

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.

## **QUESTIONS ANSWERED:**

### **Question 1**

#### **ANSWER:**

In my view, the rapid development of new biofuels markets has been driven by short-term economic interest, with public debate, adequate regulation and oversight trailing behind. I believe there is a role for the use of some biofuels, but we need to recognise that this will be relatively limited in scale if they are not to have important negative consequences for society. They are certainly not a panacea for climate change, and could make things worse, not better, unless well regulated.

### **Question 2**

#### **ANSWER:**

Some focus on the interesting dilemmas posed by synthetic lifeforms, but in my opinion this is a distraction from the most important ethical issues, which relate to land use change and biodiversity loss. If we continue to appropriate an ever larger proportion of the earth's surface for human needs, we leave ever less space for the other species that share this planet, and because extinction is forever, we are making irreversible choices on behalf of future generations, with little consideration of their interests. This applies especially to first-generation biofuels, but future generation biofuels such as lignocellulosic or algae are also likely to demand huge areas of land unless they are very tightly regulated.

### **Question 3**

#### **ANSWER:**

Reasonably well informed. I am an academic and get most of my information from the peer-reviewed literature.

### **Question 4**

#### **ANSWER:**

It seems likely that economic justifications and powerful industry lobbies will be most important in driving biofuel development. Governments and regulators should strive as much as possible to step back from the issue, and make decisions based on the ability of new technologies to provide solutions to climate change and rural development, not their ability to make money for corporations at the expense of society and the environment. In terms of extra advantages, biofuel production could be integrated with waste disposal, wastewater amelioration, CO<sub>2</sub> scrubbing of factory emissions, etc. - a positive synergy, but one that will be inevitably limited in scale.

### **Question 5**

#### **ANSWER:**

New biofuels that do not contribute to additional demand for land are those that are most likely to help. They could be encouraged by tight regulation of land-demanding biofuels, and by explicitly directing support towards developing non-land-demanding feedstocks. One reason to be very cautious of lignocellulosic biofuels is that it could lead to a situation where any natural vegetation becomes a potential feedstock - incentives to "woodchip" rainforests for biofuel production would be a perverse but not inconceivable outcome (e.g., at present, rainforests in Sumatra are being pulped for paper production, a model that could be easily adapted to biofuel production).

### **Question 9**

**ANSWER:**

I think all of these technologies are appropriate under some circumstances, if the risks are assessed and controlled. However, there could be a risk of focusing on the development of lignocellulosic or other crops to the detriment of R&D on food crops.

**Question 10****ANSWER:**

Intellectual property and access issues are probably the single greatest issue that has hampered the development of GM crops. For that reason, it would be important to consider ways in which R&D can continue to be incentivised and rewarded, while making as much information as possible publicly available.

**Question 13****ANSWER:**

Yes. When algal and lignocellulosic feedstocks prove profitable, there will be incentives to establish them on a massive scale. Although they have potential to be much higher-yielding than first generation feedstocks, they still have enormous potential to cause direct and indirect land use change, that could potentially negate many of their GHG benefits. Algal biofuels could pose a particular threat to freshwater and shallow marine ecosystems (marshlands, mangroves, mudflats, coral reefs), which often have high biodiversity. Lignocellulosic biofuels could incentivise the conversion of carbon-rich habitats such as forests and woodlands, for conversion into ethanol, which could make economic sense but be perverse from the perspective of GHG emissions.

**Question 14****ANSWER:**

There are several important differences. 1. Developing countries typically have less capacity to regulate, so the letter of the law is less likely to translate into responsible behaviour on the ground. 2. The largest, most intact and richest habitats for biodiversity are in developing countries, therefore the threats are potentially much greater. 3. There are greater development needs and population growth rates in developing countries. Conflicts with other objectives, such as food production, is likely to be greater. 4. Land tenure is often informal or poorly defined in developing countries, so there is a greater risk of poor people being dispossessed of their land for large scale deployment of, say, lignocellulosic crops. Having said this, there are also considerable opportunities in developing countries to increase yields on existing lands (e.g. co-production of food and lignocellulosic feedstocks), more so than in developed countries where land is already more intensively used. Deserts are mainly in developing countries, and could potentially be suitable sites for algal biofuel production, with minimal impacts on rural people or on biodiversity.

**Question 15****ANSWER:**

Absolutely, yes. In some cases, consideration of iLUC could change the picture from a beneficial effect of biofuels to a negative effect on climate, therefore it is essential that this is taken into account - despite the fact that it is difficult and complex. There are several streams of work ongoing about how to do this. I am skeptical that specific indirect land use changes can be reliably associated with particular developments of biofuels, so it should be the marginal contribution of new crops to aggregate land-use change that is considered. In some cases, such as algae in deserts, there might not be any iLUC.

**Question 16****ANSWER:**

Potential advantages: amelioration of air and water pollution and other waste streams by using waste products to produce biofuels. Potential disadvantages: Incentives for further land-use change, especially in high biodiversity, high biomass, high productivity areas. I am skeptical that developing crops that could grow in hostile conditions (high salt, or in deserts) would have overall positive environmental effects. It might avoid competition with food crops, but that would be a neutral rather than a positive impact. For such crops to be high yielding, they would require water and energy inputs. Even if seawater was used, this could make areas of land unsuitable for future use, and would require considerable infrastructure. I am also highly skeptical of the idea that new crops could "create new habitats". Why would growers use inhospitable parts of the planet for production when regulation is lax enough that they can plant in high-rainfall areas with reasonable soils? If we want, as a society, to create new habitats for biodiversity conservation, let's do that, but I very much doubt that the contribution of next-generation biofuels to this objective would be positive overall. In my view there is a substantial risk of unsustainable harvesting of wild biomass, and land-use conversion of natural habitats, for lignocellulosic biofuel production. It is clear that many governments do not have the capacity to regulate this area, so importing countries (e.g., EU, USA) should show restraint in implementing incentives. Additionally, some form of global regulation is required - perhaps an international treaty designed to avoid environmental harm from biofuel production.

#### **Question 17**

##### **ANSWER:**

Both algae and lignocellulosic biofuels are quite likely to compete to some extent with food crops, as there will be economic incentives to produce them on flat land, with accessible water supplies, good infrastructure and high insolation. The new approaches themselves do not avoid these issues, so strong regulation will be needed. The new approaches do raise the possibility of being able to produce feedstocks with minimal impact on food production, but this will remain only a hypothetical possibility unless the right incentives and controls are in place.

#### **Question 18**

##### **ANSWER:**

Agriculture in developing countries is typically much further below its yield potential, so there is potential to increase yields greatly and produce some biofuels (e.g. from co-products such as bagasse) without compromising food production. However, the food needs of developing countries (population x need for better diets) are also growing at least as rapidly as past rates of yield increase, so any new technology that competes with food crops (e.g. lignocellulosic crops) could adversely impact food security.

#### **Question 19**

##### **ANSWER:**

Land tenure is one of the important issues. New approaches could offer new economic opportunities for small farmers and workers, but there is also the risk of them being dispossessed of their land and other rights.

#### **Question 20**

##### **ANSWER:**

Developing world: land tenure rights often informal or poorly defined. Governments often have less capacity to provide adequate protection for workers' rights.

#### **Question 21**

##### **ANSWER:**

General comment: I think investment should be directed into new technologies that use waste, are

compatible with rural development, and are not likely to lead to large-scale land-use change.

**Question 22**

**ANSWER:**

Any biofuel feedstock that contributes to land-use change or large-scale harvesting of wild biomass needs to be approached with great care. Technologies that use waste products are likely to pose lower risks.

**Question 23**

**ANSWER:**

In the long run, effective regulation will do much to build consumer and market confidence in the sustainability of biofuels, so credible regulation is needed if they are to be promoted effectively. Regulation should include effective measures to control land-use change impacts, through, for example, comprehensive land-use planning. Consideration could be given to international policy measures, such as a convention on sustainable biofuels.

**Question 24**

**ANSWER:**

Thoughtful consideration of our ethical obligations towards other species would be useful - to what extent is avoiding the destruction of other species an ethical issue? Intergenerational justice is another major topic. We are making decisions today that will in some cases irreversibly change the nature of the biosphere. How much consideration do we owe future generations who have no say in these decisions?