Bioenergy is part of the energy mix

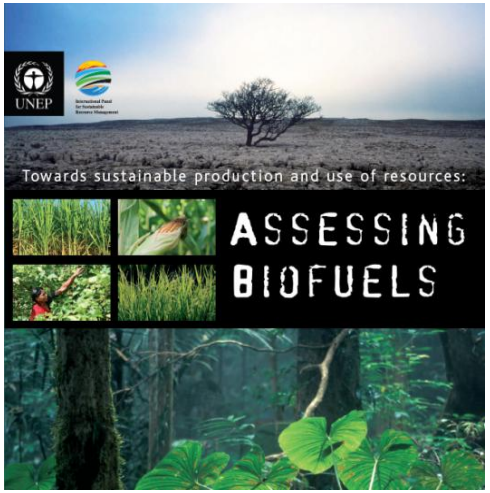
- modern bioenergy can help increase access to energy
- the actual mix depends on the country context

Not all biofuels are equal

- Not all biofuels perform equally well in terms of their impact on climate change, energy security and on ecosystems.
- Environmental and social impacts need to be assessed throughout the entire life-cycle.

Putting biofuels into perspective

- sound policies and planning
- global trends, including population growth, yield improvements, changing diet patterns and climate change



Water: a limiting factor

- Water quality
- Water consumption

Reducing pressures

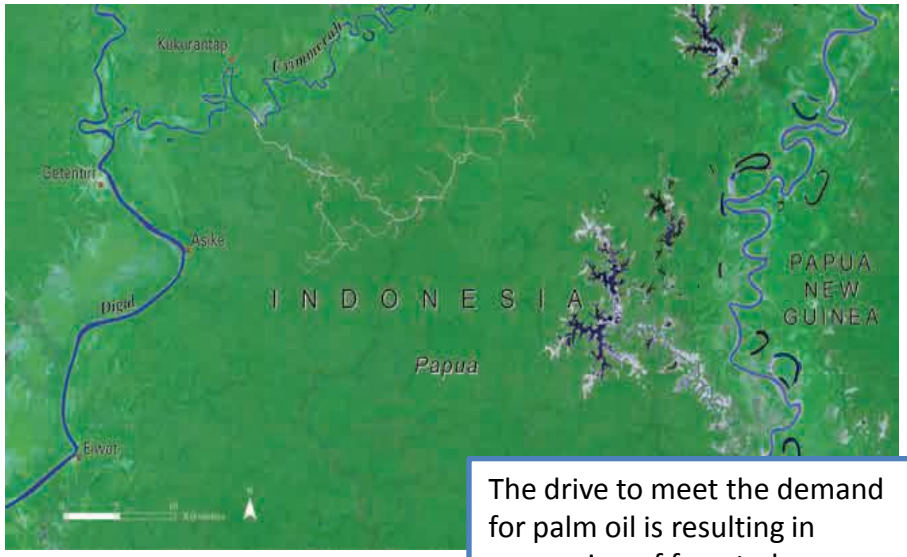
- Improving the production of biomass (yield increases; restoring formerly degraded land)
- Using biomass more efficiently (waste and residues; combined systems)

Land: a limiting factor

- 4F: Food, Feed, Fuel and Fibre
- Land conversion can lead to negative environmental impacts including on biodiversity, GHG balance and food security

Land - a limiting factor

- **Conservative estimates of projected land use for biofuel crops vary between 35- 166 Mha for 2020.** Ravindranath et al (2009) estimated that 118-508 Mha would be required in 2030 to provide 10% of transport fuel demand with 1st gen biofuels.
- Estimates of long-term potential land requirements for biofuels vary widely and depend on the basic assumptions made - mainly type of feedstock, geographical location and level of input and yield increase.
- **There is little truly 'unused land'; hence biofuel development may come with land use change, both direct and indirect.**
- **Land use change has a range of potential implications, including on GHG balance, biodiversity and ecosystem services, and on land tenure and food security.**



The drive to meet the demand for palm oil is resulting in conversion of forested areas into palm oil plantations.

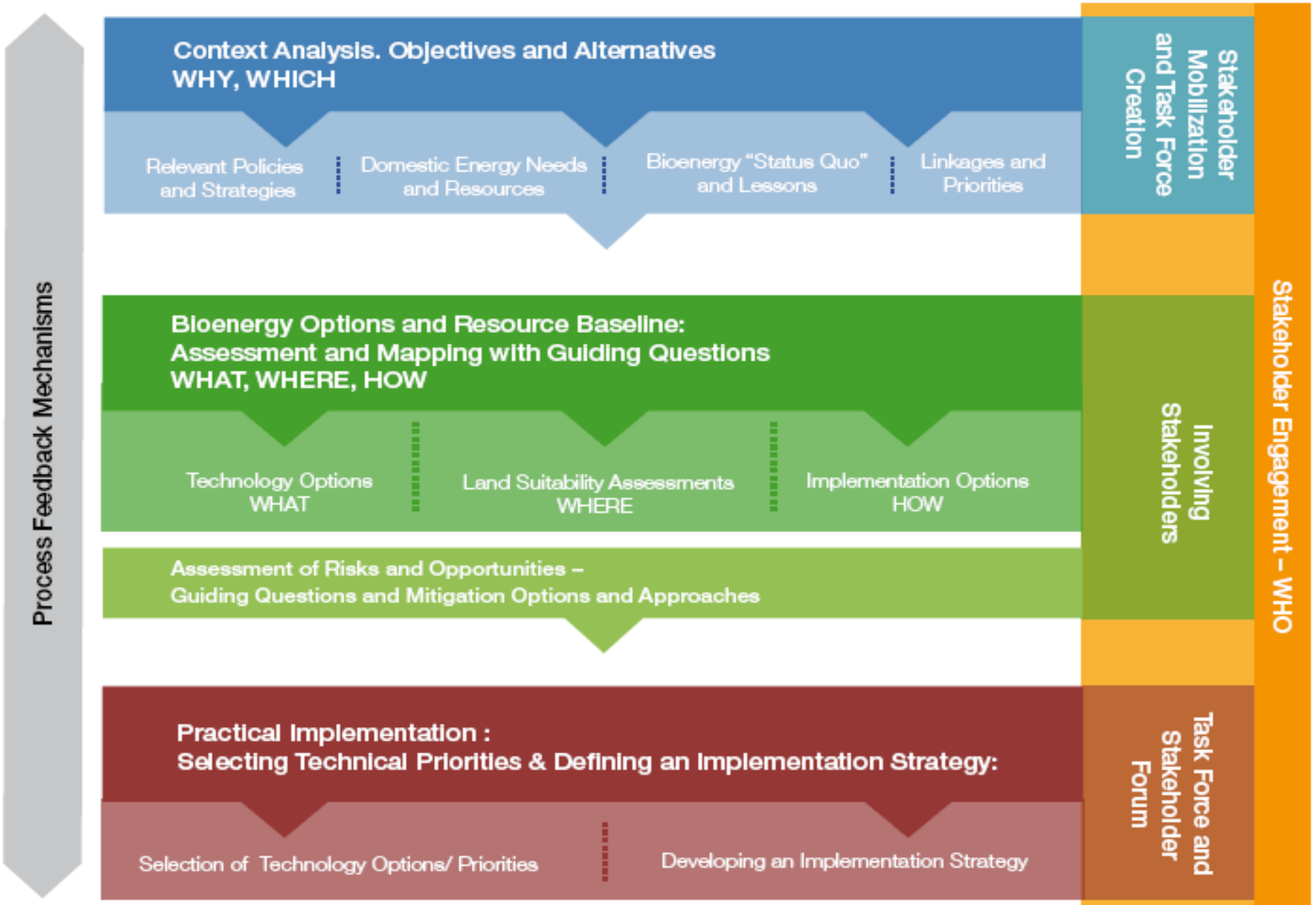
These satellite images reveal how a combination of transmigration, logging interests, and palm oil plantation development have transformed an area that was previously tropical lowland rain and swamp forest.

Source:
UNEP Atlas One Planet - Many People

Water - a limiting factor

- **Water is already a scarce resource.** By 2025, 2/3 of the global population will be living in areas experiencing water stress. Agriculture is consuming approx. 70% of global freshwater supplies.
- **Water quality** is alarming. Nutrient loads in freshwater bodies from agricultural runoff, household waste and effluents from industry have resulted in eutrophication and hypoxia in some regions.
- **Expanding and intensifying bioenergy production add to existing pressures,** depending on regions, climatic conditions, and choices in feedstock, production methods, conversion technologies and end product.
- Extreme weather events due to **climate change** may increase uncertainty.
- Addressing potential environmental (ecosystem services), social (access to water) and economic (GDP) implications is critical.

UN Energy, Bioenergy Decision Support Tool



WHERE?

Determining a country's potential for bioenergy production must **build upon an assessment of the suitability and availability of land resources**.

- conduct a land **suitability assessment** to identify land that holds promise for feedstock production and map suitability and potential yield across the country
- identify and map **areas of special sensitivity**, i.e. 'high risk areas' in terms of potential damage to vital ecosystem functions
- identify and map **existing agricultural production areas**; assess the likely expansion path for food production over the short to medium term
- overlay **infrastructure information** to evaluate market accessibility and the economic feasibility of feedstock production
- conduct '**ground-truthing**' in areas that have been identified as areas having potential for feedstock production, to complement the top down approach by involving local communities and other relevant stakeholders

mapping and zoning

- **Building blocks for a solid mapping methodology**

  The level of detail (i.e. scale and accuracy) for each variable matters; and the optimal data is a decision between availability and cost.

- **Data collection may present a particular challenge for developing countries.**

- **Data gaps** have been identified, particularly regarding biodiversity (only information on PAs designated under the CBD and Wetlands under the Ramsar Convention is easily accessible).

- In areas of special ecological sensitivity and concerns for food security appropriate **mitigation measures and good practices** that safeguard these areas and food security are a conditio sine qua non. The burden of proof is high; in doubt the area should be classified 'exclusion zone'/'no go area'.

Land Suitability

- Agro-climatic:
  Water Balance
  Temperature
- Edaphic:
  Topography (altitude and slope)
  Soils
- Climate change outlook/ adaptation

Land availability

- Environmental screening/ sensitivity areas
- PA
- Ecosystem services
- Wildlife
- HCV
- LCV/degraded land
- Land cover

Social

- Cultural / medicinal use areas
- Current land use / Food/Fodder
- Urban
- Conflict
- Archeological
- Land tenure

Infrastructure / logistics

some mitigation options

- **waste and residue use** – with caution applied to sustainable levels of residue extraction (soil quality; forest management);
- **use of marginal and recovery of degraded lands** – the definition matters as some of these lands are actually in use (pastoralists, subsistence farmers, wildlife corridors, filtration of water), and trade offs with input levels need to be considered;
- **yield improvements** – in many developing countries yields are way below the potential; this is due to limited capacity and access to modern technologies (extension services; investments);
- **combined food and energy systems** – for example, intercropping can help improve food security;

- **reducing demand for energy** – improved energy efficiency but also changing production and consumption patterns.