



Food and Agriculture  
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# GUIDANCE TO PUT FORWARD SUSTAINABLE FORESTRY INTERVENTIONS IN DISPLACEMENT SETTINGS IN KENYA

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## List of acronyms

CRRF	Comprehensive Refugee Response Framework
CIDP	County Integrated Development Plan
DRC	Danish Refugee Council
FaIDA	Fafi Integrated Development Association
FAO	Food and Agriculture Organization of the UN
FMNR	Farmer managed natural regeneration
GoK	Government of Kenya
IGAD	Inter-Governmental Authority on Development
KFS	Kenya Forest Services
KISED	Kalobeyei Integrated Socio-Economic Development Plan
KRCS	Kenya Red Cross Society
LPG	Liquefied Petroleum Gas
LOKADO	Lotus Kenya Action for Development
NGO	Non-Governmental Organization
NRC	Norwegian Refugee Council
RRDO	Relief, Reconstruction and Development Organisation
UNHCR	United Nations High Commissioner for Refugees
WFP	World Food Programme

# 1. Introduction

## 1.1. Background

Kenya is surrounded by countries that have suffered political and civil unrest over decades. The influx of refugees from those countries has therefore seen Kenya hosting one of the largest refugee populations in Africa over the years (Kariuki et al, 2008; IOM, 2015). According to UNHCR statistics, Kenya was hosting 485,524 registered refugee and asylum seekers by October 2019<sup>1</sup>, of whom 89% were refugees. Most of them reside in Dadaab and Kakuma refugee camps (44 percent and 40 percent<sup>2</sup>, respectively), while approximately 16 percent reside in the country's urban areas (mainly Nairobi) (World Bank, 2019). By 2019, most of the refugees were from Somalia (54%), and South Sudan (24%), with fewer from the Democratic Republic of the Congo (9%), Ethiopia (6%), Burundi (3%), Sudan (2%), Uganda (0.5%), Rwanda (0.4%) and Eritrea (0.4%) (UNHCR, 2019a).

The main legal framework that governs displaced people in Kenya is the New York Declaration for Refugees and Migrants and its Comprehensive Refugee Response Framework (CRRF), adopted by the UN General Assembly on 19 September 2016 (UNHCR, 2018c). The primary national legislation is the Kenya Refugee Act (2006), which supports the encampment of refugees. Encampment renders refugees mostly dependent on international humanitarian assistance for their survival and developmental needs since it provides for few employment, business, and local integration opportunities (Kariuki et al., 2008). Humanitarian assistance is, however, less than adequate given the high refugee population and extended displacement. Refugees supplement humanitarian support through livelihood activities that are dependent on the natural resources available in the neighbourhood of camps. The extractable resources dwindle with increasing land degradation (Gerrard and Myers, 2016), which causes constant competition between the refugees and local communities for the diminishing resources (Fernandez et al., 2014). Consequently, there is a massive strain on the fragile environments that define Kenya's displacement settings (Kariuki et al., 2008).

The Refugee Policy of the Government of Kenya (GoK) is shifting in response to these realities. A more progressive Refugees Bill has been drafted and is currently under legislative consideration. The draft bill is perceived as being more progressive because it gives provisions for promoting self-reliance and entrepreneurship for both refugees and local communities by granting refugees the right to work and use the land for livelihood. Other significant enabling strides include Kenya becoming a Comprehensive Refugee Response Framework (CRRF) pilot implementation country in 2017, and development of the IGAD Nairobi Action Plan by Horn of Africa countries. Establishment of integrated semi-urban settlements for refugees at Kalobeyei and incorporation of refugees in county / subnational level Integrated Development Plan and

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<sup>1</sup> <https://www.unhcr.org/ke/wp-content/uploads/sites/2/2019/11/Kenya-Infographics-31-October-2019.pdf>

<sup>2</sup> 20% of the Kakuma population is settled at Kalobeyei but most UNHCR population statistics report a combined figure. Kalobeyei population was 38 546 and 36 025 in January and February 2019 respectively

five-year Plans such as Garissa Socio Economic and Development Plan 2020-2022 are further positive developments.

Presently, refugees have restricted access and rights to cutting trees, including for fuelwood in Kenya (Betts, et al., 2018). Even in the newly designed Kalobeyei settlement, refugees do not have ownership rights to land and the assets developed thereof, which reduces incentives to invest (Betts et al., 2018). In the backdrop of these disincentives, several interventions have been undertaken in the past to reduce the environmental impacts of refugees, especially pressure on tree resources. Interventions include tree establishment, distribution of improved stoves for energy efficiency as well as environmental education and awareness creation (Kariuki et al., 2008). Proper planning and implementation of sustainable natural resources management strategies is crucial for building resilience in these impacted areas. Well-planned forestry and tree-based interventions can ensure a sustainable supply of fuelwood, timber, and other tree/forest products for those communities.

## **1.2 Objectives of the study**

The overall objective of the guidance notes was to identify opportunities and challenges for forest and tree-based interventions to develop site-specific guidance for different interventions aiming to support energy needs, restore degraded forests and other woodlands, and develop agroforestry systems in the specific context of displacement settings in Kenya as part of a broader study in Eastern Africa.

This work aims to support countries, FAO and other partners and stakeholders in developing sustainable natural resources management solutions in order to secure environmental conservation, restoration of degraded land and a sustainable supply of tree and forest products in the context of displacement settings in the country. As well as leveraging opportunities to address environmental degradation, such initiatives should address the constrained access to energy while also building livelihood resilience in situations of displacement that encompass both displaced and host communities.

## **2. Methodology**

The development of these guidance notes involved a combination of a desk review and consultations with relevant stakeholders through key informant interviews and stakeholder workshops in the two counties hosting refugee camps in Kenya (Turkana and Garissa). Field visits were also conducted around the camps to observe current relevant interventions and opportunities for improvement or adaptation.

### **2.1 Site selection**

As part of a broader study covering five countries, pre-determined criteria guided the selection of study sites (Table 1). There are, however, only three locations specifically hosting displaced

persons in the country - Kakuma refugee camp and Kalobeyei settlement in Turkana county and Dadaab refugee camp complex in Garissa County and all the three were included in the study (Table 1).

Table 1: Site selection criteria for Kenya

Factors	Scale	Kakuma	Kalobeyei	Dadaab
<b>Category A</b>				
Agro-ecological zones (as per country classification)	1=Wet/Humid >800; 2=Semi-arid 400-800; 3=Arid <400	3	3	3
Precipitation/Rainfall mm per annum				
Proximity of forest areas/woodlands	1=Forested/woodland area; 2= deforested area; 3= degraded land	3	3	2&3
<b>Category B</b>				
Displaced persons	1= Refugee; 2=IDP	1	1	1
Type of settlement	1=Camp; 2=Settlement; 3= Other specify	1	2	1
Time since establishment	1=<5; 2= 5-15; 3=>15	3	1	3
<b>Category C</b>				
Population levels no. of people (Scale of 3 categories as per country statistics)	1=<50,000; 2=between 50,000 and 100,000; 3=>100,000	3	1	3
Land tenure (Land available/ accessible/ to displaced persons)	1=Granted use rights; 2=Assumed use rights; 3=No access	2	1	2

## 2.2. Literature review

The study was guided by a protocol with a conceptual framework that takes a holistic approach to sustainable resources management encompassing: i) biophysical conditions, ii) livelihood systems, iii) population dynamics, and iv) governance and institutional mechanisms. The literature review was conducted based on search terms that included the six factors describing site characteristics and the 25 descriptors (information and data needs) listed in Annex 1. Online searches were conducted in *inter alia*, Google Scholar and websites of relevant organizations e.g. UNHCR, FAO, WFP, national/subnational government line ministries, and NGOs. The information obtained from all relevant publications (reports, articles, maps) was recorded in a standard Excel template for ease of synthesis. The information was synthesized, and a draft report produced for validation during stakeholder consultations.

## 2.3 Stakeholder consultation

Face-to-face interviews were conducted with representatives from the government ministry responsible for refugees<sup>3</sup>, FAO, UNHCR, key NGOs working in humanitarian, development, environment, agriculture, food security, energy, water, forests, and administration as well as refugee and host community leaders in the target sites. The interviews were used to: i) validate information obtained from literature, ii) fill in identified gaps or get more current data/information not available in literature, and, iii) acquire forest/tree management and

<sup>3</sup> primarily Department of Refugee Affairs in the Ministry of Interior and Coordination of National Government



utilisation information/data regarding the specific sites using a checklist. Information gathered was synthesised and incorporated into the relevant sections of the report.

## 2.4 Stakeholder workshops

Stakeholder consultation workshops were conducted during site visits to Kakuma and Dadaab on 28-30 October 2019 and 4-6 November 2019, respectively (alongside key informant interviews) (Figure 1). The objective of the workshops was to further validate the synthesised information and solicit more information from agencies implementing relevant programs at local level in both sites. The workshops brought together a broad spectrum of stakeholders from county government, humanitarian organizations, national government agencies, NGOs, host communities, and refugee communities (Annex 3). A presentation of preliminary results from the literature review was made at the workshops to initiate further discussions with key stakeholders. The workshops fostered discussions on the potential and contextually appropriate sustainable natural resources management strategies focusing on forest and tree-based solutions (e.g. establishment of energy woodlots, restoration of degraded areas, agroforestry systems etc), and preferred tree and forest-based interventions. The outputs of the group discussions were incorporated into the relevant sections of the report. Field visits were conducted around the camps during site visits to observe current relevant interventions and opportunities for improvement or adaptation.



Figure 1: Participants at the stakeholder workshops (left) LOKADO offices in Kakuma, and (right) UNHCR offices, Dadaab (*Credit: ICRAF*)

## 3. Displacement context and related site-specific characteristics

### 3.1 Description of refugee sites

In Kenya there are two main refugee camps, Kakuma and Dadaab, and one refugee settlement known as Kalobeyei. Kakuma camp and Kalobeyei settlement are in Turkana West Sub County of Turkana County while the Dadaab camp complex is in Dadaab and Fafi Sub-Counties of Garissa County. Both Turkana and Garissa Counties are among the most underdeveloped counties in Kenya, being part of a region referred to as frontier counties. The counties suffer from a high level of human insecurity since they border the volatile nations of South Sudan (Turkana) and Somalia (Garissa) (O'Callaghan and Sturge, 2018). Low population density,

poverty and low levels of human development define the counties, a situation that partly results from a long history of economic marginalization and social exclusion (Kumsaa and Jones, 2014).

### 3.1.1 Dadaab Refugee Camp

Dadaab refugee camp complex was established in 1991 and is one of the oldest refugee camps in the country. The complex is approximately 100 km west of the Kenya-Somalia border and 350 km east of Nairobi. It spreads over a 13 km<sup>2</sup> area around Dadaab town and has consisted of up to six camps (Dadaab, Ifo I, Ifo II, Dagahaley, Hagadera, and Kampioos; Figure 2). Dadaab was the first camp to be established in 1991 as a result of large influxes of refugees following the collapse of the Somali government. This was followed in the same year by the establishment of Ifo (also called Ifo 1), Dagahaley and Hagadera camps respectively. Ifo 2 and Kambioos were later set up in 2007 and 2011, respectively to accommodate a further refugee influx (Fernandez et al., 2014). Dadaab, Dagahaley, Ifo 1, and Ifo 2 are in Dadaab sub-county while Hagadera and Kambioos are in the Fafi sub-county (GoK, 2017). In a bid by the Kenya government to consolidate the camps, Kambioos was closed in March 2017 (UNHCR, 2018<sub>a</sub>), followed by Ifo 2 in April 2018.

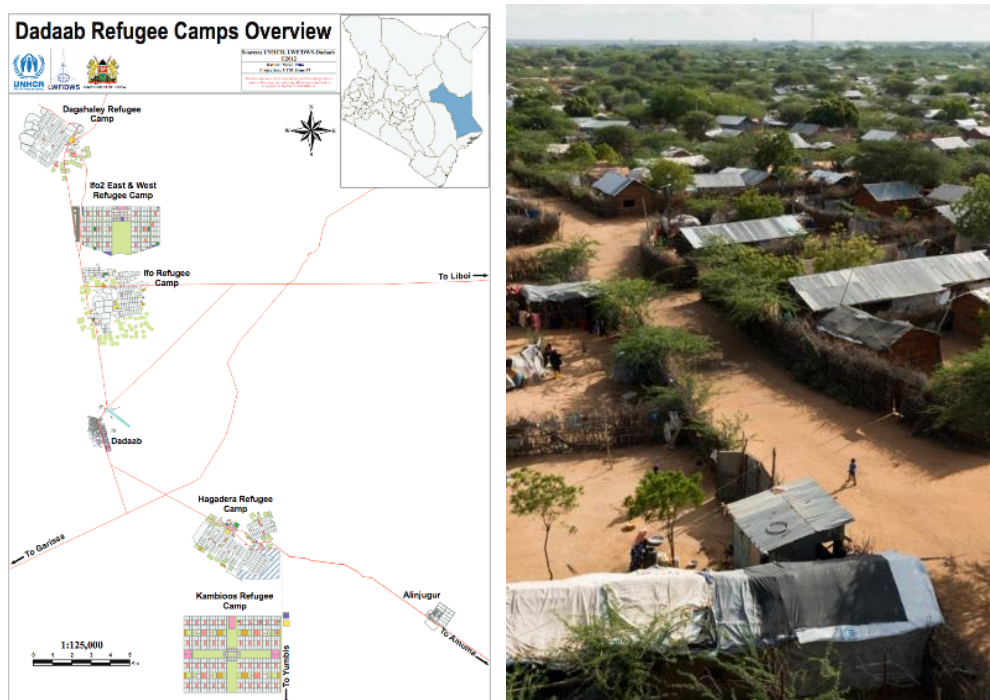


Figure 2: (left) Map of Dadaab Camp Complex showing the six camps (Credit: UNHCR; 2014<sub>a</sub>); and, (Right) Picture of Dagahaley camp in Dadaab refugee complex, Kenya. (Credit: Adriane Ohanesian /Getty Images <https://www.sapiens.org/culture/somali-refugees/>)

Dadaab and Fafi Sub Counties experience arid and semi-arid climatic conditions. The land is predominantly occupied by the Somali community whose major livelihood activities are nomadic pastoralism, trade, and agro-pastoralism. Due to fact that pastoralism is the dominant production system, there is a high demand for livestock forage resources. The high rate of

population growth since 1991 has put high pressure on natural resources, especially tree products such as fuelwood, construction poles, timber, and others like leaves and pods for livestock fodder.

### 3.1.2 Kakuma Refugee Camp

Kakuma is located in Kakuma Ward, about 850km north-west of Nairobi and 150 km south of the South Sudan border. Kakuma town, the urban area near the refugee camps, consists of businesses and residences clustered along a 100 km stretch on the Kitale-Lokichogio-Juba Highway, with an estimated population of 60,000 persons (Oka, 2014). The refugee camp was established in 1992 to serve refugees that had fled the North-South conflict in Sudan in 1991, but who had initially been hosted in a temporary camp in Lokichogio town, close to the border with South Sudan (Manji and de Berry, 2019). The camp thereafter expanded to accommodate refugees of many nationalities such as South Sudanese, Somalis, Eritreans, Ethiopians, Rwandese, Congolese, Ugandans, and Burundians (Bizzarri et al., 2010). By 2003, the whole camp had expanded to cover an area of about 25 km<sup>2</sup> (Fernandez et al., 2014).

The main drivers of forced displacements into Kakuma are civil unrest, sustained interethnic conflict, famine, and recurring drought in South Sudan as well as the prevailing instability in Ethiopia (Bizzarri et al., 2010; UNHCR, 2014, UNHCR, 2015). Kakuma was home to 192,301 refugees and asylum seekers by October 2019 (UNHCR and GoK, 2019) encamped in four camp villages, Kakuma I-IV (GOK, 2017<sub>a</sub>). The villages are roughly established along national and ethnic lines (Corbyn and Vianello, 2018). Kakuma II was opened in 1998 primarily to settle Somali refugees who were transferred from camps in Mombasa, while Kakuma III was opened in 1999 to cater for more Sudanese refugees. Kakuma III, however, later expanded to cater for refugees from other nationalities (Kariuki et al., 2008).

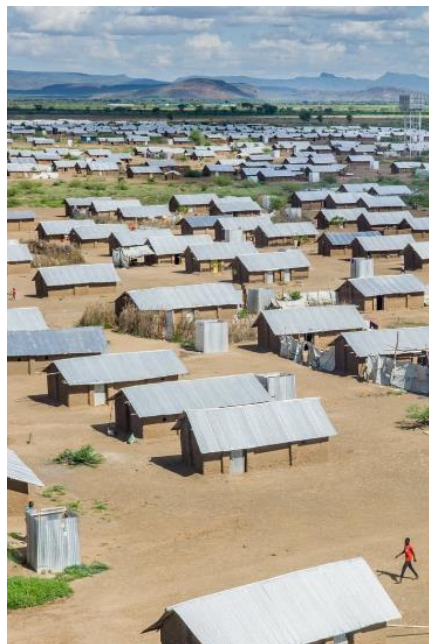
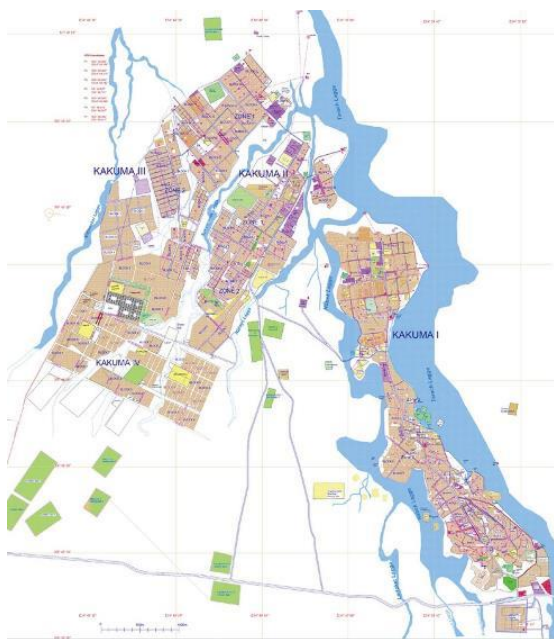




Figure 3: Kakuma refugee camp: (right) Layout map showing the four villages (Source: Bauman et al, 2017); and, (left) houses in one section (Photo by Hubert Hayaud/The Guardian)

### 3.1.3 Kalobeyei

Kalobeyei is a new integrated settlement located within Kalobeyei ward (GOK, 2017) in Turkana West subcounty, just 30 km from the Kakuma refugee camp. The settlement was established in 2015 as a collaboration between UNHCR and the Turkana County government (Betts et al., 2018). Kalobeyei settlement currently hosts about 20% of the Kakuma refugee population, a majority of whom are South Sudanese, with 90 percent of them having arrived after June 2016 (Manji and de Berry, 2019).



Figure 4: Kalobeyei refugee settlement: (Top) The settlement Plan (Source: UNHCR<sup>4</sup>) and (bottom left and right) homesteads in the settlement (Photo credit: ICRAF)

<sup>4</sup> <https://data2.unhcr.org/en/documents/download/62220>. The green stripes represent agricultural land

## 3.2 Population trends in Kenya displacement settings

The trend of refugees and asylum seekers' population has been largely on the decrease in Kenya from 2015 to 2019 (Figure 5; UNHCR, 2019<sub>a</sub>). As stated earlier, Kenya was hosting 485,524 registered refugee and asylum-seekers as of 31<sup>st</sup> October 2019, with 217,108 persons (44%) at the Dadaab camp complex and 192, 301 (40%) hosted at Kakuma and Kalobeyei (UNHCR, 2019<sub>b</sub>). The population dynamics in each of the camps are outlined in the following subsections.

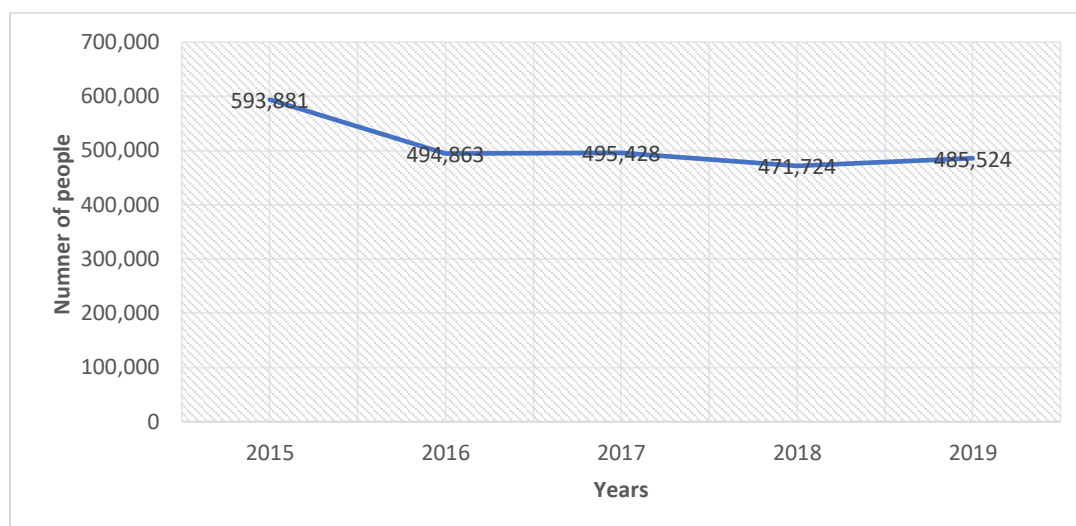


Figure 5: Population trend of refugees and asylum seekers in Kenya from 2015-2019 (Source: UNHCR, 2019a)

### 3.2.1. Dadaab

Dadaab was established in 1991 with initial plans to host 90,000 refugees (Gerrard and Myers, 2016; Fernandez et al., 2014), but by 2009 this capacity had been exceeded by 270% (O'Callaghan and Sturge, 2018). The number further rose to 356,663 by November 2014, which was 60% of the total refugees in Kenya at the time (593,663) (UNHCR, 2014). The population in the Dadaab Complex, 99% of whom are of Somali origin<sup>5</sup>, has however, been declining since 2015 to 347,980 persons by January 2016 (UNHCR, 2016) and 225,557 by April 2018. As of February 2019, Dadaab complex was hosting 210,038 refugees, 58% of them (121,822) being children.

### 3.2.2. Kakuma and Kalobeyei

Kakuma refugee camp population dynamics are predominantly defined by displacements in South Sudan (Manji and de Berry, 2019). As of September 2018, more than half of Kakuma's population were from South Sudan, just under 20% from Somalia, and the remainder from the

<sup>5</sup> Close to 70% originate from south and central Somalia, with just over 20% originating from Puntland and less than 10% from Somaliland (Kamau and Fox, 2013).

Democratic Republic of the Congo, Ethiopia, Burundi, and Sudan. Approximately 56 percent of the camp's inhabitants were aged below 18 years (Manji and de Berry, 2019).

The first group of refugees was the Sudanese Nuer, who reached Kakuma in 1992, followed by the Sudanese Dinka, Ethiopian Amhara, Ethiopian Oromo, and some Somalis in 1993 and 1994. In 1997, Kakuma received a massive influx of Somali refugees after the destruction and closure of the Utanga-Benadiri camp in Mombasa. A significant dip in the camp population happened between 2006 and 2008 when more than 40,000 Sudanese refugees were repatriated to various areas in present-day South Sudan following the Sudan Peace Accord in 2005 (Vemuru et al., 2016). The influx of refugees to Kakuma, mainly from South Sudan, has however, continued since 2005, thereby significantly raising the population in the Turkana West Sub-county, the host of Kakuma camp and Kalobeyei Settlement.

In less than four years between 2011 and 2014, the population of Kakuma grew more than twofold, from 85,862 refugees to 181,821 (IOM, 2015). In 2014 alone, almost 50,000 South Sudanese refugees, having fled the renewed violence in the country, were registered in Kakuma and sheltered mainly in Villages III and IV (UNHCR, 2014<sub>a</sub>). There were approximately 186,000 refugees in both Kalobeyei settlement and Kakuma camps and 320,000 people in the host community, making a total population of 506,000 in Turkana West in 2018<sup>6</sup>. Refugees constitute approximately 40 percent of the Turkana West population that resides within the 15 km radius from Kakuma (UNHCR and GoK, 2019).

### **3.3 Status of land and natural resources in displacement settings**

#### **3.3.1 Land tenure and land use**

Historically, land in Kakuma and environs was for pastoral activities, but the presence of refugees has catalysed sedentary living, which, together with recurrent droughts, is believed to have reduced grazing land and to have accelerated land degradation (UNHCR, 2018<sub>c</sub>). Likewise, in Dadaab the rise in population and increased livestock levels resulting from influx of refugees is blamed for the pressure on natural resources, especially pastures (Bizzarri et al., 2010). The host communities agreed to share the land with refugees (Nasrullah, 2019), but refugees do not have ownership rights for the plots of land they live on, nor the fixed assets they build on the land (Betts et al., 2018). This limits their incentive to invest in sustainable natural resource management in their dwellings. The new refugee settlement at Kalobeyei is better planned and gives the refugees more land to settle per family. The families have more space to build stone/brick homes and to engage in small scale agricultural practices at homestead level such as kitchen gardens and planting of trees.

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<sup>6</sup> The source – KISED (UNHCR & GoK, 2019) – mentions these population figures but the Kenya Population and Housing Census 2019 gave the total population of Turkana West Sub-county as 239,627 (excluding refugees) so KISED figures are more of indicative

### 3.3.2 Rainfall pattern, water availability

The areas hosting the camps receive low and unreliable rains, which are bimodal in pattern (UNHCR, 2018c). Dadaab receives a mean annual rainfall of 372mm (GOK, 2017), and the Kakuma area (including Kalobeyei) receives 320 mm of annual rainfall on average (Bauman et al., 2017). The long rains fall between March and April and the short rains between October and December, mostly peaking in April and November. The areas are prone to flash floods, which of late have been increasing in frequency (UNHCR, 2014a; GOK, 2017). Boreholes are the primary source of water in both Dadaab and Kakuma camps (WFP and UNHCR, 2014). In Kakuma IV, water is trucked to the camp due to limitations related to the inadequacies of the reticulation system in the newly established area for new arrivals. Water taps are located at the centre of the settlement blocks, and the farthest household from the water tap is about 200 metres.

### 3.3.3 Typical vegetation, forest/woodland and deforestation

#### 3.3.3.1. Kakuma and Kalobeyei

The soils in Kakuma and Kalobeyei are shallow and poor with almost no organic matter, being directly on top of a weathered rock. The soils have a low infiltration rate, leading to run-off and flooding. The vegetation in this area is mainly scattered *Acacia* bushes, annual herbaceous plants and grass, mostly *Chloris virgata* and *Aristida mutabilis*. Around Kakuma, woody species are dominated by *Acacia reficiens*, *Acacia mellifera*, *Grewia tenax*, and *Prosopis juliflora*. Riverine vegetation is dominated by *Acacia tortilis*, *Hyphaene coriacea*, *Salvadora persia* and *Prosopis juliflora*. The vegetation is of low density and poor in diversity and the area is gradually being covered by invasive *Prosopis* (Oloang, 1988; FOK, 2018). Introduced species include *Azadirachta indica* (neem), *Moringa oleifera*, *Parkinsonia aculeata*, *Senna siamea* (Cassia), and *Cordia sinensis*.

#### 3.3.3.2 Dadaab

Areas around Dadaab camp were dominated by shrubby vegetation combined with grass and trees (Massimiliano et al., 2017). Dry forest species, tall shrubs, and small trees are principally located in the northern plains and the southeast of Hagadera Camp. The vegetation in the Dadaab area is described as “desert shrub”, which is dominated by *Acacia* spp. In the immediate surroundings of the camps (<2km), completely bare areas are generally well visible (Massimiliano et al., 2017). The woody vegetation in the area was dominated by a few species including *Dalbergia*, *Commiphora*, *Acacia tortilis*, *Delonix elata* and *Boscia* (Beaudou and Cambrezy, 1999). Other tree species present include *Cordia sinensis*, *Salvadora persica*, *Balanites aegyptiaca*, *Azadirachta indica*, *Acacia reficiens*, and *Acacia mellifera*. The shrubby layer is mainly composed of *Indigofera* and *Dysphora* (Beaudou and Cambrezy, 1999).

#### **3.3.4. Impacts of refugee settlements on forest resources**

Before 1986, the area presently occupied by the Kakuma refugee camp was an *Acacia tortilis* riverine forest, but by 2005 the original forest had been largely replaced by the expansion of the camp (Kariuki et al., 2008). There is subsequently low tree cover near the camp, which increases with distance, while the reverse is true with shrub cover (Vemuru et al., 2016). Construction and charcoal production are the main reasons for cutting down trees near the camps, including species that were an important source of forage for livestock. Cutting down of important trees such as *Acacia tortilis* denies pastoralists the pods that serve as livestock feed during the dry season, and the resultant bare soils are vulnerable to erosion. The area within a radius of 10 km from Dadaab camp has been intensely deforested with species of commercial value severely decimated by harvesting (Enghoff et al., 2010).

#### **3.3.5. Forest, tree products supply basin/zones/harvesting regimes**

According to the stakeholders consulted for this study, the demand for forest products is high in all refugee camps and host communities compared to the supply. This is due to the high dependence on forest products for livelihood and energy. The tree products mostly sought by the refugees are fuelwood, timber, fodder, and medicine. Fuelwood and timber are most sought after and are even sourced from afar. For example, timber is brought into camps from nearby counties, and even distant areas such as Bomet and Meru counties whilst women were reported to travel as far as 40 km away from camps to obtain firewood using donkey carts. The invading *Prosopis* has been promoted as an alternative energy source but has not been very well accepted by the community. In Dadaab, community members were reported to opine that charcoal from *Prosopis* (locally dubbed *mathenge*) is very light, burns up quickly, and produces an awful smell.

#### **3.3.6 Forest and tree-based interventions by various stakeholders**

A number of organisations are implementing interventions to enhance livelihood resilience for both refugees and host community members in Kakuma, Kalobeyi, and Dadaab complexes (Annex 2). Several of them are involved in promoting and supporting environmental and natural resources management activities, including those pertaining to forest and tree resources such as the establishment of green belts, tree nurseries, orchards, and planting trees around homesteads in the camps (Table 2). In all three refugee sites, local NGOs supply tree seedlings for planting.



Table 2: Summary of the forest and tree-based interventions observed in the refugee settlement sites

Type of intervention / Area	Specific activity being undertaken	Organization responsible
<b>Kakuma/ Kalobeyei</b>		
'Green belt' enclosures	Enclosing selected communal land and allowing natural regeneration. Enrichment planting of <i>Acacia spp</i> ( <i>A. mellifera</i> , <i>A. nilotica</i> , <i>A. tortilis</i> ), <i>Balanites aegyptiaca</i> , <i>Salvadora persica</i> , <i>Parkinsonia aculeata</i> ,	LOKADO
Tree nurseries	Producing tree seedlings of indigenous and exotic species. Seven nurseries were functional during the time of study	LOKADO
Vegetable farm plots	These are communal land areas designated for community members to plant vegetables and raise tree seedlings	LOKADO
Tree planting around homesteads	Each homestead was given tree seedlings to plant and care for. The activity was more prominent in Kalobeyei settlement	LOKADO
<b>Dadaab</b>		
'Green belt' enclosures	The green belts are a mixture of agroforestry practices. Indigenous trees, fruit trees and vegetables are planted within the same plot of land. Natural regeneration is also promoted	RRDO, KRCS, FaIDA
Tree nurseries	Producing tree seedlings of indigenous tree species and some exotic species	RRDO, KRCS, FaIDA
School fruit orchards	Fruit trees are planted in a fenced off section of the school compound. The school children help care for the trees and the fruits supplement their diet. The orchard is also used as a learning centre.	RRDO, FaIDA
Tree planting around homesteads	Each homestead is given tree seedlings to plant and manage	RRDO
Fodder grass planting (34 hectares)	Alfalfa grass has been planted on about 34 hectares to provide fodder for the community. The grass is maintained using a pivot irrigation method supported by a 5 million litre water pan that has been constructed.	KRCS

"Green belts" were initiated in the 1990s by implementing organisations especially GIZ and LOKADO. These are areas that are enclosed to encourage natural regeneration for increased vegetation cover and fuelwood availability with little, if any, form of management (GOK, 2017; Massimiliano et al., 2017). They are established in the more degraded areas outside the settlements. The areas identified for "green belt" establishment were fenced off with live hedges consisting mainly of *Commiphora spp* to protect the remaining trees inside from destruction while additional trees are planted. Each green belt is managed and monitored by a family selected by the community.

By 2015, four hectares had been put under "green belts" in Kakuma and, at some point, the Lotus Kenya Action for Development (LOKADO) was managing more than 30 green belts around the camp. The modalities for community engagement as well as access and benefit-sharing had not been effectively worked out, however, and the intervention was increasingly viewed with scepticism by other organisations and communities. For instance, there was exclusive access by a few individuals and ultimately communal land ended up being privatized (Ali, 2010). In the area close to Kakuma camp, to the north/west, a slight increase in the number of green belts is visible, but both the green belts and pastoral enclosures scarcely have any vegetation. To the south of the camp pastoral enclosures have been replaced by new settlements.

NGOs supported the establishment of tree nurseries in Dadaab and Kakuma camps mainly consisting of *Delonix regia*, *Acacia mellifera*, *Azadirachta indica*, *Psidium guajava*, *Carica papaya*, *Terminalia catapa*, and *Musa spp.* In Kakuma, there were four nurseries in the camps and three in the host communities where refugees and community members were employed as nursery attendants. In addition, refugees and host communities were also trained in tree planting and various aspects of tree management. Tree nursery establishment was however persistently difficult in some Dadaab camps with the main challenges being lack of water and sources of seeds. In some instances, the Norwegian Refugee Council (NRC) supplied the water for the seedlings (Otieno and Gazarwa, 2013; GOK, 2017).

Fruit tree orchards were mainly established in schools for demonstration and nutritional purposes. Some orchards were also established within the green belts by KRCS, RRDO, and FaIDA. The variety of fruit trees planted included paw paws, mangoes, bananas, lemons, and guavas. More than a thousand such plants were established in the former Ifo 2 camp in Dadaab, a project initiated in March 2018. In a recently established 25-hectare orchard ran by Kenya Red Cross, 10,000 fruit trees were planted (Nasrullah, 2019), and some of them were irrigated using drip kits. At the camp level, trees are planted in small orchards around the shelters and watered using water from irrigation as well as domestic wastewater. Various tree species are planted but mainly fruit trees as aforementioned.

The foregoing shows various attempts to promote indigenous trees, manage invasive species like *Prosopis* and plant *Commiphora* live fences in addition to protecting, rehabilitating, and restoring forests and woodlands. Trees were also planted within the camp and in community land (Kagwanja, 2000; Beaudou and Cambrezy, 1999). However, negative attitudes and practices by the refugees and host communities contributed to the poor performance of the interventions, as generally, people have not fully embraced tree planting and management. Encampment policy is also a disincentive for refugees to engage in these interventions as they do not have the rights to land and/or tree products harvesting.

Efforts at restoration of forest and tree resources have been further impacted negatively by protracted rumours and politics about camp closure in Dadaab. This has discouraged refugees from investing in the interventions when the future is uncertain, an issue that came out strongly during stakeholder consultations. The entrenched lack of attachment/feeling of belonging by the refugees in their host country has also been a challenge to afforestation. There has also been a decline in funding allocation for forest and tree-based interventions in the recent past.

### **3.4 Livelihood systems**

#### **3.4.1 Agricultural systems**

Nomadic pastoralism and agro-pastoralism are the major agricultural activities in Garissa, whilst in Turkana, nomadic pastoralism is more prominent (Bizzarri et al., 2010). Most refugees in Dadaab are pastoralists and keep a few livestock. However, most products are purchased from the host community, thus offering a ready market for camel, cattle, sheep, and goats, like milk and meat (Kumssa and Jones, 2014). The limited, overgrazed, and degraded rangelands have hampered herd growth, leading to a reduction in stock numbers and driving many pastoralists to perpetual food insecurity. Inadequate water for agriculture and livestock further escalates food insecurity. Consequently, there is increasing competition for scarce grazing and water resources, which in turn causes conflicts, insecurity, reduced incomes, and access to other basic services (ibid). In Kakuma, livestock keeping by refugees is restricted to prevent conflict with the host community.

NGO personnel indicated that there have been some interventions to promote farming in flood plains by both refugees and the host community in Dadaab. The NGO, Refugee Education Trust (RET) initiated a greenhouse project, which primarily targeted Somali Bantu refugees to enable them to produce and sell their products to retailers involved in the fresh food voucher programme (Manji and de Berry, 2019). The Garissa County Integrated Development Plan (CIDP) 2018-2022 also documents water and irrigation projects as being implemented in Fafi and Lagdera Sub-Counties, which house the refugee camps.

According to the Turkana CIDP II (2018-2022), agricultural production is dominated by maize and sorghum, which are cultivated mainly at the subsistence level with limited commercial production. Refugees and host community were engaged in farming to produce vegetables, cereals, pulses, and fruits (Vemuru et al., 2016). In Turkana, farming is mainly practiced through small scale irrigation along the Turkwel and Kerio rivers and rainfed production around Kakuma and Lokichogio. Organizations implementing the Kalobeyei Integrated Socio-Economic Development Plan (KISED) were investing in climate-smart irrigation technologies and the construction of rainwater harvesting structures for crop and livestock productions (Manji and de Berry, 2019).

#### **3.4.2 Energy Access**

In both Dadaab and Kakuma, firewood and charcoal are the primary sources of cooking and heating energy. Some unsuccessful efforts to promote ethanol stoves in the camps, especially in Dadaab, were reported during stakeholder consultation meetings but were said to have failed as a result of the high cost of sustaining the initiative against a backdrop of unreliable funding.

A majority of camp residents used firewood because it is cheap and relatively available in both Dadaab and Kakuma, although not adequate (UNHCR, 2014; Ali, 2010). Demand is high, and the capacity of the surrounding environment to provide it sustainably has been eroded over the years (Otieno and Gazarwa, 2013). The scarcity of fuelwood causes competition between refugees and local communities, often causing tension and even conflict (Kariuki et al., 2008). Moreover, the scarcity of firewood has resulted in refugees selling their food rations to access energy for cooking (UNHCR, 2014<sub>b</sub>). Charcoal is a more expensive energy source than firewood but still in very high demand. The increased demand has caused increased unsustainable and illegal harvesting of trees for charcoal production.

In both Kakuma and Dadaab camps, refugees acquire firewood in three ways: i) free distribution from aid organizations, ii) purchasing from vendors at the market, and iii) collecting it themselves. In Kakuma, UNHCR distributes 10 kilograms of firewood per person every two months. This equates to 935 tons per month for the entire camp of Kakuma and costs about USD 900,000 per year to deliver and distribute (Patel and Gross, 2019). LOKADO is contracted by UNHCR to manage the firewood supply chain, which in turn tenders the supply of the firewood to the host community. The wood, mainly consisting of *Prosopis*, is chopped, portioned into bundles of 10 kilograms and trucked to the camp distribution centers for collection by refugees. This provides jobs and income generation opportunities for the host community (Corbyn et al, 2018).

Organized supply of firewood by UNHCR and partners meets only less than 20% of the refugee domestic energy needs. The remaining 80% and more is sourced elsewhere but mainly by purchasing firewood or charcoal from local people. Some refugees have, at some point, taken up the role of intermediaries, buying from locals, and selling within the camps (Jacobsen, 2002). Fuelwood consumption in Dadaab refugee camps is estimated at 1kg per person per day (UNHCR, 2014<sub>b</sub>), which implies that total daily consumption by the entire population (more than 200,000) exceeds 200 tons of firewood per day.

Where refugees themselves collect fuelwood, both men and women are involved. Women and children tend to collect firewood close to the camps, up to a radius of about seven kilometers, depending on the availability of firewood, and the degree of insecurity increases as they move further from the camps (Muia, 2003). According to women leaders in Ifo camp, Dadaab, firewood is collected three times a week to adequately cater for daily cooking needs if they use an energy-saving stove, and five times per week if a three-stone fireplace is used. In Dadaab, women usually leave early in the morning and take about four hours to reach the collection areas (Bizzarri et al., 2010). Fuelwood collection beyond the seven-kilometer radius is dominated by men with semi-mechanized ways of transportation such as wheelbarrows and donkey carts.

Men cover distances of up to 100 kilometers with donkey carts (Kagwanja, 2000) and can spend one or two nights on a trip in order to collect high-quality firewood. *Terminalia* species (mainly *T. obicularis* and *T. spinosa*) are most preferred for fuelwood followed by *Acacias* (*A. tortilis*, *A. mellifera* and *A. reficiens*) and other species such as *Cordia sinensis* (Kariuki et al., 2008). Firewood from these species fetches up to KES 2,000 (about US\$20) per cart compared to lower quality firewood harvested within the periphery of the camps that goes for KES 1,500 per cart (Otieno and Gazarwa, 2013). Moreover, rent-seeking practices add to the cost of accessing firewood. Access to firewood supply basins is based on clan affiliation, and the more powerful clans are, the larger the harvesting zones they control. Donkey cart owners pay taxes to clan gangs in order to be allowed to harvest firewood. To reduce vulnerability in terms of access to energy by disadvantaged persons in refugee camps, FaIDA has been distributing energy-saving stoves and providing them with firewood purchased from the host community vendors. They also had an initiative where they provided LPG to the disadvantaged persons with monthly refilling schedules, but funding for the project ended.

In Kakuma, refugees are excluded from participating in wood harvesting and rely on purchasing firewood or charcoal from the Turkana people (Manji and de Berry, 2019)<sup>7</sup>, although some of them do risk going out to collect. There is a vibrant charcoal market in Kakuma, with 23,000 bags entering the camp per month (Corbyn et al., 2018). By 2014, 40 percent of firewood used in Kakuma was from indigenous tree species and the remainder from *Prosopis spp* (UNHCR, 2014b), but the proportion of *Prosopis* had increased to about 80% in 2019, as reported by stakeholders during the consultation workshop.



Figure 6: Firewood transportation to (left) Dadaab Camp and (right) in Kakuma camp (Photo credit: ICRAF)

<sup>7</sup> Although some women refugees are reported to take the risk and go out to collect firewood for themselves (Bizzari et. Al., 2010)

### 3.4.3 Major livelihood and economic activities including forest and tree-based livelihoods

Humanitarian assistance remains the main source of income and employment for refugees in Kenya. With no right to work or live outside the camp, most refugees remain entirely dependent on aid agencies (Betts et al., 2015; Manji and De Berry, 2019). As many as around 80 to 90 percent of the refugees sell some of the food items for cash or other necessities such as firewood and charcoal (Otieno and Gazarwa, 2013; Manji and De Berry, 2019). Most of the bartered food items, mainly whole grains, are then repackaged, and sold by retailers, wholesalers and shop owners. The items become part of the merchandise mix, which generates as much as \$400,000 per month in sales in Kakuma town alone (Oka, 2014).

Some of the sources of income in refugee camps included the running of small businesses such as selling vegetables, livestock, and firewood and remittances from relatives (Ali, 2010). In Kakuma, a majority of the women engage in petty trade or casual work in order to earn a living since men at the camp have difficulties in finding work and fully supporting their households (Fernandez et al., 2014). Some Somali refugees in Dadaab are entrepreneurs, producing and selling charcoal. Others are involved in agriculture, a more prevalent activity in Kalobeyei, given that most refugees have kitchen gardens. Most of the produce from the gardens is however consumed at household level with little surplus remaining for sale. Few refugees engage in animal husbandry, an activity reserved for the host pastoralist population. Sale of *khat* leaves (a chewable stimulant, also called *miraa*) is also another key activity in the Dadaab camps, albeit that the plant is considered a drug by many organizations and individuals (Carrier, 2005).

The host communities in Turkana and Garissa counties have been benefiting from the presence of refugees. For example, a study commissioned by the Royal Danish and Norwegian Embassies in 2010 estimated that the host community earned US\$3 million annually from the sale of livestock and milk to the refugees. The study projected an overall turnover of camp-based business at around US\$25 million annually for Dadaab (Royal Danish and Norwegian Embassies in Kenya, 2010).

### 3.4.4 Major livelihoods challenges including forest and tree-based activities

- General deprivation in the area where camps are located. The counties have suffered food insecurity, high food prices and high rates of malnutrition, limited access to basic social services and infrastructure, political marginalization, limited livelihood opportunities, poverty, hostile climate, and remoteness (Manji and de Berry, 2019).
- Rising poverty levels and the decline in food rations over recent years has forced the refugees to turn to unsustainable overexploitation of the natural resources, especially for charcoal production to earn an income to meet their needs.
- There is a lack of awareness on tree planting and management approaches and limited understanding on the benefit of trees. This knowledge limitation, coupled with limited access to seedlings and low seedling survival due to harsh climatic conditions, has

limited the success of forest and tree-based interventions (Kariuki et al., 2008; Bizzarri et al., 2010).

- Livestock numbers are higher than the land carrying capacity. This has led to overgrazing, increased livestock deaths during drought, and increased conflict over natural resources (i.e., pasture and water).
- The encampment policy by the Government of Kenya is a disincentive and constraint for refugees to engage in formal employment and income-generating activities as well as investing in tree planting (Otieno and Gazarwa, 2013; Vemuru et al., 2016).
- Access to water and seeds remains a challenge for agricultural production, including kitchen gardens.
- Some extreme weather events have impacted these areas, which exacerbate vulnerability and hopelessness. These include recurrent, prolonged and severe droughts that lead to famine, dust storms, and poor pastoral livelihoods. Recently there has been severe flooding in the area coupled with the outbreak of livestock diseases (UNHCR, 2018; Manji and de Berry, 2019).
- Recurrent threats of armed conflicts lead to massive population influxes, competition, and pressure on natural resources, thus resulting in tensions with host communities (UNHCR, 2018; Manji and de Berry, 2019).

## **4. Guidance notes for contextually appropriate forest and tree-based options**

### **4.1 Dadaab**

Tree planting is gaining more appreciation around Dadaab as the host community increasingly adopts a more sedentary life involving both animal husbandry and crop production as opposed to a solely nomadic lifestyle. There is also a rising demand for fruit trees among the refugee and host communities. This provides an opportunity to enhance efforts to promote interventions such as fruit tree orchards and agroforestry. Water scarcity remains a significant challenge due to little rainfall. The tree-based practices that can be implemented in Dadaab include:

1. Farmer managed natural regeneration (FMNR) and enrichment planting in enclosures
2. Woodlots
3. Fruit tree orchards
4. Establishment of tree nurseries
5. Homestead and institutional tree planting

#### **4.1.1 Farmer managed natural regeneration (FMNR) and enrichment planting in enclosures**

Farmer managed natural regeneration (FMNR) is a tree establishment method that does not rely on tree planting, but natural regeneration of trees coupled with intentional management of the established trees in order to restore trees in forests, woodlands, rangelands, and even farmlands. FMNR provides an opportunity for re-vegetating degraded lands in Dadaab through



the management of trees from natural regeneration from stumps and germinating saplings, given the lack of soil moisture. The pruning and management of regenerating trees can provide wood and fodder to community members as the tree(s) continue growing. The remaining stems will increase in size and value each year and continue to protect the environment as well as provide other useful materials and services such as fodder, humus, habitat for beneficial fauna, and protection from the wind and sun. Enhancing FMNR practices together with enrichment planting in the established enclosures can make the green belts more productive as more enclosures are established. RRDO and KRCS established several green belts, especially in Ifo 2 (Figure 7). Detailed guidance on this model is provided in Table 3.



Figure 7: Enclosures ('Green belts') initiated in Dadaab (Photo credit: ICRAF).

Table 3: Summary guidance for establishment of FMNR enclosures and enrichment planting in Dadaab

<b>Objectives</b>	<ul style="list-style-type: none"> <li>• Production of firewood, poles, fodder</li> <li>• Promote natural regeneration and increase vegetation cover, rehabilitate degraded areas</li> <li>• Create favourable microclimates and improve soil productivity</li> </ul>
<b>Current activities</b>	<ul style="list-style-type: none"> <li>• The land is fenced off using wire fence</li> <li>• Natural regeneration is allowed without significant management practices</li> <li>• Tree seedlings are planted to aid regeneration (enrichment planting)</li> <li>• Enclosures are manned by caretakers identified by the community while some community members till the land within the enclosures so as to tend to the planted tree seedlings</li> <li>• Fruit trees and vegetables are grown in some plots in the green belts to sustain the caretakers</li> <li>• During the dry season the caretakers and volunteers are allowed to let in small browsers to graze on the grass.</li> <li>• They are managed by the community with support from local NGOs i.e. RRDO and FaIDA</li> </ul>
<b>Suggested activities</b>	<b>Step 1. Selection of species and stumps/ saplings</b>



	<ul style="list-style-type: none"> <li>• Together with the community, generate a list of useful tree species locally available in area and able to regenerate in the enclosure</li> <li>• Identify and mark regenerating tree stumps, wildlings and saplings of the priority species</li> <li>• In patch work fashion, thin unwanted herbaceous cover to encourage tree and grass growth</li> </ul> <p><b>Step 2. Pruning and management of regenerating trees</b></p> <ul style="list-style-type: none"> <li>• Where the regeneration is from stumps, remove unwanted or weak stems and side branches in order to leave only those stems with potential for robust growth (the removed twigs/branches can be used as fodder or mulch)</li> <li>• Protect the remaining trees/branches from livestock, fire and competing vegetation or weeds.</li> </ul> <p><b>Step 3. Maintenance and utilization of trees</b></p> <ul style="list-style-type: none"> <li>• Periodically prune side branches from time to time.</li> <li>• Monitor pest and disease incidence in order to put control measures in place</li> </ul> <p><b>Step 4. Conduct enrichment planting for fast growing fodder/timber species</b></p> <ul style="list-style-type: none"> <li>• Zone the land in the enclosures for establishment of different species for different purposes and with different management plans</li> <li>• Plant adaptable species that are in high demand as per the zonation</li> <li>• Ensure periodic harvesting of branches and grasses to increase the short-term benefits</li> <li>• Protection of remaining trees/branches from livestock and competing vegetation</li> <li>• Undertake grass reseeding to provide ground cover and cut-and-carry fodder to the community while they care for and wait for the trees to mature</li> </ul>					
Current tree species	<b>Tree species</b>	<b>Use</b>				
		<b>Fuelwood</b>	<b>Poles</b>	<b>Food</b>	<b>Timber</b>	<b>Fodder</b>
	<i>Balanites aegyptica</i> (I)*	✓				✓
	<i>Boscia senegalensis</i> (I)	✓				✓
	<i>Acacia senegal</i> (I)	✓			✓	✓
	<i>Cordia sinensis</i> (I)	✓	✓		✓	✓
	<i>Salvadora persica</i> (I)	✓	✓		✓	✓
	<i>Acacia mellifera</i> (I)	✓	✓			✓
	<i>Acacia seyal</i> (I)	✓	✓			✓
	<i>Acacia tortilis</i> (I)	✓	✓			✓
	<i>Mangifera indica</i> (E)	✓		✓		
	<i>Citrus limon</i> (E)	✓		✓		
	<i>Citrus sinensis</i> (E)	✓		✓		
	<i>Psidium guajava</i> (E)	✓		✓		
Other recommended tree species	<i>Acacia nilotica</i> (I)	✓	✓	✓		✓
	<i>Adansonia digitate</i> (I)	✓		✓		✓
	<i>Cadaba farinose</i> (I)	✓		✓		✓
	<i>Commiphora africana</i> (I)			✓	✓	✓
	<i>Combretum aculeatum</i> (I)					✓
	<i>Terminalia brownii</i> (I)	✓			✓	✓

\* I – indigenous; E - Exotic

#### 4.1.2 Woodlots

A woodlot is an area set aside more or less entirely for trees. In woodlots, fast-growing trees, like neem, are recommended. In Dadaab, most of the land is degraded and exposed to elements, hence woodlots are recommended for quick tree cover and windbreaks as well as to prevent soil erosion and restore degraded lands. Woodlots are very important in Dadaab to meet the high demand for wood fuel and timber while improving conditions for the establishment of other important plants. Vegetables or crops are often intercropped in the woodlot in the early stages of establishment, but this ceases with time as the trees mature since wood production is the main objective. For instance, in Dadaab, maize, millet, sorghum, capsicum, okra, pepper, onions, spinach, beans, kales can be planted along with the trees.

Woodlots are however only recommended where water is available either near oases or riverine areas. If such areas lack water availability, this practice is not feasible for Dadaab. Detailed guidance on this model is provided in Table 4.

Table 4: Summary guidance for establishment of woodlots in Dadaab

<b>Objectives</b>	<ul style="list-style-type: none"> <li>• Increase access to woodfuel and building materials</li> <li>• Increase tree cover in the degraded areas</li> <li>• Create favourable microclimates</li> </ul>				
<b>Current activities</b>	Currently none				
<b>Suggested activities</b>	<ul style="list-style-type: none"> <li>• Fast-growing and coppicing species are best for woodlots including <i>Azadirachta indica</i>, <i>Cassia</i></li> <li>• Initial intercropping with crops or vegetables helps protection and weed control and optimal use of space ensuring early benefits from the land area.</li> <li>• The initial spacing can be very dense: 2.5 by 2.5m or less, if there is a demand for thin poles or firewood and watering intensity can be managed. Gradual thinning will then enable the trees to grow to the desired size, while at the same time small-dimension wood can be harvested.</li> <li>• Protection from livestock and fire is always important for young trees.</li> <li>• Pruning and thinning must be continuous to produce good-quality poles and timber.</li> <li>• If the trees compete for moisture with adjacent crops, deep ploughing or digging a trench 50-80 cm deep will reduce the penetration of tree roots into the rooting zone of the crop.</li> <li>• Different tree species should be planted in rows in the same land area to ensure diverse benefits</li> <li>• Monitor pest and disease incidence in order to put control measures in place</li> </ul>				
<b>Potential tree species</b>	<b>Tree species</b>	<b>Use</b>			
		<b>Fuelwood</b>	<b>Poles</b>	<b>Food</b>	<b>Timber</b>
	<i>Balanites aegyptica</i> (I)*	✓	✓	✓	✓
	<i>Boscia coriacea</i> (I)	✓		✓	✓
	<i>Azadirachta indica</i> (E)	✓	✓		✓
	<i>Moringa oleifera</i> (E)	✓		✓	✓
	<i>Senna siamea</i> (E)	✓	✓	✓	✓
	<i>Melia volkensii</i> (I)	✓	✓	✓	✓

\* I – indigenous; E - Exotic

#### 4.1.3 Fruit tree orchards



The fruit orchards can be set up as separate entities or at school compounds such as the one established at Hormuud primary school (Figure 8). In schools, they also serve to teach the children about fruit growing, a skill they can carry home even after repatriation. The children also eat the fruits thus gaining nutritional value. Detailed guidance on this model is provided in Table 5.

Figure 8: Hormuud Primary School fruit orchard supported by RRDO (Photo credit: ICRAF)

Table 5: Summary guidance for establishment of fruit tree orchards in Dadaab

<b>Objectives</b>	<ul style="list-style-type: none"> <li>To improve fruit and vegetable production</li> </ul>					
<b>Current activities</b>	<ul style="list-style-type: none"> <li>The local NGOs supported establishment of orchards in schools</li> <li>RRDO and KRCS have established orchards inside the green belts</li> <li>NGOs support supplementary watering of the orchard in the first years to assist in tree establishment</li> <li>Pruning of the young trees to provide a strong structure, minimize wind damage and increase fruit bearing area</li> </ul>					
<b>Suggested activities</b>	<ul style="list-style-type: none"> <li>Separate the orchards from the general purpose green belts to enable better management and optimum production of fruit trees and crops</li> <li>Use high quality tree seedlings from known sources</li> <li>Consider intercropping with crops such as sorghum or maize within the orchard for income, nutrition and labour optimization</li> <li>Put in place water conservation structures such as <i>Negarim</i> micro-catchments to sustain the crops and trees when rains end</li> <li>Apply manure in the soil mixture at planting and maintain mulch around the base of the trees to conserve soil moisture and improve fertility</li> <li>Manage the trees using proper pruning techniques</li> <li>Monitor pest and disease incidence in order to put control measures in place</li> </ul>					
<b>Current tree species</b>	<b>Tree species</b>	<b>Use</b>				
		<b>Fuelwood</b>	<b>Poles</b>	<b>Food</b>	<b>Timber</b>	<b>Fodder</b>
	<i>Carica papaya</i> (E) *			✓		
	<i>Mangifera indica</i> (E)	✓		✓		
	<i>Citrus limon</i> (E)	✓		✓		
	<i>Citrus sinensis</i> (E)	✓		✓		
	<i>Psidium guajava</i> (E)	✓		✓		
<b>Potential tree species</b>	<i>Moringa oleifera</i> (E)	✓		✓		
	<i>Ziziphus mauritiana</i> (I)			✓		
	<i>Tamarindus indica</i> (I)			✓	✓	✓
	<i>Adansonia digitate</i> (I)			✓		

\* I – indigenous; E - Exotic

#### 4.1.4 Homestead and institutional tree planting

Both refugee and host communities' households are encouraged to plant and nurture trees of their preference for their own use around their living spaces. One of the main challenges this intervention faces in the host community setup is the pastoral migrations during dry seasons. The trees are left unattended and may dry up or face human or animal destruction. In Dadaab, the space within the homesteads is quite small, thus not allowing much tree planting. Water shortages, especially in the dry season, is another challenge. Detailed guidance on this model is provided in Table 6.



Figure 9: Dadaab refugee camp (left) homestead tree planting and (right) trees planted at Hormuud primary school, Dadaab (Photo credit: ICRAF)

Table 6: Summary guidance for establishment of homestead and institutional tree planting in Dadaab

<b>Objectives</b>	<ul style="list-style-type: none"> <li>• Increase tree cover, provide for small scale needs for wood fuel, poles, fruits and food</li> <li>• Windbreaks and shade</li> <li>• Regreen homestead and offices, residential areas and offices</li> </ul>					
<b>Current activities</b>	<ul style="list-style-type: none"> <li>• Each household that is interested is provided with tree seedlings by the local NGOs (i.e. RRDO &amp; FaIDA) from their nurseries for planting especially during rainy season.</li> <li>• Tree planting and management training conducted</li> </ul>					
<b>Suggested activities</b>	<ul style="list-style-type: none"> <li>• Promote planting of high value species such as fruit and shade to incentivize caring for the trees to maturity</li> <li>• Train the community on domestic water recycling options to enable watering of the trees during periods of low water availability</li> <li>• Promote other water conservation methods such as hydrogel and innovations around planting hole size, manuring and mulching to improve seedling survival</li> <li>• Encourage integration of vegetables and other crops in the planting holes for moisture optimization</li> <li>• Pest and disease control measures to be put in place</li> </ul>					
<b>Current tree species</b>	<b>Tree species</b>	<b>Use</b>				
		<b>Fuelwood</b>	<b>Poles</b>	<b>Food</b>	<b>Timber</b>	<b>Fodder</b>
	Bananas ( <i>Musa sp</i> ) (E)*			✓		
<b>Potential tree species</b>	<i>Salvadora persica</i> (I)	✓		✓	✓	✓
	<i>Carica papaya</i> (E)			✓		
	<i>Psidium guajava</i> (E)			✓		
	<i>Tamarindus indica</i> (I)			✓	✓	✓
	<i>Citrus limon</i> (E)			✓		
	<i>Citrus sinensis</i> (E)			✓		
	<i>Moringa oleifera</i> (E)			✓		
	<i>Azadirachta indica</i> (E)	✓			✓	✓
	<i>Ziziphus mauritiana</i> (I)	✓		✓	✓	✓

\* I – indigenous; E – exotic

#### 4.1.5 Boundary planting

Trees and shrubs can be planted between and around shelters, homes homesteads, camps, and offices as hedges (Figure 10). They act as boundaries and, at the same time, increase tree cover and meet various needs. Within the Dadaab camp, the refugees can be encouraged to plant hedgerows in combination with the existing dry wood fences to provide shade and shelter. This intervention is also a suitable method to demarcate the boundaries of the various camps or sections within the camps. Institutions such as schools, hospitals, NGOs can also use them as fencing options. Detailed guidance on this model is provided in Table 7.



Figure 10: Current fencing system in Dadaab refugee camp using dried tree branches (Photo credit: ICRAF)

Table 7: Summary guidance for establishment of boundary planting in Dadaab

<b>Objectives</b>	<ul style="list-style-type: none"> <li>Establish a windbreak and live fences to demarcate boundaries and keep out livestock</li> <li>Increase vegetation cover in the camps and host community area</li> </ul>					
<b>Current activities</b>	<ul style="list-style-type: none"> <li>Currently none</li> </ul>					
<b>Suggested activities</b>	<ul style="list-style-type: none"> <li>Plant hedge rows between settlement sections to act as demarcations/boundaries</li> <li>Promote hedge rows between homesteads in the settlements and the host communities</li> <li>Manage the hedges by regular trimming so as not to overgrow</li> </ul>					
<b>Potential tree species</b>	<b><i>Tree species</i></b>	<b>Use</b>				
		<b>Fuelwood</b>	<b>Poles</b>	<b>Food</b>	<b>Timber</b>	<b>Fodder</b>
	<i>Acacia horrida</i> (I)*	✓				✓
	<i>Azadirachta indica</i> (E)		✓			
	<i>Leucaena spp</i> (E)		✓			✓
	<i>Parkinsonia aculeate</i> (E)			✓		✓
	<i>Commiphora Africana</i> (I)			✓	✓	✓
	<i>Senna siamea</i> (E)	✓		✓	✓	✓

\* I – indigenous; E – exotic

#### 4.1.6 Establishment of tree nurseries

Tree nurseries are managed sites, designed to grow tree seedlings in controlled conditions until they are ready for planting (Figure 11). The tree nurseries provide optimum care and attention to seedlings



during their critical juvenile stage, resulting in the production of healthy, vigorous seedlings for the host community and refugees to plant. The local NGOs (RRDO and FaIDA) also use the tree nurseries as important training and advisory centres. Viable and healthy tree nurseries are important to support all the interventions recommended above. Detailed guidance on this model is provided in Table 8.

Figure 11: RRDO's tree nursery in IFO camp (Photo credit: ICRAF)

Table 8: Summary guidance for establishment of tree nurseries in Dadaab

Objectives	<ul style="list-style-type: none"><li>• Increase availability and diversity of seedlings and trees planted in Dadaab area</li><li>• Supply the community with suitable and productive and high-quality tree seedling</li></ul>					
Current activities	<ul style="list-style-type: none"><li>• Six tree nurseries have been established by RRDO and FaIDA at designated institutions like schools, hospitals, police stations, organizations compound and communal lands</li><li>• Distribution of tree seedlings is mostly during rainy seasons (May-July&amp; Nov-Dec)</li><li>• FaIDA records distributed approximately 100,000 tree seedlings a year</li><li>• During government tree planting activities in Garissa, tree seedlings are often sourced from these nurseries</li></ul>					
Suggested activities	<ul style="list-style-type: none"><li>• Raise seedlings suited for the area including indigenous trees</li><li>• Ensure the seedlings don't overgrow while in the nursery</li><li>• Intensify training on growing and managing the seedlings among community members</li><li>• Pest and disease control measures to be put in place</li></ul>					
Current tree species	Tree species	Use				
		Fuelwood	Poles	Food	Timber	Fodder
	<i>Balanites aegyptiaca</i> (I)*			✓		✓
	<i>Terminalia brownie</i> (I)	✓			✓	✓
	<i>Cordia sinensis</i> (I)	✓	✓		✓	✓
	<i>Moringa oleifera</i> (E)	✓		✓	✓	
	<i>Acacia mellifera</i> (I)	✓				
	<i>Azadirachta indica</i> (I)	✓	✓		✓	✓
	<i>Persea Americana</i> (E)	✓		✓		
	<i>Carica papaya</i> (E)			✓		
	<i>Mangifera indica</i> (E)			✓		
	<i>Psidium guajava</i> (E)	✓		✓		
	<i>Salvadora persica</i> (I)	✓		✓	✓	✓
	<i>Acacia senegal</i> (I)	✓		✓	✓	✓
Potential tree species	<i>Acacia tortilis</i> (I)	✓	✓			✓
	<i>Acacia nilotica</i> (I)	✓	✓			✓
	<i>Grewa bicolor</i> (I)	✓		✓		✓
	<i>Grewia tenax</i> (I)	✓		✓		✓
	<i>Dobera glabra</i> (I)	✓			✓	✓
	<i>Casuarina equisetifolia</i> (E)	✓			✓	
	<i>Boscia coriacea</i> (I)	✓		✓		✓
	<i>Adansonia digitata</i> (I)			✓		✓
	<i>Ziziphus mauritana</i> (I)	✓		✓		✓
	<i>Tamarindus indica</i> (I)			✓		✓
	<i>Citrus limon</i> (E)	✓		✓		
	<i>Citrus sinensis</i> (E)	✓		✓		
	<i>Cadaba farinosa</i> (I)			✓		✓
	<i>Commiphora africana</i> (I)	✓		✓	✓	✓
	<i>Combretum aculeatum</i> (I)	✓		✓		
	<i>Melia volkensii</i> (I)				✓	✓

\* I – indigenous; E – exotic



## 4.2 Kakuma Camp and Kalobeyei settlement sites

Kakuma and Kalobeyei have a large South Sudanese community, some of whom originate from farming communities, hence there has been demand for fruits like pawpaws and bananas. With the rising population, demand on natural resources is also increasing with extensive forest degradation already evident in the immediate surroundings of the settlement. Given the offer to refugees of more space per homestead at Kalobeyei and allowing them to carry out interventions such as kitchen gardens and tree planting, garden-based tree established interventions can be adopted for this site.

The interventions listed below have been promoted by development partners but are constrained by several challenges, the largest being water availability due to the low rainfall. The institutions have tried to address this situation by increasing water sources, drilling boreholes, installing water storage facilities such as earth dams.

### 4.2.1 Green belts (enclosures)

The green belts model in Kakuma was established through a collaborative effort between the community elders and LOKADO and can also be adopted for Kalobeyei. The green belts are established on degraded communal lands that are being rehabilitated. The green belts are enclosed with net wire and planted with diverse tree species. The main species planted was *Acacia reficiens*. Detailed guidance on this model is provided in Table 9.



Figure 12: Green belt established at Kakuma (Photo credit: ICRAF)

Table 9: Summary guidance for establishment of green belts in Kakuma and Kalobeyei

<b>Objectives</b>	<ul style="list-style-type: none"> <li>Restoration of degraded lands and improve the local climate</li> <li>Promote natural regeneration and increase vegetation cover</li> <li>Provision of wood fuel, poles, timber, fodder</li> </ul>							
<b>Current activities (in Kakuma, none in Kalobeyei)</b>	<ul style="list-style-type: none"> <li>The land is fenced off (using chain link or live fence) and planted with trees in half moon catchments.</li> <li>Managed by caretakers</li> <li>Tree seedlings are planted at the onset of rainy season as rain is the main water source</li> </ul>							
<b>Suggested activities</b>	<ul style="list-style-type: none"> <li>Select the trees to be planted based on community needs</li> <li>Divide the green belts into zones for planting trees based on their use i.e. trees for poles, firewood, food, timber etc.</li> <li>Undertake grass reseeding for fodder provision (through cut and carry), increase soil cover and prevent soil erosion</li> <li>Install rainwater harvesting structures such as infiltration pits and ridges, half-moon catchments to improve water infiltration and moisture availability for vegetation especially during drought</li> <li>Develop detailed management and harvesting plans for each green belt to avail tree products to the community sustainably</li> <li>Increase community involvement and sensitization on the management and benefits</li> </ul>							
<b>Current tree species (in Kakuma but also potential for Kalobeyei)</b>	<b>Tree species</b>	<b>Use</b>						
		<b>Fuelwood</b>	<b>Poles</b>	<b>Food</b>	<b>Medicine</b>	<b>Timber</b>	<b>Live fence</b>	<b>Fodder</b>
	<i>Acacia reficiens (I)</i>	✓	✓					✓
	<i>Balanites aegyptiaca (I)</i>			✓				✓
	<i>Acacia mellifera (I)</i>	✓	✓					✓
	<i>Acacia senegal (I)</i>	✓	✓	✓				✓
	<i>Acacia tortilis (I)</i>	✓	✓	✓				✓
	<i>Acacia nilotica (I)</i>	✓		✓			✓	✓
	<i>Salvadora persica (I)</i>	✓		✓				✓
<b>Other recommended tree species</b>	<i>Parkinsonia aculeata (I)</i>							✓
	<i>Cordia sinensis (I)</i>	✓	✓		✓	✓		✓
	<i>Ziziphus mauritiana (I)</i>	✓		✓	✓		✓	
	<i>Grewa bicolor (I)</i>	✓		✓	✓			✓
	<i>Grewia tenax (I)</i>	✓		✓	✓		✓	✓
	<i>Commiphora africana (I)</i>			✓	✓		✓	✓
	<i>Tamarindus indica (I)</i>		✓	✓	✓			
	<i>Boscia senegalensis (I)</i>	✓						✓
	<i>Acacia seyal (I)</i>	✓	✓					✓
	<i>Adansonia digitata (I)</i>			✓				
	<i>Cadaba farinosa (I)</i>			✓	✓			✓
	<i>Terminalia brownii (I)</i>				✓	✓		✓
	<i>Melia volkensii (I)</i>		✓			✓		✓

\* I – indigenous; E – exotic

#### 4.2.2 Tree-crop intercropping

Integrating trees in cropping fields will not only benefit the community with the supply of wood and other tree products but also help ensure the land remains fertile and productive. Leaf litter from the trees adds to the organic matter in the soil and acts as a mulch to retain soil moisture and prevent soil erosion. Trees/shrubs recommended for cropping fields include *Moringa oleifera*, *Leuceana*, *Sesbania*, *Cajanas cajan*, neem, *Ziziphus*, as well as fruit trees such as mangoes, bananas, citrus, guavas, and pawpaw. These trees can be planted together with the vegetables and food crops such as maize, sorghum, cowpeas, and cassava, which are preferred in Turkana. Water harvesting structures should be established to harvest and conserve



rainwater for faster and more vigorous plant growth. Detailed guidance on this model is provided in Table 10.

Table 10: Summary guidance for establishment of tree-crop intercropping in Kakuma and Kalobeyei

<b>Objectives</b>	<ul style="list-style-type: none"> <li>• Improve food crop productivity</li> <li>• Improve soil health, water retention and shade for crops</li> <li>• Re-introduce indigenous trees and other fast-growing trees in the landscape</li> <li>• Meet food and fodder needs</li> </ul>				
<b>Current activities</b>	None				
<b>Suggested and activities</b>	<ul style="list-style-type: none"> <li>• Trees seedlings planted to meet the diverse needs of each homestead i.e. food, fodder, construction material, shade, fence, etc</li> <li>• Each plot holder to be encouraged to manage useful tree species that sprout on their plots, pruning them at the beginning of every season to manage crop shading while encouraging growth of poles</li> <li>• Construct rainwater harvesting/management structures such as <i>Negarim</i> micro-catchments, ridges and furrows, zai pits system</li> <li>• Pest and disease control measures to be put in place</li> </ul>				
Recommended tree species	<b><i>Tree species</i></b>	<b>Use</b>			
		<b>Fuelwood</b>	<b>Poles</b>	<b>Food</b>	<b>Fodder</b>
	<i>Carica papaya (E)*</i>			✓	
	<i>Citrus sinensis (E)</i>	✓	✓	✓	
	<i>Psidium guajava (E)</i>	✓	✓	✓	
	<i>Moringa oleifera (E)</i>	✓		✓	
	<i>Cordia sinensis (I)</i>	✓	✓		✓
	<i>Mangifera indica (I)</i>	✓		✓	
	<i>Citrus limon (E)</i>	✓		✓	
	<i>Leuceana spp (E)</i>	✓			
	<i>Sesbania sesban (I)</i>	✓			✓
	<i>Cajanas cajan (E)</i>	✓		✓	✓
	<i>Azadirachta indica (I)</i>	✓	✓		
	<i>Senna siamea (E)</i>	✓	✓		
	<i>Ziziphus mauritiana (I)</i>			✓	✓

\* I – indigenous; E – exotic

#### 4.2.3. Homestead tree planting

Both refugee and host community households are encouraged to plant and nurture trees of their preference for their own use. One of the main challenges this intervention faces in the



host community setup is the migrations during dry seasons in search of pasture. The trees are left unattended and may dry up or face human or animal destruction. Water shortages especially in the dry season is another challenge but there are opportunities of

rainwater harvesting and storage as well as recycling of grey water. A further challenge specific to Kakuma camp is the limited land allocated to each household. In Kalobeyei settlement each homestead has a larger compound space than in Kakuma hence able to plant more trees per homestead. Detailed guidance on this model is provided in Table 11.

Figure 13: Tree planting within homesteads in Kalobeyei (Photo credit: ICRAF)

Table 11: Summary guidance for establishment of homestead tree planting in Kakuma and Kalobeyei

<b>Objectives</b>	<ul style="list-style-type: none"> <li>• Increase tree cover, provide for household needs for wood fuel, poles, fruits and food</li> <li>• Control soil erosion</li> <li>• Wind breaking and shade</li> </ul>					
<b>Current activities</b>	<ul style="list-style-type: none"> <li>• LOKADO provides each interested household with tree seedlings from their nurseries for planting especially during rainy season.</li> <li>• Training in tree planting and management is provided</li> <li>• There is occasional monitoring by the field staff to monitor progress and survival</li> </ul>					
<b>Suggested activities</b>	<ul style="list-style-type: none"> <li>• Promote planting of high value species such as fruits and shade to incentivize caring for the trees to maturity</li> <li>• Train the community on water harvesting and recycling options to enable watering of the trees during periods of water scarcity</li> <li>• Promote other water conservation methods such as hydrogel and innovations around planting hole size, manuring and mulching to improve seedling survival</li> <li>• Encourage integration of vegetables and other crops in the planting holes for moisture optimization</li> </ul>					
<b>Current tree species</b>	<b>Tree species</b>	<b>Use</b>				
		<b>Fuelwood</b>	<b>Poles</b>	<b>Food</b>	<b>Live fence</b>	<b>Fodder</b>
	<i>Bananas (Musa spp) (E)*</i>			✓		
	<i>Salvadora persica (I)</i>	✓	✓	✓		✓
	<i>Moringa oleifera (E)</i>			✓		
<b>Potential tree species</b>	<i>Carica papaya (E)</i>			✓		
	<i>Psidium guajava (E)</i>			✓		
	<i>Citrus sinensis (E)</i>			✓		
	<i>Citrus limon (E)</i>			✓		
	<i>Senna siamea (E)</i>	✓	✓	✓	✓	✓
	<i>Commiphora africana (I)</i>	✓	✓	✓	✓	✓

\* I – indigenous; E – exotic

#### 4.2.4 Boundary planting

Tree are planted to demarcate properties in crop fields, homesteads, camps, institutions. They act as boundaries and at the same time increase tree cover while meeting various needs. This intervention is suitable for Kalobeyei since the homesteads in the settlements are more spaced and large tracts of land are allocated for crop production. The host community can also adopt this intervention as way to demarcate homestead boundaries and crop fields. Detailed guidance on this model is provided in Table 12.

Table 12: Summary guidance for establishment of boundary planting in Kakuma and Kalobeyei

<b>Objectives</b>	<ul style="list-style-type: none"> <li>Establish wind break and increase vegetation cover</li> <li>Provide boundaries fencing and protect property from livestock, wildlife, etc.</li> </ul>				
<b>Current activities</b>	<ul style="list-style-type: none"> <li>None</li> </ul>				
<b>Suggested activities</b>	<ul style="list-style-type: none"> <li>Plant hedge rows between settlement sections to act as demarcations/ boundaries</li> <li>Promote hedge rows between homesteads in the settlements and among the host communities</li> <li>Manage hedges by regular trimming so as not to overgrow</li> </ul>				
<b>Potential tree species</b>	<b>Tree species</b>	<b>Use</b>			
		<b>Fuelwood</b>	<b>Poles</b>	<b>Food</b>	<b>Live fence</b>
	<i>Parkinsonia aculeate (I)*</i>			✓	✓
	<i>Commiphora Africana (I)</i>		✓	✓	✓
	<i>Senna siamea (E)</i>	✓	✓	✓	✓
	<i>Azadirachta indica (E)</i>	✓	✓		✓

\* I – indigenous; E – exotic

#### 4.2.5 Establishment of tree nurseries

In Kakuma some tree nurseries were established and managed by LOKADO with support of UNHCR. There were seven functional nurseries and three that are no longer functional due to lack of water to sustain the seedling production. Also, a past project, the Global Resilience Project, supported establishment of tree and vegetable nurseries in the host communities. A few more nurseries could be established adjacent to the water storage structures already in place and those that get established in

future.



Figure 14: LOKADO supported tree and vegetable nursery in Kakuma (Photo credit: ICRAF)

In Kalobeyei, no tree nurseries were encountered, but LOKADO supplies tree seedlings to the settlement with support of the UNHCR. There is an opportunity for tree nurseries since there is adequate space and high demand for the trees in the bare and new settlement. Due to the need for adequate supply of water for the seedlings while they are young, the nurseries could be established adjacent to the water pan that has been set up for the horticulture project. Detailed guidance on this model is provided in Table 13.

Table 13: Summary guidance for establishment of tree nurseries in Kakuma and Kalobeyei

<b>Objectives</b>	Supply the community with high-quality tree seedling suitable for the respective areas							
<b>Current activities in Kakuma</b>	<ul style="list-style-type: none"> <li>Tree nurseries are established at designated institutions and communal lands</li> <li>The tree seedlings are planted and cared for by LOKADO with the help of local communities</li> <li>Nurseries are fenced off to protect them from human and animal destruction in addition to constant surveillance by the caretakers</li> <li>Some of the nurseries are watered using borehole water that is pumped using solar pumps</li> </ul>							
<b>Suggested and activities</b>	<ul style="list-style-type: none"> <li>Raising seedlings as per demand to avoid over supply or overgrowing of seedlings in the nursery</li> <li>Intensify training on planting and managing the trees including pests and disease control</li> <li>Diversify species especially fruit trees</li> </ul>							
<b>Current tree species</b>	<b>Tree species</b>	<b>Uses</b>						
		<b>Fuelwood</b>	<b>Poles</b>	<b>Food</b>	<b>Medicine</b>	<b>Timber</b>	<b>Live fence</b>	<b>Fodder</b>
	<i>Balanites aegyptiaca</i> (I)*			✓	✓		✓	✓
	<i>Terminalia brownii</i> (I)				✓	✓		
	<i>Cordia sinensis</i> (I)				✓			
	<i>Moringa oleifera</i> (E)			✓	✓			
	<i>Acacia mellifera</i> (I)				✓		✓	
	<i>Azadirachta indica</i> (E)			✓	✓			✓
	<i>Persea americana</i> (E)	✓		✓				
	<i>Carica papaya</i> (E)			✓				
	<i>Mangifera indica</i> (E)			✓				
<b>Potential tree species</b>	<i>Psidium guajava</i> (E)	✓		✓				
	<i>Salvadora persica</i> (I)			✓				
	<i>Acacia reficiens</i> (I)	✓				✓	✓	✓
	<i>Acacia Senegal</i> (I)	✓				✓		✓
	<i>Acacia tortilis</i> (I)	✓	✓		✓			✓
	<i>Acacia nilotica</i> (I)	✓	✓		✓			✓
	<i>Grewia bicolor</i> (I)	✓		✓	✓			✓
	<i>Grewia tenax</i> (I)	✓		✓	✓		✓	✓
	<i>Commiphora Africana</i> (I)			✓	✓		✓	✓
	<i>Dobera glabra</i> (I)	✓				✓		✓
	<i>Casuarina equisetifolia</i>	✓	✓			✓		
	<i>Boscia coriacea</i> (I)	✓		✓	✓			✓
	<i>Adansonia digitata</i> (I)	✓		✓	✓			✓
	<i>Ziziphus mauritiana</i> (I)	✓		✓	✓		✓	✓
	<i>Tamarindus indica</i> (I)		✓		✓			✓
	<i>Citrus sinensis</i> (E)	✓		✓				
	<i>Citrus limon</i> (E)	✓		✓				
	<i>Cadaba farinosa</i> (I)			✓	✓			✓
	<i>Combretum aculeatum</i> (I)	✓		✓	✓		✓	✓
	<i>Melia volkensii</i> (I)					✓		✓

\* I – indigenous; E – exotic

#### 4.2.6 Management of *Prosopis juliflora*

*Prosopis juliflora* invasion is a major concern in Turkana due to its fast spreading that dominates grazing lands leaving little space to conduct economic activity. On the other hand, it quickly provides wood for various uses including fencing, fuelwood and simple construction. It has been observed to improve soil quality making areas where it has been removed to be better for subsequent crop production than bare lands. Use of its wood can reduce reliance on important native tree species for fuelwood, and/or create sustainable employment and business ventures through product transformation. Awareness-raising on these alternative livelihood options can support efforts to find solutions to the energy, food security and construction materials crisis in the displacement settings in Turkana county. Detailed guidance on this model is provided in Table 14.

Table 14: Summary guidance for management of *Prosopis juliflora* in Kakuma and Kalobeyei

<b>Objectives</b>	<ul style="list-style-type: none"> <li>• Increase availability of wood for energy and construction</li> <li>• Reduce utilization of native tree species which are threatened by extraction</li> <li>• Conserve natural ecology while increasing food production</li> </ul>
<b>Current activities</b>	<ul style="list-style-type: none"> <li>• Supply of Prosopis firewood to camps by tendered suppliers</li> </ul>
<b>Suggested activities</b>	<ul style="list-style-type: none"> <li>• Create awareness to refugees and host communities on alternative livelihoods that Prosopis can support</li> <li>• Utilization of Prosopis wood especially in the production of charcoal as a substitute to commonly used acacia</li> <li>• Thin the dense impenetrable stands to separate and well-spaced trees that can be encouraged to grow into large trees</li> <li>• Cut the undesired trees at ground level to avoid fast re-sprouting</li> <li>• Allow the remaining stems to grow. Select the most sturdy and straight stems per hectare.</li> <li>• Prune the side branches of the selected trees regularly</li> <li>• Cleaning and ploughing of P. juliflora plantations should be done regularly to check any new emergence of seedlings of the species or encroachment by undesirable plants.</li> </ul>

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## Annexes

### Annex 1: Literature review information guide

Site characteristics	Descriptors (Information and data needs)	Potential Sources
1. Displacement settings	1. Country specific locations and year of establishment 2. Latest population statistics and trends	Maps and data FAO, UNHCR
2. Land dynamics	3. Land tenure 4. Land use trends 5. Land availability 6. Soil types 7. Water availability (surface, underground) 8. Degradation levels trends	Maps and data FAO, ICRAF GeoSci Lab; Country LULC dataset Maps soil, Hydrology ICRAF, FAO Deforestation/ Degradation maps Literature Key informants
3. Vegetation description	9. Vegetation types 10. Status of forests and deforestation 11. Prominent tree species (indigenous, exotic, preferred) 12. Forms/schemes of forest and tree management 13. Demand for forest and tree products 14. Sources of trees 15. Energy sources, supply and demand 16. Tree product supply chains/mechanisms	Maps FAO, ICRAF GeoSci Lab, LULC dataset Literature Key informants
4. Livelihood systems in displacement settings including host community	17. Major livelihood activities including forest and tree-based livelihoods 18. Major economic activities including forest and tree-based livelihoods 19. Major livelihoods challenges including forest and tree-based activities	Literature Key informants
5. Governance and institutional mechanisms	20. Refugee policy, CRRF provisions in regard to ownership, access to land, forest and trees, tree planting, water 21. Forest and Env policies/strategies guiding forest and tree activities in the jurisdiction 22. Key stakeholders with roles, mandate, interest and influence (supporting, guiding, controlling) in forest and tree related activities as well as displacement settings in general (Env, Forest, Energy Admin, Agric, Water, Wildlife)	Literature Local offices ICRAF, FAO, UNHCR  Literature Key informants
6. Past and present forest and tree-based interventions in the area	23. Tree planting and management (hedge rows, on farm, woodlots, orchards, plantations, area enclosures and natural regeneration) 24. Forest management (community forestry, on farm forestry, concessions etc) 25. Specific tree species planted/promoted/ desired	Literature Local offices ICRAF, FAO, UNHCR  Key informants



**Annex 2: Provisional mapping of stakeholders supporting forest and tree-based interventions in displacement settings in Kakuma, Kalobeyei and Dadaab as at October 2019**

Stakeholder	Stakeholder Role in displacement settings	Cluster		
		Dadaab	Kakuma	Kalobeyei
Department of Refugee Affairs	<ul style="list-style-type: none"> <li>Registration of Asylum seekers and refugees in Kenya; issue passes and identification documents</li> <li>Managing refugee camps, reception and transit centres</li> </ul>	✓	✓	✓
Fafi Integrated Development Association (FaIDA)	<ul style="list-style-type: none"> <li>Establish orchards and gardens</li> <li>Initiate and support green belts</li> <li>Support tree nurseries</li> <li>Distribute energy saving stoves</li> </ul>	✓		
Food and Agriculture Organization of the UN (FAO)	<ul style="list-style-type: none"> <li>Technical support to local organisations in agriculture, forest and tree-based activities</li> </ul>	✓	✓	✓
Kenya Forest Services (KFS)	<ul style="list-style-type: none"> <li>Technical support for forest and tree based activities</li> </ul>	✓	✓	
Kenya Red Cross Society (KRCS)	<ul style="list-style-type: none"> <li>Establish orchards and gardens</li> <li>Initiate and support green belts</li> <li>Support tree nurseries</li> </ul>	✓		
Local leaders/representatives	<ul style="list-style-type: none"> <li>Community organisation and mobilisation</li> </ul>	✓	✓	✓
Lotus Kenya Action for Development (LOKADO)	<ul style="list-style-type: none"> <li>Initiated and supports tree and vegetable nurseries</li> <li>Initiated and supports green belts</li> <li>Distributes fruit tree seedlings</li> <li>Supply woodfuel</li> </ul>		✓	✓
Relief, Reconstruction and Development Organisation (RRDO)	<ul style="list-style-type: none"> <li>Establish orchards and gardens</li> <li>Initiate and support green belts</li> <li>Support tree nurseries</li> </ul>	✓		
United Nations High Commission for Refugees (UNHCR)	<ul style="list-style-type: none"> <li>Technical, protection and financial support to local organisations and refugees</li> </ul>	✓	✓	✓

**Annex 3: A brief profile of the organizations represented at the stakeholder workshops in Kakuma & Dadaab.**

Camp/ settlement	Organization	Category of Organization
Kakuma	Food and Agriculture Organization (FAO)	International organization
	Danish Refugee Council (DRC)	Humanitarian organization
	Lutheran World Federation (LWF)	Humanitarian organization
	Lotus Kenya Action for Development organization (LOKADO)	Local NGO
	Action Africa Help International (AAHI)	NGO
	Welthungerhilfe (WHH)	NGO
	The Refugee Affairs Secretariat (RAS)	Government
	Turkana County Government (TCG)	Government
	GIZ	INGO
	Refugee Community members	Community
	Host Community Members	Community
Dadaab	United Nations High Commissioner for Refugees (UNHCR)	United Nations agency
	Kenya Red Cross Society (KRCS)	Humanitarian organization
	Lutheran World Federation (LWF)	Humanitarian organization
	Relief, Reconstruction and Development Organisation (RRDO)	Local NGO
	Fafi Integrated Development Association (FaIDA)	Local NGO
	Kenya Forest Services	Government Agency
	Refugee Community members	Community
	Host Community Members	Community

**Annex 4: Key stakeholders interview during the field visits to Kakuma and Dadaab**

Camp/ general area	Name	Organization	Position
Kakuma	Ezekiel Dida	LOKADO	Programme Manager
	Paul Esekon	LOKADO	Energy and Environment officer
	Kennedy	LOKADO	Peaceful co-existence officer
	Boaz Ekiru	Turkana County Government	Principle Natural resource and Environment Officer
Dadaab	Victor Kiprotich	KRCS	Agronomist
	Ibrahim Abdi Salat	Garissa County Government	Sub County Environment Officer
	Mohammed Farah	FaIDA	Project Coordinator
	Adegengedi Sugow	FaIDA	Environment Officer
	Peter Nyabuti	Kenya Forest Services (KFS)	Forester
	Kassim Abdi	RRDO	Afforestation Officer
	Hassan Ahmed	RRDO	Officer in charge Dadaab
	Farukh Keter	KRCS	Head of Operations Dadaab