

This response was submitted to the consultation held by the Nuffield Council on Bioethics on *New approaches to biofuels* between December 2009 and March 2010. The views expressed are solely those of the respondent(s) and not those of the Council.

The Linnean Society of London

QUESTIONS ANSWERED:

Question 1

ANSWER:

We consider the move towards greater use of biofuels, including future generation, to be very hazardous and unsustainable (for explanations see below)

Question 2

ANSWER:

Our planet has limited land surface to preserve natural ecosystem functions and food production for a growing world population. In virtually all documented and projected cases large-scale use of biomass for biofuels will compete with food production and harm the last remnants of land (including marginal lands) for the conservation of biodiversity and the huge ecosystem functions of the habitats that harbour that biodiversity. These problems are self evident for first generation biofuels from for instance oil palm, corn or sugarcane, but are also inherent in any upscaling of the use of biomass for second generation biofuels. Furthermore the use of whole plant/crop for dual food and biofuel use will lead to depletion of soil minerals and soil biodiversity and thus be unsustainable.

Question 3

ANSWER:

Yes, the Linnean Society of London has a keen interest in all interactions of man with his environment. Some of us have organised national and international symposia on the interaction of Biofuels and Biodiversity, most recently at the international Open Science Conference of Diversitas in Cape Town, South Africa (October 2009).

Question 4

ANSWER:

The financial benefits for large energy companies and other interest groups to produce biofuels (often initiated with government subsidies) will put heavy pressure on governments and parliamentarians not to listen to the scientific arguments demonstrating the unsustainability or limited contributions to energy security and climate mitigation of biofuels

Question 5

ANSWER:

The key principle in identifying potential biofuel sources is to base these on a thorough and integrated assessment of their overall sustainability, that is their direct and indirect impacts on greenhouse gases as well as on other environmental sources, including biodiversity, soils and water, on people and landscapes. In this respect 2nd and 3rd generation technologies THAT USE URBAN WASTE should be encouraged. On the other hand, all first generation biofuel crops should be discouraged - even as an intermediate solution, because their effects on land use and ecosystems (as well as carbon emissions - notably the peat forest - oil palm plantation conversion) are disastrous. Second generation biofuels, using waste material, have better potential, although the conversion of all agricultural or forestry waste into biofuels will have a negative effect on soil productivity and soil biodiversity, because a fair portion needs to be ploughed back into the ecosystem. The use of micro-algae may be more promising, although the conversion of large land or ocean surfaces to industrial micro-algal cultures clearly has its limitations as

well as yet unforeseen negative impacts. However, it seems increasingly evident that GHG emission savings can much better be achieved by solar, hydraulic, and wind energy and by energy-saving measures than by large-scale use of biofuels. The taboo on nuclear energy should also be reconsidered.

Question 6

ANSWER:

Energy security should not be a primary driver in the development of new generation biofuels. In the answers to questions 1-5 the reasons are given why upscaling the use of biofuels should NOT be encouraged.

Question 7

ANSWER:

See questions 1-5. For sustainable economic development, in most cases discouragement is better than encouragement. Development of technologies to create bio-energy from waste are the exception to the rule. Simple biofuel technologies for local energy security in developing countries may be promising for economic development, although great care should be taken not to create new problems by solving old ones (e.g. the competition for water by biofuel crops such as Jatropha, which will certainly aggravate water resources in semi-arid regions of the world). Unfortunately the experience with local biofuel production in the developing world is very negative; instead of promoting rural economic development, multinational corporations have disenfranchised local farmers and small businesses.

Question 8

ANSWER:

In the final analysis NONE of the approaches to biofuel feedstock development (and thus for pretreatment and processing) will contribute to energy security or climate mitigation (see question 1).

Question 9

ANSWER:

ADVANCED PLANT BREEDING STRATEGIES - No, even very highly productive biofuel plants will put too heavy demands on land use. GENETIC ENGINEERING - As above. SYNTHETIC BIOLOGY - Perhaps for micro-algal production of high energy oils and very energy efficient conversion of waste materials by micro-organisms. In all cases a precautionary approach should be adopted, and on a case-by-case basis the impacts on environment (local and global) in short, medium and long term be considered.

Question 10

ANSWER:

No comment.

Question 11

ANSWER:

Our problem is that it is NOT CONSTRAINED ENOUGH by demands that all R&D approaches to Biofuels should include the effect of biofuel production on land use (especially on unethical competition with food production), ecosystem services and biodiversity conservation. For example, many economists think it is highly beneficial for development in third world countries to grow biofuel crops on marginal lands, especially Jatropha. Jatropha and other plants that would do well on such poor lands are, however, invasive species that rapidly destroy the ecosystems of the whole region and are so good at utilising water from the soil, that they will predictably cause future problems for water supply (and water is a more

vital commodity than fuel in these countries!). A very good reason for the Republic of South Africa to ban *Jatropha* as a biofuel crop. Many other species could be cited with such side effects, that MUST be taken into account.

Question 12

ANSWER:

R&D should be targeted at stopping the Biofuel Diesel Locomotive, and look for other solutions like energy saving (50% is realistically achievable with clever investment), solar, wind and nuclear energy.

Question 13

ANSWER:

It is not entirely clear what is meant by "new approaches" here. If second and third generation biofuels are meant, the answer is that so-called "waste" from agriculture or forestry, using biomass that traditionally is recycled back into the soil, also places additional pressure on land use that should be targeted for food production or general ecosystem services. Covering thousands of acres with algal cultures also puts pressure on land use.

Question 14

ANSWER:

There are no fundamental differences, but in tropical countries the habitat protection may be more difficult on account of governance and accountability problems.

Question 15

ANSWER:

Yes. We should not ignore the impacts of new generation biofuels. It should be taken into account when drawing up and revising default emission footprints of each feedstock/processing chain. It should also be taken into account in drawing up support mechanisms and targets, i.e. the cumulative effects.

Question 16

ANSWER:

As evident from the above answers we see many potential disadvantages for environmental and social security. ROBUST standards of environmental and social sustainability should be set, including the protection of species and habitats that are of importance at local, national, regional and global levels. If these are operating effectively they should serve to constrain and limit production of future generation biofuels. Weak standards would only serve to "greenwash" production (as in the case with the current biofuel criteria within the Renewable Energy Directive) and provide no real environmental and social protection.

Question 17

ANSWER:

Yes, if - as we believe - these new technologies use any significant amount of land and other natural resources like water they will lead to displacement of food production and increased food prices. See also answers to earlier questions.

Question 18

ANSWER:

The poor in developing countries are of course much more vulnerable to decreased food security and increasing food prices than the rich in the developed world. It is very sobering to realise that the energy security problems are largely due to high energy consumption in the developed world, and that developing countries are the victim of our unsustainable hunger for fuels and other global resources.

Question 19

ANSWER:

Yes, just as current biofuel (or indeed many other commodities) production is. For instance, in the tropics small farmers are disenfranchised by large companies who convert land to huge oil palm and *Jatropha* plantations or sugarcane estates.

Question 20

ANSWER:

See above.

Question 21

ANSWER:

See answer to question 12.

Question 21

ANSWER:

See answer to question 12.

Question 22

ANSWER:

See answer to questions 1 and 11.

Question 23

ANSWER:

See above. Please do NOT incentivise!

Question 24

ANSWER:

No.