Annex B: Some Thoughts on GMOs and Organic Agriculture

On Genetically-Modified Organisms

1. We have not included genetically-modified organisms as variables in this project. Given the current extent of commercially-cultivated GMOs, some farmers may be using them in sustainable agriculture projects, in particular for cotton in China, and soybeans in Argentina and southern Brazil. The expansion in the cultivation of GM crops has been very rapid in recent years. The first year to see commercial cultivation of GM crops (soya) anywhere in the world was 1995. In 1996, 1.7 million hectares were planted (not counting China), rising to 11 million ha in 1997, to 28 million ha in 1998, and over 40 million ha in 1999 (EPA, 1999; James, 1999; Kydd et al, 2000; Chen, 2000; Pretty, 2000b).

2. Only a few years after the development of the first GM crops, it is already clear that opinion on benefits and risk is sharply divided. Some argue that GMOs are safe and essential for world progress; others state they hold too many risks. The first group believes that media manipulation and public scare-mongering are limiting useful technologies; the second that scientists, private companies and regulators are understating hazards for the sake of economic returns.

3. Neither view is entirely correct, for one simple reason. Genetically-modified organisms are not a single, simple technology. Each product brings different potential benefits for different stakeholders; each poses different environmental and health risks. It is, therefore, useful to distinguish between different generations of GM technologies:

    i) *The first generation technologies* came into commercial use in the late 1990s, and have tended not to bring distinct consumer benefits (one reason why there is so much current public opposition). The realisation of promised benefits to farmers and the environment has only been patchy.

    ii) *The second generation technologies* comprise those already developed and tested, but not yet commercially-released, either because of uncertainties over the stability of the technology itself, or over concerns for potential environmental risks. Some of these applications will clearly bring more public and consumer benefits, and include a range of medical applications;

    iii) *The third generation technologies* are those that are still far from market, but generally require the better understanding of whole gene complexes that control such traits as drought- or salt-tolerance, and nitrogen fixation. These are likely to bring more explicit consumer benefits than the first generation.

4. There are five potential environmental risks and two potential health risks posed by GM crops and foods.

    i) Horizontal gene flow (also known as gene exchange or `genetic pollution') to wild or weedy relatives of crops, and/or to bacteria in soils or human

guts;

ii) Emergence of new forms of resistance amongst insect, nematode, or fungal pests, and emergence of secondary pest and weeds problems;

iii) Recombination of viruses or bacteria to produce pathogenic strains (`super-viruses'), and their possible escape into natural ecosystems;

iv) Direct effects of novel toxins on beneficial bacteria, insects and higher animals, through direct effects from GM pollen on beneficial insects, breakdown of crop tissue and release of toxins (eg *Bt)* into the soil, or sequestration by herbivores into somatic tissue, leading to secondary effects on predators;

v) Changes in farm practice that lead to further loss of biodiversity and/or change to environment (eg changed use of herbicides and other pesticides);

vi) Allergenic and immune system reactions to new substances contained in foods produced by the modified genes and so in both human foods and animal feed;

vii) Incorporation of antibiotic-resistance marker genes from GM foods into bacteria in the gut, leading to spread of antibiotic resistance.

5. As each GM application is potentially different, it requires individual assessment of risks and benefits. A framework for judging risks involves setting the environmental and health benefits on one side of the balance sheet and the risks on the other. The problem that regulators face is that too little is yet known about either of these. The technologies are young, and the risk research continues to identify new areas for both concern and confidence.

6. One of the distinct features of the intense debate about the pros and cons of GMOs is the way that GM has acted as a lightning rod for other concerns about our food and farming systems. Some are specifically about the benefits or risks of GM technologies. Others, though, are about vitally important indirect effects, such as the politics of world agriculture, or the centralisation of corporate power in the food chain. A selection of views includes:

- Some say GMs simply continue to promote `technofix' approaches to modern agriculture, when what is needed is wholesale redesign along sustainability principles.

- Some say GM technologies are essential for feeding a hungry world; others say hunger is a result of poverty, and poor consumers and farmers cannot afford modern and expensive technologies.

- Some say genetic modification across species represents a breakdown of natural species barriers; others say there are many gene sequences common to very

different species and their transfer is simple and straightforward.

- Some say GMOs are contributing to greater consolidation of corporate power in the food system; others that such globalised operations are a necessary and desirable part of economic growth.

On Organically-Certified Agriculture

7. Organic farming is defined as an approach to agriculture where the aim is to create integrated, humane, environmentally and economically sustainable agriculture systems (Balfour, 1943; Lampkin and Padel, 1994). Maximum reliance is put on self-regulating agro-ecosystems, locally or farm-derived renewable resources, and the management of ecological and biological processes. The use of external inputs, whether inorganic and organic, is reduced as far as possible. In some countries, organic agriculture is known as ecological or biological agriculture.

8. We do not focus in this project specifically on certified organic agriculture. A relatively small number of sampled projects/initiatives set out to be organic: 14 out of 208 projects were explicitly `organic'. A much larger number, however, have eschewed purchased inputs owing to domestic economic circumstances. Many others have seen substantial steps taken towards low to zero external input methods. By our definition of sustainability, almost all projects have made substantial use of agro-ecological or organic principles in production processes.

9. The majority, though, are currently using external inputs of some type. The key issues for both sustainability and poverty reduction are:

    i. whether these products cause harm to human or environmental health, and if alternatives could be equally or more effective;
    ii. whether these products are accessible to all types of farmers (particularly smaller and more remote), and whether alternatives based on renewable natural capital are locally-available and more effective;
    iii. whether current reductions in fossil-fuel derived inputs, such as pesticides, could lead to their widespread eventual elimination in certain agroecosystems.

10. Nonetheless, there remains much confusion amongst some commentators and analysts about what is `organic' agriculture, and this has led to many outspoken attacks (cf Borlaug, 1992, 1999; Avery, 1995, 1999; Stott, 1999; Hillman, 2000). Many of these are misguided, in that they see organic methods of farming as a threat to world food security, mainly due to certified organic systems in industrialised countries appearing always to yield less than high-input modernised systems.

11. The prevailing assumption is that any system founded on organic or agroecological principles will fail. But these attacks on organic systems are misguided for several reasons:
    i) these commentators commonly fail to account for the real costs of

producing food (including the externalities);

ii) few analysts argue that industrialised country organic systems should be directly transferred to developing countries;

iii) most food-poor in developing countries are in regions where yields are already low, and where modern agriculture has already failed them;

iv) most sustainable agriculture analysts believe that an agriculture built on agroecological principles and accumulating natural, social and human assets can be highly productive, but that if this is not enough, then external inputs should be used.