EVALUATION OF BIOMASS PRODUCTION AND THE UTILIZATION IN THE MEKONG DELTA OF VIET NAM

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2. Bio-energy (makapuno, cassava, sugar cane, sweet potato; new materials suggested: jatropha, elephant grass hybrid, *hymenachne acutigluma*, *brachiaria mutica*, pansagius)

3. Conclusion & challenges
Catfish (*Pangasius gigas*) grow over 3m in length and more than 270kg is found in the Mekong River and recorded as the world's largest freshwater fish by *The Guinness Book of World Records*. (Source: WWF, Nov, 2004)

Almost rice exported to the world comes from the Mekong River Basin.
Dams and climate change impacts to Mekong water regimes

CLIMATE CHANGE
- High temperature
- Low precipitation
- Sea level rise

UPSTREAM DAMS
- Change the water regimes
- Store water in dry seasons
- Release water in wet seasons

More erosion
Limit navigation
More drought
More saline intrusion
Less fresh water
Higher flood
Health impacts
Poor fisheries
Less protein
More pollution
Reduce biodiversity

Change Mekong water level and flows
Forecast on climate change in Mekong Delta high flood
Biomass: The planted area, production of rice in the Mekong delta (thous. ha)
Utilization: Rice straw + husk

Rice straw bulk for energy and buffalo
Energy from rice husk

Rice husk is made into wood by farmer

Rice husk wood
Jatropha

Fig. 1. Parts of Jatropha curcas and their possible uses

- **FRUITS**
  - Seeds
  - Husks
  - Kernels
  - Oil

- **LEAVES**
  - Anti-inflammatory agent
  - Biodegradable
  - Fuel, mulch & biogas

- **BARK**
  - Tannins
  - Dyes

- **WHOLE PLANT**
  - Erosion control
  - As a hedge
  - Shelter plant for other crops
  - Fertilizer
  - Medicinal uses

**Seed cake or expeller**

- Animal feed (protein supplement)
- Organic fertilizer
- Rodent repellent
Jatropha fields & products
Viet Nam policy to develop bio-energy to 2015

• Decision No. 177/2007/QD-TTg 20-11-2007

• -2015: ethanol+oil=250.000ton (diluted with 5.000.000ton E5,B5)-> 1% requirement of the nation

• -2025: ->1.800.000 ton->5% requirement of the nation.
Risks in mekong river in the future

Risks in society - ecology

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<tr>
<th>Increase</th>
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<td>Sea water intrusion</td>
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<td>Unsustainable</td>
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Makapuno
makapuno
makapuno seedling propagation
Coconut somatic embryogenesis at Cantho University (2009)
Bio-energy plants
The planted area, production of Cassava in the Mekong delta (thous. ha)

Sodium glutamate
Ethanol
Powder-> foods + animal
The planted area, production of **sweet potato** in Viet Nam and the Mekong delta (thous. ha)
The planted area, production of Sugar cane in Viet Nam and the Mekong delta (thous.ha)

molasses → Industrial ethanol
Potential source of biomass for fuel- but this could change in the future

• Elephant grass: (*Pennisetum purpureum*).
  • * It is propagated by rhizomes or by micropropagation, so seeds are not needed to produce material for commercial use
    * Its dry biomass, burned in ovens,
    * It can generate 25 times as much energy as the amount of fossil fuel used to produce it, while sugarcane converted into ethanol only produces nine times as much. (By Mario Osava, 2007)
New grass materials: Elephant grass
8.2 Mom (Hymenachne acutigluma)
Several characters of Mom grass (*Hymenachne acutigluma*)

- **Gramineae**
- **Common names** Mom grass.  
- **Description** Tall, stoloniferous perennial, culms to 2 m; panicles narrow 15 cm long.  
- **Distribution** Northern Australia, Papua New Guinea, Assam, Burma, Malaysia, Viet Nam and Polynesia.  
- **Season of growth** Perennial in the tropics.  
- **Rainfall requirements** It is a swamp grass, more or less independent of rainfall.  
- **Drought tolerance** It generally escapes drought because of the high soil moisture in its usual habitat, unless the drought is very prolonged.  
- **Soil requirements** It generally grows on heavy clays.  
- **Sowing methods** It is propagated by stolons.  
- **Response to defoliation** It stands grazing well, but very heavy grazing by feral pigs and buffaloes in Viet Namnorthern leads to a reduction in density  
- **Palatability** It is very palatable.  
- **Natural habitat** In shallow water at the margins of swamps and slow rivers in the Mekong delta  
- **Tolerance to flooding** It survives floods well and is aquatic in nature.  
- **Economics** It is an important grazing plant for swamp buffaloes in the Dong Thap province. The buffaloes will submerge and graze it from below.  
- **Animal production** The *H. acutigluma* plains are ideal for the swamp buffalo and live-weight gains of 0.27-0.31 kg per day have been recorded. Reproductive performance of buffalo is superior to that of cattle, with calving rates of 85 percent,  
- **Tolerance to salinity** It grows in fresh water swamps.  
- **Green Yield : 200-300 ton/ha/year.**
Distribution of Mom grass and elephant grass hybrid in the Mekong Delta

Mom grass can’t be developed in the coastal region

Fig. Status of saline intrusion in Mekong Delta
*Scirpus littoralis* (nang tuong) could be developed along the coastal region.
Algea

- Chlorella (2-3 days, extract 97% biodiesel).
- 6-10% oil content <= 15-77% World)
- Suggestion: import algea-> 3,600 km
9. Biomass from Aquaculture in Viet Nam

- Pansagius 1,200,000 ton, year-round harvested
- Shrimps 560,000 ha, 239,000 ton in Mekong Delta
Total Fisheries production of Vietnam

Mekong Delta production

Sources: Annual report of Ministry of Fisheries, Vietnam (2000-2006)
Pangasius catfish

*Pangasius hypophthalmus* (Sauvage, 1878)  *Pangasius bocourti* (Sauvage, 1880)
Harvest Pansagius cat fish
Bio-diesel from cat fish oil
Climate change & Challenges

I. THE MEKONG BASIN

The Mekong River Delta (MD) is confirmed as a huge tropical wetland and a part of the international biodiversity conservation Mekong River basin.

The endangered Sarus Cranes in Tram Chim
Dams and climate change impacts to Mekong fish

- **Dams**
  - Mekong inflow
  - Mekong inflow
  - Rainfall

- **Climate Change**
  - Water salinity
  - Water quality
  - Soil acidity

- **Rice**
  - Freshwater quantity for rice
  - Water quality for rice

- **Fish**
  - Water quality for estuarine wild fish
  - Water quality for freshwater wild fish
  - Estuarine wild fish
  - Freshwater wild fish
  - Aquaculture fish

- **Aquaculture**
  - Water quality for aquaculture

- **TOTAL INCOME**
  - Rice production

- **FOOD SECURITY**
  - Fish production

- **ENVIRONMENT**
  - Crab production
  - Shrimp production
• Super rice is being developed
Dynamic of salinity in the fields
Detected saline tolerance marker

-> collect rice planting surround coastal areas is urgent!
Breeding for higher quality

Well 1: THL03-03-01 Well 5: TP5
Well 2: THL03-03-02 Well 6: OM1490
Well 3: THL01-03-01 Well 7: DNA Marker
Well 4: THL02-01-01
Planted area & production of some perennial industrial crops (thous. ha)
Main products of livestock (ton)
Conclusion & Challenges

- Biomass such as rice straw, husk- a dead biological material that can be used as fuel or for industrial production. Super rice is needed to develop higher biomass.
- Bio-energy should be used: makapuno, catfish oil, hybrid elephant grass, *hymenachene acutigluma*, as plant matter grown to generate electricity or produce biofuel.
- Drying and compacting the biomass are also a challenge.
- Elephant grass compressed into pellets, similar to wood pellets, in its blast furnaces as an economical and environmentally friendly solution.
- Breeding for higher rice yield (>10 ton/ha) should be done. Selection or breeding rice varieties tolerant to high saline concentration should be done from now on.