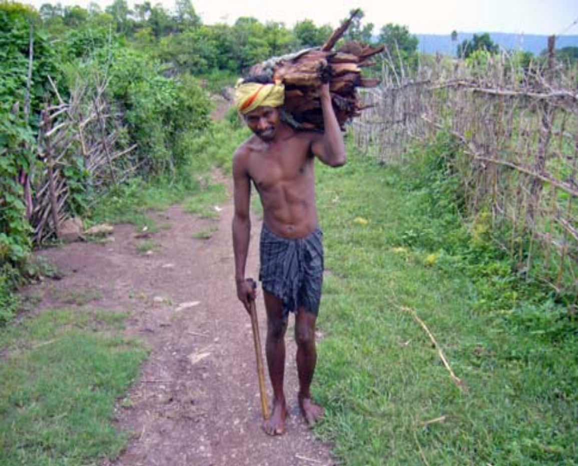
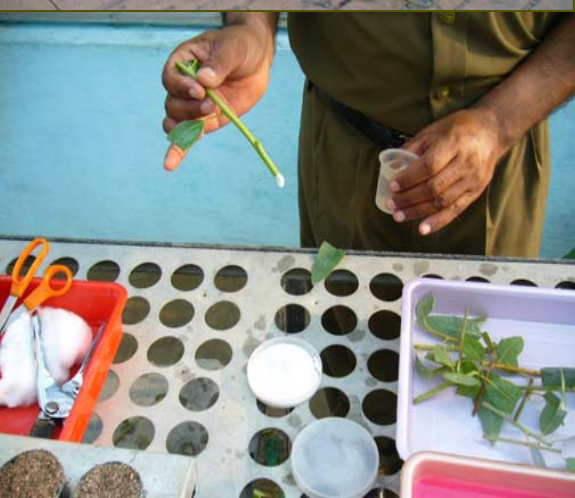




Forest and Bioenergy in the Carbon Market - Current Situation

Jürgen Blaser and Carmenza Robledo,
Intercooperation, Bern

Workshop in Pakistan
1 June 2007

Some basics…

- Trees remove CO_2 from the atmosphere, sequester C and stock up carbon pools
- Burning “renewable biomass” (wood) is neutral for the climate
  → CO_2 emitted = CO_2 sequestered
- A 30 MW biomass-fired power plant needs about 10,000-12,000 ha of dedicated energy crops
  (supply for ~ 30,000 homes in Switzerland)
- Bioenergy has potential but biomass stocks are limited
  - Tree planting may be necessary
- Tree harvesting does not mean forest degradation or deforestation
  - Sustainable wood production can act as carbon sink (plantations, natural forests

More: IEA Bioenergy Task 38 http://www.ieabioenergy-task38.org/publications/faq/

Limits to Forestry and Bioenergy in the Clean Development Mechanism

- CDM carbon market only accepts Afforestation/Reforestation (A/R) and reduction of non-CO_2 emissions from agriculture
- Afforestation/Reforestation allowed to supply credits for maximum 1% of Annex I 1990 emissions (x5 years)
- A/R only on land without forest since December 31, 1989
- A/R generates temporary credits (tCERs/lCERs): 5-year leases
- Replacement of temporary credits after max 60 years
- Cap on small-scale A/R projects at 8,000 t CO_2e/yr

→ How to combine Afforestation/Reforestation and Bioenergy in single project without having "double accounting" of C?

→ There is yet not a clear approach accepted for substitution of non-renewable biomass by renewable biomass

→ There is yet no methodology developed for biofuels

Existing methodologies in Biomass (CDM Energy)

- Grid-connected electricity generation from biomass residues
- Avoidance of methane production from biomass through composting
- Avoidance of methane production from decay of biomass through controlled combustion

Hybrid Sequestration/Substitution Projects?

- Problem: A single CDM project cannot combine A/R and use of biomass to replace fossil fuel as energy source.
  - No recognition
    - That today's reforestation is tomorrow's bioenergy
    - Of the combination of environmental and social benefits
- Result: Transaction costs are high (doubled).
  - Preparation: At least 2 projects are needed using 2 different methodologies, and separate registration.
  - Implementation: Separate verification/certification.

→ Solution: Develop options for combining combination and design a methodology for doing so.

Replacement of Non-Renewable Biomass

- Problem: Projects that reduce the consumption of non-renewable biomass (NRB, usually fuelwood) lack an appropriate methodology, so are currently ineligible in the CDM
  - Most such project opportunities are found in poor communities in rural areas where fuelwood is one of the only available energy sources
- Result:
  - Limits project development in degraded and energy-poor rural areas
  - Limits participation of rural areas in carbon market

→ Solution: A new methodology is needed

(Submissions to and approval by the CDM Executive Board)

Biofuels

- Problem: No methodology exists for projects proposing to use vegetable oils produced from biomass to reduce GHG emissions from fossil fuel combustion
  - *Jatropha curcas*
  - *Pongamia pinnata*
  - *Croton megalocarpus*
- Result:
  - So far no biofuel project has been registered to produce compliance-grade carbon credits in the market
  - Incentives for biofuel/biodiesel production are limited

→ **Solution:**

A methodology for calculating GHG emission reductions at the production site is needed

Example Biofuel 1: Jatropha curcas (EUPHORBIACEAE)

Shrub or tree to 6 m

<u>Germplasm</u>

There is an endemic species in Madagascar: *J. mahafalensis*, with equal energetic promise.

<u>Distribution</u>

Though native to America, the species is almost pantropical now, widely planted as a medicinal plant which soon tends to establish itself. It is listed as a weed in Brazil, Fiji, Honduras, India, Jamaica, Panama, Puerto Rico, and Salvador

<u>Ecology</u>

Ranging from Tropical Very Dry to Moist through Subtropical Thorn to Wet Forest Life Zones, physic nut is reported to tolerate annual precipitation of 480 to 2400 mm and annual temperature of 18 to 28°C

.

Example Biofuel 2: Pongamia pinnata FABACAE

Fast growing, glabrous, deciduous, tree to 25 m tall

Germplasm
reported to tolerate drought, frost, heat, limestone, salinity, sand, and shade

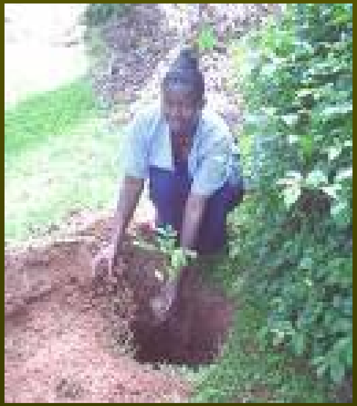
Distribution
An Indomalaysian species, a medium-sized subevergreen tree, common on alluvial and coastal situations from India to Fiji, from sea level to 1200 m. Now found in Australia, Florida, Hawaii, India, Malaysia, Oceania, Philippines, and Seychelles.

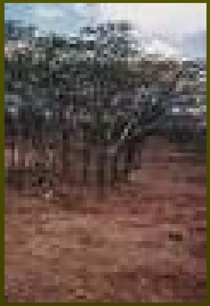
Ecology
Ranges from Tropical Dry to Moist through Subtropical Dry to Moist Forest Life Zones. Withstanding temperatures slightly below 0°C to 45°C and annual rainfall of 50-2500 mm, the tree grows wild on sandy and rocky soils, including oolitic limestone, but will grow in most soil types, even with its roots in salt water

Example Biofuel 3 : Croton megalocarpus EUPHORBIACEAE

Fast growing tree grows to 15-35 m

Germplasm
C. megalocarpus is a pioneer species and it is found growing in cleared parts of natural forests, forest margins or as a canopy tree





Distribution
Native : Burundi, Democratic Republic of Congo, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda .

Ecology
Altitude: 1 200-2 450 m Mean annual temperature: 11-26 deg. C Mean annual rainfall: 800-1 900 mm

Yields and Economics of main Biofuels

Pongamia

- Trees of ten reach adult height in 4 or 5 years, bearing at the age of 4–7 years. A single tree is said to yield 9–90 kg seed per tree, indicating a yield potential of 900—9000 kg seed/ha, 25% of which might be rendered as oil (assuming 100 trees/ha). In general, Indian mills extract 20-28% oil
- The thick oil from the seeds is used for illumination, as a kerosene substitute, and lubrication. It would seem that with upgraded germplasm one could target for 2 MT oil and 5 MT firewood per hectare per year on a renewable basis. The oil has been tried as fuel in diesel engines, showing a good thermal efficiency

Jatropha

- seed yields approach 6–8 MT/ha with ca 37% oil. Such yields could produce the equivalent of 2,100–2,800 liters fuel oil/ha.
- The clear oil expressed from the seed has been used for illumination and lubricating, and more recently has been suggested for energetic purposes, one ton of nuts yielding 70 kg refined petroleum, 40 kg "gasoil leger" (light fuel oil), 40 kg regular fuel oil.

Comparative values: Jatropha and agrocomercial crop species

	Crop production Mt/ha	Fuel production /ha	Energetic eq. Kwh/ha
Elaeis guineensis	18–20	3,600–4,000	33,900–37,700
Jatropha curcas	**6–8**	**2,100–2,800**	**19,800–26,400**
Aleurites fordii	4–6	1,800–2,700	17,000–25,500
Saccharum officinarum	35	2,450	16,000
Ricinus communis	3–5	1,200–2,000	11,300–18,900
Manihot eaculenta	6	1,020	6,600

Source:
Gaydou, A.M., Menet, L., Ravelojaona, G., and Geneste, P. 1982. Vegetable energy sources in Madagascar: ethyl alcohol and oil seeds (French). Oleagineux 37(3):135–141

References

www.biocarbonfund.org

www.joanneum.at

http://www.ieabioenergy-task38.org/publications/faq/

www.worldagroforestrycentre.org

www.worldagroforestrycentre.org/SEA/Products/AFDbases/AF/asp/SpeciesInfo.asp