project will be among the largest private industrial investments in Sierra Leone and an important step in diversifying the economy and promoting agriculture.

2.8 The Addax project is aligned with the Government of Sierra Leone's social, investment and development policy objectives, at national and local level through its poverty reduction strategy – "An Agenda for Change – Second Poverty Reduction Strategy (PRSP II) 2008-2012" in its effort to enhance:

- a) Poverty reduction;
- b) Employment creation; and
- c) Food security.

The project is fully aligned with the Sierra Leone investment policy because it is a large agriculture and industrial project which:

- i.) will provide job opportunities for Sierra Leoneans at all skills levels,
- ii.) provide significant foreign direct investment;
- iii.) is export oriented;
- iv.) makes extensive use of local raw materials;
- v.) will ensure the development and transfer of a variety of skills and technology;
- vi.) will produce a surplus of electricity for commercial purposes; and
- vii) makes use of renewable energy resources.

In addition the project and its farmer development and training programmes are in line with the "National Sustainable Agriculture Development Plan (NSADP)", including the nation-wide initiative "Smallholder Commercialisation Programme (SCP)", which is a broad sector-wide framework for putting the objectives of the "Agenda for Change" into action. The FDP and FFLS programmes will improve local farming practices and contribute to enabling farmers to reach a commercial capacity.

### **3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK**

3.1 The legal framework which has guided the ESHIA includes both international and national legislation, including the African Development Bank's environmental and social policies, the Equator Principles and the International Finance Corporation's (IFC) Performance Standards. Performance standards 1-6 and 8 were applied to this project as performance Standard 7 (indigenous peoples) was deemed not to apply. Three sector specific IFC Environment, Health and Safety (EHS) guidelines were applied: Electrical Power Transmission and Distribution, Plantation Crop Production and Sugar Manufacturing. The following African Development Bank policies were applied: the Policy on the Environment, the Gender Policy, the Involuntary Resettlement Policy and the Policy on Poverty Reduction.

3.2 In terms of National legislation, the National Environmental Policy and National Environmental Protection Act are the most important pieces of legislation to comply with in Sierra Leone. These indicate, in a very general manner, the need for sound environmental management in order to stimulate the health and welfare of Sierra Leonean citizens. The policy provides for the execution of a social and environmental impact assessment before the development of a project. The Addax project's ESHIA has been presented to the Sierra Leone Environmental Protection Agency (SLEPA), the authority responsible for ensuring compliance with environmental legislation. SLEPA has stated that the ESHIA complies with their requirements for the issuance of an Environmental License. The Environmental License is still awaited. In addition, the Agricultural Policy, the National Water and Sanitation Policy and the National Lands Policy are regarded as important policies that the project will comply with. Others include the Labour Policy, the Health and Safety Regulations, Transport Sector Policy and Hazardous Materials Policy.

3.3 In addition to Sierra Leonean legislation, the international conventions which the Addax project will comply with include: the International Labour Organization Conventions (ILO), the United Nations (UN) International Covenant on Economic, Social and Cultural Rights, the UN International Convention on the Elimination of All Forms of Racial Discrimination, the UN Declaration on Rights of the Indigenous Peoples, the World Heritage Convention concerning the Protection of the World Culture and Natural Heritage, the Stockholm Convention on Persistent Organic Pollutants, the FAO

International Code of Conduct on the Distribution and Use of Pesticides, the Rotterdam Convention on Prior Informed Consent Procedures for certain Hazardous Chemicals and Pesticides in International Trade, the UN Convention on Biological Diversity, the Ramsar Convention on Wetlands, the Convention on the International Trade of Endangered Species of wild Flora and Fauna, the UN Framework Convention on Climate Change, the Cartagena Protocol on Biosafety, the UN Convention to Combat Desertification, the Abidjan Convention for the cooperation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region, the UN Convention on the Law of the Sea, and the International Convention for the Prevention of Pollution from ships. Sierra Leone adopted a National Adaptation Programme of Action (NAPA) under the United Nations Framework Convention on Climate Change (UNFCCC). The NAPA identifies priority areas and adaptation actions for vulnerable sectors, such as agriculture, food security, water resources, and erosion. The Addax project is aligned to Sierra Leone's NAPA.

3.4 Important international biofuels sector guidelines, standards and policies applicable include: The Council of the European Union (EU) Promotion of the Use of Energy from Renewable Resources (Document 2008/0016, 11 December 2008) – the Renewable Energy Directive (RED); the Criteria for Sustainable Biomass Production (June 2006), commonly referred to as the Cramer Principles; the Round Table on Sustainable Biofuels (RSB – prepared by the Energy Centre in 2007 and revised in 2009) and; the Better Sugarcane Initiative.

3.5 A number of best management practice guidelines for security arrangements which apply to this project were also identified and used to guide the security management component of the project.

## 4. DESCRIPTION OF THE PROJECT ENVIRONMENT

### Climate, Topography and Drainage

4.1 The project area receives approximately 3,000mm/year of rainfall. Most falls between May to October, hence supplemental irrigation is required for the dry months (November-May) when natural rainfall drops to less than 20 mm per month between December and March. The project area consists of gently undulating, rolling plains made up of low lying drainage depressions and swampy low lands. These are interspersed with higher, well drained upland areas and some granite hills. The low lying swamps and bolilands, although imperfectly drained, are more fertile than the upland regions.

4.2 The Rokel River bounds the study area to the south and runs from East to West. It is a substantial river system, and the flow is now regulated by the Bumbuna hydro electric dam, located 80km upstream. This regulation increases flows during the dry season (November-May) when irrigation water is required. Smaller important rivers which flow across the site are the Tabai and the Belia Rivers.

### Flora

4.3 An extensive biodiversity assessment was conducted on flora in the project area. The findings are captured in the Biodiversity and Ecological Impact specialist study. Seven vegetation types were distinguished in the project area, with the abrupt boundaries between them being the result of land use (vegetation clearing and fire). The vegetation types were consistent in structure and species composition throughout the study site: Riparian and swamp forest, village/terrestrial forest, bolilands, wetlands<sup>1</sup> (inclusive of open water bodies), Lophira woodlands, palm plantations, elephant grass.

4.4 The ecological sensitivity of each vegetation type was rated based on its general overall state using criteria defined in the ESHIA in order to determine “no-go” areas and areas of conservation value. Wetlands, terrestrial/village forest and riparian forests were classified as high or very high sensitivity vegetation.

### Fauna

4.5 An extensive biodiversity assessment was conducted on fauna in the project area, including amphibian, reptile, bird, and mammal species in the project area. The findings are captured in the

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<sup>1</sup> Wetlands are defined here according the Ramsar Convention, which uses a broad definition of the types of wetlands covered in its mission, including lakes and rivers, swamps and marshes, wet grasslands and peatlands, oases, estuaries, deltas and tidal flats, near-shore marine areas, mangroves and coral reefs, and human-made sites such as fish ponds, rice paddies, reservoirs, and salt pans. The Ramsar definition is used, as this is how wetlands are defined in the EU RED. No Ramsar site was identified in or near the project area.

Biodiversity and Ecological Impact specialist study. Species of special concern, which includes protected, rare or endangered animal species, were identified through a review of relevant literature. However, none of these species were observed during the field studies and this is mainly attributed to the lack of forest habitat in the project area:

- Three listed bird species potentially occur in the project area.
- Two near threatened Pangolin species have distribution ranges which overlap with the project area.
- Due to the Rokel River corridor it is possible that Campbell's monkey, spot-nosed monkey, sooty mangabey, green monkey and baboon have access to the project area.
- The only red data antelope species which may occur in the study area is the 'near threatened' Bongo (*Tragelaphus eurycerus*).
- The endangered Chimpanzee (*Pan troglodytes*) and the forest buffalo (*Syncerus cafer nanus*) may occur in the project area.

The Biodiversity and Ecological Impact specialist study did not identify any mammals in the project area where the Addax project will be realized. The possible occurrence of large fauna is due to the existence of these species in adjoining areas to the Addax project area, specifically in the Bumbuna Dam corridor. The Bumbuna Dam corridor is mainly a forest/ savannah transition zone while the Addax project area is a pure savannah.

4.6 The study area falls within a region called the Atlantico-Guinean region and the fishes from this area are regional endemics. A fish survey undertaken in the Rokel, Tabai and Mabole Rivers recorded a total of 3,213 fish representing 55 species and a great deal of overlap in species between all three rivers.

#### **Carbon Stocks and Greenhouse Gas Lifecycle Assessment**

4.7 An analysis of carbon stocks in areas to be cleared indicates that most areas carry low carbon stocks (generally less than 30 tonnes of carbon per hectare). Indigenous palms and forests carry significantly more carbon, but were avoided in the project planning. Therefore forests will not be cleared and only small portions of palms may be cleared. A Greenhouse Gas (including carbon) Life Cycle Assessment (LCA) in line with ISO14044 was undertaken, based on rules set out in Annex VII of the European Union Renewable Energy Directive (EU RED). Calculated emissions associated with the cultivation, processing, transport and use of product yield total emissions of approximately 23.90 grams of CO<sub>2</sub>equivalent/MJ. This will result in Greenhouse Gas Emission savings against the fossil fuel comparator of 71.48%, which is well above the EU RED minimum emission saving thresholds of 35%, and 50% post 2015.

#### **Social Environment – Population Demographics**

4.8 The project area is largely located in the Bombali District, with the town of Makeni as its main centre, and in the Tonkolili District, and predominantly in the Chiefdoms of Makari Gbanti (pop. 53,742) and Bombali Shebora (pop. 88,674) in Bombali District and Malal Mara (pop. 10,227) in Tonkolili District. The Chiefdom is sub divided into sections comprising a number of villages. Sections are headed by a Section Chief and villages by a Town Chief. The majority of people in the study site are Muslim (85%), with the remaining being Christian and indigenous religions. There are more adult women than adult men in the area, and the household survey showed that the average number of members per household is 9.9.

#### **Livelihood Strategies**

4.9 The majority of households practice a mixed economy, including crop cultivation, bee keeping, charcoal production, hunting, fishing and animal husbandry. Agriculture is the main livelihood strategy in the area, with 95% of households involved in small scale farming. The average area cultivated over a year is generally estimated between 0.4-2ha, and the household survey results indicate that 78% of households cultivate more than 1.2ha of land in the rainy season. Rice is the main crop grown during the rainy season and sweet potato and cassava the main crops during the dry season. In addition, a large variety of crops are grown in smaller quantities. Both men and women are involved in farming activities. Rice is the main cash crop but all surplus crops are sold when households need cash. Livestock is a minor economic livelihood in the area. In the majority of villages only between 10 and 20% of the population keep livestock (other than chicken). Cattle in the area are mainly kept by the Fullah, a nomadic pastoralist people descended from Guinea, who graze their herds on local village land. Natural resource use is an important aspect of local livelihoods, with many people involved in charcoal production, wild plant collection, beekeeping, hunting and fishing.

#### **Access to Land**

4.10 Customary land tenure rules apply in the area. Through customary law, ownership of land is

vested in the chiefdoms and communities, and can never be owned freehold. Land always belongs to the communities under different forms of tenure under customary law. This principle is established by the Chiefdom Councils Act as well as by Section 28(d) of the Local Government Act 1994 (Ajei, 2008). The Provinces Lands Act (Cap 122) regulates the ownership of land by non-natives in the provinces. According to Section 4 of Cap 122, non-natives (such as Addax) can only acquire a leasehold interest of fifty years in land in the provinces.

4.11 In the project area the customary land tenure system is based on family tenure, which is based on lineage or clan and unites all the descendants of a particular ancestor or group of ancestors who are identified as founders of that family or clan. Such family units are legal bodies with the right to claim and hold land. The paramount title to family land is vested in the family as a group. Responsibility for the management of family land is vested in a head of family assisted by a council comprising of principal family members. Although title to land is vested in the family, varying degrees of lesser interests in specific portions of family land may be held by some family groups or individuals.

4.12 Although family land tenure prevails in the area, it is locally acknowledged that the Paramount Chief is the custodian of the land on behalf of the entire chiefdom, and land disputes are arbitrated by him. Land is regarded by the local landowners as their most precious possession. It is their only security in an otherwise economically insecure environment. Land is regarded as a safeguard for the maintenance of livelihoods. The majority of people have access to more than 8ha of land and households have access to more land than they cultivate.

### Land Use Analysis

4.13 Table 1 below provides definitions and areas for the land requirements referred to in this report. Using a Geographic Information System (GIS), recent (2009) colour aerial photography and visual identification classification methods, a land use classification system was developed for the vegetation types. The land cover of the 46,370.5ha project area was digitised (this area excludes all lands above the Makeni-Freetown highway contained in the leased area but unlikely to be developed) and the plantation (pivot fields) and infrastructure layout overlaid on the digitised image. Through a number of analyses which considered social, environmental, agronomic and economic constraints, the project layout shown in Annex 1 was achieved. This layout avoids all forested areas (in line with the EU RED), and minimises physical displacement of local people. The total area planned for pivots amounts to 10,088.2ha and 1777.7ha of land for the ecological corridors and 310.5 ha for infrastructure requirements (these amounts exclude FDP and resettlement lands).

**Table 1 – Definition of land requirements and areas used in this report**

Name	Definition	Area
Leased area	Land for which Addax have signed lease agreements	57,000 ha
Project area	Land assessed using the aerial photographs, which is the Leased area below the Makeni to Freetown Highway	46,370.5 ha
Pivot area	Sugarcane fields in the project area	10,088 ha
Ecological corridors	Areas in the project area that will be rehabilitated and used for biodiversity conservation	1,777.7 ha
Infrastructure area	Land in the project area to be used for project related infrastructure such as roads, power lines, staff housing, factory etc	310.5 ha
Land remaining*	Land in the project area that falls outside of the pivot area, ecological corridors and infrastructure area	34,194.1 ha

\* Note that the land remaining calculation does not exclude FDP land (estimated to be approximately 2,000ha and displacement lands estimated to be approximately 23ha. This is because the location of these two lands has not been determined since it requires stakeholder engagement and consensus).

4.14 The main land-use categories linked to livelihoods, which were identified using the digital aerial pictures and through ground truthing are as listed in Table 1. The table includes the amount of each vegetation type that will be used for the plantation, infrastructure and ecological corridors associated with the Addax project. In total Addax will require an estimated 12,167.3ha (excluding FDP lands and resettlement lands) of land, and therefore 34,194.1ha will remain in their current state and can continue to be used by the local population.

**Table 2 - Vegetation types which fall into the land use categories.**

Land use category	Amount Required for Addax Project (Excluding FDP and Resettlement Lands) (Ha)	Amount Remaining (ha)	Sensitivity Classification*
Burned vegetation	826.7	3,608.4	Low
Cultivated lands - current	288.8	1,317.2	Low
Cultivated lands - fallow	1,106.9	2,991.0	Low
Grassland	4,404.8	10,751.4	Low
Hamlet <sup>2</sup>	0.7	4.5	Low (easily replaceable)
Lophira scrubland <sup>3</sup>	3,839.4	10,414.6	Low
Palms	104.7	282.8	Low
Riparian forest	492.0*	459.7	High
Riparian zone	171.0*	497.2	High
River buffer zones	623.9*	16.4	High
Terrestrial forest	10.4*	75.2	High
Village <sup>4</sup>	1.6	80.3	Very high
Village forest	22.3*	390.4	Very high
Wild palms	122.3	1933.4	Low
Woodland <sup>5</sup>	160.6	1,371	Medium
<b>Total</b>	<b>12,176.3</b>	<b>34,194.1</b>	

\*protected from development as included in ecological corridors.

### Project Affected People

4.15 Estimates generated through analyses and counts of all structures in all villages from the aerial photos were cross checked against villages in which the total population was known from a census exercise. This resulted in an accurate assessment of 13'617 people living in areas affected by the project (Table 2). The project has been designed to avoid village areas and therefore only 77 people living in two small settlements will be physically resettled. All other PAPs will be able to continue living in their villages but will be subjected to economic displacement as a result of the project. Economic displacement varies across the project area and is addressed through compensation processes within the site specific Resettlement Action Plans including the Farmer Development Programme.

**Table 3 – Estimated Project Affected Persons**

Year of Development	No of Villages	Estimated Total Population
2010	8	1,642
2011	21	5,718
2012	13	3,576
2013	18	2,681
<b>Total</b>	<b>60</b>	<b>13,617</b>

### Farmer Development Programme

4.16 In order to mitigate potential impacts from economic displacement, Addax has started to implement a Farmer Development Programme (FDP) incorporating the FAO Farmer Field and Life Schools (FFLS) concept. The FDP will ensure PAPs have access to sufficient land and appropriate

<sup>2</sup> These are classified as low sensitivity because they can be easily replaced and do not involve physically resettling people since the hamlets are temporary shelters for people working in the fields during planting and harvesting.

<sup>3</sup> Lophira scrubland is classified as low sensitivity because the vegetation in this classification is recovering from cultivation. This is different to lophira woodland which is classified as medium sensitivity.

<sup>4</sup> Villages and village forests are classified as very highly sensitive since any activities in these areas would require either resettlement in the case of a village or disturbance to graves and other culturally important artefacts which have important social consequences.

<sup>5</sup> Woodlands are classified as medium sensitivity because they have the potential to contain relatively high plant diversity.

agricultural training to be able to produce enough rice to achieve food security and enhance their livelihoods.

The primary objective of the FFLS programme is to ensure its participants are trained in modern agricultural practice and techniques to enable them achieve higher crop yields. 2000 farmers from the communities in the project area will be offered 30-week training programmes. The program teaches better farming practices to improve productivity and earnings capacity but also life skills including health and sanitation, money management etc.

The FDP will also offer agronomic services which focus on the preparation of rice fields for each PAP and to ensure that the affected communities realise the full benefits of the improved farmer skills taught in the FFLS. Each household will be entitled to an allocation of the plots designated by the communities. The Addax FDP staff will then plough and prepare the land for planting for the first year. A total of 1960 ha of community rice fields will be established by the FDP.

The FFLS and FDP mitigation plans are described under 6.7 and 6.8.

### **Livelihood Enhancement and Sustainability**

4.17 In order to enhance livelihood security, defined as the *adequate and sustainable access to income and other resources to enable households meet basic needs (Frankenberger 1996)*, such as food, housing, clothing, basic health and education, Addax will provide community training on aspects of health, safety, basic education, business skills, improved farming techniques and sanitation through the implementation of the project's Social and Environmental Management Programme (SEMP) and the various Environmental and Social Management Plans (ESMPs) contained therein. These include the Community and Skills Development Plan, the Community Health and Safety Management Plan and the Farmer Development Programme Management Plan. These plans will enable the people to broaden their skill sets (services, manufacturing, money management etc), improve sanitation, increase productivity, and improve their earnings base, all of which contribute to enhancing and sustaining their livelihood security. Addax is committed to livelihood enhancement and as indicated below under the Monitoring Programme the project's impacts on the PAPs will be closely monitored.

## **5. PROJECT ALTERNATIVES**

5.1 There are no site alternatives at present apart from the no-go option (i.e. no project option). Due to the size of the project area a number of alternatives exist in terms of the location of individual fields. Numerous layout options were assessed in the ESHIA, and the layout developed by Addax shown in Annex 1 is regarded as the most sustainable option on social and environmental grounds (limited physical and economic displacement and sensitive vegetation and forested areas are avoided).

5.2 A number of technological alternatives for the factory layout and designs were assessed, including different options for the processing of the sugarcane (e.g. diffusers versus mills to extract the sugar from the sugarcane), and different boiler options. Decisions regarding most of the technological alternatives are based on financial and operational criteria. The factory design that has been retained is regarded as the best compromise between capital costs, process efficiency and specific operating conditions. It is also located far from urban centres with high population density.

## **6. POTENTIAL IMPACTS AND MITIGATION/ENHANCEMENT MEASURES**

The project philosophy has been to avoid negative impacts wherever possible. This was clear in the planning and design phase where the project layout was adapted several times to avoid or minimize any negative impacts. Extensive field studies, detailed land planning based on high-resolution aerial photography and ground-truthing enabled the project to steer away from bio-diverse and populated areas as well as the main food producing areas. 14 specialist studies were undertaken as detailed below:

1. Biodiversity and Ecological Assessment
2. Hydrology and Surface Water Assessment
3. Preliminary Sustainability Appraisal of Agricultural Production
4. Land Use Analysis
5. Social Impact Assessment
6. Comprehensive Resettlement Policy Framework

7. Preliminary Visual Impact Assessment
8. Co-Products Management Study
9. Air Quality Impact Assessment
10. Infrastructure and Transport Assessment
11. Greenhouse Gas Lifecycle Assessment
12. Carbon Stock Assessment
13. Fisheries Assessment
14. Health Impact Assessment

These specialist studies thoroughly identified the project's environment and social impacts as well as mitigation measures and other recommendations to effectively address those impacts. The findings from the specialist studies were integrated into the comprehensive ESHIA. However, a large-scale agricultural project cannot be implemented without changing the project environment and despite the company's efforts to avoid impacts, risks remain which have been identified in the specialist studies and are summarized below. In areas where impacts cannot be ruled out or are likely to occur, additional mitigation measures have been developed to minimize or reverse the impacts.

### **Impacts on Terrestrial Fauna and Flora**

6.1 Likely or potential impacts on terrestrial fauna and flora were identified and categorised. Although previous farming activities by the local population, including de-forestation and slash and burn agriculture have adversely affected most original bio-diversity in the area, the nature of the Addax project, introducing industrial activities and monoculture, has the potential to further impact on biodiversity. Therefore, the project layout was specifically designed to avoid all forested areas (terrestrial and riparian forests), which were identified as the most biodiverse areas on the site. In addition, the creation of 1,777ha of ecological corridors across the site is the primary mitigation measure to enhance protection and recovery of bio-diversity. These corridors will be conserved and rehabilitated where appropriate. Monitoring and the appointment by Addax of Environmental Control Officers will also be undertaken to ensure negative impacts are kept in check.

### **Impacts on the Aquatic Environment and Fisheries**

6.2 The possible negative aquatic impacts relate to the risk of soil contamination and potential pollution of surface and ground waters. Contamination of aquatic environments by nutrients and pest control agents could be of moderate significance, as are the physical and cumulative impacts of water extraction from the Rokel River. Addax has adopted agricultural best practices and the main mitigation strategies have been incorporated into project design. An Integrated Nutrient Management Plan and Integrated Pest Management Plan is required as part of the Estate Operational ESMP. A number of field design recommendations have been made to minimise runoff such as the incorporation of a network of coordinated shallow drains, the use of grassed spoon drains wherever possible, the use of filter strips around the edges of the fields etc. In particular, the segregation of vinasse returned to the fields through a separate pipe-line network and application via the irrigation system minimizes the risk of contamination of waterways and sources. Ongoing monitoring of surface and ground water quality and quantity, fish populations and fisheries and abstraction rates will be implemented.

### **Visual Impacts**

6.3 The introduction of a large industrial facility into a rural landscape will be visually intrusive and will result in a change in the character of the landscape. Mitigation measures to counter this include the rehabilitation of existing forests to improve landscape quality and the implementation of monitoring programmes to monitor the levels of light and dust around the factory.

### **Socio-Economic Impacts**

6.4 The social impact assessment identified seven issues associated with the project that could result in significant socio-economic impacts. Socio-economic benefits include the creation of job opportunities during the operational phase and the return of young people to the area. Employment policies favour employment of local workers, women and disabled people. Others include development and construction phase job opportunities, associated job creation and stimulation of economic growth in the area, benefits arising from FDP, expansion of the local skills base and small business opportunities that will arise as a result of the project.

Possible negative impacts include a loss of, or reduced access to agricultural land, the loss or disruption to existing access routes, the potential for community conflict associated with land disputes, the influx of people into the area and local and regional decreases in the standard of living at closure of the project.

6.5 One of the major mitigation measures for negative social impacts was incorporated into the project design by ensuring that the project layout avoids as far as possible any physical displacement, and ensuring that the Addax land selection strategy was based on avoiding the lower lying swamp lands which are currently used for rice production by local people.

6.6 The primary mitigation measures to enhance the positive impact of providing job opportunities include: setting up a Labour Desk/Employment Committee, conforming to IFC Performance Standard 2, employing local people as far as possible during the development, construction and operation phase, enhancing opportunities for women and disabled people, ensuring opportunities for people directly affected by the project compared to people indirectly affected (for example by assessing how much of their land they have leased to the project), providing assistance with household budgeting and long term sustainable investments and planning for the gradual replacement of expatriates by local people through on-the-job training of assistant managers to eventually take over management responsibility.

6.7 Implementation of the Social and Environmental Management Programme (SEMP), in particular the Resettlement Action Plans, the Community and Skills Development Plan, the Community Health and Safety Management Plan and the Farmer Development Programme will further mitigate against economic displacement and enhance and sustain food and livelihood security. Addax will provide community training on aspects of health, safety, basic education, business skills, improved farming techniques and sanitation through the implementation of the above mentioned Environmental and Social Management Plans (ESMPs). Addax will also set up an internal training centre to transfer agricultural and industrial know-how and best practices to the company's national staff (>95% of the workforce).

6.8 The primary mitigation measures for addressing the loss or reduced access to livelihood assets are the:

- preparation and execution of RAPs – to adequately compensate for the loss of assets on the land;
- implementation of the SEMP including the FDP – which will provide PAPs with sufficient land and agricultural skills to enhance and sustain their food and livelihood security;
- the Community and Skills Development Plan – to provide training opportunities to the local communities to broaden their skills base and provide people with further opportunities to diversify their income earnings opportunities, and to participate with local government and other development partners in the improvement of social infrastructure;
- the Community Health and Safety Management Plan – to ensure that the loss of agricultural lands and livelihood assets thereon does not negatively impact on the health of the local communities, that the health of local communities is not detrimentally affected by the project activities, that the safety of local communities is not compromised by the project; and
- a nutritional study to aid in monitoring the efficacy of these plans.

6.9 Primary mitigation measures to enhance the positive impacts associated with the expansion of the local skills base include implementing a thorough health and safety policy including community outreach and a formal in-house skills training programme for Addax employees and eligible third parties under the Community and Skills Development Plan.

6.10 Potential cultural impacts from the project were identified and mitigations measures to avoid these include precluding graveyards and sacred places for the project, and in those cases where sacred sites may be affected, the development a culturally sensitive procedure for the dismantling and potential re-instatement of sacred areas.

6.11 Mitigation measures for addressing potential social conflicts and social problems within and between communities, as well as between communities and Addax management and staff include: implementation of the Stakeholder Engagement Plan, the Labour Recruitment, Purchase and In-Migration Management Plan, workshops to improve budgeting skills of local communities encouraging and facilitating the use of banking facilities, awareness campaigns regarding alcohol abuse and sexual behaviour, workshops to inform workers of the employer's expectations aimed at assisting workers to adapt to formal employment, hosting gender, health and nutrition workshops, ensuring fair access to the benefits of the project, transparent and effective communication with local stakeholders, appointment of community liaison officers, regular contact between Addax and the traditional leaders, gaining insight into all existing land disputes through engagement with the traditional leadership (who arbitrate land disputes), and setting up a special committee to assist with resolving the disputes associated with the leasing process.

6.12 In order to further mitigate against economic displacement and to achieve the objectives of the Comprehensive Resettlement Policy Framework (CRPF) and the various Resettlement Action Plans (RAPs), in particular in respect of food and livelihood security, Addax has created a Farmer Development Programme (FDP), including a Farmer Field and Life Schools (FFLS) farmer training programme. The FDP focuses on (a) farmer skills training and (b) mechanical support and provision of inputs to enable sufficient rice production by the communities. The FDP has dedicated staff, including farmer trainers, and mechanized equipment. It is run by a dedicated manager under the supervision of the HSSE manager.

6.13 The FFLS programme will train local people in better farming practices through a 30 week in-field training programme involving demonstration plots and classroom material. The FFLS concept has been adapted from the Food and Agriculture Organisation (FAO) farmer training programme and will enable about 2,000 local farmers to improve productivity of food crops, health, sanitation, money management etc. This will reduce the need for local farmers to leave their land fallow for extended periods (years) in order for the soil to rest, thus increasing the planting period and making more efficient use of the land. The FFLS groups will consist of about 25-30 persons per farmer school. One participant per one hectare of FDP community fields will be invited. Participants will be selected so as to ensure that each household benefits from the programme. The FFLS training programme will be entirely paid for by Addax

6.14 Empowerment of small and marginalized farmers by improving their understanding of the determinants of farm performance and awareness of technical options of improvement will significantly contribute to enhancing and sustaining food security. The FFLS will lead to farmers organising themselves in Farmer Based Organisations (FBOs) and eventually merging their activities into Agricultural Business Centres (ABCs) in line with the Government of Sierra Leone and FAO national agricultural development strategy for rural livelihood enhancement and commercialisation of smallholders. This concept has been promoted by the FAO and successfully implemented in other parts of the country. Addax has therefore signed Memorandums of Understanding with the FAO and with the International Institute for Tropical Agriculture (IITA) regarding support, quality assurance, technical assistance and backstopping for its FDP and FFLS.

6.15 The second component of the FDP involves making provision of 0.143ha of agricultural land for each project affected person (i.e. about 1 ha for 7 people). This has been calculated on an average net yield of 0.7 tons of rice per hectare and a food security baseline of about 100 kgs per person per year. These figures are based on FAO in-country statistics on yield and food requirements. The FDP will plough, prepare and sow community rice fields calculated on the number of PAPs in the community. This results in about 60 community fields (one per village) and a total area of 1960 ha (0.143 ha x 13'600 PAPs) which will add to the current 1'600 ha of permanently cropped lands and therefore more than double the land under food production in the project area. Thus the FDP will ensure that each household affected by the project is indefinitely provided with enough land and appropriate training to ensure sufficient rice production and enhance and sustain food security. In order to avoid excessive dependency of the local population on the company, the support subsidy will be phased out over three years. The land preparation work for community fields and seed input will be free of charge to the community in the first year of establishment. Land preparation will be subsidised at 2/3 in the 2nd year and 1/3 in the 3rd year and thereafter charged at cost. Seeds (except for first establishment which is free) and other inputs will be charged at cost. After the 3<sup>rd</sup> year, at the request of the communities, Addax will continue to provide the inputs and recover its cost after harvesting. The programme will run in accordance with the project phasing and its establishment is anticipated to be fulfilled in 2013. The FDP is already being implemented in anticipation of the development of the commercial plantations.

### **Land Use impacts**

6.16 The use of land for agro-industrial purposes, and the resultant threat that this can pose to community food and livelihood security were the main issues identified in the Land Use specialist report. The land required for community cultivation was estimated for the study area of 46,370ha as 8,639ha with a very long average rest period of 12 years. In addition, 14,750ha of Lophira scrubland with a rest period of 10 years are required for charcoal production. The Addax project will require 12'176 ha in the project area (excluding FDP lands) and the use of this land could result in a decrease in the rest period of community agricultural land from approximately 12 years to 8 years if not mitigated. This could impact on crop yields if productivity is not improved, and hence the primary mitigation is to train farmers to increase yields through the FFLS program and by ensuring people are provided with sufficient croplands through the FDP.

6.17 The following mitigation measures will serve to address the impacts associated with land use change:

- The development of comprehensive RAPs as the phased expansion of the project occurs, in accordance with the framework set out in the Comprehensive Resettlement Policy Framework (RPF) and in compliance with IFC PS 5.
- The implementation of the FDP in accordance with the concepts and guiding principles described in great detail in the RPF.
- The development of guidelines for the monitoring of food security and livelihoods as outlined in the RPF.

### **Health Impacts**

6.18 A health assessment was undertaken to formulate the baseline health status of the potentially affected communities, and to understand what the high level health risks and impacts could be.

6.19 The following were determined to be important health risks that could be favoured by or affect the project:

- Transmission of communicable diseases due to overcrowding – To be mitigated through an Influx Management Plan and project based Tuberculosis (TB) management to provide support to improve access to case detection and community based Information, Education and Communication (IEC) campaigns.
- Malaria burden –An integrated malaria and vector control programme will be required for the project.
- Arboviral diseases –Arboviral control as part of the project's Integrated Pest Management Plan is required.
- Access to drinking water – This is currently a constraint for communities, and social investment strategies that include the provision of safe and clean water and the establishment of water and sanitation committees in the communities will be developed under the project and will result in a low beneficial impact.
- Sanitation and waste management – Health risks to local communities as a consequence of poor sanitation are presently high. The project will develop its own water, sanitation and waste management systems. The effect of the water bodies on potential snail habitat will need to be studied and mitigation measures developed. Screening for schistosomiasis should be performed on prospective employees, and health education on hygiene and sanitation will be included in the FFLS curriculum.
- Transmission of STIs and HIV/AIDS – Current infection rates are less than 2%, but influx into the project area can play a major role in disease transmission. Primary Health Care Units (PHU) must be equipped to deal with AIDS. The Influx Management Plan will ensure that all age and gender groups in the receiving community are well-informed about the risks of HIV and how to protect themselves from infection with HIV/STI.
- Malnutrition and food security – These are important issues in the project area due to a seasonal lack of food due to poor yields and inadequate storage facilities, low input farming techniques with lack of mechanisation, limited variety in diet, expense of food and also lack of knowledge regarding nutrition practices. The FDP will almost double the permanent cropping areas, train farmers in improved farming practices and life skills, including nutrition practices, and therefore significantly contribute to improving food security. The FDP alone is designed to enable the production of about 1400 tons of rice per annum which meets the food security baseline of the PAPs (104 kgs per person). The implementation of the SEMP, including the Community Health and Safety Management Plan and the Community and Skills Development Plan, will further sustain and enhance food security.
- Non-Communicable Disease (NCD) burden – Information on this is limited, but the project has the potential to increase these diseases as standards of living increase. IEC programmes that aim to reduce risk factors such as smoking, poor eating habits, exercise and other prevention strategies should be undertaken throughout the project.
- Work related illness and injuries –The project will increase traffic and accident risks impacting the communities There are numerous occupational health risks that may play a role in community health and to mitigate these, Addax will prepare and implement an Occupational Health and Safety Management Plan that includes a formal Health Risk Assessment to reduce impacts.
- Exposure to Pesticides, Herbicides and Fungicides – These and other chemical agents are unlikely to have an impact on human health if properly managed. Purchasing, transportation,

storage, handling, application and disposal of pesticides will be in accordance with the relevant Materials Safety Data Sheet (MSDS) and the Integrated Pest Management (IPM) plan is required to reduce pesticide use. These policies will be applied through the ESMPs under the responsibility of Addax's HSSE department.

- Health system strengthening – Health care services in the community are very limited at present. The project will place an additional burden on the existing health care infrastructure, compounded by an influx of people into the area and the workforce. To reduce the burden on the local health facilities a stand alone on-site occupational and emergency health care service will be developed by Addax to cater for the needs of the workforce and additional support to local government structures and improved existing health care need to be considered.

### **Co-products Impacts**

6.20 Almost all of the wastes produced by the project will be used in other processes (for example the use of bagasse as a boiler fuel and vinasse as fertilizer); hence the term co-products rather than waste. The main issues identified with this project include adequate management and handling of all waste types throughout the lifetime of the project and ensuring that storage areas for hazardous materials, fuel and waste are properly designed to avoid and/or minimize negative impacts. The following mitigation measures will effectively reduce all impacts to low significance except for health risks which remain moderate due to their severity. Recommendations include: the application of the principles of the waste management hierarchy to all waste streams, the implementation of an Environmental and Quality Management System (EMS), meeting the IFC general and sector specific guidelines in terms of waste and wastewater management; and the implementation of an Integrated Waste Management Plan (IWMP) covering all aspects of the project to facilitate correct identification, quantification, management, disposal and monitoring of waste streams.

### **Transportation and Infrastructure impacts**

6.21 The potential environmental issues associated with the transportation and infrastructure components of the project include loss of biodiversity and habitat and contamination of the environment. Mitigation for these impacts includes adequate storm water management, careful choices for linear infrastructure pathways implementation of a ballast water management plan and the preparation of an Emergency Response Plan.

6.22 Worker and community health and safety issues were identified and included: the risk of minor injury to personnel; and occupational hazards due to vehicle and other emissions associated with in field transportation, risks of major and minor vehicle collisions during haulage operations between the fields and the factory, risk associated with a serious and minor vehicle collision during transport to Freetown; and fire risks associated with handling ethanol.

6.23 Although some impacts remain significant after mitigation (and could result in serious injury or death of a worker) the risk of these impacts taking place can be greatly reduced by implementing the suggested mitigation measures to address health and safety issues; which are summarised below:

- For in-field vehicles – Regular vehicle maintenance, dust control measures, appropriate personal protection equipment (PPE's), a Code of Practice for trackless vehicles, compensation payments to community members who lose stock, recording and reporting all incidents;
- For overland traffic – No travelling by heavy vehicles at night; vehicles must avoid delivering products to Freetown during peak traffic and pedestrian use periods, consider constructing traffic calming structures in high risk areas, all product transport vehicles must comply with industry regulations and all local road safety and other laws; undertake random safety checks, impose maximum speed limits for vehicles; undertake driver training and awareness programmes;
- The Kissy terminal, ethanol tanks, jetty and access road to the terminal will be upgraded in the near future by Oryx Oil & Gas and PetroLeone. Mitigation measures suggested by the report will be incorporated into the designs for the upgrade and an IFC and AfDB compliant impact assessment will be prepared as a separate study and will deal specifically with the upgrade; and
- A health and safety management system will be implemented. This system will ensure the ongoing identification and rating of hazards, recording and investigation of incidences, appropriate training and awareness-raising, the correct use of personal protective equipment (PPE) and the development of appropriate emergency response plans.

### **Air Quality**

6.24 An assessment of air quality in the project area was undertaken, and the findings are detailed in the Air Quality Impact specialist study. The methodology consisted of a baseline assessment, an emissions inventory, and an impact assessment. Baseline concentration measurements of various emissions such as carbon dioxide, inhalable particles, polycyclic organic matter, nitrogen dioxide and carbon monoxide, were assessed to measure potential impacts on air quality. After the introduction of mitigation measures, only one impact, namely impacts from inhalable particles, will remain moderate in significance while the other impacts will be reduced to low significance. The following actions will be undertaken in monitoring air quality impacts throughout the duration of the project: ambient monitoring, stack monitoring during operations, the use of internal floating roofs on the ethanol tanks to reduce vapour build up and venting, and staff training.

### **Carbon Stock Impacts**

6.25 The carbon stock assessment identified the impacts of the loss of carbon pool in the different vegetation types which occur in the project area that would result from clearing of vegetation and turning of soils on the site. Only one impact, the loss of carbon stored in Lophira woodlands was of moderate significance. The impact of any carbon loss in forests was rated as moderate positive, as Addax will not clear forests and will actively improve the protection of this resource.

### **Greenhouse Gas Emissions**

6.26 The detailed greenhouse gas lifecycle impact assessment carefully considered the greenhouse gas emissions associated with each step of the project. There are no impacts of high negative significance associated with GHG emissions, and only one was rated as being of moderate significance, resulting from land clearing and preparation. Calculated emissions associated with the project yielded total emissions of approximately 23.90 gCO<sub>2</sub>eq/MJ of sugarcane ethanol. This will result in Greenhouse Gas Emission Savings against the fossil fuel comparator of approximately 71.48%. A large number of easily incorporated technical recommendations that are in line with other reports have been made to further enhance the positive overall greenhouse gas impact.

### **Preliminary Sustainability of Agriculture Appraisal**

6.27 An appraisal of the sustainability of the project using an assessment of the implementation of the 12 principles for biofuel production defined by the Round Table for Sustainable Biofuels (RSB) was undertaken. For all criteria the project scored at least two (full compliance) out of three (exceed), indicating full compliance and that the necessary objectives and systems are in place. The project exceeds overall sustainability objectives with respect to its compliance with international treaties relevant to biofuel production, especially RSB, and its contribution to the social and economic development of local people.

### **Cumulative Impacts**

6.28 Cumulative impacts were briefly considered by analysing the following potential project related cumulative impacts:

- Cumulative impacts on the Rokel River.
- Implications of the Tonkolili Iron Ore Project.
- Social, environmental and safety impacts on the Makeni-Lunsar-Freetown highway.
- Cumulative impacts on the natural resource base due to in-migration of job seekers.
- Combined effects of individual impacts, e.g. noise, dust and visual from the Addax project development on a particular receptor.
- Cumulative economic benefits resulting from the Addax project acting as a catalyst for related developments in the Makeni area that are required to support the project
- Improved socio-economic situation and community infrastructure in the project area and environs.
- The potential widening of the Makeni-Lunsar-Freetown highway.
- The potential construction of the Yiben Dam upstream of the Bumbuna Dam.
- The electrification of Makeni resulting in additional influx into Makeni.

6.29 None of the cumulative impacts identified are considered significant, and in cases where the impacts are a result of activities external to the Addax project, the creation and support of discussion fora between Addax and concerned stakeholders to address and mitigate the impacts have been recommended.

### **Climatic Impacts**

6.30 Sierra Leone is faced with adverse weather conditions, such as droughts, storms and floods,

which may damage crops and lower yields. These risks are likely to increase over time due to climate change. As a result, a number of “climate proofing” project design elements have been incorporated. Drought risks will be mitigated by the use of irrigation during the dry season to ensure that there is sufficient water. The plantation is also carefully designed to limit flood and erosion risks through leveling, grassed water evacuation drains and vegetative barriers. These are all in line with the recommendations of Sierra Leone’s NAPA for the agricultural sector.

## **7. ENVIRONMENTAL HAZARD MANAGEMENT**

### **Major hazardous installations**

7.1 All facilities that incorporate the production, storage and transportation of large volumes of flammable materials which could pose a hazard beyond the borders of the facility are Major Hazard Installations (MHI). The risks associated with fires and explosions, will be assessed more accurately in order to establish whether certain risks could be reduced through changes in the design of the facility and appropriate standard operating procedures and emergency response strategies will be developed. Hazard operability studies (HAZOP) will be undertaken at the ethanol plant, for the ethanol transportation operation and at the Kissy terminal. Each HAZOP study will be undertaken prior to construction and identify and evaluate design and operational aspects that may represent risks to personnel or equipment, or prevent efficient operation and provide plans to manage these.

### **Emergency Preparedness**

7.2 Emergency preparedness management plans will rely on the results of the HAZOPS to identify risks and ensure that all eventualities are considered. The development of emergency response plans will be required for emergencies linked to externalities such as run-away fires. A number of action plans are therefore anticipated, such as: Emergencies preparedness for spillages action plan; Strategy for operational upset conditions action plan etc. Close integration between company and the government will be required.

### **Health and Safety**

7.3 Addax will create and instil a safe working culture and environment and provide the workers with a safe and healthy work environment, taking into account inherent risks in this particular sector and specific classes of hazards. Addax will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimising, so far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice, Addax will: identify potential hazards to workers, particularly those that may be life-threatening; provide preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; train workers; document and report occupational accidents, diseases, and incidents; and develop emergency prevention, preparedness and response arrangements.

### **Security**

7.4 Addax will perform a site-specific risk assessment for its facilities and operations co-operation with relevant Government agencies. The objective will be to determine the likelihood that identifiable hazards or threats that could harm its operations and personnel and will allow Addax to be better prepared to meet potential hazards and threats and eliminate or mitigate consequences. A Security Operational Management Plan will be implemented and a large local security force will be deployed to manage security issues.

## **8. MONITORING PROGRAM**

8.1 The SEMP serves as the overarching framework for comprehensively monitoring and addressing the project’s impacts on the environment and on surrounding communities. The SEMP will provide Addax with the means for regularly monitoring and addressing the project’s environmental, social and health impacts: surface and groundwater, soils, climate and weather (air quality), waste disposal, biodiversity, fish and fisheries, greenhouse gas, transport safety, social monitoring, agriculture, education, health, household economy, housing, community health, accidents and incidents, security. This may change depending on the project implementation and any comments received through the grievance mechanism. Monitoring will be intensive in the initial phases to ensure that good baseline data is collected and the identification of suitable indicators. Following this, the frequency of monitoring will be revised according to the analyses of the findings of the monitoring. Monitoring, reporting and documentation requirements will be based on requirements agreed to by all

lenders, including the Bank. Annual reports will be made available to authorities, lenders and to interested and affected parties. Addax will be required to submit to the Bank each subsequent RAP for review and approval by the Bank. The Bank will monitor the implementation of each subsequent RAP throughout the duration of the project to ensure that Addax complies with its respective obligations.

8.2 The SEMP consists of numerous ESMPs that will be developed throughout the duration of the project. Each of these ESMPs will be implemented during the project's phases and will cater to the planning, land preparation, planting, factory design and construction, factory commissioning and estate establishment activities. The ESMPs range from the Construction ESMP to the Integrated Waste Management ESMP to the Cultural Heritage Management Plan, for example. A full list of the ESMPs to be developed under the SEMP is provided in Annex 2. Monitoring forms part of activity specific ESMPs and as such there is no single monitoring plan. The SEMP also consists of a Social and Environmental Management System (SEMS) that Addax will establish to facilitate its ability to effectively monitor the project. Overall responsibility for monitoring will lie with the Health, Safety, Social and Environment (HSSE) Manager. The various managers in the HSSE section (Resettlement and Social Affairs, Environmental Affairs and Sustainability, Health and Safety, Quality Assurance and the Farmer Development Programme) will report to the HSSE Manager on the monitoring from their various fields of responsibility on a quarterly basis and monitoring will form part of the day to day management planning activities attributed to each section manager. Data from the monitoring will be disclosed to the local communities and stakeholders and any comments or questions received during the disclosure will be addressed as appropriate. The security component of the operation will be monitored through a verifiable 'due diligence' process in the selection/hiring and performance of security companies. The implementation of the SEMP for the duration of the project will amount to a total of USD 9,683,607.

## **9. PUBLIC CONSULTATIONS AND PUBLIC DISCLOSURE**

### **Scoping Phase**

9.1 During the scoping phase (January-April 2009) stakeholder engagement was predominantly geared at providing information on the project and gathering stakeholders' views. Consultations were held with a diversity of stakeholders at national, district and local level through dedicated consultative forums, and the stakeholders' views and concerns were captured in Issues and Response Trail documentation. The ESHIA specialists addressed stakeholder comments in their respective impact assessment studies. During community meetings undertaken throughout the ESHIA disclosure phase specific representatives from the villages were invited, including chiefs, land owners, representatives of women's organisations, and youth organisation representatives in addition to other community members and stakeholders. Local and National government officials, NGOs and other Interested and Affected Persons were also provided with ample opportunity to participate in all aspects of the disclosure period. The main concerns outlined during the scoping phase included: concerns regarding the duration of the land leases, concerns regarding the loss of land, concerns about impacts related to fish and fisheries, and concerns about pollution. Each issue was assessed during the specialist studies, and recommendations were proposed to appropriately address the issues and to guide the project design and implementation.

### **Land Lease Preparation**

9.2 Several meetings were held with communities and local government. The land owners were generally in agreement to rent out their land but wanted to understand the benefits and drawbacks of the land lease terms. Stakeholders generally believe that Addax should go beyond payment of a lease fee and provide jobs and development for the area in terms of agricultural assistance and social infrastructure to compensate for leasing of land. More meetings were held to provide additional clarification about the land lease process including the Acknowledgement Agreements and a last round of meetings at district and community level was held in March 2010 and land leases signed on 9 April 2010. During the whole land lease negotiation process, landowners were represented by their legal counsel and the leases were only signed once consensus was reached between the parties.

### **Disclosure of the ESHIA**

9.3 One of the main requirements of the Sierra Leonean government and the IFC is the disclosure of the ESHIA report, as outlined below: A review period was held from 30 October to 30 November 2009. During the review period several activities took place:

- The release of the draft ESHIA was advertised in newspapers and the radio,
- The specialist reports, the draft ESHIA report including an executive summary and the

framework ESMP<sup>6</sup> were presented at meetings,

- A full set of reports (in English) were deposited in various locations,
- Executive summaries of the ESHIA (in English) were distributed to all section chiefs and village chiefs and all secondary stakeholders attending the meeting,
- Mail boxes at various villages and in Freetown were set up to enable stakeholders to provide further comment.

9.4 In general the meeting attendants bestowed a lot of praise on the ESHIA process and the engagement of stakeholders. Many questions and comments were presented (generally similar to those presented during the scoping and the land lease stakeholder meetings). They relate predominantly to issues of loss of land and natural resources, employment, social service benefits and health and safety. All comments received were collated and responses were provided to each issue raised. Stakeholders' perspectives were captured in Issue and Response Trail and Minutes documentation during the disclosure process. A Stakeholder Engagement Plan has been developed for the project after a thorough stakeholder identification and analysis and will guide all future stakeholder engagement. This plan demonstrates Addax's commitment to ensuring a transparent and inclusive consultation process on the environmental and social aspects of the project. The stakeholder engagement requirements for the RAP processes, prior to and at the start of project activities, during the operational phase and for the closure phase are also outlined in the Stakeholder Engagement Plan. Active engagement and participation with diverse stakeholders will continue under the project.

## 10. COMPLEMENTARY INITIATIVES

10.1 A Comprehensive Resettlement Policy Framework (CRPF) was developed and outlines the conditions under which resettlement must take place, whether displacement is physical or economic and defines the scope of the Resettlement Action Plans (RAP). The CRPF details the RAPs that will be drawn up according to the phased project expansion. The CRPF provides for the overall implementation of the project's resettlement and compensation policy and indicates Addax's intentions, planning and budgeting for the entire project. The development of subsequent RAPs will be closely guided by an ongoing consultative process with concerned communities--- a cornerstone of the Addax project. The phased approach in the development of subsequent RAPs is aimed at minimizing disruptions to the livelihoods of the project affected persons. The RAPs will also be implemented to compliment the FDP as well as the Land Lease and Acknowledgement Agreements.

10.2 Although RAPs are not a legislated requirement in Sierra Leone, the lease agreements are legally binding and best practice implies that PAPs should be: compensated for any attendant loss of livelihood; compensated for loss of assets at replacement costs; and be assisted in case of relocation or resettlement. Since the Addax project will be rolled out in phases over several years, resettlement will be dealt with on a year by year basis, with several RAPs anticipated at present. Each RAP will be undertaken as stated in the CRPF. A pilot phase RAP has already been undertaken for the Pilot Phase and the results of this RAP are presented below. The total number of people to be affected by economic displacement during the various development phases is estimated to be 13,617 people. 77 people will be physically resettled.

10.3 The following assets were compensated during the pilot phase RAP: Land: leases were signed on the 9 of April 2010 and rent paid for land leases for the first year stands at US\$460,000 for the entire area, while Acknowledgement Agreement payments amounted to US\$11,536 for the pilot area (400 ha of commercial fields and infrastructure) for which the RAP has already been done. The family boundary survey and resulting direct payments in the remaining areas are done in the frame of the RAPs and are on-going. Crops and trees: in total, 67,726,316 Leones (about 20'000 USD) were paid to compensate for loss of these assets. Impacts on grazing lands are not significantly affected, and access to natural resources is not impeded and communities have been given the right to use bush that has been cleared from the fields for firewood and charcoal. No homestead structures or other fixed property, or graves and sacred sites were affected by the pilot RAP. In addition, the FDP has been initiated and in the pilot area alone, 160 ha of rice were planted and harvested. There are 7 FFLS in the villages affected by the Pilot Phase. 180 individuals are participating in the programme; of these participants 49% are female. All compensation for assets lost as a result of the project was undertaken in accordance with Sierra Leone legislation and African Development Bank and IFC requirements.

<sup>6</sup> During the disclosure of the ESHIA, a Framework Environmental and Social Management Plan (ESMP) was disclosed. The report has now been upgraded to a Social and Environmental Management Program (SEMP).

10.4 In addition to the project's ESHIA disclosure process, consultation during the RAP process with the communities in the project's Pilot Phase area have been undertaken through the formation of Village Liaison Committees (VLC) which represent the affected communities and serve as the primary means of consultation between the project and the affected communities. Subsequent meetings with the VLC focused on the principles under which compensation would be made available, field work required to determine land boundaries and identify fields and trees that would be lost to the project, compensation rates, the grievance procedure and the FDP.

10.5 The project development is planned to take place over a four year period commencing with the Pilot Phase in 2010. The four development phases and the estimated number of project affected villages and population are as follows:

- Pilot Phase: 8 Villages, estimated population 1,642
- Phase 2 (2011 development area): 21 villages, estimated population 5,718
- Phase 3 (2012 development area): 13 villages, estimated population 3,576
- Phase 4 (2013 development area): 18 villages, estimated population 2,681

10.6 The project will ensure that no assets, crops or trees are destroyed prior to those affected being resettled and compensated for any loss. When physical displacement is required compensation and the resettlement process will be monitored to ensure that the affected households are satisfied with their compensation in kind (replacement structures).

10.7 Monitoring of the RAP implementation will primarily ensure that the project resettlement activities are implemented within the prescribed time frame, that the costs and resources are available as required and that the conditions of the RPF are met. The monitoring of the RAP implementation is the responsibility of Addax as the implementing agents of the project's resettlement programme. The affected persons and local authorities will participate in the monitoring process.

10.8 Monitoring indicators during implementation of the project RAPs inter alia include: 1) food security; 2) quality and standard of living; 3) asset and livelihood security; and 4) gender equality and vulnerable persons security. Post displacement and resettlement monitoring indicators also include household income and livelihood restoration, payments under land lease, community skills development, farmer development, access and development of services, grievances and resolution outcomes.

## **11. CONCLUSIONS REGARDING ISSUES AND IMPACTS**

11.1 Issue 1: Loss of habitats and associated species – The project will cause a loss of habitat and potentially impact associated species, but much of the land to be affected by the project is already degraded. The Addax project will modify the environment further but the introduction of ecological corridors will increase the overall biodiversity value of the area.

11.2 Issue 2: Contamination of the terrestrial and aquatic environment by pest control agents and fertilizers – The project is a potential source of contamination to the aquatic and terrestrial environments. This could potentially have serious impacts on the ecological functioning of various systems, as well as impacting on the health of the local human population. Several management strategies and monitoring programmes have been introduced to manage these issues. Using these and international Best Management Practices (BMPs), this key issue has been adequately mitigated and can be effectively managed.

11.3 Issue 3: Community conflicts – The project has the potential to cause conflicts both within the communities themselves, as well as conflicts between communities and Addax directly. Addax has from the start of the project sought to communicate with communities and local authorities directly and through their local partners, and have designed the lease agreements to establish a direct link with the communities. Ongoing open engagement with all stakeholders will ensure that this issue continues to be properly addressed.

11.4 Issue 4: Economic and Physical displacement – Local communities subsist off the land and the project will result in the loss of access to an area of 14,300ha. 77 people will also need to be physically displaced. However, the leases have been signed by the Chiefdom Council by virtue of a power of attorney by the landowners so nobody has been forced to lease land. Acknowledgement Agreements with individual landowning families will also be signed to ensure that they receive direct

compensation from Addax. The RPF sets a framework for the conditions under which any resettlement might take place, whether displacement is physical or economic, and is applicable to all phases of the project.

The lease payments, acknowledgement agreements and monetary compensation for physical assets lost (determined through the RAPs) provide a financial mitigation for this impact. The implementation of the SEMP including the FDP and a number of ESMPs which deal with the communities provide a second, longer term mitigation and the combination of both these types of mitigations will adequately deal with impacts related to food and livelihood security. The outcome of the financial and skills training measures will be to sustain and enhance food and livelihood security in the project area, thus adequately addressing economic displacement issues.

11.5 Issue 5: Socio economic benefits – The project has the potential to significantly enhance the standard of living of those directly affected, as well as of the population in the Bombali and Tonkolili Districts in terms of employment, agricultural capacity building, creation of small businesses and social development. These impacts are particularly important in an area where poverty is endemic and where employment opportunities are lacking. Expectations of job opportunities and development projects are high amongst local residents. It is very important to instil realistic expectations with regards to benefits from the project, and to develop a strategy of equitable distribution of job opportunities and benefits amongst the affected parties. As the skills base in the area is poor, in order to optimise local employment opportunities and involvement in the FDP, skills training will be necessary. Particular attention will need to be given to women and youth. With these strategies in place, in general socio-economic benefits were seen to be of high or very high significance.

11.6 Issue 6: Health, safety and security issues – The project has the potential to impact on health, safety and security. These issues are primarily management issues and are dealt with through the implementation of several management plans.

11.7 Issue 7: Sustainability of the project – The project has been designed to ensure it is sustainable and results in net carbon emissions savings. The sustainability assessment found that the project complies with all sustainability criteria based on the RSB Principles, and in some cases even exceeds them.

11.8 This Project will result in environmental, social and health impacts that can be managed to levels of significance that would be regarded as acceptable to society and the natural environment, provided the recommendations presented in this report are implemented as part of the social and environmental management programme developed as part of the ESHIA process.

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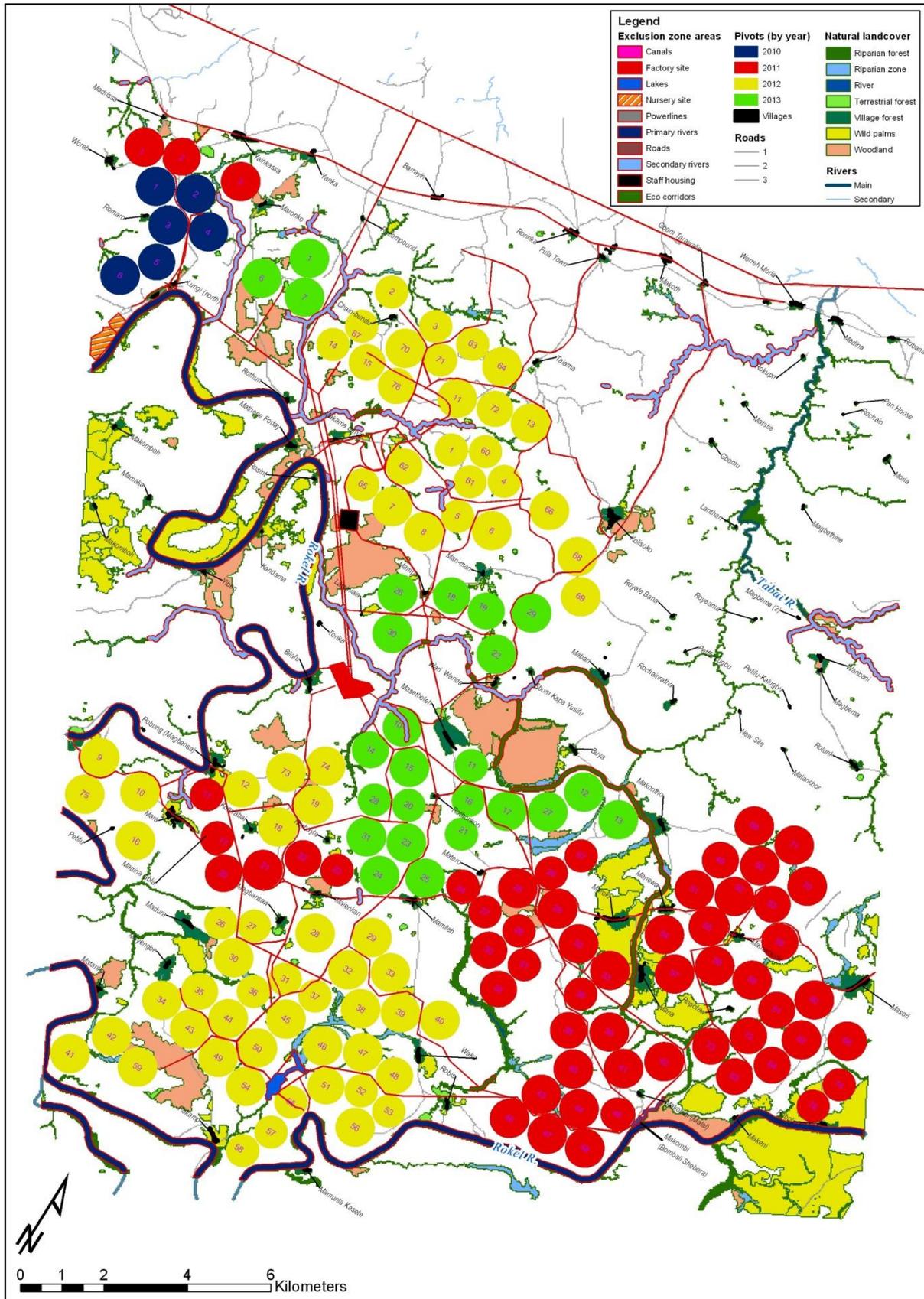
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Annex 1: Addax Project Land Requirements (pivots, ecological corridors and infrastructure)



**Annex 2: SOCIAL AND ENVIRONMENTAL MANAGEMENT PROGRAMME (SEMP)****Overview of the Environmental and Social Management Plans (ESMPs)**

<b>Report</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
<b><i>Planning, Land Preparation and Planting – Year 1</i></b>				
Site Specific Environmental and Social Management Plan – Year 2010 Pilot phase (ESMP 2010.01)				
Resettlement Action Plan (RAP) – Year 2010 – Pilot phase (ESMP 2010.02)				
Stakeholder Engagement Plan (ESMP 2010.03)				
Site Specific Occupational Health and Safety Management Plan (Pilot phase) (ESMP 2010.04).				
Farmer Development Program (ESMP 2010.05)				
<b><i>Land preparation, planting and factory design and construction – Year 2</i></b>				
Construction ESMP (ESMP 2011.01)				
Resettlement Action (RAP) Plan – Year 2011 planting area (ESMP 2011.02)				
Ethanol Plant Hazard Operability Study (ESMP 2011.03)				
Land Preparation and Planting Environmental and Social Management Plan (ESMP 2011.04; 2012.04)				
Comprehensive Health Impact Assessment (ESMP 2011.05)				
Community Health and Safety Management Plan (ESMP 2011.06)				
Occupational Health and Safety Management Plan (ESMP 2011.07)				
Cultural Heritage Management Plan (ESMP 2011.08)				
Community and Skills Development Plan (ESMP 2011.09)				
Security Management Plan (ESMP 2011.10)				
Labor Recruitment, Purchase & In-migration Management Plan (ESMP 2011.11)				
Socio-Economic Monitoring Framework (ESMP 2011.12)				
Estate Operation Environmental and Social Management Plan (ESMP 2011.13) (incorporating Integrated Pest Management and Integrated Nutrient Management Plans).				
Integrated Water Resources Management Plan (ESMP 2011.14)				
<b><i>Land preparation, planting and factory construction and commissioning – Year 3</i></b>				
Integrated Waste Management Plan (ESMP 2012.01)				
Resettlement Action Plan (RAP) – Year 2012 Planting Area (ESMP 2012.01)				
Emergency Preparedness Management Plan (ESMP 2012.03)				
Ethanol Plant Environmental and Social Operation Management Plan (ESMP 2012.05)				
Kissy Terminal Hazard Operability Study (ESMP 2012.06)				
Transport Hazard Operability Study and Management Plan (ESMP 2012.07)				
<b><i>Factory operation and Year 4 and Year 5 estate establishment – Years 4 &amp; 5</i></b>				
Resettlement Action Plan (RAP) – Year 4 and Year 5 Planting Areas (ESMP 2013.02)				
Closure and Decommissioning Plan (ESMP 2014.01)				