

ACRE Consultation

Managing the Footprint of Agriculture: Towards a Comparative Assessment of Risks and Benefits for Novel Agricultural Systems

Response from GeneWatch UK

8th June 2006

GeneWatch UK is a not-for-profit policy research group that monitors developments in genetic technologies from a public interest, environmental protection and animal welfare perspective.

One of our main areas of interest is the risk assessment of GM organisms and how current methods could be improved. For example, GeneWatch, in collaboration with Andy Stirling of the University of Sussex, has undertaken research on comparative assessment methodologies for GM crops, including the development of a new technique, multi-criteria mapping.¹ Copies of the findings of this research are included with this consultation response.

Therefore, GeneWatch welcomes ACRE's recognition of the need to move beyond conventional risk assessments in making decisions about GM organisms. GeneWatch also welcomes in principle the introduction of the concept of comparative sustainability assessment. GeneWatch also very much welcomes many of the references to the need for innovation and transparent evaluation in assessment systems (e.g 4.20) and the search for a methodology that will reveal gaps in knowledge and uncertainty (e.g, 5.9).

We hope our submission will be useful to ACRE in its revision of the report. Although it may sound critical, this is intended to be entirely constructive criticism to support what we think is a far-sighted and progressive step in finding more robust approaches to the evaluation of new technologies. As we explain below, there are several areas where the approach described could be improved by drawing on knowledge and experience of the use of comparative analysis, and multi-criteria methods in particular, elsewhere. We also believe the multi-criteria mapping process that we have been involved in developing deserves attention from ACRE in refining its proposal because it converges with ACRE's thinking and because it has been used in practice. We would be pleased to have the opportunity to present it to the committee.

¹ Stirling, A. & Mayer, S (1999) Rethinking Risk. A pilot multi-criteria mapping of a genetically modified crop in agricultural systems in the UK. SPRU: Brighton; Stirling, A. & Mayer, S. (2000) Precautionary risk appraisal of a genetically modified crop. *International Journal of Occupational Health and Environmental Medicine* 6(4): 296-311; Stirling, A & Mayer, S. (2000) A precautionary approach to technology appraisal? – A multi-criteria mapping of genetic modification in UK agriculture. *TA-Datenbank-Nachrichten* 3: 39-51; Stirling, A & Mayer, S. (2001) Multi-criteria mapping the genetically modified crop debate: A pilot study of a genetically modified crop in the UK. *Environment and Planning C* 19: 529-555; Mayer, S. & Stirling, A. (2002) Finding a precautionary approach to technological developments – lessons for the evaluation of GM crops. *Journal of Agricultural and Environmental Ethics* 15 (1) 57-71; Stirling, A. & Mayer S (2005): "Confronting risk with precaution: a multi-criteria mapping of genetically modified crops" in *Alternatives for Environmental Valuation*, Edited by Michael Getzner, Clive L Spash, and Sigrid Stagl. (Abingdon: Routledge) Pages 159-184.

The need for a broader and more balanced approach to the assessment of the environmental impact of novel crops and agricultural practices

We agree that there is a need for a broader assessment of the impacts of agricultural practice on the environment and that the goal should be to move towards more sustainable systems. The controversy over GM crops has helped force us to consider these issues. GeneWatch has long argued that the framing of the current risk assessment process is too narrow, and welcomes the recognition by ACRE that this is the case. Establishing the exact scope of any new assessment is discussed further below.

In relation to 'balance', which is largely associated with the explicit introduction of benefits into the assessment in the proposed methodology, this is not likely to be straightforward. Whilst GeneWatch agrees that benefits should be part of the evaluation of agricultural practices and GM crops, in relation to the expectations that are being raised particularly in the summary and introduction - that GM crops are likely to be seen in a better light and that achieving 'balance' is a straightforward concept – further depth of analysis is required. In particular:

- Agreement on what constitutes a benefit is likely to be as contentious as what constitutes a risk. Questions about who gains and to what extent, how trade-offs between risks and benefits are handled, whether the benefits are real at all and if they could be achieved by other means will be debatable. For example, herbicide tolerant crops may reduce the use of some herbicides and make farming practices for weed control easier possibly giving benefits in terms of reduced energy use. However, it can be argued that alternative, low input or organic systems will also give similar and possibly greater benefits in this respect. A 'balanced' decision will depend entirely on who is undertaking the balancing and what is included or excluded from the process. Simply leaving this dimension to expert judgement as the report proposes (and is discussed in more detail below) will not resolve this issue as it will be entirely dependent on the particular experts involved. The report needs a much more in-depth consideration of this issue.
- Sustainability is a multi-dimensional issue, with interactions between the three classical pillars of sustainability - environmental, economic and social. As a result, all require consideration because they are inter-dependent and this will have implications for the scope of assessment. For example, environmental benefits from one GM crop may lead to benefits to certain farmers and losses to others. This may then have impacts on local economies, with consequent social and environmental effects. One example of this would be if a certain agricultural practice favoured large farms and further squeezed small farmers out of business. Any environmental benefit may be lost as a result and sustainability on a community level compromised. So there are also real dangers if sustainable development is equated with environmental impact and social issues are neglected.² Because physical or economic costs appear more amenable to quantification, social dimensions tend to be excluded but allowing the marginalisation of social dimensions leads to the loss of one of the major influences on sustainability outcomes. The description on para 1.11 of possible conflicts between the pillars of sustainability is too limited and means this issue and its implications for the methodology adopted for assessment, is not considered later.

Therefore, we feel that the analysis in the report is currently too simplistic. The consequence of this is that the solution proposed is not robust enough to meet the demands that are being placed upon it.

² Pearson, CJ (2003) Sustainability: perceptions of problems and progress of the paradigm. *International Journal of Agricultural Sustainability* 1:3-13.

The principles of the comparative sustainability assessment, the assessment matrix and the criteria used in it

Whilst welcoming the move to open up the assessment process for GM organisms (and in other domains), we are concerned that the in development of the methodology a very large area of theory and practice in appraisal and decision analysis has been neglected. For example, in 2000, the Government produced a manual on multi-criteria appraisal which documents and points to the strengths and weaknesses of the various approaches which have been developed (including the multi-criteria mapping method mentioned above),³ but this and other relevant literature do not seem to have been considered. Whilst the very limited evidence and examples considered at the Open Meeting and in other submissions understandably led to the conclusion that another approach was needed, there is a considerable body of work that could have informed the development of the proposed approach and facilitated a discussion of some of the benefits and disadvantages of different techniques. Although the CSA methodology is presented as being rather novel, in fact it represents just one of a range of different multi-criteria techniques. Section 3, 'Evidence considered', needs to be expanded if it is to provide an adequate basis for the approach adopted.

One consequence of the limited investigation of analytical methodologies available is that the normal organising approach to multi-criteria analysis is absent. The common basic steps of a comparative assessment are explained in the, then, DTLR's manual.⁴ Together with how they relate to the subject of agricultural systems these are:

- *Identifying objectives* (such as protecting a crop from insect attack or producing biomass)
- *Identifying options* for achieving the objectives (such as Bt crops, management techniques and biological control for insect attack; or miscanthus, short rotation copicing, energy conservation to remove demand for energy generation);
- *Identifying the criteria* to be used to compare the options (such as effectiveness; effect on biodiversity; reversibility; potential for mitigation);
- *Analysis of the options* (considering each option under each criterion and making the evaluation against the desired benchmark/goal – such as various sustainability indices);
- *Making choices* (using the outcome of the comparison between options to give advice/make decisions).

We believe that if the report was reorganised around these steps, common to the many variations of comparative appraisal (quantitative or qualitative, for example), and discussed the relevant issues under each, the report would be much more logical, comprehensive and comprehensible.

Below, following some comments on the key principles, we then give our views on the CSA matrix and its use in the examples by using these basic appraisal steps.

Key principles

The problem with the key principles in 4.9 is that most of them are not principles but are desirable attributes or requirements of the system (e.g accepting that all factors cannot be reduced to a single score; comparing effects of a new crop against key targets; proportionate; applicable to different spatial scales), others are criteria to be used in the evaluation (such as mitigation) and one (ii) simply specifies that a multi-

³ DTLR multi-criteria analysis manual, 2000.

http://www.odpm.gov.uk/pub/252/MulticriteriaanalysismanualPDF1380Kb_id1142252.pdf

⁴ DTLR multi-criteria analysis manual, 2000.

http://www.odpm.gov.uk/pub/252/MulticriteriaanalysismanualPDF1380Kb_id1142252.pdf

criteria matrix has to be used. GeneWatch suggests that these be reorganised and described as required attributes of an assessment system and then used to justify the selection of the multi-criteria methodology used.

The list of desirable properties GeneWatch would support is:⁵

- Flexibility and breadth of scope
- Openness to divergent choices, values and framing assumptions
- Candour about uncertainties (ie: avoiding the use of probabilistic risk assessment artificially to 'average out' possible ranges)
- Heuristic mapping of performance – accepting there will be no single right or wrong outcome
- Analytical discipline and rigour – the technique should be theoretically well founded, repeatable and verifiable
- Transparency to review
- Openness to participation
- Feasibility and efficiency as part of a regulatory process – while remaining robust

While the basics of the CSA outlined in the report do meet some of these attributes, as we describe below, GeneWatch considers it could be improved both in its construction and operation.

Identifying objectives

Identifying objectives drives the working of any comparative assessment system. In the description and worked examples of the proposed CSA, such as on miscanthus grass, this fundamental step is not formally considered, leading to a situation where there is no comparator or the options compared are restricted. In the case of miscanthus, the objective appears to be the production of biomass, so comparators might be other means of producing biomass (such as short rotation coppicing) or systems to reduce energy demand and the need for biomass.

This process of discussing the objectives is also crucial in the broader consideration of trade-offs. For example, the trade-off between an easier-to-manage golf course and the spread of herbicide tolerant weeds is different that if the objective was to grow food or feed. Changes in agricultural or horticultural practice for 'trivial' purposes could be ruled out at this stage if 'defining objectives' was included in the system.

Identifying options

The way in which the CSA is described apparently only allows the comparison of two options. In fact, it is relatively easy to use multi-criteria analysis to compare a range of options. By adopting a multi-option approach, a realistic range of technical and non-technical options can be compared. This would give policy and decision makers a much more comprehensive picture. For example, the Bt cotton and *Tricogramma* examples could be directly compared alongside conventional, organic and other management systems simply by adapting the matrix to a simple criteria x option table. The positive and negative elements of the eight criteria listed so far would simply be two criteria. We describe a possible matrix in the section on criteria below.

Identifying criteria

The selection of criteria will have a very large impact on the final outcome, often even more than any weighting that is subsequently placed on criteria.⁶ Therefore, the process of selecting criteria is extremely important. GeneWatch considers that this

⁵ For more details see Table 1 in: Stirling, A. & Mayer, S (1999) Rethinking Risk. A pilot multi-criteria mapping of a genetically modified crop in agricultural systems in the UK. SPRU: Brighton;

process has to be open, inclusive and transparent. A wide range of perspectives and the views of the public have to be taken into account in selecting which criteria should be considered. More thought should be given to this process in the report.

In relation to the eight criteria selected in ACRE's example, the number seems to have been selected to 'be proportionate'. In reality there are 16 criteria (benefits and negative impacts under each criterion) although this division does not work well for reversibility and mitigation. Although we agree that practicability is important, the issue of robustness also has to be given some importance. The information provided by a multi-criteria matrix will be of little assistance to decision makers if it is artificially constrained in a manner which leads to the exclusion of important criteria. Forcing restrictions on the number of criteria also leads to what has happened in criterion 5, where many different criteria (direct and indirect effects on environmental goods (biodiversity, water, air, landscape, aesthetics) are all rolled into one, probably impossible to assess, criterion! By reducing this intense complexity to one value, a whole range of issues is probably being neglected or marginalised. The shaping of a criterion in this way is an example of how different views of the (un)importance of the elements in this criterion are viewed by the designers of the matrix, compared to the other criteria such as 'inputs required'. This underlines the need to develop a process to negotiate a set of criteria which have broad agreement. The report from ACRE should introduce a section that considers how such a process may take place and only use criteria in a very illustrative manner, rather than taking a prescriptive approach.

How criteria are described also needs further thought. The first criterion, effectiveness, is described as being economic in nature although it is not always used in this way in the examples (eg Trichogramma). Two separate issues seem to have been conflated – whether the product is effective (ie does what it says on the tin – kill certain weeds or other pests) and the economic effects of using it (e.g. large or small effects on yield – the effect of having killed such pests). Such issues need to be carefully considered in criteria selection and description.

One of the issues that the report addresses in relation to the evidence presented by the statutory conservation agencies, is whether there should be a two-step model of assessment whereby if a novel crop or management system would lead to damage of biodiversity, it would not be assessed further. We agree that an assessment system should allow for an option to be ruled out because it breaks a key policy objective or matter of principle. 'Red lining' is simply a way of ensuring that some key criteria can be given this priority status. Where appropriate, this practice of 'ruling out' is no less intrinsically 'rational' than the process of trading off using weightings – being referred to in the rational choice literature as reflecting 'lexical' (as distinct from 'utilitarian') reasoning.⁷ Such ruling out is routine, for example, with respect to illegal or morally unacceptable practices. Whether this is something that takes place before an option enters into analysis or during a single stage assessment is not important, but the opportunity to have this is a clear requirement of any assessment system. In the example matrix below, this is a simple matter of flagging up a criterion where this applies.

In relation to the issue of being able to rule something out if one criterion is considered of particular importance, there also needs to be a mechanism to introduce relative weighting or importance of criteria. The CSA approach currently does not deal with this issue and this has to be considered. It, like the selection of

⁶ Stirling, A & Mayer, S. (2001) Multi-criteria mapping the genetically modified crop debate: A pilot study of a genetically modified crop in the UK. *Environment and Planning C* 19: 529-555.

⁷ Spash C (2000) Ecosystems, contingent valuation and ethics: The case of wetland re-creation. *Ecological Economics* 34 no.2: 195-215.

criteria, is a very subjective process and requires wide input and negotiation. Or there needs to be the exploration of the effect of different weightings on the outcome. Introducing a form of sensitivity analysis in this way would greatly increase the quality of the knowledge arising from the use of the system because it would allow decision makers to know how socially robust a decision may be by exploring divergent views.

Example of a matrix which could be used as a qualitative assessment or could be used in a quantitative system to give relative rankings

Criterion	Sub-criterion*	Option 1	Option 2	Option 3	Option 4
Inputs	Beneficial effect	Range to reflect uncertainty/ gaps in knowledge	1-2	2-8	4-10
	Negative effect		Low-low	Low-medium	Low-high
Biodiversity	Benefits				
	Negative effect				
Key species**	IF AN OPTION LEADS TO DECLINES IN A CERTAIN SPECIES OR BIODIVERSITY OVER ALL IT COULD BE RULED OUT.				
Impact on farm economies					
Reversibility					
Potential for mitigation of negative environmental effect					
Etc					

* not every criterion will have sub-criteria

** red lining on matters of principle or where policy imperative exists

In relation to the criteria for assessing GM crops in relation to sustainable development, ACRE might find it useful to consider the approach adopted in Norway, where '*benefit to the community and sustainable development*' are explicitly assessed under the Gene Technology Act (Section 10). The Norwegian Biotechnology Board has produced a discussion paper⁸ which discusses the kinds of questions (or criteria) that need to be consider. How such questions can be included in the CSA system proposed, would be a useful assessment step.

Analysis of the options

In this stage of the assessment, there is a choice to be made between qualitative and quantitative approaches or a combination of the two. The CSA model adopted by ACRE, is on the face of it qualitative, and we agree that it is important to have a method which captures the qualitative data such as the contingencies, nature of the uncertainties, gaps in knowledge and so on. However, the high, medium, low, system of judgement is a crude 1,2,3 scoring method which has a very restricted range and no opportunity to express the range of confidence that exists in the measurement. In contrast, the multi-criteria mapping system developed by Andy Stirling and GeneWatch allows for a range of scores to be entered which reflects the scale of uncertainty - which may be high (e.g. in a 0 –10 entry) or low (e.g. in a 4-5 entry) - with either end being a representation of optimistic and pessimistic scores.

⁸ The Norwegian Biotechnology Advisory Board (2000) Sustainability, benefit to the community and ethics in the assessment of genetically modified organisms.
<http://www.bion.no/publikasjoner/sustainability.pdf>

By using a simple linear additive model, it is possible to consider relative rankings of options according to pessimistic and optimistic scoring.

The role of experts

The role of experts in the operation of the CSA is frequently emphasised through out the report (e.g. 4.7, 4.8). There are many unexplored questions such as 'which experts?', 'expert in what?'. There is also an implicit assumption that expert judgement will come up with the 'right' answer with no need for reference to wider constituencies. There is no exploration of some of the limitations of experts and bias that may be introduced. However, simply leaving things to 'experts' conflicts with current Government policy in relation to scientific advice and risk evaluation.

The Government's 2005 Guidelines on Scientific Advice in Policy Making states, in relation to expert advisors, that:⁹

'Departments should ensure that their selection of advisers matches the nature of the issue and the breadth of judgment required and is sufficiently balanced to reflect the diversity of opinion amongst experts'. (para 13)

Therefore, the need for diversity in expertise should be reflected in the report. The Guidelines also require public engagement at critical points in the process stating that:

Departments should consider how best to frame the particular questions which the experts will be asked to address. Making the question too narrow may prejudice the result. Where issues may be sensitive, departments must ensure that questions are framed to cover the concerns of all relevant stakeholder groups, including consumers and the general public. On these occasions, public dialogue should begin as early as possible. Ideally, the public should be involved in framing the questions that experts and policy makers need to address in order to make Ministers aware of the most important issues before taking a decision. (para 18) (emphasis added)

'When assessing the levels of risk or establishing risk management strategies in relation to a specific policy, the use of evidence is essential. Analysts and policy makers must ensure that they include evidence of any differing perspectives of risk (including perspectives from the public) as well as scientific risk assessments as part of any decision making process. Early public engagement is vital to ensure this happens'. (para 20)

Again, the report needs to consider how this dimension would be brought into the assessment system proposed.

Research needs

While welcoming the recognition that more research will be needed, GeneWatch does not consider it is possible to be specific about what this will entail at this point. In particular because this is dependent upon the criteria selected and their relative weighting (as research needs would require prioritisation). However, by considering broadly what areas of research are likely to be needed to engage in the kind of process the CSA would entail, and comparing this to current research agendas, it is likely that areas where research effort is limited would become evident. This may span from both the kinds of new options and innovations being proposed (where investment in organic and low input systems is weak), to studies on how farming practices affect the environment, economies and society.

⁹ <http://www.dti.gov.uk/files/file9767.pdf>

Possible routes for implementation

Initially, this is an approach that could be used by DEFRA and others as they consider which approaches to new developments in sustainable agriculture they support through funding or other mechanisms. Collaborating with the Sustainable Development Commission or other advisory bodies with a broader perspective on sustainable development would help both in the evolution and implementation of any new approach.

In relation to becoming a statutory requirement, it is unlikely that proposals to revise the Europe GM regulations would be warmly welcomed in Brussels! However, in relation to GM we consider that expanding the discussions with the European Commission, national competent authorities and the European Food Safety Authority would be productive.