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The background of the slide features a light green and yellow color scheme with a grid pattern. Overlaid on this are four stylized globes, each showing a different continent (Asia, Africa, South America, and Europe) in a darker shade. The text is centered over these globes.

Agricultural and Bio-Fuel Programs for Rural Development

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Bio-Fuels and the Global Energy Economy

- **Rising Fuel Prices, Growing Energy Demand, Concerns of Global Warming and GHG emissions**
- **These have all pushed for a keener interest in renewable energy sources – particularly in bio-fuels**
- **Energy security concerns and import-substitution are also factors**
- **Also the desire to expand markets for crops (in face of world trade outlooks)**

Bio-Fuels and the Energy Portfolio

- **‘Bio-fuels’ in a broad sense already constitute a sizeable share of energy consumption in many countries – especially poorer regions where access to electricity and refined fuel is scarce**
- **Many of these rural consumers of bio-fuels for heating, cooking and lighting are rationed out of the marketed fuel products by low incomes**

Bio-Fuel Feedstocks and Products

Biomass Feedstocks	Bio-fuel produced	Energy services
Agriculture and forestry residues	Wood pellets, briquettes, biodiesel	Heat, electricity, transport
Energy crops: biomass, sugar, oil	Char/charcoal, fuel gas, bio-oil; bioethanol	Heat, electricity, transport
Biomass processing wastes	Biogas, bioethanol, solvents	Transport
Municipal waste	Refuse-derived fuel, biogas	Heat, electricity

Source: Adapted from IEA Bioenergy 2005

Bio-Fuels for Transport Energy

- **Bio-fuels are most commonly discussed in the context of transportation energy demands, which embodies much of the industrialized country demand**
- **Most production facilities for bio-ethanol or bio-diesel for transport are concentrated in relatively few countries**
- **For ethanol from sugarcane or maize, Brazil leads, with US following closely – then China.**

Bio-Ethanol Production

Country or Region	2005 Ethanol Production (million liters)	Share of Total (percent)
Brazil	16,500	45.2
United States	16,230	44.5
China	2,000	5.5
European Union	950	2.6
India	300	0.8
Canada	250	0.7
Colombia	150	0.4
Thailand	60	0.2
Australia	60	0.2
World Total	36,500	100.0

Source: Licht, 2005.

Bio-Diesel for Transport Energy

- **Bio-diesel is the other major bio-fuel product for transportation which uses a different conversion process (trans-esterification) and a different set of feedstock crops**
- **The oil crops that are feedstocks for bio-fuel are largely lower-yielding – and require more land area (although lower in fertilizer, labor and water input demand)**
- **EU (oilseeds) leads with US (soybean) and others following**

Bio-Diesel Production

Country or Region	2005 Biodiesel Production (million liters)	Share of Total (percent)
Germany	1,921	54.5
France	511	14.5
Italy	227	6.4
Austria	83	2.4
Denmark	80	2.3
United Kingdom	74	2.1
Czech Republic	68	1.9
Poland	68	1.9
Spain	57	1.6
Sweden	9	0.3
Other Europe	23	.06
Europe Total	3,121	88.6
United States	290	8.2
Other	114	3.2
World Total	3,524	100.0

Source: Licht, 2005.



Bio-Fuels and Land Use

- **While some Bio-Fuel feedstock crops can occupy potential prime food-producing land (grain, root and sugar crops), others can thrive on more marginal lands with lower input levels (oil crops)**
- **Switchgrass and other rangeland grasses or tree products compete even less with agricultural land – but require cellulosic conversion technologies not quite ready for large-scale, economically-competitive use**



Global Supply-Demand Distribution

- **Somewhat ironic that the countries with the best climates for feedstock crops are not the ones with the greatest demand for fuel (Sub-Saharan Africa) – role for trade**
- **Both production economics and environmental comparative advantages determines the prevailing feedstock (sugar in Brazil, oil crops in India) – and domestic agricultural support can be an influence (soybeans in the US)**



Potential for Agricultural Development

- **The potential for trade in feedstock crops is an opportunity for developing agricultural economies – a means of expanding markets**
- **Obviously domestic trade barriers matter**
- **Domestic bio-fuel production can also increase markets for feedstock crops – but what are the pre-conditions, in terms of agricultural development?**
- **The question of the ‘chicken-and-egg’**



Rural Potential for Feedstock Supply

- **Many use potential bio-fuel feedstocks as livestock feed (although this may apply more to stalks and residues that are used more for domestic burning than commercial conversion)**
- **Commercialized, large-scale agriculture create much different economies for bio-fuel production, in terms of distribution, storage and processing costs than small-holder, low-density, family-labor farms in developing regions**

Countervailing Impacts to LDCs

- **Bio-fuel production in industrialized nations could soak up the excess supply of feedstock that would otherwise be put on global food markets (and lower prices)**
- **Has to be balanced with the effects of higher food prices on net consumers and poor, vulnerable & food-insecure hholds**
- **Domestic policies in industrialized countries could shift away from support of high-value export crops of developing countries (cotton) towards feedstocks (generating benefits) – but have to look at the net effect of all impacts**

Duality of Bio-Fuel Capacity and Food Security

- **The development of domestic bio-fuel production capacity need not crowd out the strengthening of food systems and enhancement of food security – they can be complementary and interact synergistically**
- **The pre-conditions for the development of bio-fuel capacity can be the very same ones for ensuring the proper functioning of food systems**
 - **Efficiency in storage, distribution and processing**
 - **High productivity to maximize returns to land**



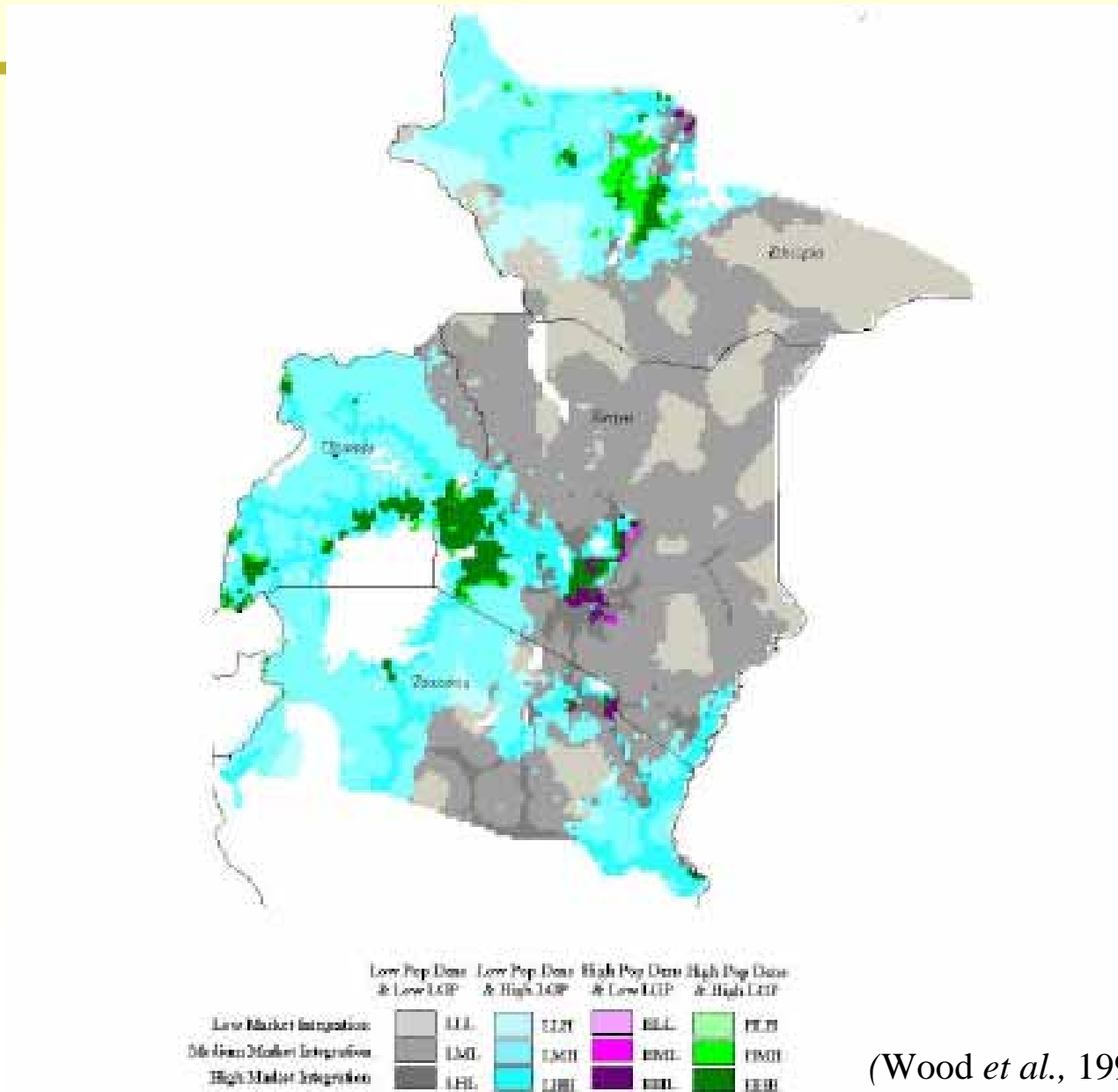
Duality of Bio-Fuel Capacity and Rural Development

- **A parallel duality and synergy could also exist between the emergence of bio-fuel capacity and rural socio-economic development**
- **The duality might differ in nature and scale when considering bio-fuels for domestic heating, lighting and cooking uses (as opposed to transport) – but exist, nonetheless**
- **Poor rural infrastructure will limit the marketability of feedstocks and favor the domestic uses of bio-fuel products**
- **Where to target this kind of development?**

Development Domains

- **Using purely bio-physical characteristics to target favorable areas for crop productivity enhancement misses important constraints to long-term development**
- **Accounting for access to markets (in terms of proximity to population centers and good roads) is also important**
- **Myriad cases of enhanced crop productivity that went nowhere because of missing marketing, storage and distribution facilities (boom-bust)**
- **Explains low-input usage in much of SS Africa**

Mapping Development Domains



(Wood *et al.*, 1999)



Targeting Rural Agricultural Development

- **Given the abundance of rural poor dependent upon agriculture – a logical target for development is in complementary infrastructure that can help agricultural growth but also lead to off-farm income opportunities (from mkts)**
- **These types of development enhance food security through higher productivity, and strengthening the performance of food systems (storage, distribution, marketing, processing)**
- **All these developments are complementary with enhancing the potential for bio-fuel development**
- **Economic growth → energy demand → bio-fuels**

Summary (1)

- **The impacts of global bio-fuel development and growth on rural poor can be mixed – both positive and negative**
- **Trade-related impacts can be complex – some working in favor of rural poor, and others working against (higher prices, trade policy shifts)**
- **Not necessarily a ‘crowding-out’ effect – there’s room for complementarity and synergy**
- **There is a duality between rural development and socio-economic growth and bio-fuel capacity potential**

Summary (2)

- **The extent of rural infrastructural development determines the exact nature of the dualistic relationship and its scale and scope**
- **Targeting rural development towards those domains with high development potential can achieve multiple goals contemporaneously**
- **Rural agricultural development and socio-economic growth can go hand-in-hand with enhancement of off-farm opportunities and market access for food and non-food goods**
- **These all build towards food-security, growth and expansion of renewable energy capacity**