Implications of biofuels on water resources

The main objective of IWMI's work on biofuels is to assess the implications of biofuel production on water resources. Here are some of the findings:

- **Biofuel crops require large quantities of water.** The development of biofuels will have an impact on water, food, energy and the environment. How biofuels will affect these must be considered before going ahead. Pursuing biofuel production in water scarce areas will put pressure on an already stressed resource, especially if it is using a crop that requires irrigation. Additional abstraction of water is likely to have negative impacts on water resources and wetlands.

- **The water requirements for the production of biofuel are mainly related to crop water requirements, particularly where crops are irrigated.** For example a liter of ethanol based on irrigated sugarcane in India requires 3,500 liters of irrigation water; a liter of ethanol based on irrigated corn in China takes 2,400 liter of irrigation. But in Brazil where sugarcane is largely rainfed it only takes 90 liters. In Europe crops for biodiesel (rapeseed) are largely rainfed. In comparison processing typically takes about 4-10 liters of water per liter of ethanol (for cooling and distillation).

- **From a global perspective the impacts of biofuels production on overall water use is modest compared to the amount of water used in food production.** Globally around 7,130 km3 of water is evapotranspired by crops per year, without accounting for biofuel crops . It is estimated biofuel crops account for an addition 100 km3 (i.e. ca. 1.4%). In terms of irrigation water the share is slightly higher because of the relatively large share of irrigated sugar cane in the biofuel mix. Total irrigation withdrawals amount to 2,630 km3 per year globally of which 30.6 km3 (i.e. 1.7%) are used for biofuel crops. Globally, there is enough water to produce both food and biofuel. But, in countries where water is already scarce growing biofuel crops will aggravate existing problems.

- **However at individual country level the situation is more serious, in particular for China and India.** Both countries, the world's two largest producers and consumers of many agricultural commodities, already face severe water limitations in agricultural production, yet both have initiated programs to boost biofuel production. If implemented, the strain on water resources would be such in China and India that it is unlikely that policy makers will pursue biofuel options, at least those based on traditional field crops. Both countries are exploring the use of alternative crops.

- **Environmental and water impacts depend on both the type of crop used in the biofuel production and where the crops are grown.** From a water perspective it makes a large difference whether biofuel is derived from fully irrigated sugarcane grown in semi-arid areas or rainfed maize grown in water abundant regions. The use of water-extensive oilseeds (such as Jatropha trees), bushes, wood chips and crop residuals (i.e. straw, leaves and woody biomass) is promising in this respect, though a few caveats are necessary. With existing technologies biofuel yields from Jatropha trees are fairly low and processing is relatively expensive. Crop residuals, grass and tree leaves often are used as animal feed or organic fertilizer.

- **Option to reduce the water footprint of biofuels include:**
  1) Grow less thirsty biofuel crops with the caveats mentioned in the bullet point above
  2) Grow energy crops under rainfed conditions, where possible
  3) Improve the water productivity of biofuel crops
  4) Grow biomass for energy in multifunctional plantings. For example coppice, shrubs and grass may act as vegetation filters for treatment of nutrient-bearing water (wastewater from households, runoff from farmlands, or leachate from landfills). Soil-covering plants and vegetation strips can also be located to limit water erosion, reduce direct surface runoff, trap sediment, enhance infiltration and reduce the risks of shallow landslides. This may have positive effects for downstream water resources.

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