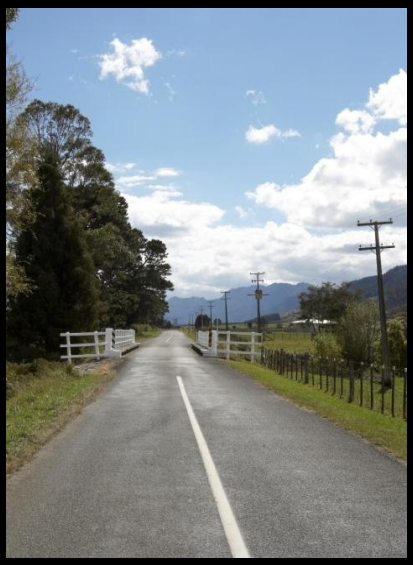
Agro-Ecological Investment Management

THE FALLACY OF FOOD MILES



The ‘food miles’ and ‘local food’ concepts with their overt simplicity are popular and seen as intuitively appealing, especially so in higher latitudes with cooler temperate climates, regions that ironically benefit most from imported food.

They are however concepts that are fundamentally, demonstrably and irreversibly flawed.

‘Food Miles’ totally fails to take into account the complexity of the entire farm to fork food chain (transport method, type of production system etc.), and as such is at times more of a distraction from, than part of the solution to, agriculture’s climate change and wider environmental impact.

Introduction

The concept of and concern surrounding the issue of 'food miles' is still gaining headlines, despite having been widely shown to be critically flawed. This Agro-Ecological short analysis paper explains the flaws in the concept of food miles; how its use in virtually all public discussions is poorly informed and why its valid use is just one component among a multitude used in lifecycle analysis.

A grain of truth

Ironically, right at the heart of the food miles idea lies a grain of truth. The transportation of food requires energy, to power engines and to build infrastructure such as vehicles and roads. If the energy for this transport comes from fossil fuels then it directly and indirectly contributes to climate change.

The fundamental problem with the discussion of food miles in the public arena, and even some academic discourse, is that this kernel of truth has been inflated to 'the truth, the whole truth, and nothing but the truth', which it categorically is not.

To be used correctly the food miles kernel needs to be weighed up against all the other kernels of grain that represent all the other climate change and environmental impacts of food production, and then, and only then, can its true and relative impact be determined.

The absurdity of food miles

Reductio ad absurdum (Latin for "reduction to the absurd") is a philosophical analysis by which an idea is shown to be incorrect by following its implications to an absurd conclusion. Food miles met its *Reductio ad absurdum* in a story from the middle of 2010 where a pineapple (singular) was grown in the UK at a cost of some £10,000 (see World's most expensive pineapple, The Independent). The fruit was consumed at the 'Lost Gardens of Heligan' where it was grown, so that its food miles were mere metres.

The total energy used to produce it however, means that its total climate change impact was many magnitudes greater than a typical pineapple grown under a tropical climate, outside, in the soil, and then transported to the UK by ship. Also the vast effort and therefore expense required means that the UK pineapple is totally impractical as a means of food production to feed a society. So while the pineapple had nearly zero food miles, on every other measure of environmental sustainability, including climate change, and practical food supply, it was a conspicuous failure.

Clearly this is no way to run agriculture. This absurd pineapple highlights the issues that need to considered in order to gain a more detailed understanding of the fallacy of food miles.

Energy and transport

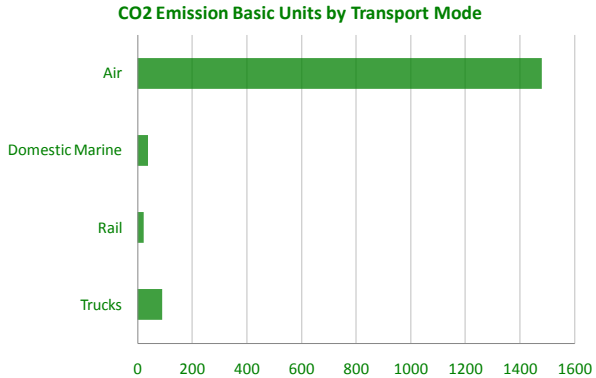
There is much talk of the 'energy crisis' facing humanity; however, the world is awash with energy. Some 174,000 terawatts of energy from the sun traverse the biosphere each year while total human energy use is 10 terawatts, i.e. 0.0057% of the biosphere's annual energy flow. The opulent use of energy is therefore not in and of itself a problem if it comes from truly renewable, environmentally and ecologically sustainable sources (wind, waves, tidal, micro-hydro, solar etc.).

The energy crisis is actually a fossil energy/fossil fuel crisis; the era of very cheap and very widely available fossil fuels that civilisation has become utterly dependent on is coming to an end and fossil fuels will become ever more expensive and scarce. If truly renewable energy sources are used to transport food then the miles a food has travelled is almost a non-problem from an energy consumption perspective.

Not all miles are equal

The idea that it is distance (the miles a food has travelled) alone that gives an accurate measure of the energy used in transporting food is also utterly flawed.

Different modes of transport such as muscle power, (horse and bicycle) and mechanical power, (ship, airplane, train, lorry and car) vary dramatically in the amount of energy required to transport each unit of food, setting aside the difference between fossil and renewable energy for the moment.



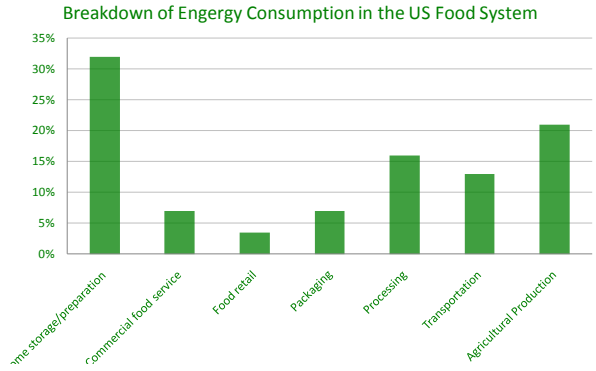
Source: The Ministry of Economy, Trade and Industry Notification No. 66 (March 29, 2006)

Ships and boats are in most cases the most efficient means of transportation, due to many factors, such as the weight that can be carried for the size/weight of the vessel and the seas and oceans do not need to be constructed or maintained unlike roads or rail, etc. A fully laden transport ship can move an item of produce from one side of the world to the other for much less

energy than the final consumer uses transporting the same item of produce from the supermarket to their home. This is because they use a car weighing around a tonne (1000 kilograms) to move only a few tens of kilograms of food so all the energy used to move the car has to be attributed to the few kilos of food. It is therefore not the distance that an item of food has travelled that is the real issue; it is the amount of energy, and particularly the amount of fossil energy, that has been used to transport it.

Miles and energy use

The energy used to transport food from farm to fork is in many cases only a small percentage of the total energy used in the food's production. In fact it has been shown in various studies that transport accounts for only around 10-15% of the food system's emissions (See chart below).



Source: University of Michigan Centre for Sustainable Systems

It is at this point that the reductionist canard of food miles completely unravels. As discussed in other Agro-Ecological papers (see our climate change paper) reductionism is where an analysis, focused on only one part of a large complex system, draws a conclusion that is then applied to the system as a whole, often producing an outcome completely at odds with the one desired.

Many foods, particularly industrial agricultural foods (i.e., non-organic), consume far greater amounts of energy in their production, than they do in their transport. Three examples follow: wheat and corn/maize, glasshouse tomatoes and feedlot beef.

Wheat and corn/maize crops, especially in higher latitudes can use more energy in their production than is contained in the harvested crop, i.e. there is a net loss of energy. Most of the input energy is in the form of Haber-Bosch nitrogen, but also from the various herbicides, insecticides and fungicides applied to the crop, plus the fuel used to power the tractors.

If you substitute energy for money, such an approach makes no sense at all, as any farmer that made a financial loss year on year would soon be bankrupt. And wheat and corn are far from the worst offenders.

Glasshouses, especially heated ones, allow crops from hotter Mediterranean climates to be grown in colder temperate climates, e.g. tomatoes and cucumbers, even in the middle of winter. While this is quite a technological achievement it is an energy disaster. Almost every aspect of this system is energy hungry: the glasshouses are chiefly made of glass, aluminium and concrete, all are very energy intensive materials to make. Heating such buildings requires huge amounts of energy as heat is rapidly lost through the large areas of thin single pane glass and aluminium support structures (it is economically unviable to use more energy efficient systems such as double glazing). The crops are almost exclusively grown in hydroponic systems (instead of the soil), which requires considerable energy to construct and also depends on soluble fertilisers, including highly energy intensive Haber-Bosch nitrogen and soluble forms of the rock fertilisers, many of which also require vast amounts of energy to produce. Numerous crops receive supplemental light to boost photosynthesis, plus carbon dioxide enrichment all of which consume large quantities of energy.

The net result is the amount of energy used to transport such tomatoes from the glasshouse to the consumer is utterly dwarfed by the energy used in their production. It also completely dwarfs the amount of energy in the tomatoes; tomatoes are about 90% water, in comparison with grain (wheat and corn) at only 15% water.

Feedlot systems, called Concentrated Animal Feeding Operations (CAFOs) in North America, are also extremely energy intensive. Instead of eating grass at foot, animals in these systems, such as beef cattle, are fed grains (wheat and corn), which are produced on highly mechanised farms using large amounts of Haber-Bosch nitrogen, pesticides and fuel. As described above, such crops are often already energy inefficient, even negative. When they are fed to stock, even more energy is lost because only a small proportion (20%) is converted into energy contained in the meat that reaches consumers' plates. The rest of the energy 'lost' is in the normal life processes of the animals, such as keeping warm, moving around (where they can) and just being alive. The result is that many times the amount of energy contained in each kilo of meat goes into its production. Amounts that dwarf the energy consumed transporting the meat to the consumer's plate.

Holism, systems thinking and lifecycle assessment

These three examples above demonstrate the reductionist fallacy of focusing on food miles energy compared with the often much larger amounts of energy consumed in the production of the food. The antidote to reductionism is holism, also known as systems thinking. This approach takes the whole of the production system into account when analysing and deciding if and what changes need to be made.

When it comes to practical tools to undertake such holistic thinking Life Cycle Assessment (LCA), also known as cradle-to-grave analysis, is the gold standard. In such an approach, it is not just the fuel used in a tractor to cultivate the fields that is measured, it is also all the energy that has gone into the production, use and demise of the tractor; from mining the metal ores to final assembly and distribution, plus the energy spent maintaining it, and on its final dismantling and recycling/destruction. This has to be attributed to each unit of food that the tractor produces over its entire life. The same detailed analysis then has to be done for every part of the system that contributes to the production of an item of food; tillage, planting, fertilisers, pesticides, harvest, drying, storage, processing, packaging etc.

This provides an indication of the complexity involved with a holistic approach. The volume of information that needs to be analysed is enormous, and often difficult to measure. This is one reason why reductionism is so popular - it is easy to understand and measure. But, like the person who lost their keys on a dark night and looks for them under a street light, even though they lost them in the darkness, the reductionism of food miles is a fool's errand. Just because it is the easy option does not make it right (or particularly intelligent).

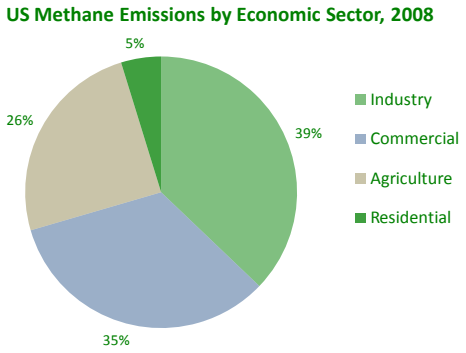
Contribution to climate change

The underlying concern of the food miles 'debate' is that transporting food requires energy, which (predominantly) comes from fossil fuels, and the burning of fossil fuels releases carbon dioxide into the atmosphere which is a cause of climate change. Climate change is bad, so following the causal chain backwards the obvious solution is to reduce food miles to reduce climate change. The problem once again is bad old reductionism.

The point is that burning fossil fuels is not the only contribution agriculture makes to climate change. Indeed, agriculture's main contributions to climate change come from methane and nitrous oxide. Most of the methane comes from enteric fermentation (the digestive process of ruminants such as cows and sheep) and rice paddies, and most of the nitrous oxide from Haber-Bosch nitrogen.

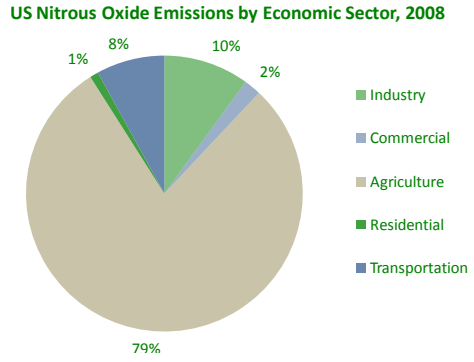
If the ultimate aim is to reduce climate change, there is little point in reducing fossil energy consumption in agriculture, including food miles, if these non-CO_2 green house gasses being produced are not addressed or worse are allowed to increase.

This is a particularly acute problem because methane has approximately 20 times and nitrous oxide 300 times the climate changing power of carbon dioxide (depending on the measurement duration). This means that to keep the climate change impact of a farming system constant, you must reduce the amount of CO_2 by 300 molecules for every one additional molecule of nitrous oxide you produce and vice versa.



Source:EPA, Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2008, Table 2-14.

If you reduce nitrous oxide by one molecule, you can release 300 more CO_2 molecules and keep the climate change impact constant. So, just as all food miles are not equal, all green house gasses are not equal.



Source:EPA, Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2008, Table 2-14.

The impact on the climate of the many different components and practices within agriculture varies hugely. The devil is in the detail, hence understanding the detail is critical. For a more in-depth analysis of agriculture and climate change and what ecological/organic agriculture is doing to mitigate and adapt please see our climate change paper.

Many impacts

Climate change is 'just' one (though a big one) of many impacts agriculture has on the environment and human society. These include impacts such as:

- biodiversity loss;
- ecosystem function;
- soil erosion/loss and pollution;
- human health and disease, especially cancer;
- nutrient and pesticide pollution of water bodies;
- social justice;
- animal welfare;
- local and regional cultures;
- employment;
- landscape values etc.

If an individual's and/or society's aim is to minimise the negative impacts of agriculture, why focus on reducing food miles alone? Even advancing the process to consider the total fossil energy consumed by agriculture, or even agriculture's total climate change impact is insufficient. Why focus on food miles while ignoring polluting production systems, accelerating decreases in biodiversity, inhumanely treated feedlot beef, soil loss/degradation, and many other negative impacts of agriculture?

The only valid approach is to analyse the system as a whole. This involves identifying the biggest problems, understanding the complex interactions between the different parts of the system and then taking the most effective course of action.

THE COROLLARIES OF FOOD MILES: LOCAL IS NOT ALWAYS BETTER, BUT SOMETIMES IT IS

Local can be boring

Many of the nations where food miles continue to be a topic of concern among the general public, politicians and the media are situated at higher latitudes with cooler temperate climates, i.e. where the winters are sufficiently cold that crop growth is very slow or impossible due to snow cover. Eating locally in such climates, especially eating locally and seasonally, is a recipe for a 'challenging' gastronomic experience.

The food supply and type in such areas is exceptionally uneven. There is almost no fresh food available in the 'hungry gap' (as farmers and growers still call it) which occurs in spring when overwintered crops (e.g., leeks, cabbages) go to flower and are inedible and the newly planted crops have not yet grown enough to be harvestable. After summer the autumn harvest generates a huge glut of food, followed by winter when there is a preponderance of hardy vegetables such as cabbages and roots. Eating truly locally and particularly seasonally in such climates is a remarkably unappealing prospect.

This situation has only changed in living memory, mainly due to the advent of refrigeration (first commercial and then domestic) and the long distance transport of food that refrigeration allowed.

Traditions such as harvest festival, the large Christmas feast and terms such as 'spring chicken' are echoes of this situation. Even less understood is that many of our traditional foods, such as jams, pickles, preserves, cheese, butter, cake, biscuits, etc. were not invented because their creators were trying to craft a 'taste sensation', they were simply trying to find ways to make the huge glut of often highly perishable food that arrived in autumn (harvest) last through the winter and spring in the absence of refrigeration.

That many of these foods are now considered delicacies would be lost on our forbears of only a few generations ago; you only have to see a traditional German farm's sauerkraut pit, which is a 'well' about a metre wide and three deep, dug in the ground, to realise just how horribly boring the diet was for half of the year. The typical German farming family depended on three cubic meters of pickled cabbage for their green vegetable for much of the year.

The only valid approach is to analyse the system as a whole.

The ability to transport food around the world to balance out the highly seasonal supply in the higher latitudes and bring foods that could not be grown in such places, is essential to maintain a diverse and stimulating diet. Clearly local is not always better.

One of the reasons food miles is a concern in the higher latitude, highly seasonal, areas is that it is these places that benefit most from the transportation of food from afar. It is these areas that therefore tend to import the most food and as a result the issue is conspicuously apparent to consumers, especially where there is country of origin labelling.

At the other extreme, tropical areas have a largely year round/continual supply of a highly diverse range of food so have little to gain from food transportation. You only have to spend a little time in the tropics to understand the luxury of just being able to harvest breakfast, lunch and dinner fresh from the trees outside your house, all year round.

Local is not secure

Another problem with a purely local food supply is, somewhat counter intuitively, lack of food security. Once again this problem is most acute in the higher latitude, highly seasonal, areas where concern about food miles is greatest. If the harvest fails in a seasonal food production system with only local supply, then there will almost certainly be a famine.

Times of such food scarcity still (just) reside in living memory even in the developed world. In some places it is indelibly etched on the national psyche, for example in the Republic of Ireland where the 1845 Great Famine, caused by the arrival of potato blight, resulted in a reduction of about a quarter of the population: one million due to starvation, another million due to emigration.

The Irish situation may seem unique but it has occurred many times in many countries where the population was dependent on a small range of seasonal staple foods and/or where the harvest failed for climatic, biological and/or political reasons.

The global movement of food is essential if humanity is to mitigate the natural variability of food production. Clearly, depending on local food production alone in seasonal climates is a hazardous and strategically irresponsible approach to take.

Local is good

In contrast to the above issues there is a lot of good to be said for a local food supply. Even in today's global village, much of a location's culture, from the level of village through nation-state to supra-national areas (Asia, Europe, South America, for example), is linked with the type of foods that are/were grown and how they are cooked.

Many view the homogenisation of food as a regression, and the Slow Food movement is an unambiguous reaction to such trends. Clearly, if we are to maintain our local food culture and the wider local cultures that go with them, axiomatically they can only be maintained locally, whether at the level of the village or the continent, as it is impossible for them to be maintained by other cultures. Celebrating local foods and culture is therefore a positive.

At the same time, the transportation of food and culture means that we can now also celebrate and enjoy the cultures and foods of others. There is nothing intrinsically wrong with enjoying Ossau Iraty and Cerise Noir one day, roast lamb with a fine Central Otago Pinot Noir the next and Jamon Iberico de Belotta the day after.

Clearly, depending on local food production alone in seasonal climates is a hazardous and strategically irresponsible approach to take.

While totally relying on local food is a recipe for food insecurity, total reliance on imported food is equally problematic. The UK provides a clear and recent example. In the late 1990s through the 2000s food security (and agriculture as a whole) fell completely off the UK political agenda. When questioned about this, the government ministers responsible simply said that it was a non-issue as the UK could import all the food it needed.

The global grain and fertiliser price spike of 2008 saw this position change, with food security rapidly moving up the political agenda. Food prices jumped and issues of food scarcity emerged as large food exporting nations placed restrictions on exports to protect local supply and/or keep local prices down. Clearly, having insufficient local food supply generates a significant risk. This can be an issue and perhaps increasingly will be for even the most developed nations.

Conclusion

'Food miles' in isolation are a demonstrated nonsense based on a kernel of truth that ignores all the other climate change and environmental impacts of food production.

Starting with the *Reductio ad absurdum* of food miles (the UK Pineapple) we have moved to identify and demonstrate:

- that we don't have an energy crisis on our hands, we have a fossil energy crisis;
- that the idea that all food miles are equal is a fiction;
- that the whole of the production system uses energy, not just the transportation of food;
- that it is not simply burning fossil fuel that causes climate change but the actual production system itself; and
- that agriculture needs to reduce its impact with respect to a wide range of issues, in addition to climate change.

We have also discovered that local food can be better but it isn't always and that despite our tendency in the Western world for Cartesian duality, there is no right or wrong answer, i.e. 'local good, foreign bad'. Local food is much more a matter of balance, detail and understanding the 'big (cradle to grave) picture'.

Without the global transportation of food however, those in higher latitudes would have to revert to a much restricted range and availability of food - to the point of boredom and considerably reduced food security. It is therefore indeed ironic, that those countries that most benefit from food miles are those that are most vocal about the 'problem'. Does it owe more to xenophobia than to environmental concern?

The operation of the agriculture production and supply chain as a whole requires a holistic approach, one that is capable of successfully undertaking the many interdependent steps required to achieve a truly sustainable value chain from paddock to plate. An agriculture that evolves to address environmental challenges (climate change, biodiversity, soil) is robust in the face of the inevitable resource limitations, i.e. adapted for the future, not an extension of 'business as usual'; and is above all a measurably environmentally, socially and financially sustainable agricultural system.

Food Miles - The 5 Key Points

- It is not the distance that an item of food has travelled that is the issue; it is the amount of energy, and particularly the amount of fossil energy, that has been used to transport it.

- The energy used to transport food from paddock to plate is only a small percentage of the total energy used in the food's production. Various studies indicate that transport accounts for only 10-15% of the food system's emissions. Many foods consume far greater amounts of energy in their production than in their transport.

- The only valid approach is to analyse the system as a whole (Life Cycle Assessment).

- Burning fossil fuels is not the only contribution agriculture makes to climate change. Indeed agriculture's main contributions to climate change come from methane and nitrous oxide, not carbon.

- If the aim is to minimise the negative environmental impacts of agriculture, why focus on food miles alone, while ignoring polluting production systems, accelerating decreases in biodiversity, inhumanely treated feedlot beef/pork, soil loss/degradation, and many other negative impacts?

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For further information please contact us at:
Tel: +44 (0)20 7183 8981
Fax: +44 (0)20 7183 8982
Email: farmland@agro-ecological.com
Web: www.agro-ecological.com



"For of all gainful professions, nothing is better, nothing more pleasing, nothing more delightful, nothing better becomes a well-bred man than agriculture."
Marcus T. Cicero