Jamaica's sugar industry

Main findings from the UWI/UNEP study: integrated Assessment of Trade-Related Policies in the Agriculture Sector and Biological Diversity

Convention on Biological Diversity
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Professor Anthony Clayton
University of the West Indies

Background

Global population projected to rise from 7bn to 9.2bn by 2075, mainly because of the continuing rise in world average life expectancy and the relatively high fertility levels in developing countries.

Conclusion: it will be necessary to provide food, clothing, housing, fuel and water for over 2bn more people, as well as absorb them into labour markets.

This has major implications for resource demand – and therefore for biodiversity.

Responding to the crises

- On the current trajectory, the world may face a bleak future, with failing crops, dwindling supplies of energy, critical shortages of water and conflicts to control resources.
- We have to find the solutions for five problems simultaneously: strengthening economic growth, meeting energy needs, mitigating climate change, increasing food security and protecting biodiversity.
- Failure is likely to result in conflict; almost 70 countries have combination of high risk factors (including resource scarcity, population growth, predominantly young population).

The future for agriculture & land-use

- The projected increase in human population & changes in diet means that it will be necessary to approximately double agricultural production by 2050; and the move to replace fossil hydrocarbons with biofuels will create yet more pressure on available land.
- This is likely to result in rapid losses among the remaining biodiversity unless agricultural production is made much more efficient and intensive, so that greater volumes of output can be generated on smaller areas.

Need to solve more than one problem simultaneously

Jamaican sugar

Jamaica was the world's largest producer in the period 17th - early 19th centuries.

Today, Jamaica's share of world production is just 0.1%, the tonnage of sugar slumped from 514,450 tonnes in 1965 to 124,206 in 2005, the contribution to export earnings has fallen from 49% in 1952 to 1.8% in 2006, the contribution to GDP has fallen from 9% in 1953 to 0.8% in 2006.

The industry still occupies 53,294ha (of which 46,000ha producing, for quota) = 30% of agricultural land in Jamaica; 41% of permanent crop land.

It became uncompetitive, in part because it was protected from competition by EU trade preferences, so was profoundly threatened by phasing-out of trade preferences.

Employment

The industry employs 38,000 people, in two groups.

The first group is 7 large estates, 2 private and 5 public, with 6,000 employees and 60% of the land under cane. The public estates are very dilapidated, with obsolete machinery dating back to the 1960s.

The second group consists of 9,600 cane farmers, 60% of whom have <2 ha of cane, 40% in larger units up to 300 ha, plus labourers.

Employment was government's primary concern.

Environmental impacts

Sugarcane has caused > loss of biodiversity than other crops due to loss of wetland for plantations, intensive use of water for irrigation (1,500-3,000 litres of water to produce 1 kg sugar), agrochemicals and wastewater.

The most rapid loss is incurred when land is converted for agricultural production. The main expansion of sugar in Jamaica was in the 17th and 18th centuries.

The impacts now are mainly due to wastewater (the industry has old plants with higher economic and environmental costs). Effluent includes fertilizers, pesticides, ripeners, heavy metals, oil, grease, cleaning agents, vinasse; surges kill fish, crustaceans, coral.

Biodiversity

- Jamaica is still rated fifth in the islands of the world in terms of endemic plants; there are at least 3,304 species of vascular plants in Jamaica, of which 923 (27.9%) are endemic.
- There is also a high level of endemism for many species of animals including snails, terrestrial grapsid crabs, amphibians, reptiles, and land birds.
- Many are now vulnerable or endangered.

Species	Total	Endemic	Vulnerable	Endangered	Critical
Fauna	1,496	730	17	8	6
Flora	4,015	1,021		462	

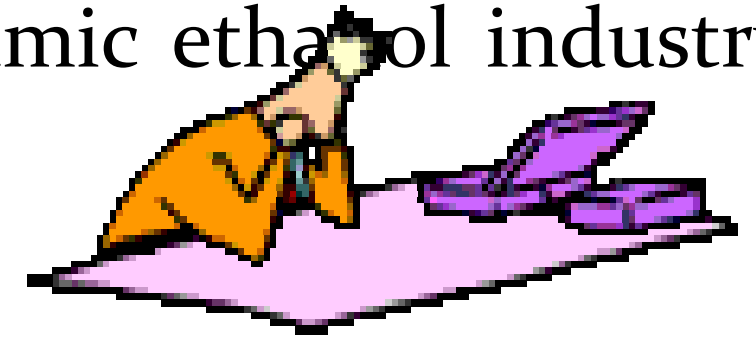
- Some part of this (especially loss of wetland and mangroves) is related to the sugar industry.

The loss of the reefs

- In the late 1970s Jamaica's reefs had live coral cover averaging 52% at 10m depth.
- In 2005, average live coral cover ranged from 34% to 0%. So most of Jamaica's reefs are now unhealthy or dead.
- This is multi-hit; the main factors are overfishing, loading with nutrients and silt, warmer and more acidic seas.
- Jamaica's beaches depend on the reefs, the tourism industry depends on the beaches; tourism 2nd largest source of f/x, contributes (directly and indirectly) over 30% of employment, still has significant growth potential.
- The sugar industry contributes to nutrient & silt loading, so has negative impact on Jamaica's future tourism development potential.

The government's great idea

- Jamaica: dependent on imported oil for about 93% of energy demand.
- Sugar industry needed complete re-engineering.
- Solution to both problems: convert moribund sugar industry into dynamic ethanol industry, thereby:
  - ✓Saving jobs
  - ✓Generating revenue
  - ✓Reducing dependence on imported oil
  - ✓Reducing carbon emissions



The government's plan

Privatise public estates, sell to Brazilian firm BioInfinity, manufacture ethanol for domestic market, but most for export to USA under CBI.

Government mandates E10, creating demand for 70 million litres ethanol. This requires ~16,000/46,000ha of cane to be switched into ethanol production + 13,000 additional ha of cane. Output to double (150,000-300,000 tonnes), productivity to increase by 35% (5.92 to 8.0 tonnes/ha), production costs to fall by 30%, all over three years. In the interim, wet ethanol would be imported from Brazil. Total cost: €555.7 million over 2006 to 2015.

Environmental impact: depends on quality of plant, probably positive.

Analysis of the plan

- The real plan: the US has a tariff of US$0.54/gallon on ethanol from Brazil. Ethanol from Jamaica can enter the US at a zero tariff under the CBI system, up to 7% of US demand. So Brazil can supply wet ethanol to Jamaica, blend it, dewater it, then export anhydrous ethanol to the US.
- This plan depended on 3 variables (price of oil, CBI renewal, US tariff on Brazilian ethanol).
- So policy had (½ * ½ *½) = 1/8 chance of working.

Alternative:integrated,high-value land use

- Intensive, high-value agriculture (yam, potatoes, cassava, dasheen, breadfruit and other complex carbohydrates, high-value plant extracts such as oleoresins and flavonoids for export and production for tourism.
- Forestry
- New housing developments, light industrial plant, green spaces.
- Conservation
- Recreational, eco-tourism, heritage, health and retirement tourism.
- 3rd generation biofuels

Nutraceuticals and functional foods

- NCDs (CVD, cancer etc) are already the major killers – will be more so in future as result of ageing populations.
- By 2050 over 1/3rd of Europeans will be aged 60 or over; there will be two pensioners for every child. China's demographic transition will be even more abrupt.
- Nutraceuticals/functional foods: actives and micro-nutrients, mostly plant extracts, used to reduce the impact of age-related degenerative disease.
- The actives concerned can be given in medical formats (*nutraceuticals*) or used as food additives in standard food products (*functional foods*) as a cost-effective way of raising the health status and average life expectancy of a population.

Nutraceuticals

- A Clayton and C Staple-Ebanks. Nutraceuticals and Functional Foods: A New Development Opportunity for Jamaica: Market-Scoping Study: Technical report for the National Commission on Science and Technology. EFJ, Jamaica, 2002.

Another missed opportunity?

The Economist

Oct 29th 2009

- Sales of functional foods in western Europe grew by 10.2% a year between 2004 and 2007.
- In America, sales of functional foods grew by 15.8% a year between 2002 and 2007, compared with overall food-sales growth of 2.9% a year.
- PricewaterhouseCoopers predicts that the global market for functional foods will grow in value from $78 billion in 2007 to $128 billion in 2013.

Biofuels

- **G 1:** cane/corn derived ethanol. Energy balance ratio for corn = 1.3/1, sugar = 8/1.
- **G 2:** cellulosic ethanol. EBR for cellulose = 12/1 to 16/1

But – G1 and G2 biofuels cannot solve our energy problems; if the US converted all its available biomass into ethanol, it could only displace 30% of its current gasoline demand.

- **G 3:** Algae can produce 10-20,000 gallons of fuel per acre per year, so 85 billion gallons (sufficient for all US transport) could be produced on 15,000 square miles (4.5 million acres), about the size of the State of Maryland.
- The US farms 938 million acres; fuel would take 0.47%.
- **G 4:** Synthetic biology/genomics: turn organisms into bioreactors to make fuel.

Recent projections

- Trials suggest that GM algae can produce long-chain hydrocarbons which can be refined into synthetic high-octane gasoline. This is compatible with refineries, filling stations and cars, does not have contaminants such as sulphur, nitrogen and benzene, will have higher energy density and offer more complete combustion than gasoline and diesel.
- Process uses non-arable land, non-potable water, delivers 10-100 times more energy per acre than cropland biofuels.
- GM algae may grow faster (* 2 mass in 1 hour), fix nitrogen from air.
- Production costs are still high; cost-effective algae-based biofuels by 2012-2015, replacing gasoline by 2020.

Microalgae can double their mass several times per day, produce 15-30 times more oil/acre than oil plants. Inputs: sunlight, CO^2 and nutrients (from e.g. sewage). Absorb atmospheric CO^2 while growing (although released again when fuel is burnt).

Production is continuous; mature algae skimmed every day (unlike oil plants). Oil is high in triglycerides, can be mixed with alcohol (e.g. ethanol) to produce biodiesel and glycerol (transesterification).

Algae in high-density vertical bioreactors

Picture from Vertigro Global Green Solutions

http://www.abc.net.au/science/news/stories/2007/2064607.htm

Prototype bioreactor

This is not an information problem

Proposal 1: key recommendations:

1) Break up the estates into smaller holdings, allocate the land to the workers.
2) Diversify out of cane into other tropical products.

British Sugar Commission, 1897

Proposal 2: key recommendations:

1) Break up the estates into smaller holdings, allocate the land to the workers.
2) Diversify out of cane into other tropical products and energy.

Jamaica Observer, March 1st 2009

The decisions to date have been:

- Dominated by sugar interests
- Taken without consideration for cross-sectoral effects (e.g. environment)

BUT

☑ There is still a strong wish to achieve a viable future

☑ Sufficient technical capacity

So the problem has been:

✘ Weak governance, lack of resolve, denial, 110 years of political failure to arrive at a solution, policy incoherence.

✘ EU locked in to failed models of development.

The Great Ethanol Disaster

Jamaica Ethanol shuts down plant, cuts 31 jobs

Jamaica Observer Wednesday, August 03, 2011

JE started ethanol operations in 2006 to take advantage of the price differential between Brazilian ethanol exported directly to the US and Brazilian ethanol processed in the Caribbean. CBI countries could supply up to 7% of US ethanol duty-free.

So Jamaica Ethanol imported hydrous ethanol from Brazil and processed it into anhydrous ethanol.

Now, due to US financial constraints, the industry is bracing for the possible end of the CBI tariff differential.

Petrojam Ethanol which began operating in 2005 also shut down its plant temporarily.

Thank you !