

6.1 USEFUL TREES AND SHRUBS FOR KAMBI YA SIMBA

In addition to utilizing positive management practices, certain trees and shrubs have long been incorporated in agricultural systems for their direct benefits on soil fertility and erosion control (agroforestry). All such species are characterized by having some or all of the following desirable traits, as described by Young (1989): high biomass production, high rate of nitrogen fixation, high balanced nutrient content (both above-ground and in roots), a well-developed rooting system, the absence of toxic substances in the foliage or root exudates, and either rapid litter decay (where nutrient release is desired) or a moderate rate of litter decay (where increased soil cover for erosion protection is desired). While the total number of species that could be used in Kambi ya Simba are too numerous to list, there are eight that have had considerable success in parts of East Africa with similar soils and climate. These species are inexpensive, easy to propagate, and provide rapid soil quality improvement. Their benefits and common applications are summarized below.

Leucaena leucocephala (Kiswahili – mlusina): This exotic, evergreen species is the most widely used tree in modern, scientific agroforestry (Young, 1989). It exhibits optimal growth in moist and dry subhumid climates with moderate dry seasons (6-7 months) at temperatures of 15-25°C (AFT, 2004). The species has been promoted as a substitute for chemical fertilizers, as its foliage has particularly high contents of N (2.5-4.0%) and K (2.5%), in addition to substantial content of other nutrients (e.g., P and Ca), and undergo rapid decomposition (Kang et al., 1984). It is one of the highest quality and most palatable fodder trees in the tropics, makes excellent firewood, and can also provide shade and timber (although these are limited due its small size—i.e., 3-15 m height, 10-50 cm bole diameter), (AFT, 2004). It is often intercropped or planted along contour ridges in maize fields (at 4 m intervals), where it has been found to increase productivity significantly (Young, 1989). The species' aggressive root system makes is useful for erosion control (reducing runoff and increasing saturation) and penetrating compacted soil layers (e.g., ploughpan); it also thrives on steep slopes and in marginal soils, thus it is often used for reclamation and bush/graze regeneration. Seedlings and direct sowing are recommended methods for species propagation, and germination

and growth are rapid, reaching maturity after 2 years (AFT, 2004). *L. leucocephala* tolerates fast fires and can regenerate after being burned to the crown by slower fires.

Cajanus cajan (a.k.a. pigeon pea, Kiswahili – mbaazi): This is a short-lived, exotic, perennial shrub that produces edible peas and is widely intercropped with maize. Its leaves have high content of N (3.6%) and a small amount of P (0.2%) and thus it is used to improve soil fertility in fields when grown at high densities (Kang et al., 1984). In addition, the species is able to break through ploughpan and provides a small amount of shade and leaf litter during the dry season (Young, 1989). It tolerates a wide range of climates and soils, although it is susceptible to waterlogging. *C. cajan* can also be used as an adequate source of fodder, good fuelwood, light timber, medicine (e.g., for sores, herpes), and fiber (AFT, 2004). It is mainly propagated by cutting and matures over the course of a single growing season.

Calliandra calothyrsus (Kiswahili – mkaliandra): This exotic shrub is often used to rehabilitate degraded soils and produces abundant litter rich in N, which decays rapidly. Its cultivation is limited to altitudes below 1800 m and the species requires at least 700 mm of annual rainfall (AFT, 2004). Freshly cut fodder from leaves and seeds are rich in protein and the species provides good shade and fuelwood (which can be converted into charcoal and sold). It is compatible with intercropping and planting along contour ridges at 4 m intervals (Young, 1989). In addition to improving soil quality, the species is fast growing (forming thickets) and its well-developed rooting system can penetrate compacted soils; thus it is often used to reclaim eroded lands and for secondary afforestation (AFT, 2004). It can be propagated from seedlings or direct sowing, although it germinates and proliferates rapidly under natural conditions, reaching maturity after 2 years.

Acacia tortilis (Kiswahili – munga): This native, evergreen species is particularly effective in increasing nutrient content in areas used for grazing, although negative effects on crop yield have been reported when it is intercropped (AFT, 2004). It has high N in leaves (3.0%) and seeds (6.5%), as well as moderate amounts of P (1.20%), Ca, and P (Kang et al., 1984). The species is drought resistant and can thrive in a wide range of climates and soil types. Its leaves can be used for fodder, it makes for suitable firewood, and its lustrous wood is often used for furniture, although it is prone to decay and is not durable in open conditions. Due to its drought hardiness and fast growth, the species is useful for erosion control and afforesting marginal lands and steep slopes (AFT, 2004). It can be grown from potted seedlings or direct sowing, but proliferates rapidly under natural conditions and reaches maturity after 6 years.

Erythrina abyssinica (Kiswahili – mbamba ngoma, mjafari, muhuti, mwamba ngoma): This native, deciduous tree species occurs frequently in open

woodlands but can also be planted along contour ridges for erosion control. It produces abundant litter (in dry seasons) with high N content that decays at a moderate rate and therefore offers improved soil protection (Young, 1989). The tree prefers cooler (16-26°C) climates and requires more than 800 mm of annual rainfall for adequate growth. It provides good fodder (mostly for protein needs), acceptable fuelwood, and non-durable timber only used for furniture (AFT, 2004). *E. abyssinica* is usually propagated from cuttings (seedlings and direct seeding can also be used) and reaches maturity after 3-4 years.

Cordia africana (Kiswahili – makobokobo, mringamringa, mringaringa, mukumari): This native, deciduous tree is often found in open woodland and grazing areas and can be used in fields to provide excellent crop shade. Heavy leaf litter in the dry season provides good protection against soil erosion, as it decays at a moderate rate. The species exists at altitudes greater than 600 m and requires over 700 mm of annual rainfall to support adequate growth, thriving in more humid conditions (AFT, 2004). It can also be used for adequate fodder in the dry season, durable timber, and good firewood. Propagation is through seedlings, which germinate slowly (40-60 days), and the tree reaches maturity after 7 years.

Grevillea robusta (Kiswahili – mgrivea, mukima): This large, exotic, semi-deciduous tree is often used for reclaiming cleared lands and to provide good crop shade. Leaf litter is extremely thick during the dry season (30 – 40 cm) and decays at a moderate to slow rate, thus it provides immense protection against erosive forces, though it only provides sparse canopy cover (Young, 1989). It prefers alluvial soils but can be grown in most clayey/loam soils with annual rainfall greater than 600 mm. It provides good fuelwood and charcoal, as well as hardwood with economic potential (AFT, 2004). Species used for crop shade should be spaced widely, as they can compete with crops (Young, 1989). Propagation is mainly through cutting (seeds are difficult to collect and germination takes up to 2 years) and trees grow quickly (2 m in height per year), (AFT, 2004).

Albizia gummifera (Kiswahili – mchani mbao, mkenge, mshai): This large, native, deciduous tree is used to curtail gully erosion (their extensive root system holds soil well) and provides substantial N (2.0-3.0%), (Kang et al., 1984). It occurs in a range of moist, warm climates, but thrives in forested areas. The tree provides abundant leaf litter during the dry season, which decays at a moderate rate and provides good soil protection (Young, 1989). It can be used in fields for shade, nitrogen fixation, and organic matter input. Timber and firewood are good and the species also has a variety of medicinal purposes (e.g., for malaria, stomachache, trypanosomiasis), (AFT, 2004). Propagation can be accomplished using direct seeding or seedlings, germination is rapid, and growth is moderate.

Each of these species has multiple benefits if planted in suitable environs and used discriminately. The species best suited for each soil type's needs are included as recommendations in the next two sections.

6.2 AGRICULTURAL RECOMMENDATIONS

Based on the discussion in section 5.4, RU2 and RL1 have been prioritized as the heavily cultivated soil types most in need of agroforestry development and greater utilization of soil conservation measures. RU1 and L1 are prioritized second, while the alluvial soil type is third. For each soil type's fields, a set of recommendations is provided using data from Tables 2.3.1 (soil type descriptions), 4.1.1 (crop productivity), 4.1.7 (geographic distribution of land by socioeconomic groups), 4.2.2 (extent of cultivation and residue management), and 4.3.2 (soil quality indicators), as well as from Figures 3.4.1 (average annual rainfall by elevation) and 4.4.7 (estimated soil loss). Based on current management practices, soil quality, and estimated soil loss risk, a set of "key concerns" is provided for each soil type. To address these key concerns, certain management practices and trees/shrubs are recommended. "Priority locations" correspond to the high risk areas numbered in Figure 6.i that belong to each soil type, while "primary socioeconomic target(s)" correspond to the socioeconomic group(s) that has the greatest acreage in each soil type. The summary and recommendations for fields in each heavily cultivated soil type appear below.

RU1 (Northern region)

Altitude: 1500 – 1850 m Slope: < 4° Stoniness: n/a Rainfall: 700 – 1000 mm

Total area used for cultivation: 3.95 km² (86.4%)
Residues: 1.41 km² (35.7%) Bare: 2.54 km² (64.3%)

Major crop(s): wheat, maize
Wheat productivity (2003): 5.8 bags/acre
Maize productivity (2003): 8.1 bags/acre

Soil quality: relatively high
Clay: 24.2% C_{org}: 3.29% N: 0.23% C/N: 14.5 Exch. K: 1.40 me/100g

Avg. field age: 41 yrs Avg. management rating: 22.9 Avg. field size: 7.3 acres

Estimated soil loss range: 2.5 – 10.4 t/ha/yr (tolerable)

Key concerns: lack of natural vegetation, lack of residues (mainly for wheat fields), old field age, developed ploughpan, large field sizes

Recommended management practices: preventing livestock from grazing crop residues, tillage by ox-plough, reduced burning of residues, frequent crop rotation

Recommended tree/shrub species: *L. leucocephala*—intercropped with maize or on contour ridges in wheat fields to increase nutrient content and penetrate ploughpan; *C. cajan*—intercropped with maize at high density to increase N content and penetrate ploughpan; *E. abyssinica*—at moderate density in line with contour ridges to increase N and organic matter content and to provide greater soil protection; *C. africana*—intercropped at low density to increase organic matter content and to provide shade and greater soil protection.

Priority locations (on Figure 6.2.1): **2, 3, 4, 5**

Primary socioeconomic target(s): Group A

RU2 (Northern region)

Altitude: 1500 – 1850 m Slope: 2 – 10° Stoniness: n/a Rainfall: 700 – 1000 mm

Total area used for cultivation: 6.44 km² (79.1%)
Residues: 2.84 km² (44.1%) Bare: 3.60 km² (55.9%)

Major crop(s): wheat, maize
Wheat productivity (2003): 4.9 bags/acre
Maize productivity (2003): 6.0 bags/acre

Soil quality: relatively low
Clay: 25.5% C_{org}: 2.82% N: 0.17% C/N: 16.7 Exch. K: 1.10 me/100g

Avg. field age: 37 yrs Avg. management rating: 20.1 Avg. field size: 5.0 acres

Estimated soil loss range: 4.3 – 37.6 t/ha/yr (tolerable to severe at slopes > 5°)

Key concerns: soil loss exacerbated by slope, lack of natural vegetation, lack of residues (mainly for wheat fields), low N and K content, old field age, developed ploughpan, large field sizes

Recommended management practices: vegetated contour ridges, tillage by ox-plough, reduced burning of residues, increased manure usage, frequent crop rotation

Recommended tree/shrub species: *L. leucocephala*—intercropped with maize or on contour ridges in wheat fields to increase nutrient content and penetrate ploughpan; *C. cajan*—intercropped with maize at high density to increase N content and penetrate ploughpan; *C. calothyrsus*—at altitudes below 1800 m on steeper slopes and other highly degraded areas, intercropped with maize or on contour ridges in wheat fields to increase N and organic matter content, to penetrate ploughpan, and to provide shade and greater soil protection; *E. abyssinica*—at moderate density in line with contour ridges to increase N and organic matter content and to provide greater soil protection; *A. gummifera*—intercropped at moderate density on steeper slopes to slow runoff, to increase N and organic matter content, and to provide greater soil protection; *G. robusta*—intercropped at low density on steeper slopes and other highly degraded areas to increase organic matter content and to provide shade and greater soil protection; *C. africana*—intercropped at low density to increase organic matter content and to provide shade and greater soil protection.

Priority locations (on Figure 6.2.1): **1, 2, 4, 5, 10, 12**

Primary socioeconomic target(s): Groups A and B

RL1 (Central region)

Altitude: 1430 – 1550 m Slope: < 4° Stoniness: n/a Rainfall: 620 – 750 mm

Total area used for cultivation: 3.69 km² (81.8%)
Residues: 2.64 km² (71.5%) Bare: 1.05 km² (28.5%)

Major crop(s): maize
Wheat productivity (2003): 6.1 bags/acre
Maize productivity (2003): 5.3 bags/acre

Soil quality: relatively low
Clay: 26.9% C_{org}: 2.00% N: 0.16% C/N: 13.1 Exch. K: 1.01 me/100g

Avg. field age: 25 yrs Avg. management rating: 19.2 Avg. field size: 5.3 acres

Estimated soil loss range: 5.2 – 15.3 t/ha/yr (tolerable to high)

Key concerns: lack of natural vegetation, developed ploughpan, large field sizes, low N, K, and organic matter content, high soil loss mainly due to poor soil quality, drought prone

Recommended management practices: vegetated contour ridges, increased manure usage, preventing livestock from grazing crop residues, tillage by ox-plough, increased fallow period

Recommended tree/shrub species: *L. leucocephala*—intercropped with maize or on contour ridges to increase nutrient content and penetrate ploughpan; *C. cajan*—intercropped with maize at high density to increase N content and penetrate ploughpan; *C. calothyrsus*—in highly degraded areas, intercropped with maize or on contour ridges to increase N and organic matter content, to penetrate ploughpan, and to provide shade and greater soil protection; *A. gummifera*—intercropped at moderate density to slow runoff, to increase N and organic matter content, and to provide greater soil protection; *G. robusta*—in highly degraded areas, intercropped at low density to increase organic matter content and to provide shade and greater soil protection; *C. africana*—at higher altitudes, intercropped at low density to increase organic matter content and to provide shade and greater soil protection.

Priority locations (on Figure 6.2.1): **6, 7, 15, 16**

Primary socioeconomic target(s): Groups B and C

L1 (Southern region)

Altitude: 1350 – 1430 m Slope: < 4° Stoniness: fair Rainfall: 580 – 620 mm

Total area used for cultivation: 2.27 km² (84.7%)
Residues: 1.40 km² (61.6%) Bare: 0.87 km² (38.4%)

Major crop(s): maize
Wheat productivity (2003): n/a
Maize productivity (2003): 7.7 bags/acre

Soil quality: relatively high
Clay: 32.7% C_{org}: 2.83% N: 0.19% C/N: 14.9 Exch. K: 1.21 me/100g

Avg. field age: 21 yrs Avg. management rating: 11.3 Avg. field size: 4.0 acres

Estimated soil loss range: 2.6 – 10.9 t/ha/yr (tolerable)

Key concerns: lack of natural vegetation, low use of positive management practices, stoniness, drought prone

Recommended management practices: vegetated contour ridges, preventing livestock from grazing crop residues, increased manure usage, extensive intercropping

Recommended tree/shrub species: *L. leucocephala*—intercropped with maize or on contour ridges to increase nutrient content; *C. cajan*—intercropped with maize at high density to increase N content; *A. gummiifera*—intercropped at moderate density to slow runoff, to increase N and organic matter content, and to provide greater soil protection.

Priority locations (on Figure 6.2.1): **8, 9, 18, 19**

Primary socioeconomic target(s): Groups B, C, and D

ALLUVIAL

Altitude: 1350 – 1800 m Slope: < 4° Stoniness: n/a Rainfall: 600 – 1000 mm

Total area used for cultivation: 1.42 km² (57.8%)
Residues: 0.53 km² (37.3%) Bare: 0.90 km² (62.7%)

Major crop(s): wheat, maize
Wheat productivity (2003): 9.3 bags/acre
Maize productivity (2003): 9.7 bags/acre

Soil quality: relatively high
Clay: 29.0% C_{org}: 2.41% N: 0.17% C/N: 14.9 Exch. K: 1.18 me/100g

Avg. field age: 34 yrs Avg. management rating: 17.4 Avg. field size: 2.0 acres

Estimated soil loss range: 1.1 – 4.3 t/ha/yr (tolerable)

Key concerns: lack of residues (mainly for wheat fields), old field age, developed ploughpan, low organic matter content, risk of flooding

Recommended management practices: preventing livestock from grazing crop residues, tillage by ox-plough, reduced burning of residues, frequent crop rotation

Recommended tree/shrub species: *L. leucocephala*—intercropped with maize or on contour ridges in wheat fields to increase nutrient content and penetrate ploughpan; *C. calothyrsus*—in older fields, intercropped with maize or on contour ridges in wheat fields to increase N and organic matter content, to penetrate ploughpan, and to provide shade and greater soil protection; *A. gummifera*—intercropped at moderate density below areas of high relief to slow runoff, to increase N and organic matter content, and to provide greater soil protection; *G. robusta*—in older fields, intercropped at low density to increase organic matter content and to provide shade and greater soil protection.

Priority locations (on Figure 6.2.1): **n/a**

Primary socioeconomic target(s): Group B

6.3 RECOMMENDATIONS FOR LIVESTOCK MANAGEMENT

Current livestock numbers are an order of magnitude greater than the carrying capacity of the village's land. Based on empirical data, Hocking and Mattick (1993) recommend a ratio of 5.0 hectares per livestock unit for Tanzanian open woodlands that receive an average annual rainfall of 750 mm. In Kambi ya Simba, by extrapolating from livestock per field-acre densities reported by farmers in the survey to land use estimates in Table 4.2.2 (see appendix for methods), the ratio appears to be 0.10 hectares per livestock unit. Although this is a very rough approximation, it is nonetheless a staggering indication of the village's land shortage problem and inability to support the extensive grazing system. The only way to truly combat the problem would be for farmers to reduce their livestock holdings. Yet livestock are lucrative assets, and while farmers with numerous livestock should be encouraged to reduce their holdings, the problem can also be addressed by increased penning and agroforestry.

While overgrazing is most pervasive in the village's less arable soil types (i.e., valleys, RU3, RL2, L2), the recommendations outlined below should also be used in the heavily cultivated soil types (where applicable) for further benefits. Table 4.4.4 indicates that estimated soil loss without inclusion of slope factors is greatest in valley, mbuga, and L2 soil types. By including slope factors, RU3 also appears to experience severe rates of soil loss. Thus, these soil types should receive priority and, since valleys are by far the largest of the marginal soil types and, in most places, have the steepest slope, the valley soil type should receive precedence.

As previously mentioned, overgrazing can be reduced in two ways: by increased penning and increased use of agroforestry in areas that have been heavily grazed. Penning can be facilitated by planting the fodder species *L. leucocephala*, *C. cajan*, *C. calothyrsus*, *E. abyssinica*, and *C. africana* in fields and, where applicable, in line with contour ridges, as recommended for fields in certain soil types in section 6.2. Fodder can be collected from these species and fed to penned livestock to reduce the need for extensive grazing (and to ease manure collection). In addition, *E. abyssinica* can be planted in grazing areas in the Northern region to restore soil quality and, consequently, graze quality; *A. tortilis*, which already exists at high density throughout the village, can be planted in all grazing areas to improve nutrient content. All species listed in section 6.1 should also be planted near people's homes, as this is where most grazing occurs, where fodder collection is easiest, and where their benefits on soil quality are likely to have the most direct impact for the families who plant them.

Many of the gullies in the village's valleys and mbuga are located along former grazing paths. Gully formation can be curtailed by planting sisal hedges around gully sides (as is the current practice) and by planting *G. robusta* in areas of lesser slope (i.e., less than 10°) to provide surface cover and *A. gummifera* around sisal hedges (at slopes less than 25°) mainly to prevent channel formation. Especially in areas of steep slope, herders should avoid leading livestock along heavily used paths to prevent future gully formation. This can be facilitated by reducing the number of livestock taken on grazing expeditions, as a smaller herd size is easier to manage and has less impact on path formation.

6.4 TARGET AREAS

Figure 6-i illustrates the locations of the areas that should be targeted for expanding soil conservation and agroforestry. This section discusses each of these areas and presents steps that can be taken to reduce soil loss and improve soil fertility. The numbers used to represent each site are not indicative of the priority they should receive; priority shall only be assigned after consulting with MESO and the farmers with holdings at stake in these areas.

Sites 1-5

These sites are located in the Northern region on soil types RU1 and RU2. All are fields that experience severe levels of soil loss (rank 10 or above) without inclusion of slope factors. In each of these areas, wheat appears to be the major crop grown as all lack substantial residue cover and field sizes are relatively large; the photographs in Figures 5.4.2, 5.4.3, and 5.4.5 are representative of conditions likely to be observed on the ground. Based on ground truth observations, there is a low use of contour ridges in these fields and tillage is mainly performed using tractors. Optimal use of soil conservation and agroforestry would entail construction of contour ridges vegetated with elephant grass, *L. leucocephala* (both soil types), *C. calothyrsus* (only in steeper slopes in RU2), and *E. abyssinica* at low densities. In addition, *C. africana* can be intercropped at low density in both soil types and, in fields that are highly degraded or of steeper slopes (mainly in RU2), *A. gummifera* and *G. robusta* can be intercropped at moderate and low density, respectively, to improve organic matter content and provide greater soil protection. It is also recommended, where

applicable, that residues are no longer burned or grazed after harvests. In addition, these are some of the oldest fields in the village; thus they probably have very developed ploughpan and should be tilled by ox-plough in the future. If possible, farmers should try to increase the amount of time these fields spend fallow to facilitate their recovery and should rotate, as much as possible, between wheat and other crops in successive growing seasons.

Sites 6-9

These sites are located in the southern regions of the village (i.e., Central and Southern) and are likely used mainly for maize and bean cultivation. All exhibit severe rates of soil loss (rank 10 or above) without inclusion of slope factors. Based on ground truth observations, these fields may have semi-cracking to cracking soils due to poor moisture retention ability. Many do not have vegetated contour ridges and livestock have often been observed grazing them, although burning of crop residues is less pervasive than in the Northern region's wheat fields. These fields are recommended to focus mainly on increasing organic matter content by intercropping *A. gummifera* at moderate density and *G. robusta* at low density (only in the Central region) in maize fields. Both of these species provide good shade and *G. robusta* also fixes nitrogen. In addition, *C. africana* can be intercropped at low density in the areas of higher altitude around sites 6 and 7. The use of contour ridges should be expanded and these should be vegetated with elephant grass, as well as high densities of *L. leucocephala* (both regions). In maize fields, *C. calothyrsus* (in highly degraded areas of the Central region) and, especially, *C. cajan* (in both regions) should be

intercropped to increase organic matter and N content. Increased application of manure and preventing residue grazing will also contribute to improving these soils' moisture retention ability.

Sites 10-13

These sites correspond to the intersections between valley and heavily cultivated soil types in the Northern region where gully formation is likely to occur (if it has not already). Photographs in Figures 5.4.4, 5.4.8, and 5.4.9 are examples of areas where gullies are already well developed. These gullies have been formed in areas of steep slope and/or areas that have been heavily grazed, often along old herding paths, and directly below areas extensively used for cultivation (where sheet and rill erosion go unchecked). To prevent expansion of these gullies and new ones from forming in vulnerable areas, it is necessary to adopt soil conservation and agroforestry both in the areas of bush/graze where the vulnerable areas are located and in the fields above them. Farmers with fields above such areas should take extensive action, as described for sites 1-5, so as to reduce the amount and speed of water flowing off of their farms and to inhibit gully formation below. Gullies and vulnerable areas should not be grazed and should be fenced off with sisal hedges and, where applicable, *A. gummifera* and *G. robusta* (as indicated in section 6.3). In preexisting gullies of low slope, piles of stones and straw/brushwood can be piled along the floor to prevent deep erosion and should be concentrated towards the head of the gully to prevent "waterfall" erosion. In severe, steep gullies, checkdams can also be constructed, although this is a more capital and labor intensive method of intervention. It is not

difficult to stop gully erosion in its early stages and thus priority should be given to emergent gullies (rather than preexisting ones) to prevent their proliferation.

Sites 14-20

These sites correspond to areas in the southern regions with conditions similar to those of sites 10-13. However, based on ground truth observations, gully erosion appears minimal in these areas in comparison to the Northern region. Nonetheless, valley sides are pockmarked by cracking soils and numerous rills, and small gullies can be observed near the valley floor. In general, vegetation is much sparser in the southern regions due to the drier climate and stoniness of the soils and thus emphasis should be placed on increasing the amount of organic matter present in these soils. This can be accomplished in part by planting *A. tortilis* at high density, as well as *A. gummifera* and *G. robusta* in the most vulnerable areas and along forest margins. Fields above these areas should implement the recommendations presented for sites 6-9. Lastly, grazing intensity appears to be highest in valleys and in areas of L2 near the escarpment (e.g., site 20); pressure can be reduced off these lands by moving herds to the less degraded areas in soil types RL2 and, in general, westwards. As is the case for all areas though, the goal is not to evenly distribute grazing (and degradation), but rather, to decrease its effects on soil quality. Moving herds to these less degraded regions should only be seen as a short term recommendation designed to give the highly degraded areas a chance to recover.

6.5 TAKING ACTION

The farmers of Kambi ya Simba would be the first to say that there is critical need for increased soil conservation and agroforestry, and would strive to implement these recommendations if the resources were available. It is here that MESO provides a valuable service to the village, as they are able to supply farmers with some of the necessary resources and can facilitate proper, widespread utilization. The village nursery, constructed and run by MESO, currently contains useful agroforestry species *E. abyssinica*, *C. africana*, *G. robusta*, and *A. gummifera*, and shall be expanded to also hold large numbers of *L. leucocephala* and *C. calothyrsus*. *A. tortilis* and *C. cajan* are already widely used throughout the village and can be easily propagated. Although MESO staff in the village work as volunteers, they have previously donated their labor, resources, and expertise to assist farmers in developing contour ridges, fuel efficient stoves, and green manure. They also hold public discussions and seminars with poster presentations by local farmers, and maintain a library/agricultural information center at their office in the village center. In this way, MESO shall serve as the vehicle for acting upon the recommendations included in this report, while, at the same time, critiquing and tailoring them to meet the most up-to-date and pressing needs of the village's farmers.