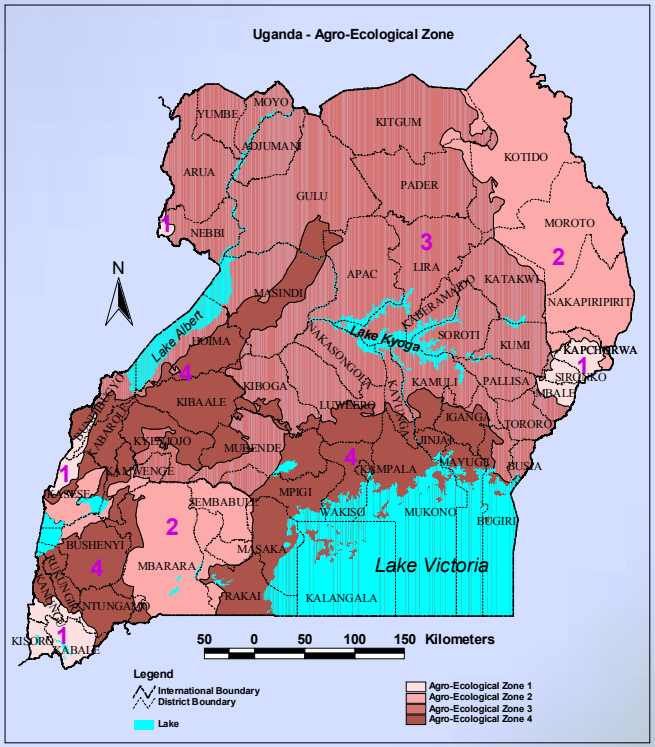
KEAN DEVELOPMENT ENTERPRISES LTD

Quantifying B_y and $f_{NRB,\,y}$ in a dynamic baseline



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A typical stand of uneven-aged mixed stand in Uganda.

Quantifying the biomass in such a stand can be a big challenge

Challenges of estimating *By Related to Nature of Stand*

Uneven-aged mixed species stands:

•There are different tree species (different wood density, tree form), of different age.

•Increment is a summation of individual tree growth plus recruits or regeneration (in growth).

•Various uses with no definite rotation age

Note:

Increment (potential growth) is assessed as a summation of growths, recruits / regeneration – less removal. The variation in species, age, use and no defined rotation age implies that the term MAI (Mean Annual Increment) can not be used in its strict sense

Challenges posed by nature of stand continued

Establishing Permanent sample plots:

Too many border case trees / shrubs

Poor accessibility affects output / increases cost of plot measurements

Existence of multi-stemmed plants may call for adoption of other methods e.g., cutting and weighing;

Species identification and gathering information of species density

Challenges posed by nature of stand continued

Re- measuring Permanent sample plots:

- Difficult to re-locate sample plots
  - may need expensive systems like high accuracy GPS for after-plot re-location
- Difficult to identify previously measured trees
  - Some were cut, or others died
- Regeneration, sprouts, recruitment issues
- Shrinking in diameter, crown or height due to fires, termite attack or human activity
- Special markings help the situation but may cause preference in treatment

Challenges of estimating B*y* due to external factors

Human activity

Clearing land for crop production or pasture is a big issue especially on private land

This clearing is mainly sporadic resulting in satellite deforestation. This causes high variation in biomass statistics

Timber harvesting, charcoal production and firewood especially for commercial purposes may have same effect as above

Natural factors

Termite attacks, destruction by large mammals e.,g elephants, natural physiological breakdown (death), ‘fires’, wind throws may also pose challenges .

Example of high biomass variation due to Satellite clearing for charcoal and wood production

Challenge III

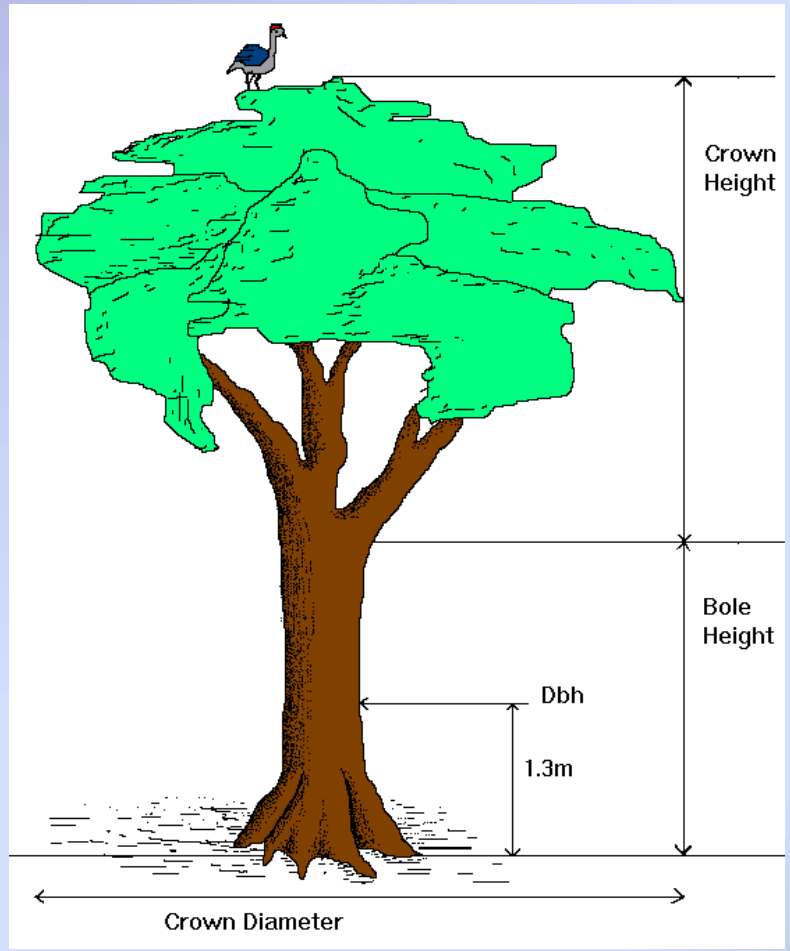
- No organized charcoal production industry.

- Producers can start from any soft spot, resulting into satellite patches of degraded forest that cannot be seen from land sat images.

- High resolution remote sensed data and physical surveys may be the answer. (High cost implications in terms of purchase price, data storage and processing)

Estimating standing stock

Tree parameters:



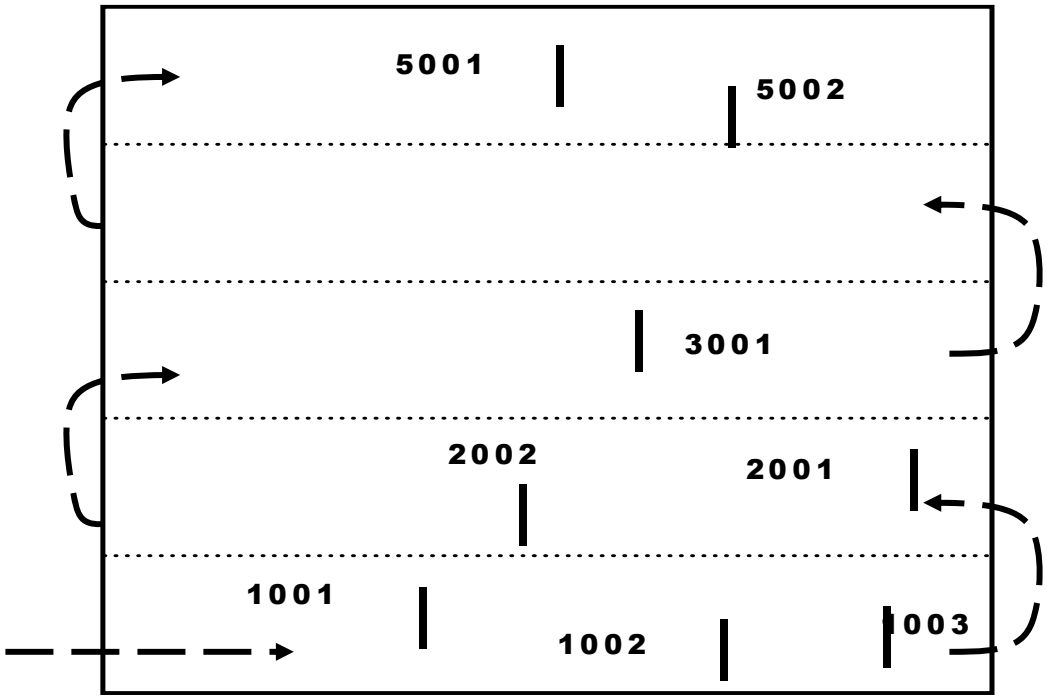
Estimating standing stock

Three major steps involved:

- Stratification / Mapping homogenous units (time series)
- Distributing/allocating sample plots (Time series)
- Plot measurement
- Data analysis (assuming allometric equations are already developed)
- Extrapolating results to project the real situation

Measures to overcome stand complexity,

Avoid double counting and avoid missing out trees



Assessing Tree increment and in-growth (need for a good Relational database)

PLOTNO	TREENO	DBH	BOLE	HEIGHT	CROWN	SPECIES	PWS_AIRDRY
112028	1001	4	1.3	3.0	1.5	Persea americana	3.8
112028	1002	7	1.4	4.0	2.5	Persea americana	12.3
112028	1003	6	1.3	4.0	1.0	Citrus nobilis	8.7
112028	1004	5	1.7	4.5	1.0	Citrus nobilis	7.0
112028	1005	6	1.3	4.0	1.0	Citrus nobilis	8.7

PLOTNO	TREENO	DBH	BOLE	HEIGHT	CROWN	SPECIES	PWS_AIRDRY
112028	1001	5	1.3	3.5	1.5	Persea americana	5.8
112028	1002						Cut
112028	1003	6	1.3	4.3	1.0	Citrus nobilis	9.0
112028	1004						dead
112028	1005	6	1.3	4.3	1.0	Citrus nobilis	9.0
112028	R101	3	1.3	3.0	2.5	Mangifera indica	3.5

PLOTNO	TREENO	DBH	BOLE	HEIGHT	CROWN	SPECIES	PWS_AIRDRY
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112028	1003	6	1.3	4.0	1.0	Citrus nobilis	8.7
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Overview of biomass dynamics in Uganda

Estimated gross biomass supply is 468 million tons of air-dry equivalent of wood (above ground tree biomass).

156 million tons held in protected areas (Forest Reserves, National Parks and Game Reserves)

317 million tons is held in private woodlots

(National Biomass Study – 2002)

Overview of biomass dynamics in Uganda

- The consumption of wood products (mainly sawn timber, charcoal and firewood) was estimated in 1995 to be 20 million tons. Today estimated at 30M.
- At an estimated growth rate of 3.6% the consumption of wood products would almost triple to about 60 million tons by the year 2025.

(Uganda Forestry Sector Co-ordinating Secretariat, 2001)

Overview of biomass dynamics in Uganda

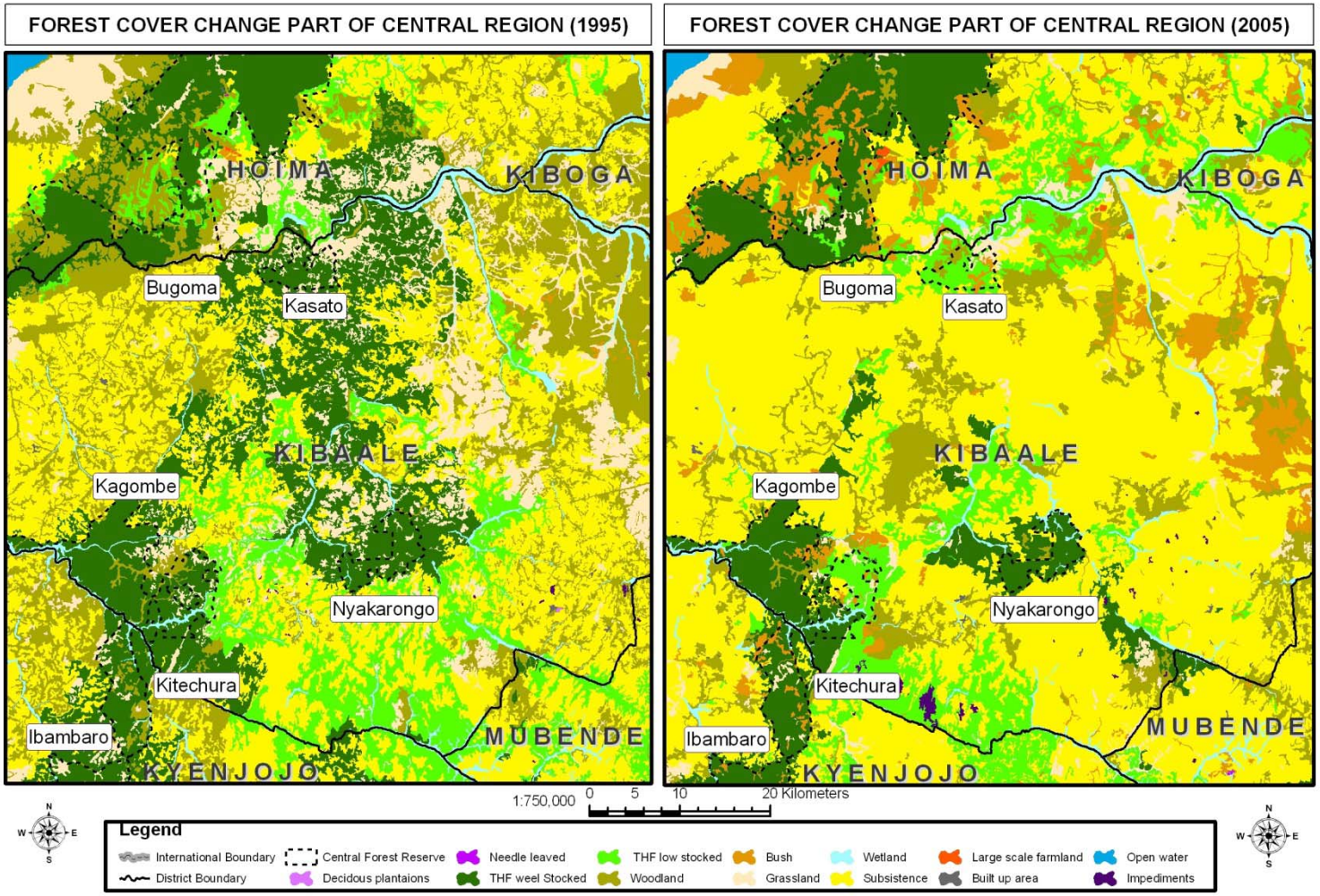
About 30 million tons of biomass is lost per year with the highest being in tropical high forests (70% of Uganda's forests are on private land, hence a management/regulation issue)

Proof of non-renewability in Uganda (degradation)

Land Cover/Use	Predicted Weight 1st Visit(Tons/ Ha Airdry)	Predicted Weight 2nd Visit(Tons/Ha Airdry)	Difference between the 1st and 2nd Visit	Duration in Decimal Years	Rate of annual change (Tons/Ha Airdry)	Rate of annual change (%)
CLASS	VistA (TON-HA)	VistB (TON-HA)	Difference	YEARS	change	Change in %
Plantations (Hardwoods)	46	38	-7.8	2	-3.4	-7%
Tropical High Forest THF	189	110	-79.0	3	-24.3	-13%
THFDegraded	119	87	-31.2	4	-8.3	-7%
Woodland	39	33	-6.3	3	-1.9	-5%
Bushland	15	12	-2.3	4	-0.6	-4%
Grassland	8	7	-0.2	3	0.0	-1%
Wetlands	0	0	0.0	2	0.0	
Subsistence Farmland	8	8	0.2	3	0.1	1%
Commercial Farms	0	0	0.0	4	0.0	-25%
Built up Area	4	5	0.4	3	0.1	3%

National Biomass Study - 2002

Proof of non-renewability in Uganda (deforestation)



NFA_ National Biomass Study - 2008

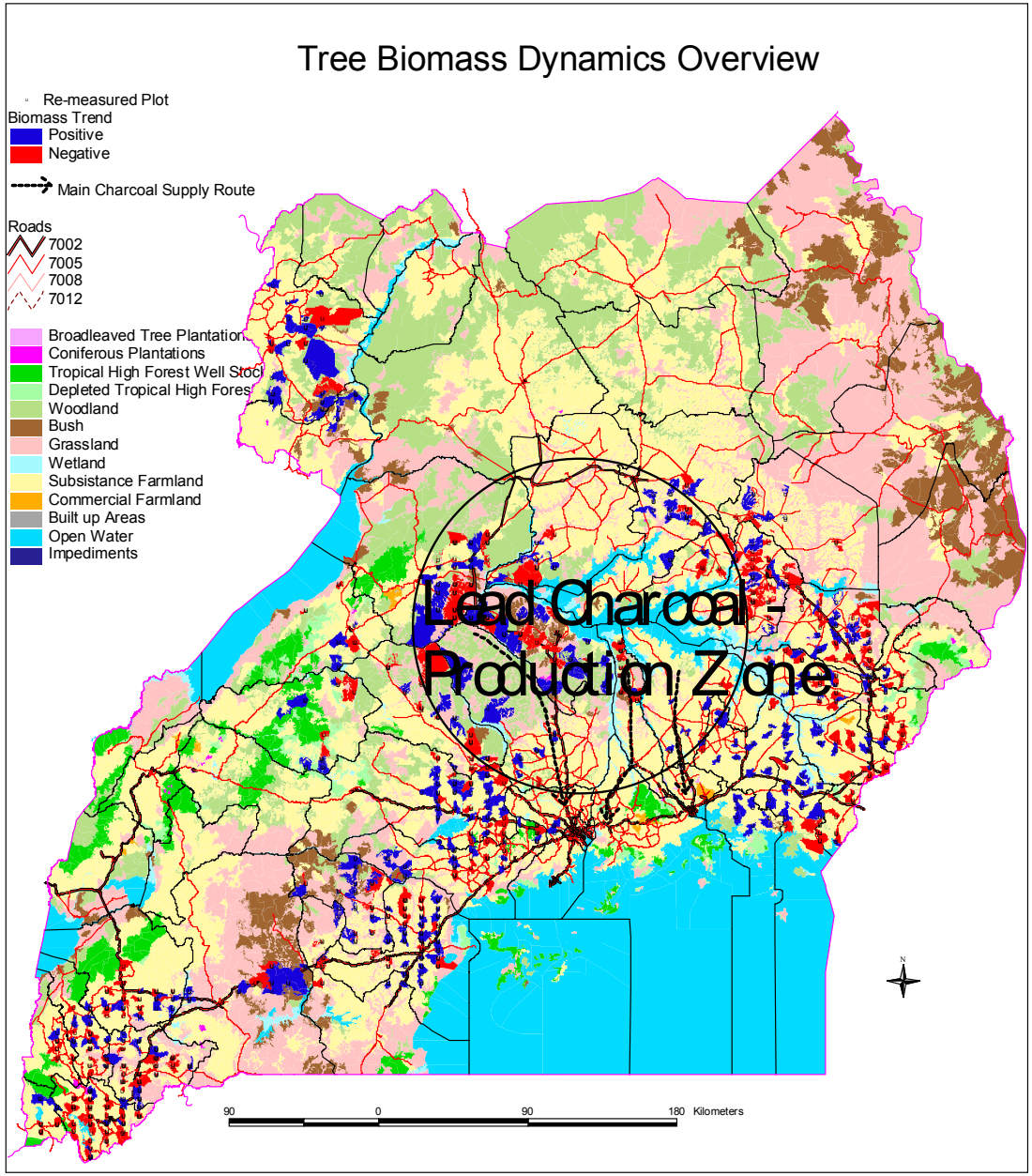
Proof of non-renewability in Uganda

The increasing distances between the catchments for wood and charcoal have exceeded ‘ordinarily’ commercially viable limits.

For dry wood (energy density of $15MJKg^{-1}$) optimum radius is 100Km.

Because of higher energy density for charcoal ($30MJKg^{-1}$) the radius may be double.

In Uganda, Charcoal is transported from as far as a 300Km radius (but at the expense of persistent price increase)



Charcoal routes to the three major urban centres in Uganda Kampala, Jinja and Entebbe

Aggregated cahracoal conusmption in smaller urban centres is great. Rate of urbanization about 6% per annum

$f_{NRB, y}$

The fraction of the non-renewable biomass that is saved by the project activity can then be determined by establishing the efficiency of the appliances to be introduced by the project activity, monitoring the numbers that are in constant use and the functional life time.

Conclusion

The technicalities involved in determining B_y and $f_{NRB,\,y}$ raise the transaction costs beyond the threshold of a small scale project.

The above situation is exacerbated by the ever increasing distances between the wood catchments and the consumption centers. Monitoring costs are therefore a major issue in a dynamic baseline.

Is this the right time to propose a new methodology for large scale household energy projects?

Thank you for your attention.