



Sustainable Intensification in Agriculture

Navigating a course through competing food system priorities

**Stakeholders Comments on the
Food Climate Research Network / Oxford Martin Programme
on the Future of Food 2012 Report**

The workshop that the report was based on was part funded by the UK Government's Foresight Programme as part of its follow up activities to the *Future of Food and Farming* Project



Introduction

This report is a collation of comments on the report, released in July 2012, entitled: **“Sustainable intensification in agriculture: Navigating a course through competing food system priorities”**.

Sustainable Intensification Report

The original report was based on discussions held at a two-day workshop held in January 2012, co-organised by the Food Climate Research Network and the Oxford Martin Programme on the Future of Food. The workshop was facilitated by Kath Dalmeny of Sustain and funded by the Foresight Programme and the Oxford Martin Programme on the Future of Food.

The purpose of the workshop was to bring together key thinkers from the academic and policy community, and from diverse disciplines, to consider the meanings, issues and challenges around sustainable intensification in general, and particularly in relation to three areas of concern: environmental sustainability; animal welfare and human wellbeing (specifically nutrition).

The report drew upon these discussions and upon further analysis and exploration subsequent to the workshop. It was written by Tara Garnett and Charles Godfray with valuable input from all the workshop participants, most of whom provided comments on a draft version.

You can download the report here:

<http://www.futureoffood.ox.ac.uk/sustainable-intensification>

and here:

<http://www.fcrn.org.uk/fcrn/publications/sustainable-intensification-agriculture>

Comments on the Report

After release, the report was sent to around 30 experts in this field, from academic, governmental, NGO and industrial organisations, to elicit comments on the report.

This report consists of the responses to that call for comments.

Commenters were asked two key questions:

1. Where has the report helped resolve issues, and where it is misguided or simply wrong?
2. How should we move forward, and what is required for sustainable intensification to become a concept useful for those charged with implementing policy?

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Ian Crute - Agriculture and Horticulture Development Board

Sustainable Intensification calls for data and dialogue not dogma and diatribe

Having been involved in both the Royal Society “Reaping the Benefits” report and the Foresight report I greatly welcome the debate about Sustainable Intensification that the report from the Oxford Martin School and Food Climate Research Network workshop has begun to stimulate. For me, the added value that derives from what some have referred to as an oxymoronic term is simply this: it provides the vehicle for meaningful dialogue and stimulates us to erect and test hypotheses by collection of data. In this way, it flushes out those who are not interested in dispassionate analysis but are more interested in advocacy and the maintenance of polarised positions founded on dogma and delivery of diatribes.

So if I put my cards on the table of this forum for debate, I have my own hypothesis that, as someone steeped in the scientific tradition, I seek data to invalidate. My hypothesis is founded on four simple propositions (that can and should of course be challenged):

- The primary objective of agriculture is the efficient conversion of solar energy into varied and valued forms of chemical energy for utilisation by mankind; and there is competition for this energy.
- Some land is best used to produce feed or forage for animals as intermediates in the energy conversion process.
- The energy conversion involves active and intrusive manipulation and management of the interaction between domesticated genotypes (animal and/or plant) and the environment.
- The requirement for consistent and predictable productivity demands continuity of agro-ecosystem functions; and this captures the essential temporal and renewable concept of sustainability.
- Maximising efficiency by using the smallest amount of resource, particularly land, necessary to meet (but not exceed) market requirements (or those of dependents in the case of subsistence farming) provides options to deliver other ecosystem services through, for example, capture and storage of carbon, biomass for energy and conservation of biodiversity in valued landscapes.

These propositions lead to my hypothesis: **“Producing as efficiently as possible on the smallest footprint of land capable of delivering (market) requirements is the most sustainable way to farm”**. There is a rider to this hypothesis which adds “and profitable” after sustainable; but only if there is no market manipulation and other system outputs, in addition to conventional agricultural products, are appropriately valued. I should also point out, in response to a key question raised by the Garnett & Godfray discussion paper, that the importance of consumption is recognised and implicit through consideration of “requirement”. These views are amplified in a recent paper I

wrote¹ and I am now interested in any data sets that will invalidate this hypothesis.

I see the concept of “sustainable intensification” as being founded in the ecology of man-managed agricultural systems – it emerges from and embraces agro-ecology. For this reason, I find the intermingling of ethical and social issues unhelpful since they are necessarily not readily transferable across cultures including the long time horizons that sustainability infers during which values and social attitudes are in continual flux. I also doubt that human behavioural issues emanating from ethical judgements are amenable to the sorts of metrics-based quantification and analysis that will be required to enable valid comparisons to be made between systems with regard to their sustainability or indeed intensification.

Two areas that certainly require further debate and discussion, as highlighted by Garnett & Godfray are “metrics” and “scale”. What are the boundaries to the system (fields or the planet?) and how do we measure progress towards or away from sustainability? Pragmatism will be needed in addressing these two issues and I will not expand further at this point. However, it is only through the development of meaningful metrics that it will be possible to examine trade-offs under different circumstances of time and place to achieve required outcomes. I believe win-wins are elusory and the ability to adopt a systems-based approach to the analysis of trade-offs will be essential.

I wish to complete my comments by drawing attention to a specific issue that I believe warrants greater attention than was accorded to it by Garnett & Godfray. This is the importance of evolution, its impact on sustainability, and the interaction with intensification in terms of both utilisation of knowledge and deployment of resources.

In 1986 I wrote a review about plant-pathogen interactions² and I introduced it with the notion that when crop yields are considered over many seasons, rather than just one, predictability and stability is potentially of greater importance than magnitude. This observation was made in the context of the common phenomenon of a previously highly disease resistant crop genotype becoming highly susceptible due to an increase in frequency, under selection, of one or more pathogen variants capable of rendering the resistance ineffective. (This is a very familiar story in the context of the evolution of insensitivity to antibiotics, herbicides, insecticides etc.). I argued that stability in the yield of a crop genotype that was predictably neither highly resistant nor highly susceptible could be preferable to the uncertainty of performance of a variety known to be highly disease resistant only under circumstances when certain specific virulent pathogen variants are rare.

Looked at through the lens of a plant pathologist, my definition of an unsustainable cropping practice was the failure to recognise that evolution was a powerful force to be reckoned with and the adoption of an uninformed and inappropriate approach to disease management. Intensive utilisation of a single resistant genotype could clearly result in an unsustainable outcome. However, in the review I went on to illustrate how disease management and thereby sustainable yields could be founded on a knowledge intensive approach to variety selection and utilisation. I might well have referred to this as

1 Crute, I.R. (2012) Balancing the environmental consequences of agriculture with the need for food security. In: “Environmental Impacts of Modern Agriculture” Edited by R.E. Hester and R.M. Harrison. 129-149. RSC Publishing.

2 Crute, i.R. (1986) The relationship between *Plasmodiphora brassicae* and its hosts: the application of concepts relating to variation in inter-organismal associations. *Advances in Plant Pathology* 5: 1-52.

sustainable intensification of disease management – but failed to do so since I had never heard of the term at this time! I draw attention to the example above for two reasons. First to point out that it is possible to adopt an inappropriately narrow approach to the definition of sustainability in an agricultural system; in this case simply disease and yield. Secondly however, I think it is important that we move swiftly from discussion of theoretical constructs to analysis, measurement and critical hypothesis testing as well as the practical demonstration of what sustainably intensified systems of production actually look like.

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Sustainable Intensification from Magic Delivery to Practical Framework

If Sustainable Intensification (SI) hopes to be a new food system that can feed a fast growing population adequately while minimising environmental harms, this system needs to improve and increase the efficiency not only of production but also consumption as well. For example even if we could increase production “without adverse environmental impact and without the cultivation of more land” there will still be a 30% food shortage based on the current food waste figure (FAO, 2011). The challenges facing humankind cannot be solved only by increasing production. Even if we could reduce the environmental impact, we would still need to make some fundamental changes in the way we grow, process, eat and choose our food.

Therefore, sustainable intensification can be defined as a framework to improve efficiency in all aspects of the food chain to cope with a fast growing population, climate change and urbanisation and also changing lifestyles, dietary habits and expectations. Efficiency through the food chain can be achieved in three important areas:

1. Production Process

In most instances, SI has been used in the context of production rather than as a new framework for the food system that can cope with a fast growing population that is urbanising and changing lifestyles, diets and expectations. However, improving the efficiency of food production has an important role in future food security. The efficiency of the production process can be achieved by agrochemical and genetic innovation / improvement to increase nutrient and water use efficiency. This also requires exploitation of technology, such as precision farming, to improve water and nutrient application efficiency. This will increase productivity and reduce environmental harms, and can also spare land on farm to provide other ecosystem services or to stop land use changes for agriculture use (reducing GHG emissions in the longer term)

Technological innovation is the main drive to increase the efficiency of the production processes. This mainly occurs by reducing the cost of production (reduction in input losses and undesirable outputs), and by increasing efficiency in the application and use of inputs, food distribution and processing. Precision technologies and biotechnology developments will play a great role in improving efficiency in production, which ultimately will create more space to improve other ecosystem services, for example increasing efficiency of nutrient application and its use by plants will reduce leaching and improve water quality problems.

Change in consumers' perception also has a big impact in reducing natural resource use, for example substantial reduction in water used for irrigating potatoes can be achieved if retailers and consumers change the way they select products, based not on visual appearance (scab free) but on the sustainability of production. This requires a fundamental shift in the way retailers market food products, and a long term strategy to

change the celebrity culture of food products (uniformity in shape, size and colour) to more sustainable products.

Innovations to improve production efficiency in agricultural systems will open wider opportunities for UK companies to market their products in the global scale, and this will be important to keep the UK in the lead and to boost the economy. Also, by transferring the advancement in knowledge and technologies, we will contribute towards solving global food security.

2. Genetic Improvement

There has been a recent revolution in genetic science and DNA sequencing, which means the data for a whole plant genome can be available within a week, allowing gene sequences to be readily linked with the phenotype of a crop plant. This offers enormous benefits for the speed and accuracy of conventional plant breeding programmes. Marker-assisted selection in rice breeding, for example, has been instrumental in developing flood tolerant varieties.

There is enormous potential for new genetic advances to support improvements in sustainable and efficient agriculture. Third generation GM crops would enable radical changes to crops grown for food and fuel. Increasing the photosynthetic efficiency in key crops could allow substantial increase in yields (C4 Rice project) using the same level of inputs. It will also help in the development of perennial crops to prevent soil erosion, nitrogen fixation and better retention and uptake of water and nutrients from the soil. The promising increase in yield will provide opportunity to allocate more land for other ecosystem services, for example if farmers can double production on the same unit area this can be balanced by allocating a high proportion of land to enhance biodiversity.

Researchers are playing an important role in answering some of most challenging questions facing future food security. Scientists play an important role in delivering sustainable intensification through genetic improvement which will also help in improving efficiency in conversion of solar energy (photosynthesis) to food and also in increasing water and nutrient uptakes. Providing enough funding and public support to carry out scientific research to explore the potential of GM can be considered the first step towards a sustainable intensification system.

3. Consumption Management

Consumption management is almost missing in most discussions on Sustainable Intensification. The main focus is always on production, whereas consumption efficiency plays a major role in supporting the current challenges. Natural resources and the environment have been depleted rapidly in the last 100 years, threatening future food security to feed 9 billion people by 2050 and reduce poverty. Without consumption efficiency, the emphasis on production efficiency only is rather ineffective, as it cannot prevent the over utilisation of resources at the current rate.

The main role of consumption efficiency is to minimise the amount of wasted food. This will ensure efficiency throughout the food chain system and will allow it to cope with all expected threats. If we take the current global estimate that 30% of all food is wasted, then

halving that figure could reduce the food required by 2050 by an amount approximately equal to 25% of today's production.

Retailers, Consumers and Policy Makers are the main players in pushing forward/backward consumption efficiency. Reducing the proportion of waste food is the key to secure enough food in the future, and will help food production to cope with fast growing demand. Consumers' perceptions and retailers' business models also have a big impact on producing more food with fewer inputs. This requires a paradigm shift in the way we are currently consuming and marketing food products. We need to change from celebrity products to sustainable products. Also, the players need to provide support to scientists to tackle these issues by starting a rational discussion on GM and providing adequate funding to carry out more scientific research.

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General comments

The report of course says many good things and addresses the question it sets itself – basically, what the expression “Sustainable Intensification” really implies – with rigour. But the whole endeavour seems curiously out of date and out of touch; an academic exercise of a quasi-philosophical kind at a time when we (taxpayers, citizens, humanity at large) need and have a right to expect a clearly-stated strategy for food and agriculture that is deeply rooted in fundamental principles of morality and biology.

Of the report itself we should ask:

Did the workshop ask the right questions?

This may be considered unfair. The workshop did what it did – addressed the issue of “Sustainable Intensification” – and (some would say) should not be criticized for not asking questions outside its remit.

But the world really is in a desperate mess, the clock is ticking, and we need firm guidelines. We cannot afford to waste time and taxpayers’ money on exercises that are essentially academic – and indeed to a large extent are discussions about the meaning of words. “Sustainable intensification” simply means producing more food (or other biomass) per unit of land, or producing the same amount on less land, without doing more damage, or using more non-renewable resources, than the Earth can sustain. Whether or not the world really needs more food (or other biomass), who can reasonably doubt that in principle, this should be a good thing to do?

Yet of course there are many questions still to be asked – including how much such intensification is really necessary, and where it might be particularly desirable (or indeed appropriate), and how this apparently desirable end is best achieved, and whether there is a downside; and it doesn’t seem to me that this report addresses these issues in sufficient depth.

Thus, the report tells us that earlier reports tell us that the world will need to produce between 50% and 130% more food over the next few decades. But Dr Hans Herren of the Millennium Institute estimates that we already produce enough macronutrient for 14 billion people, which is 50% more than the world population is expected to reach. Others suggest that we are already producing enough for 10 billion – again more than the maximum projected. Clearly, all such statistics must be questioned. “Sustainable intensification” achieved by benign means would surely be a good thing, even if we don’t really need more food. But if we don’t really need more food, then this certainly changes the emphasis.

More significant is, “How?” There seem to be two main ways to intensify. The first is the skills-intensive, artisanal, peasant route – to produce more food from the same space through more intricate husbandry (intercropping, rotations, individual care of plants and

animals, etc); and this requires us to build up the agrarian workforce and all that goes with it. The second is the high-tech, high capital, industrial route -- to produce more food from the same space by more effective fertilizers, feeds, or growth promoters and (with or without GM) by precise manipulation of the animals' or plants' genomes, all with as little labour as possible. Big business and big governments favour the latter approach, which they equate with progress. What we need, is a critical appraisal of the two – which this report does not provide. It isn't enough at this stage of history simply to list the options.

This brings us to the second main line of criticism:

Was the thinking sufficiently radical? Can we really make progress without challenging the assumptions behind the status quo? Did the delegates take sufficient account of modern ideas?

A shortlist of huge assumptions underlies conventional, current thinking in agriculture and politics and economics in general. All of these ideas are highly questionable, yet in high circles (government, business - and modern academe) they remain largely unquestioned. They are:

That the present, neoliberal, ultra-competitive, ultra-materialist global market economy is a given, and must define all future action

The present report – and almost all reports of the kind that are allowed in to the establishment canon – take it virtually to be self-evident that the prevailing, neoliberal market economy is somehow right. It is deemed to be rooted in the ideas of Charles Darwin and therefore to be science-based – and therefore apparently incontrovertible: the natural state of humankind. Many see the 1980s, when such thinking emerged as the global norm, to be a watershed, dividing modernity from the murky past.

But the idea that the present economy is Darwinian and therefore “right” is bad science and bad moral philosophy, while the experience of most of humanity, and the plight of our fellow creatures, tell us that the market is not working for the general good, and common sense tells us that it never can. A vast and growing literature (some of it by Nobel Prize-winning economists) attests to this – and also describes alternative approaches.

In short: a report that is seriously pointing the way ahead, must question whether it is sensible to try to ram the square peg of agriculture into the round hole of neoliberalism. Yet that is what most “official” reports, including this one, take to be their remit. All economic and political alternatives are seen to be “unrealistic” and/or are taken to represent some political extreme. Yet the kind of economy that could serve our needs is tried and tested, and not at all frightening. Social democracy and the mixed economy will do – the kind that prevailed in Britain and the US through most of the 20th century. Neoliberalism is a modern aberration (though it has often raised its head in previous ages).

That science can provide the answers the world needs

People in positions of authority are wont to tell us that our policies must be “science led” – implying that science and scientists are the ultimate source of wisdom. At least, people in authority tell us this when it suits them – especially when particular strands of science suggest ways of making money. But again, for a whole host of reasons (on which again there is a vast literature) we should be asking whether the ideas of science should be

“privileged” in this way (albeit selectively). For example scientists have shown that elite livestock can be cloned (by various means) and that this can produce more profit in some circumstances in the short term. But is this wise or even humane?

That morality is entirely relative

This perhaps is the most damaging conceit of our age: that morality is what individuals, or societies, or political parties, or the market, say it is; that values are purely a matter of tradition and personal choice. So reports such as this one have no convincing moral base – and indeed no ability to ask questions of a moral kind. They do not ask why or whether for example it is right that the world should be led by the western powers; whether the west is doing the right things, and whether it has the right to impose its will on the rest.

That the right people are in charge

The assumption behind this report is that the workshop delegates were and are the right people for the job because they are academics, or represent industry and various other branches of the establishment. The ideas that emerge from such gatherings invariably and inevitably reinforce this conclusion: that the responsibility rests with such elites to sort out the world’s problems, and that they are uniquely equipped to solve them, and that they therefore have a right to take control and impose their ideas.

But this leads us to the next big question:

Did the workshop include the right people?

Notably absent from the workshop were:

- *Radical activists*, of a kind who suggest quite different approaches to the world’s problems
- *Moral philosophers*, including clerics, who could question critically the moral and political assumptions behind the discussions
- *Farmers !!!!* Isn’t it astonishing that agricultural policy makers almost never discuss what needs to be done with practicing farmers (except those who are best classed as “agribusiness people”, who are content simply to plug themselves in to the economic norms of the day)? My own experience from talking to hundreds of farmers worldwide is that their view of what needs to be done, and of their problems, is often vastly different from that of most establishment thinkers. No-one even in this authoritarian age would dream of framing medical strategy without talking to doctors, or meddle with education without consulting teachers, or plan new cities without consulting builders and engineers. But in framing the strategies of agriculture, practicing on-the-ground farmers are routinely sidelined.
(See in particular the work of Michel Pimbert, formerly of IIED, as in *Participatory Research and On-Farm Management of Agricultural Biodiversity in Europe* (IIED 2011).)
- *People at large*. Strategies are being discussed in such reports as this that affect the lives of billions of people worldwide, and especially those in poor countries who always take the brunt. But none were invited to the workshop.

Overall we should ask:

Can we – taxpayers, citizens, humanity – afford to leave our affairs and indeed our lives in the hands of academics, corporates, and politicians?

“The Establishment” has become more homogenous, and more entrenched and powerful, than it was when Anthony Sampson wrote his *Anatomy of Britain* in 1962. Then, governments, including Conservative governments, took it to be self-evident that they should at least to some extent control the economy for the benefit of the citizenry, and academe was mostly financed by taxpayers, again for the benefit of society as a whole. Now it is hard to see where government ends and industry begins, for there is free movement between the two, while academe does their collective bidding. Agriculture is of course caught up in this. Taxpayers find themselves underwriting agricultural research that is geared almost exclusively to the needs of industrial farming (now anomalously called “conventional” farming). The profits and the power lie with the corporates, while governments call those profits GDP and claim to have achieved “economic growth”. But the state of farming and farmers worldwide is dire and the world’s food supply is sadly defective, while food security is precarious even in the richest countries and the vital concept of food sovereignty – people having control over their own food supply – has gone missing altogether.

Accordingly, more and more groups worldwide both local and international, in matters of food and farming and in other essential endeavours, are beginning to take power into their own hands; and this, in truth, is one of the few signs of hope in the present world.

What has this got to do with the present report? Only that we (taxpayers, citizens, humanity) should now be questioning whether reports of this kind -- academics and commerce talking to each other on matters that in truth are peripheral -- are really pertinent to the present age.

Specifics

The context for the discussion:

“The global population is growing, globalising and urbanising; people on average are becoming richer and their lifestyles and expectations are changing.”

All this is true up to a point. But in a serious report, seriously trying to sketch a better future, it all needs to be questioned. If it is not questioned, then future strategies tend simply to reinforce the past.

Thus: the world is indeed “urbanizing” – but should we take this to be inevitable, or should we try to call a halt – not by closing the cities but by reinforcing the agrarian economy? After all, the UN tells us that 1 billion people now live in urban slums – almost a third of all city dwellers. People “on average” are indeed “becoming richer” – but the stats of the past 30 years show that while the rich have grown richer beyond the dreams of Croesus the poor have grown steadily poorer (the discrepancy is increasing both between countries and within countries, including the rich ones). And what exactly are these “expectations”? Where do they come from? Do people really want Kentucky Fried every day, or a new suite of furniture every spring, or are they simply responding to commercial pressure?

It might be argued that it is not the job of reports such as this to question these basics. But if they do not, they are condemned simply to paint a future that is a continuation of the past. Is this useful?

“It is feared that as populations grow, recent progress to reduce hunger will not be sustained and more people will go hungry”.

This may indeed be feared. But again, such statements must be questioned. The report itself points out that the world already produces enough for all, and it could and should have pointed out (as does Hans Herren) that the world already produces enough macronutrient for 14 million people – 50 % more than the maximum population projected by the UN. The idea that the world’s food problems spring primarily from an excess of people is deeply pernicious (and is echoed in Ebenezer Scrooge’s comment in the age of Malthus that famine merely lowers “the surplus population”). Far better to emphasise that population per se is not the principal problem.

“whether people can and should be persuaded to behave differently from how they do today.”

Reports like this one invariably take it for granted that people are behaving the way they really want to behave, and that reformers must persuade them to do things differently. The alternative hypothesis is that people adapt to the status quo – and in an economy geared to consumption they consume. My impression from meetings and discussions worldwide is that a huge proportion of people hate what is going on now, and would dearly like to live differently if only the opportunity was there. In short, if we seriously want to transform the world, the point is not to persuade, but to identify the people who already yearn for transformation. If only there was some coherence between those people, we would already have the critical mass needed to change the world around.

General environmental issues:

“... reliance on market mechanisms is only likely to work in countries with relatively mature agricultural markets. In low income regions of the world poor financial and physical infrastructure, as well as an insufficient institutional capacity and skills base, may require more interventionist approaches to help increase productivity sustainably”.

The above paragraph summarizes much of what I feel is wrong with the report. That is, it seems to be sensible and balanced and indeed expresses a good thought – that market mechanisms alone cannot produce the kind of agriculture we want and need (or the kind of world we want and need). But just beneath the surface lies the erroneous assumption that “market mechanisms” do indeed work in “mature” countries (like ours), while poor countries might perhaps need sorting out – “more interventionist approaches” until they can get their act together, and so become more like us. But the state of the “mature” countries of the west is not enviable (or sustainable); the neoliberal economy is not good for us any more than for anybody else; we are not a good model; and the implied dichotomy between countries that are “developed” and those that are “developing” (whatever the current euphemism is) is seriously out-moded and deeply pernicious.

Human-centred outcomes:

This whole section on nutrition again seems to encapsulate the principal defects of the report. It seems to be sensible and balanced, but in truth is timid – tending to assure the reader that everything is in hand, and that all is for the best in this, the best of possible worlds. Thus the report tells us that agriculture produces other things besides food – including biofuel. It also tells us that:

“Different stakeholders prioritise these differently; for example farmers and the agricultural industry may place greatest emphasis on profits; consumers are generally most interested in their individual welfare (including not only nutrition but also the provision of non-food ‘goods’ such as tobacco, coffee or alcohol) while governments seek to balance these many competing interests. Biofuel production is fast becoming a major desired output from the system for many stakeholders”.

But again, the report merely reports the conventional wisdom, without comment or criticism; and again we should ask, at this stage of history, whether a simple rehearsal of the received wisdom is enough. We surely should be asking: Is it good that biofuel has become a “major desired output” (now gobbling up about half the US maize crop)? Isn’t this a prime example of the market economy out of control – in which any enterprise that can make a lot of money quickly by whatever means and with whatever consequences is fast-tracked? Is it really true that “governments seek to balance these competing interests”? Is this true of the USDA in its unswerving support for big business and in particular for biofuel? Is it true of the Britain’s present government, or the previous four, or of Defra? Do governments in fact have a proper sense of balance? Do they not in fact these days invariably favour the highest bidder – and make a virtue of this? Do they not in fact tip the political balance in favour of the highest bidders? Is it a good idea in 2012 to take governments at their own valuation, or should we be asking (a) what their powers really are and (b) what they should be and (c) whether, even in ostensible democracies, they in fact discharge their duties truly in the public interest?

Very commendably the report cites the FAO which:

“explicitly links nutritional diversity with crop biodiversity, and considers diversity not just in terms of the range of foods produced and consumed (maize, beans, carrots) but the diversity within type.

“In principle, these measures, if effectively implemented, are likely to lead to improvements in people’s diets; individuals consuming a wide variety of foods are more likely to be able to obtain all the nutrients that they require, including those that are likely to be needed in the diet but whose role is not fully understood and that are therefore not the focus of current fortification programmes”.

Good. This point is valid not just because the FAO made it but because this is what all human history seems to be telling us: that people with access to truly various diets do not suffer from specific nutritional deficiencies, or from the current ills of obesity, heart disease, and diabetes. So a report that truly advances the debate should be urging us to encourage diversity across the board with all possible speed. Notably and obviously people in positions of influence should be encouraging horticulture and smallholdings (which until very recent times were the norm worldwide, including within cities); encouraging genetic diversity within all crops and livestock; and encouraging traditional cuisines, which are based on diverse, local produce. Instead, the general thrust of government and

commerce (assisted by academe) has been to produce a narrower and narrower range of crops and livestock (a trend exacerbated by the current trend for GM and the patents that go with it); to encourage monocultures, which of course reduces diversity; to reduce agricultural labour (a trend that goes with monoculture) which means that more and more people are removed from the source of food (and means that more and more are condemned to urban or rural poverty); to encourage centralization of food supply which in turn requires more processing (increasing price and reducing nutritional diversity); and to discourage traditional cooking in favour of processed meals (which are more profitable and are seen to increase GDP).

But the report makes none of these points. Instead it tells us that:

“A more immediate response to the problem of malnutrition is to enhance, through fortification, the nutritional content of the foods that people are most likely to eat. Fortification and biofortification programmes have a particular value in addressing the dietary problems of those too poor to have access to more diversified, healthy diets, and who generally subsist on small amounts of cereal staples.”

In other words, as ever, the powers-that-be have the matter well in hand – and, as ever, the solution lies largely with high tech. We can also question whether fortification does indeed provide “a more immediate response”. For example, the experience of Cuba in recent years has shown that significant horticulture can be introduced in a very short time if the will is there – and artisanal horticulture, properly various, will do almost all of what needs doing.

The report goes on to tell us that:

“Beyond this, fortification may be seen as politically and culturally simpler to implement than more diverse systems of production and consumption. It also has the advantage of reaching net food purchasers in urban and rural areas who cannot afford to buy micronutrient rich food such as vegetables, fruit, pulses and animal products.”

To express such an idea in a report that purports to provide an objective overview is unacceptable. One nutritional activist I showed this to said that this is a “disgrace”. “Politically and culturally simpler” in practice means that various large corporates are waiting to fill their boots. A principal target is deficiency of vitamin A – to be made good by various fortified foods which conceptually at least include Syngenta’s GM “golden rice”. But vitamin A is ingested in the form of carotene which, next to cellulose and chlorophyll, is one of nature’s commonest molecules: present in all dark green leaves and rich in yellow fruits and roots such as papaya, carrot, and the orange varieties of cassava, all of which are standard crops in gardens and smallholdings. Overall, worldwide, the choice for people suffering from deficiency of micronutrients is between self-reliance and food sovereignty, which for most is easily achievable, technically, if only the obstacles were removed; or further reliance on the good offices of big commercial companies, usually foreign-based.

Neither does the report ask the fundamental question: why it is that in this world that is allegedly so rich so many people cannot apparently afford good food – even in countries like Britain which are near the top of the economic heap. In truth there are several reasons – but they all trace back to the kind of economy we have, and the way we allow ourselves to be governed from the top by the complex of governments and corporates that are not,

fundamentally, on the side of the people. Academics who fail to question the wisdom of this top-down governance, and instead lend their weight to it, have seriously mistaken their role in life.

So alas, despite the undoubted excellence of many of the contributors, we must see this as a missed opportunity; another report to add to the pile of those that seem to stress the need to change direction, and urge radical thinking, but in reality serve primarily to reinforce the status quo.

As things are, hope lies primarily and perhaps entirely with the many grassroots movements that are now springing up worldwide.

Colin Tudge

Campaign for Real Farming

October 2012

Emily Lewis-Brown - Compassion in World Farming

1. Introduction

Compassion in World Farming welcomes the opportunity to comment on this important report and would welcome an opportunity to engage in future workshops on this and other topics. Compassion's primary remit is to help deliver a world where farm animals are treated with compassion and respect and where we have moved beyond factory farming. Strong environmental concern was a key principle when the organisation was established over 40 years ago by a dairy farmer who was horrified by the negative impacts of intensification of farming on farmers, their farm animals and the environment.

2. Agriculture for food security

2.1 Food Security is more than intensification or raising productivity

Food security as a contribution to wellbeing is a critical issue which Compassion seeks to advance through the development of policies and practices which help design and deliver optimal farming and food systems which enhance food security through a range of means. Enhancements on many fronts are needed and we welcome the efforts of this workshop and report to approach a multi stakeholder and multi agenda approach. However, the focus on sustainable intensification as part of the route to food security may have limited the process and we encourage a wider systems approach to delivering healthy and sustainable food security for all. Notably, increasing productivity and production may just increase waste, losses and consumption unless these are addressed with equal enthusiasm.

2.2 Intensification can reduce food security

Sustainable intensification (SI) is put forward as one of the contributing factors to achieving food security, sitting in a wider context of measures including reducing food waste and losses and consumption management. The ultimate extension of intensifying food productivity is to develop agricultural systems which maximise the number of people fed healthy and nutritious diets from a given area of land (especially arable land) with minimal negative and maximum positive impacts on all aspects of the system. The most efficient and effective way to intensify agriculture sustainably for food security is to use arable land to produce nutritious food for direct human consumption and use marginal lands, food wastes and crop residues for the production of livestock produce.

Most of the improvements in yields of livestock in intensive farming have occurred through the use of high quality grain-based feeds for animals¹. Intensification of agriculture which takes land or crops which could be used to feed people directly and uses them to feed to farm animals is inherently inefficient. Grain-based animal livestock production systems are counter-productive to both SI and food security. New research shows that intensifying livestock diets towards grain-based farming would be particularly detrimental to food security in areas where food security is already at risk and that extensive livestock farming

provides more option space for food security³.

It is vital that SI is not considered as an end in itself – it is one possible contribution to achieving food security for wellbeing. Where SI detracts from wellbeing or food security, it must be avoided.

3. Terminology

3.1 Sustainability includes ethical, environmental, economic and social issues

We are pleased that the report includes ethical considerations, including animal welfare, as a part of sustainability and would propose that this approach is adopted consistently throughout the report. Areas of the report where sustainable is limited to only environmental considerations lead to confusion and are not consistent with the generally accepted view of sustainable.

3.2 ‘Intensification’ is too close to ‘intensive’

Sustainable intensification is a very loaded phrase, due to the similarity of the word ‘intensification’ to ‘intensive’ when applied to farming. The intensification of farming in the UK and EU has a sorry history, leading to ‘intensive’ farming as we know it today. This is associated with wide scale and significant loss and degradation of biodiversity, farming jobs, small-scale farming and rural communities, with rural de-population, the worsening of human diets and terrible animal welfare. Near to 70 billion animals are farmed each year in the world, approximately two thirds of them in intensive farms, usually with crippling bad conditions of health and welfare.

3.3 Sustainable intensity

‘Intensification’ can be seen as an open ended process to become more intense, with no end, and this seems odd and holds risks. As the report notes, the baseline is key. Some regions can intensify agriculture with win wins and improve sustainability performance, while other regions, which are already heavily intensified, cannot. In fact, it is increasingly accepted that most livestock farming in the EU and USA needs to de-intensify to become nearer to sustainable, in any sense of the word. We advocate that whatever term is used, does not suggest an open ended process in one direction, as to achieve sustainability, farming systems in the global south may need to move in opposite directions in terms of intensity to those in the global north. If the term ‘sustainable intensity’ were used instead it would make clear that balance is needed and that movement towards sustainability can be differing.

Developing optimal, humane-sustainable agriculture and food systems which support food security and wellbeing is now needed. This may in some cases include intensification and in other areas might need de-intensification.

Compassion’s view is that SI is not a helpful term and should be replaced with a term

³ Karl-Heinz Erb, Andreas Mayer, Thomas Kastner, Kristine-Elena Sallet, Helmut Haberl, 2012: The Impact of Industrial Grain Fed Livestock Production on Food Security: an extended literature review. Pp 1-82.

which is less ambiguous, has fewer negative connotations, does not describe a one way process, which is inappropriate if applied to the dominant farming systems (i.e. those of the west) and does not sound so similar to a term which has wreaked such damage on so many levels.

Given the unsustainable impacts of intensified agriculture to date, the terms ‘sustainable’ and ‘intensification’ do not sit well together and produce an oxymoron.

4. Metrics and methodologies

4.1 Metrics to measure intensification, sustainability, food security and wellbeing

Compassion welcomes the report’s reference to the need to give careful consideration to the metrics used to indicate the success or progress towards sustainable agricultural systems and food security. We’d also welcome further thought on the metrics to measure wellbeing, of people and animals in agricultural systems. On animal welfare, we welcome reference to the Five Freedoms and the inclusion of both animal health and wellbeing as separate and both important.

Environmental performance of agricultural systems and eco-efficiency tend to be measured in terms of units in per units out and new research commissioned by Compassion in World Farming draws out a number of limitations to this approach. For example, yield, which considers hectares of land used to produce a kilo of meat, is not a good metric for sustainable land use given that it takes little or no account of the quality of land or the local impact on the environment, people or resource base of the land used. Water footprint as a metric, equally has significant limitations in its application to agriculture as a measure of the sustainability of the system in terms of water use. The key reason for this is that water footprint does not measure the impact of the water use on either the environment or local water resource availability and management⁴.

Water footprints of lamb and beef, for example, will be larger than that of chicken meat per kilo of product, so could be considered by this metric to be less sustainable. However, consider the water footprints of Welsh lamb and East-Anglian chicken meat. The lamb will have a far higher water footprint, but it will be of negligible impact given that it will be mostly rain water in an area of high rainfall. Manure, creating water pollution, will be dispersed over the hillside in both time and space and of little environmental impact. Chickens raised on grain in East-Anglia however, may have a smaller water footprint, but it could have a far greater environmental impact, given that it will be more comprised of irrigation water to grow the grain and in an area of water shortage. Also the manure could have a greater environmental impact given that it can be concentrated in time and space and impact on a nitrate sensitive zone and aquifers. In these cases, metrics which assess the environmental, ethical, social and economic impact of agriculture are needed. Also, a cross sector of metrics is needed to avoid sub-optimal outcomes and unintended consequences on other systems. For example, extensive beef from Brazil has a lower use of irrigation water and water pollution than beef from elsewhere and on this metric would be considered as sustainable, but it might have incurred deforestation of primary forest,

⁴ Mekonnen, M. and A. Hoekstra, 2011: A Global Assessment of the Water Footprint of Farm Animal Products. *Ecosystems* (2012) 15: 401–415.

damaging biodiversity, local hydrography, soils, people the local weather and global climate.

4.2 Methodologies to measure the metrics

One of the key methodologies used to assess the environmental performance of production systems is LCA, as mentioned in the report. Compassion has commissioned research this year which identifies a number of significant limitations of LCA when applied to livestock systems⁵. These include system boundaries, time frames, uncertainty, reliance upon modelling and averaged data and an overall lack of studies into pig and poultry systems and in the global south. In general, the range of uncertainties can be so large as to make any comparisons between intensive and extensive systems meaningless. Additionally, LCA includes a suite of methodologies and assumptions and these can materially affect the conclusion. For example, when milk production is considered, some studies show that intensive farming can have lower ghg emissions than extensive farming, however, when system expansion is used to include the production of beef calves produced by the dairy herd, then the extensive system is shown by LCA to have lower ghg emissions. LCA studies of livestock farming consistently omit important factors, including biodiversity. Additionally, no similar methodology exists for ethical considerations of the impacts of agriculture on people or farm animals.

New metrics and methodologies are needed which assess the performance of agriculture on sustainability indicators with greater precision and accuracy. These should include impacts on people, the planet and farm animals and ways to balance the value of these are needed.

5. Animal Welfare and sustainable intensification

Compassion is supportive of the report including animal welfare; farm animal welfare is an integral part of sustainability and agriculture. The report discusses two routes to the possibility of SI compromising animal welfare; indoor housing and individual physiological stress.

5.1 Intensification through indoor housing systems can reduce animal welfare

We are concerned that the use of indoor systems is dismissed as not being a source of concern and only represented as a potential positive. There is significant concern and evidence that some indoor systems can be deleterious to the physical and mental welfare of farm animals. This is not a 'rich world luxury' given that the OIE standards to protect farm animals are signed up to by over 150 nations.

The ban on the barren battery cage and the continuous use of the sow stall are clear indications that there is general agreement that close confinement is unacceptable. These indoor housing systems have evolved through the intensification of farming and are a clear example of why serious concerns arise about the use of the phrase 'sustainable intensification'. Some intensive indoor housing systems are so ill equipped to house farm

⁵ Cederberg, C., Berglund, M., Gustavsson, J. And M Wallman, in press: Environmental impacts from livestock production with different animal welfare potentials – a literature review. Pp1-89.

animals that the animals are regularly mutilated to fit them to the indoor system. These mutilations include hens having their beaks trimmed, piglets having their teeth clipped and tails docked – each of these painful operations are carried out without anaesthetic. Animals in some indoor systems often fail to have their basic needs met and can suffer high death rates. Rabbits, the second most farmed animal in the EU, typically suffer losses of between 15 and 30%.

While there is potential to develop indoor systems that improve animal welfare, this depends on the baseline and the system. The life of hens in barren cages can be improved by switching to well managed and designed barn systems, but the greatest potential for animal welfare can only be achieved when animals are allowed to perform all of their natural behaviours, usually requiring access to the outdoors. Improved animal husbandry, shelter and protection from ailments and predators and appropriate veterinary care are welcome advances in farming which can improve productivity, food security and animal welfare.

5.2 Demanding more of individuals can reduce animal welfare

Physical and physiological demands on animals have increased through agricultural intensification and this has led to systemic and inescapable suffering for billions of farm animals. Most chickens reared for meat, for example, are bred and fed on energy rich grain to grow so fast that their bodies are incapable of coping and they are slaughtered while still juvenile. Cows and pigs suffer from similarly debilitating conditions which have arisen from the intensification of their breeds and lifestyles in intensive farming systems.

Intensification of farming has led to multiple abuses of animal welfare. Further intensification of this type must be resisted and de-intensification sought to ameliorate the situation in current intensive farming. Steps to improve farm productivity through improving animal welfare are welcomed, but wouldn't be termed 'intensification'.

Emily Lewis-Brown

Compassion in World Farming

November 2012

[Emily no longer works at Compassion in World Farming]

Chris Durham - Defra

For centuries people have worried that we are shortly going to exceed the Earth's carrying capacity, but as yet we have not. A really interesting question might be, do we have more or less time today before we run out of stuff, compared to how much time people used to think we had? The answer to this question might inject some helpful historical perspective on these issues (although I don't pretend this paper could answer such a question!).

The paper discusses lots of options for ensuring there is enough food around in the future. It might be helpful to suggest how to go about choosing which to do first – a bit of everything may be needed, but perhaps more of some than others, and will some occur naturally as market signals incentivise productivity improvements etc.?

Later parts of the paper discuss objectives for sustainable intensification, and look a lot like debates on sustainable development that we have been having for many years, and debates around welfare economics for many decades. Both of these disciplines have developed (quite similar) tools for navigating complexity, like “social cost-benefit analysis”, multi-criteria analysis etc. These tools may well be helpful in this context too.

It would be helpful to more clearly distinguish recommendations from ideas that others have put on the table.

Some more detailed comments on the report:

- Some of the language in the report suggests the authors view of economics is unduly narrow – the majority of economists who are likely to engage in this paper will consider that the subject is about “maximising welfare”, and that the market is the right way to do this. As such, suggesting that slavery is economically effective is likely to draw criticism that detracts from the central argument.
- The FAO projections about demand for animal products ought to be reported as a range rather than a point estimate, to reflect the considerable uncertainty involved in this kind of work.
- The discussion of carbon impacts of meat could be improved by recognition of the approach taken to reducing carbon across the economy as a whole – we tend to focus efforts where it is cheapest to do so, and this begs the question, where does reducing meat consumption come in the hierarchy of marginal abatement costs (where costs are measured in terms of lost welfare to consumers)? Presumably different levers to affect meat consumption will appear at different stages in this hierarchy.
- There is a theme of quite heavy-handed regulation in some parts of the paper – suggesting for instance food rationing and prohibitions of types of land use. A social science perspective that works with the motivations of people, rather than trying to stifle them, might prove more effective, pick up themes in modern theories of policy-making and open this paper up to a wider audience.

- In your discussion of how to define environmental sustainability, be careful to avoid definitions of sustainability which are inherently conservative (sustaining what currently exists rather than allowing for sustainable evolutions/changes).
- Your discussion of general environmental issues describes a situation in which prices for food fall, and this leads to increases in land use change. I'm not sure this is right: you seem to be saying that when demand for food falls, demand for land may increase. You are trying to get at the income and substitution effects of a change in a farmer's income: when his income falls, he can farm less because he gets less profit per unit of output, or he can farm more to bring his overall level of income back to where it was. I've not seen any evidence to suggest the second effect exists in reality

Chris Durham

Economist

Department for Environment Food & Rural Affairs

Note: These are the views of Chris Durham, and do not necessarily represent the views of Defra or other affiliated organisations

[Chris Durham is now at the Environment Agency]

Dan Crossley - Forum for the Future

On balance, I think this is a very good report. I like what it is trying to do – namely take the much disputed but underdeveloped concept of sustainable intensification and help move it forward in a constructive way. It is a ‘grown-up’ review of what has at time seemed like an infantile debate about one particular term.

I’m pleased to see that the report argues for a systems-oriented approach to decision-making – something that we at Forum for the Future strongly support. I would also agree with the view expressed in the report that we need action on all fronts (on production, on consumption, on waste etc).

On the term itself, for me, using the term ‘sustainable’ means you have to look at environmental, social and economic aspects relating to production – rather than solely environmental ones. However, ‘sustainable intensification’ has already been interpreted in lots of different ways by different groups. Some stakeholders will regard ‘intensification’ as perjorative language and associate it (rightly or wrongly) with existing industrial models of agriculture.

There seems to be a broad emerging consensus on what many of the principles of a sustainable food system are. However, I’m not convinced that the report (on its own) will be successful in encouraging those working in the food system to put aside their differences/ conflicting opinions on sustainable intensification and to work towards a common aim. It’s a valiant attempt, but I think the term has potentially already been too tainted.

I don’t have one specific recommendation on a way forward for ‘sustainable intensification’. However, my hope/ plea is that energy is put into creating new solutions (or spotlighting existing solutions) and – critically – into scaling those up, rather than being channelled into debates about terminology. If there is a possibility that ‘sustainable intensification’ will get widely accepted and gain traction, then this work should be built on. If it looks likely there will be protracted debates about definitions/ interpretation of terms (rather than about how to drive forward practical action), then I suggest we drop the term and instead talk about the need to increase yields whilst reducing environmental impacts, whilst also tackling issues of consumption and waste. And then we can get on with much-needed action!

Dan Crossley

Principal Sustainability Advisor

Forum for the Future

October 2012

[Dan Crossley is now at the Food Ethics Council]

Vicki Hird - Friends of the Earth

The public debate on how to feed, clothe and fuel ourselves from finite amounts of land will get ever more heated as we face the crunch over matching climate reduction targets globally with feeding a growing, wealthier population from an increasingly depleted resource base. This paper very usefully explores some of the confusion around terminology and some trade-offs regarding production based measures.

But this is not just a debate about semantics – it's about politics and power in the food system. As the paper points out there is a strong school of thought that we need to increase (possibly meaning 'intensify'?) production given the difficulties of managing demand. And if so we must do it 'sustainably'. This has created justifiable concern over the potential social and environmental implications and 'sustainable intensification', as a term, has been caught in the crossfire.

The following observations cannot do justice to the entire paper and the range of arguments within it. The authors stated aim was to "*recapture sustainable intensification from those who have sought to redefine it*". Has that goal has been achieved? Not quite, but the paper provides a welcomes chance to re-examine and challenge assumptions within the context of the much needed and far wider debate about the food system.

The right tool in the box?

Much of the paper justifies the need for enhancing productivity carefully i.e. sustainable intensification (SI): as a priority for research institutes; as a goal for farmers and food businesses; and a focus for aid investment. It is arguably one useful tool in the box for ensuring we can feed people adequately whilst addressing the issue of resource depletion. And it does acknowledge that it is only one tool and on its own, it is clearly not enough.

But the paper also pushes for the continued use of the term 'sustainable intensification' – despite the fact that it tends to be used to justify more of the same/BAU with a few green tweaks rather than genuinely more sustainable approaches. And trying, through academic argument, to influence the nature of such politically charged debates, is a difficult job.

Can we separate SI from increasing production?

The paper argues that SI need not be related to particular assumptions about how much more food is needed i.e. intensification is about productivity not producing more in total. But it is not a convincing approach. How *much* more, inevitably, dominates the debates about food security and SI is the term now used to describe how we achieve targets.

The FAO and other agencies tell us that we already have enough food to feed the world¹. Yet, the wise use of the crops we already produce is often absent in key documents relating to food security – although there are growing demands for a pull back on biofuel

¹ <http://fao.org/docrep/015/i2490e/i2490e03a.pdf>

mandates and reduction in food waste. But the odd glancing, often shamefaced, reference to consumption i.e. tackling demand and the weak references to 'governance' of the food system are wholly inadequate. Producing more is far more appealing than asking people to eat differently or ensuring that corporations and investors play fair.

The push for sustainable intensification, deliberately or not, plays into this agenda.

The context is all – but who sets it?

Garnett and Godfray do make it clear that any move to intensify production must be highly 'context specific' – spatially and temporally. Any changes must be related to local environments, climate, water, skills and above all, need. Production and consumption differs from village to village let alone country to country. This is messy. And so it requires tailored approaches not simplified, top down crude policy drivers.

But all too often those who measure the parameters and define 'need' have specific agendas – even aid agencies and research institutes. There is a prevalent idea that we do not have enough time to build on existing systems and farmer knowledge and training (as suggested by the IAASTD) – and that we need quick fixes like imported fertilisers, high yield seeds and breeds. This all too often ignores key issues like debt, local appropriateness and demand, land tenure and building full soil fertility and resilience.

The fact that most commercially available GM crops have been designed for the needs of high income markets – cheaper feed for meat and dairy, cheaper cotton for disposable fashion industry and so on, illustrates that 'need' has not featured heavily so far. Why would that change? It is well established that technologies that may contribute to sustainable solutions for e.g. drought resistance or nitrogen fixing are decades off (40 years at least according to the Foresight report), so we have to look at other tools in the 'technology gap'. Are those tools locally appropriate systems – or high tech imported ones?

What about the social side?

The authors acknowledge that ensuring social equity, livelihoods and so on is largely beyond the scope of the paper. But the social and equity arguments are an unavoidable part of the equation. Much of what we achieve with food is related to power – who has it, who wields it? To illustrate:

At the individual level – Do I have the power, e.g. wealth, to buy seed or buy nutritiously and culturally suitable food locally over the long term for my family or will I have to pay a large seed corporation or rely on aid or farmers somewhere else to get some food to me at a price I can afford.

At the national or regional level – does this government have the power to control cheap imports which undermine local producers and their investment in e.g integrated systems which produce diverse outputs?

At the global level – will those at the global negotiations on food security or climate mitigation, adaptation and financing have the power to ensure that historically high climate emitters, and those with current high per capita emissions (mainly wealthy nations) take the bulk of the emission reduction targets related to food? With unfair

subsidies and trade rules ever be sorted out?

All these power plays will undermine any authentic push for context specific, appropriate sustainable intensification. Garnett and Godfray acknowledge this and their conclusions suggest significant work is needed to understand the interactions – but there needs to be more specific recognition of what drives policy changes and changes on the ground.

Crucially the impact on labour and livelihoods is a key food security issue. The development literature is littered with evidence on how large scale interventions can cause loss of livelihood and access to markets for smaller scale producers. Can SI keep itself detached from that risk?

Driving out Diversity

There is a useful discussion about the desirability of producing more on less land – land sparing - but could we be better off producing differently on the same amount of land? Land sparing versus land sharing has not had enough attention and there is a paucity of good evidence on what could work. Models suggest that gains in crop yields through intensification (140% between 1965 and 2000) have not significantly slowed expansions and yet have led to major biodiversity and ecosystem damage².

We definitely need more focus on diversification as the paper rightly notes. Can that be encompassed within an SI push? Can we rely on those funding or doing the research to start to measure output in terms of a *range of calories and nutrients (and income)* per hectare per unit of resources used? Or will it be yields of one crop per hectare per kg emissions as is increasingly the norm?

The core thesis – that we need “*more effective use of inputs and the reduction of undesirable outputs in order to achieve greater yields*” can be countered with an equally compelling thesis that we need to produce the sustainable yields in the right places of the right diversity of products matched with appropriate consumption patterns.

I doubt the authors would argue with the latter but suggest it is naïve. But equally naïve is the assumption that we have businesses geared to provide the outcomes that are good for us. The increasingly concentrated food industry is, in the main, legally obliged to maximise profits for its shareholders and will do so particularly well with unfettered access to world markets and technologies. The fact that much of the research on commercial production is funded by the private sector, often by agri-business corporations can not be ignored as a factor driving research agendas.

Governance and markets

The section on environmental issues contains some problematic logic particularly in relation to ‘mature agricultural markets’ where the paper implies that reliance on market mechanisms will be a good idea. These markets are heavily skewed by subsidies and other policies and they have a huge impact on global food availability (e.g. grains and soya for feed). Equally, the potential impact of SI on livelihoods of farmers is overlooked as is the very real risk of *unsustainable* intensification being an outcome of any push to use price

² eg. See CGIAR BRIEF No 40 Jan 2012; Matson & Vitousek 2006 Conservation Biology 20 pp 709-710

signals to increase production.

Garnett and Godfray rightly note that governance and other mechanisms such as demand side measures will be key – but implies these may be needed mostly in low income regions. Yes, governance on land rights is an issue and food demand is rising. But there is ample evidence that it is food and land demand by high income countries, institutions and even wealthy individuals is a major part of the problem. We need to look to ‘govern’ the activities of northern investors, traders and consumers.

The conclusions

The conclusions could be enhanced with three major edits: the first conclusion is flawed – the goal of *intensification* is context, specially and temporally specific and not an end in itself whereas *sustainability* is ultimately a non-negotiable wherever and whenever. So it should be prioritised.

The second conclusion should acknowledge what the paper has - that the term has also been misused and, in some cases abused. Additionally, an assessment of the role of the whole supply chain - and how business as usual should not continue to be promoted through SI when the IAASTD was so clear on the need for a radical change in direction - could be given more prominence.

A final word on terminology and language

Does Box 3 (“Concepts related to sustainable intensification”) just not confirm that we do not need new terminology when there are so many - though there are a few gaps in the definitions in the box. The phrase ‘Technological optimism’ is a useful one to explore! Why not use the term sustainable production – what is wrong with that? SI assumes that intensification is required. Surely that undermines the debate about what is a sustainable level of production relative to land and inputs used.

Yes, we do need to stop ‘*focusing excessively on terminological differences*’. But we need to know who is proposing what and why and who (and what) will benefit. And we need to be clear – those questioning the role of SI are generally not doing it out of ignorance or some sort of ‘mindset’ or belief, but rather because they draw on evidence, knowledge and experience.

Finally we welcome the opportunity to comment and be involved in future discussions.

Vicki Hird MSC FRES RSA

Land Use, Food and Water Security Programme

Friends of the Earth England, Wales and Northern Ireland

Part of an international federation of 76 organisations of Friends of the Earth International.

October 2012.

Caroline Drummond - Leaf UK

Thank you very much indeed the opportunity of looking through this report. It is very widely researched and well thought through, logical arguments.

There are a few areas that are missing with regards to sustainable intensification and although these are highlighted we think they need to be better recognised within the report. In particular, the need to engage society. This has always been a critical part of delivering more sustainable food and farming approaches and with the concept of sustainable intensification it is essential that it is not excluded. If we are addressing more sustainable production and the delivery of better sustainable environments it is very important that society understands the trade-offs and indeed the contribution that they need to make through their own choices, diets and actions.

We also feel that there is an opportunity for some mention of technology and the role of farmers themselves in terms of identifying who the key players are in moving the debate forward and the delivery of change on the ground itself.

In addition to that there are some global governance issues that are set for biodiversity targets but not really for production targets. Perhaps there is a need for us to “sustainability proof” all regulation and policy development?

Specifically, although Integrated Systems are briefly mentioned, there is no reference to Integrated Farm Management (IFM) and the contribution that such an approach has in the delivery of sustainable intensification.

Although the global perspective is implicit, there is an opportunity for it to be more explicit.

One further area that is touched on is the development of metrics and the common approach that is needed to be taken. We would wholeheartedly agree with this, having seen a new set of sustainability indicators developed every five years on a national level agreement of metrics is a big challenge. We are currently doing some work on soil metrics with the aim to develop approaches that are realistic for both researchers and farmers alike.

Finally, short-term market drivers are both a challenge and an opportunity and it would be interesting to see some discussion/reference to how the market can be engaged in this debate. Balancing what is a competitive edge with a genuine societal need.

We would agree with you wholeheartedly that there is little long term, systems research that is being carried out. From the 21 years that we have been looking at Integrated Farming approaches at LEAF and working with our partners on a European scale within EISA, we know that the management approach is absolutely critical in delivering production, environmental and social engagement benefits.

As you will be aware LEAF has a network of demonstration farms across the UK and we

run the environmental food label LEAF Marque which is now operating in 47 countries across the world. Furthermore we have engaged with some million consumers over the last seven years directly on farm through the Open Farm Sunday event and more recently we have been looking at the health benefits from engagement with nature, food and farming for those people that are deprived of opportunities to go out into the countryside through the Let Nature Feed Your Senses project that we run jointly with the Sensory Trust.

Caroline Drummond

Chief Executive

Leaf UK

Dr Andrea Graham - National Farmers' Union

This is a very helpful, generally well balanced and referenced, thought-provoking report. It tackles some thorny issues relating to how sustainable intensification (SI) is defined and interpreted by different groups. I'm sure colleagues in the NFU will find this report a useful point of reference for our future internal discussions taking forward the SI debate. I would also broadly agree with your high level conclusions and key insights about what SI needs to be and what it is not. It should be used as a useful conceptual framework and I share the view that it is virtually impossible to use SI to define an absolute level of increase in food production.

Meanwhile, please find summarised below some observations of the report which I hope that you will find constructive.

General Comments

The report is refreshing in that it does not dwell on the sometimes over quoted statistic of 9 billion mouths to feed by 2050. However, it does perhaps lack a sense of urgency in terms of the timescale of the challenges ahead. I'm aware there has been some regret that the timescales outlined in the 2011 Foresight report were too far away to muster action by the policy makers of today and might be a helpful opportunity in this report to redress that, by emphasising some of the more immediate challenges ahead such as the significant population spike expected in urban Africa by 2025 - just 13 harvests away.

Definition of environmental sustainability

We would like to see a reference to support your assertion that *“some biofuels, though renewable, have more negative effects for the environment than fossil fuels”*

With regard to your reference to possible alternative mechanisms to implement policy goals, including judging food producers on their results: just for information, the 2011 review of Agri-environment schemes (AES) in the UK (MESME) was looking at the possibility of payment by results. I think initially quite a lot of our members saw some merit in this if it meant that we moved to a less prescriptive and bureaucratic box ticking approach to how AES were implemented and importantly if it gave farmers and land managers more freedom on how they achieved the environmental objectives as long as they delivered. I have to say I'm not sure where this has finally got to, but early discussions with Defra and other national stakeholders demonstrated that this was fraught with pitfalls – not least factors outside the control of the farmer or land manager which could for example have a major negative impact on the local population of a particular species and how the outputs were actually recorded.

Land Sharing versus Land Sparring

In your discussion of land sharing versus land sparing for biodiversity and greenhouse

gas reduction, you state that “*converting natural environments to land suitable for agriculture is quick, taking weeks or months and seldom more than a year*” – I think I would strongly contest this statement because it all rather depends on the habitat you are converting to and from. It can sometimes take many years to convert land to productive agricultural land – just getting on top of problematic aggressive vegetation can take several years. This is why for example we have a specific cross compliance active management requirement (GAEC 12), the aim of which is to avoid encroachment of unwanted vegetation on land not currently under agricultural production, such that the land can be quickly returned back to production if needed. The land sharing/sparing section was particularly interesting, not least because this phrase is becoming increasingly prevalent and I sense there is a great deal of confusion regarding what exactly is sharing and what is sparing. I personally have heard UK AES referred to as examples of both sparing and sharing! Ultimately I suspect this is down to a question of scale. So for example, is the sparing and sharing on a farm business or an individual field scale? I wonder whether it is worth flagging up the concept of biodiversity offsetting here? There are six biodiversity off set projects running across the country. They started in April and run for two years. All the projects were in set up phase and as yet they have not got into delivery. So far, only one project had started working with a planning application. Info on the locations and contacts can be found here:

<http://www.defra.gov.uk/environment/natural/biodiversity/uk/offsetting/pilots/>

I think the comment about whether the AES applied under the CAP have actually delivered the desired environmental objectives, is a little negative. The principle of the broad and shallow (ELS) and narrow and deep (HLS) schemes have been very successfully adopted in England. We can argue about the deliverable results in terms of numbers of farmland birds and whether or not they should be held up as the predominant indicator of environmental success, but what these schemes have delivered in terms of engagement from farmers and land owners is a significant positive shift in increased awareness. It's fair to say that the ELS was originally rolled out with little guidance and support and there were lessons to be learnt, but we also know that where the right advice has been available (for example the Campaign for the Farmed Environment) then a much improved profile of land management option uptake has been achieved.

Just for information, a project commissioned through Natural England's Environmental Stewardship (ES) Evidence programme has shown that management undertaken by farmers as part of ES has had a significant effect on farmland bird population trends since 2005. The project involved undertaking new analyses of data collected by the BTO/JNCC/RSPB Breeding Bird Survey and showed that ES options that provide winter seed food, such as stubbles and wild birds seed mixtures, are having a beneficial effect on breeding populations of seed-eating birds such as Grey Partridge and Yellowhammer. The analysis of the Breeding Bird Survey data looked at enhanced winter seed resources for farmland birds, provided by options which were mostly taken up under Entry Level Stewardship (ELS). Whilst the effects of ES on farmland birds were statistically significant, they were small, indicating that ES was effectively reducing the rates of decline rather than reversing them. This was recently reported in Natural England's newsletter if you would like the reference:

http://www.naturalengland.org.uk/Images/lmupdate8_tcm6-33754.pdf

In the report, you raise the concern that the by-product of increasing yields in certain area to allow land sparing, could drive up profitability and skills etc. with the perverse outcome being that farmers will then wish to “*renege on the land sparing agreement*”. The counter argument to this is that productive and profitable farm businesses are also more able to invest in innovation and technology which can improve resource efficiency and improve their environmental footprint.

Animal Welfare

Animal welfare is always a sensitive issue and this has largely been covered well and in a balanced manner in that section of your report, particularly how different people give different weight and emphasis to the “Five Freedoms”. However, I wonder whether we shouldn’t be getting away from driving a wedge between the relative merits of different systems for animal welfare and instead looking at the fundamental single key factor – stockmanship. From our perspective good animal husbandry and welfare is ultimately about good stockmanship, not the farming system.

Intensification in Different Contexts

In this section, you refer to the use of “greater amounts of antibiotics” in intensive systems – this needs referencing to evidence because it’s very easy to take a statement like this out of this report and use it elsewhere out of context as a fact. From the NFU’s perspective, “prevention is better than cure”. Antibiotics are used in both human and veterinary medicine to prevent bacterial infections that have occurred in some members of a group, or that are likely to occur. There are many disease scenarios in livestock animals where prophylactic use of antibiotics is an essential part of responsible veterinary care for the protection of animal health and welfare. Any such preventive and control treatment is always under the regulation of the prescribing veterinary surgeon who will use diagnostic, clinical and epidemiological (i.e. knowledge of when and where disease is likely to occur) knowledge to inform their prescribing decisions. Therefore, it needs to be made clear that the management system per se is not the driving factor in antibiotic use.

Human-Centred Outcomes: Nutrition

In this section, the possible approach of using regulation (of food supply and/or price) to address diet-related problems is raised. I think if you are going to raise this as a possible tool, then to retain balance in your report you also need to at least mention some of the perverse outcomes, such as the Danish experience where taxation has failed and simply resulted in driving consumers over the border to Sweden.

The Need for Better Scientific Understanding and Refined Metrics

The point on the need for metrics to help capture environmental outcomes as well as nutritional outputs is well made and one with which I would agree. The recent report by the LUPG “*Exploring the Concept of Sustainable Intensification*” is of particular interest to the NFU because it attempts to move beyond the words to actually providing some, albeit in places quite crude, metrics for sustainable intensification and what it might actually look like in practice and how it might be measured on an individual farm. Overall, the

report is a helpful step forward in progressing the “ambition” of sustainable intensification and there is a lot in here we would generally recognise and agree with and perhaps worth flagging up in your report too?

Resilience and its relationship with diversity and productivity

Finally, in this section you cover the issues around resilience and how this relates to productivity and diversity. You are probably aware that Sir John Beddington’s Food Research Partnership recently commissioned a sub-group report on resilience in the food chain to short term shocks (including cyber threat, regulation and extreme weather events). I think the report was well received and will be published imminently, so worth cross referencing. One area it picks up is the potential impact of extreme weather events on the global supply of, even major, commodities. Climate change may well improve local conditions if based on the projected increase in temperature, but the increased frequency of extreme weather events could have more potentially disruptive impacts on the resilience of the food supply. If you haven’t already seen a copy I can make sure the link is forwarded to you as soon as it’s available.

Dr Andrea Graham

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National Farmers’ Union

November 2012

Lucy Bjorck & Martin Harper - RSPB

RSPB welcomes this report and its wide ranging consideration of the debate around sustainable intensification (SI), what it needs to mean and how it can help us address the range of environmental and social challenges within our food production systems. To date, the term has caused confusion and the often narrow interpretation assigned to it by some has polarised opinions rather than contributing to the process of identifying truly sustainable solutions for UK agriculture and for the environment¹.

Although we welcome this report and its attempt to “*recapture SI from those who have sought to redefine it*”, we remain unconvinced that the term ‘Sustainable Intensification’ can be a useful one in a UK context because it fails to recognise that many practices are currently unsustainable and therefore further intensification is likely to serve only to increase damage to the environment. We need to rethink these practices to ensure sustainable production in the long term. Increasing intensity, even if done in a highly efficient way, will not deliver environmental sustainability (or even necessarily any environmental improvements), particularly in terms of halting biodiversity declines across the UK countryside.

We agree with the report’s analysis that the challenge of food security is not synonymous with increasing food production. To address this issue action is needed on a number of fronts, including addressing poverty, access to food, waste reduction and demand management. The real challenge of ‘food security’ for the UK in production terms is in ensuring that our farming systems are productive whilst also operating within current and future environmental limits, and are therefore resilient for the long term. Now more than ever in the face of climate change we need to examine the sustainability of our agricultural systems as a whole and seek approaches to ensure sufficient safe, healthy and sustainable food now and in the future.

The main driver of biodiversity losses (loss of species and habitats, contractions in range and ongoing reductions in population sizes) in the UK countryside has been for many decades the intensification of farming across all sectors. This has resulted from the changes in crops, cultivation timing and techniques, use of artificial fertilizers and pesticide inputs. The National Ecosystem Assessment (NEA) has reviewed the large evidence base for this and clearly stated that this well evidenced and accepted as fact.

There has been progress in addressing these problems: through education and training, improved regulatory controls and mitigation solutions delivered via agri-environment schemes. However, due to inadequate progress on implementation and enforcement of these regulatory controls, inadequate funding, poor quality implementation and insufficient scale of take-up of agri-environment, environmental degradation from past intensification has not been adequately addressed. If we are seeking to further intensify,

¹ Jonathon Porritt, Founder of Forum for the Future, writing in a recent Food Ethics Council magazine about the term ‘sustainable intensification noted’: “*I was at first inclined to give SI terminology the benefit of the doubt. That was naive. It’s quite clear, two years on, that the idea of SI is being used by big farming interests and agrochemical companies to describe exactly the same old model of intensive farming, linguistically (and dishonestly) embellished with the ‘s’ word*” (<http://www.foodethicscouncil.org/node/674>)

even if less damaging than previously, this will not address this existing damage.

It is implicit within much of what is said and written about sustainable intensification that by focussing on efficiency we can deliver environmental sustainability. This ignores the concepts of environmental limits which is a core element of sustainable development. We need to always have a view to the long term challenges and solutions, which will require some step changes and not just incremental improvements. The natural world is critically important to both our well-being and economic prosperity, but we consistently undervalue it in decision making. Only by protecting our resources can we benefit from the array of benefits they provide and ensure a sound footing for production long into the future.

As the report points out SI is an aspiration not a prescription to be followed. It is not appropriate in all instances, it cannot be an agenda for all, nor lead to a common set of actions across sectors. The Green Food Project work shows that balancing production and environmental challenges across the UK requires spatially specific solutions.

It is important to continually restate that the UK is already a highly efficient and productive country with little scope for major yields increase. Increased production to meet growing demand is likely to come primarily from countries which are not yet reaching their sustainable potential. The UK's role should be to demonstrate best practice in terms of sustainable production, waste reduction and via policies to curb the demand for the most unsustainable food.

Biodiversity is a key element of environmental sustainability that is often left out of the SI debate, because it does not fit with the resource efficiency/cost cutting agenda. Indeed the resource efficiency approach that many utilise when talking of SI will, in livestock systems, lead to actions which will have significant negative impacts for biodiversity (as well as for climate change). Livestock grazing is an essential tool for conservation management and can be the only sensible use for some marginal areas of land. However there has been a trend towards systems based on higher inputs and greater specialisation which generate few benefits for biodiversity but generate high levels of pollution and whose welfare standards have been questioned. Therefore by only approaching the environmental and food security challenges via the SI lens, we may take ourselves down some dead ends and may even prevent more holistic long term solutions.

The most economically or resource efficient farmers are not necessarily the most environmentally friendly. Indeed many of the most valuable farming systems in terms of positive or benign impacts on the environment are likely to be considered 'inefficient' in market terms. This is often because there are no market or mechanisms to 'pay' for the environmental services they provide. Existing public funding via the common agricultural policy disproportionately favours farmers that produce the most food/crop per hectare. This is a hangover from the over-focus on production in previous decades and does not accurately reflect the value of the farming system to society.

Only 'intensification' actions which raise the environmental bar – taking into account local direct impacts and more distant indirect impacts – can possibly be considered as 'sustainable intensification'. This means that we need actions to deliver on all elements of sustainability including biodiversity. To deliver this goal government, farmers and environmentalists need to work together to embed environmental delivery into our agricultural system. In seeking to measure sustainability we need to develop more

sophisticated metrics which take into account the biodiversity and ecosystem services of different land parcels.

The discussion of the merits of land sparing and land sharing highlights some important concerns. Although the main driver of biodiversity losses in the UK countryside is the intensification of farming there is also a suite of species which depends to some extent on agricultural management. In a UK context it is important to note that to date there has been no detailed research to determine which is the most beneficial approach for our priority conservation species.

Conclusions

We agree that achieving food security requires action on many fronts including demand side actions. Demand management policies are a critical part of the package to ensure supplies of sufficient, safe, healthy and sustainable food now and in the future.

As the UK is already producing towards the top end of global yields most growth will come from areas where the potential for increased yields is greater. Instead the UK should seek to be a leader in sustainability to safeguard food supplies and our natural resources into the future.

Ensuring sustainability relies on the safeguarding and enhancing of natural resources, including biodiversity. This delivery is often unsupported by the market and effective policy mechanisms are needed, in particular the role of agri-environment schemes is crucial in rewarding farmers for structuring their business in a more sustainable way.

In seeking increased efficiency there maybe a temptation to further simplify farming systems. However this may not be the most sustainable approach, diversity in production can help ensure resilience in delivery. More research and more sophisticated metrics are required to guide policies in this area.

In the short term there are a number of actions the UK government should take to make UK farming more sustainable, these include:

- A more integrated approach to pest control. Farmers are currently heavily reliant on chemical pesticides. Despite clear evidence of the problems with this approach (water pollution, impacts on non-target organisms, widespread and growing resistance in pest populations), government is failing to act. The Sustainable Use Directive and associated UK policies (the National Action Plan on sustainable use of pesticides and the proposed Integrated Pest Management plan) provide an ideal opportunity for government to show leadership in moving UK farming towards more sustainable pest management.
- Action is needed to develop and implement demand management policies to guide UK consumers to choose healthy, sustainable diets. This will help deliver both public health benefits and reduce the demand for the most resource intensive production required in the long term.
- In order to reduce the environmental impact of agriculture which is already causing damage to existing biodiversity we need effective enforcement of existing regulations,

for example relating to diffuse pollution, to drive out bad practice. Both farmers and environmentalists agree that those who are failing in their responsibility and damaging the reputation of farming should be penalised.

Lucy Bjorck & Martin Harper

RSPB

November 2012

Tom MacMillan - Soil Association

The Soil Association has had an uneasy relationship with calls for ‘sustainable intensification’. On the one hand, it has seemed to convey an ambition that we share. Far from simply being extensive, organic farming and other forms of agroecology seek to be intensive in ways that can be sustained, for example in renewable resources, labour and management.

While we are proud of our organic standards, we are also acutely aware that they don’t hold all the answers to the challenges faced in food and farming. Our strategy, [The Road to 2020](#), sets out our commitment continually to improve organic standards, making ever surer that they are achieving the environmental, animal welfare and social outcomes intended, and to be inclusive in working constructively with non-organic farmers and others who share our aims.

However, we have felt little need for a new term to describe this inclusive, outcome-focused approach. From our perspective, it is about supporting farming and food systems in line with organic *principles* – summed up by the International Federation of Organic Agriculture Movements as ecology, care, fairness and health – as opposed to working exclusively with producers certified to our organic standards. While the standards are prescriptive, the principles are not. Organic standards are an important tool for putting the principles into practice, being the only system that is pretty consistently applied all over the world, independently and rigorously inspected so that consumers can know with confidence how the food they are buying was produced and processed. But they are not the only tool: we also operate other standards (e.g. SA Ethical Trade and the Food for Life Catering Mark), develop metrics that apply across production systems (e.g. the AssureWel animal welfare measures, set to be used across 95% of the UK dairy sector), run knowledge exchange events that are open to all farmers, campaign for changes in policy and consumer behaviour, and participate in research.

Meanwhile, on some of the occasions when we’ve heard calls for sustainable intensification, it has been to downplay those organic principles: for unquestioning investment in developing new agricultural inputs instead of a greater focus on agroecology; for a less caring approach to animal welfare or biodiversity in the name of upping production; for a narrow definition of sustainability that leaves little room for fairness, health or changes in consumption practices. In effect, for agribusiness as usual with a light green tinge.

Tara Garnett and Charles Godfray’s paper recognises such concerns but argues that the term is worth salvaging. They provide an exceptionally clear and fair-minded account of the controversies that have surrounded the concept of ‘sustainable intensification’.

Whether or not you accept their conclusion that this new form of words can be reclaimed, their account of the arguments is very useful. Their view that approaches to three key issues – the scale and scope of environmental assessment, conceptions of animal welfare, and the human benefits expected of agriculture – play a pivotal part in shaping

prescriptions for progress in agriculture, accords with our own experience. I commend their analysis, as it explores a range of positions intelligently and sympathetically in field where all sides too often argue with caricatures of the views they oppose.

Their overview of the land-sharing/land-sparing debate is particularly clear. We have got involved at the Soil Association where studies have treated organic farms as an Aunt Sally, used methods that understate their productivity (e.g. treating grazed land as unproductive), focused on single crops or metrics, or compared the actual performance of land-sharing systems with idealised scenarios for land-sparing – fine if they were just thought experiments, but unhelpful when they're reported in ways that penalise current good practice. The questions of scale and system boundaries that lie at the heart of this debate are important, and we'd welcome choices of research design and modes of argument that engage farmers and land managers who are delivering environmental benefits, rather than obliging them to defend their record.

While the paper doesn't claim to resolve the debates that they outline, it does seem to suggest a few 'no regrets' ways forward:

- When it comes to land use, better protection for 'spared' land and the people who depend on it, and investment to up productivity within 'land-sharing' systems. Productivity needs to be measured in the round, as the paper discusses, rather than just as tonnes per hectare.
- Where there has been chronic underinvestment in livestock systems, higher productivity and animal welfare can go hand in hand.
- Greater investment in demand management, including efforts towards more sustainable diets. While waste reduction has received a lot of attention, the diets problem is often seen as intractable. Yet the experience of the Food for Life Partnership and rapid uptake of our Food for Life Catering Mark, which certifies healthier and more sustainable diets, suggests otherwise. The Catering Mark now certifies over 600,000 meals a day, mainly in schools, but also in nurseries, universities, hospitals and, just starting, at workplaces.

The paper makes some recommendations for moving forward thinking and action on 'sustainable intensification'. Of these, I particularly welcome their calls for:

- Decisions to be based on a 'systems' view.
- Better metrics "that capture the multiple nutritional and non-nutritional outputs that can be obtained from agriculture, and to assess these against environmental objectives".
- For values to be discussed openly in policy debates, recognising that deciding the right course of action is rarely if ever a purely technical matter.

There are moments when I wonder whether the authors forget how distant current governance is from meeting these criteria, particularly in technology assessment. A crucial question on which they say little is how best to proceed in the meantime, and what good governance looks like in world where systems-views, metrics and representation in policy will always have some blind-spots. Precautionary decision-making and practice-based approaches to assessing environmental performance are ways of making progress in such

circumstances.

Can the concept of ‘sustainable intensification’ be reclaimed along the lines that Garnett and Godfray suggest? It won’t be my own terminology of choice, as organic principles already provide a comparable framework for innovation in sustainable agriculture, with the difference that they put fairness, care and health unambiguously centre-stage. What I now have, however, is an alternative to simply dismissing the ‘sustainable intensification’ when it gets misappropriated as a way of greenwashing business as usual – this paper provides an authoritative account of what the term should usefully mean.

Tom MacMillan

Director of Innovation

Soil Association

October 2012

Maggie Gill - University of Aberdeen

I would say this is a well-written academic treatise, but I don't quite see how it is targeted to policy-makers? I have spent some time with agricultural policy makers in the Scottish Government and Europe recently and they would not be particularly interested in a discussion about sustainable intensification. The bit of interest would be what society wants from a food system. That is valid and could be developed into a one or two page policy brief which might get read.

In terms of the content, it would have been nice to have seen some discussion of pastoralism and consideration of the different types of livestock. It reads as if all livestock produce high amounts of greenhouse gases whereas ruminants are much worse offenders than pigs and poultry and it reads as if most livestock require grain whereas ruminants can make pretty good use of grass, forages and by-products. Also what is the evidence that milk per se is bad for you? Red meat and processed meat OK increase the risk of bowel cancer but recent systematic reviews don't confirm that milk is bad.

Another point missing from the report is the issue of scale. It's fine to talk about sustainable intensification at the global scale, but actually, given the nature of farming it is what happens at the local level that counts. I am currently working with USAID and DFID to develop a research programme on sustainable intensification in Africa and one aspect of sustainability which seems to be missing is the sustainability of the local markets. Hence we are interested in the economic sustainability as well as the environmental.

Maggie Gill

University of Aberdeen