

Deconstructing sustainable intensification and issues around sustainability metrics

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The authors make a commendable attempt to tackle a problem which has bedeviled current debates around land sharing versus land sparing approaches: how do we know and measure sustainability in agriculture? They rightly emphasize the importance of outcome-based indicators, and equally rightly emphasize measurement at multiple scales. Many of their suggestions as to indicators at different scales are eminently sensible. Yet there are a number of conceptual and practical issues that the paper does not address, and they directly impact the question of what metrics we should use to measure agricultural sustainability. This is an important issue, with very direct policy and strategy implications.

The Nature Conservancy, like other environmental organizations, is more comfortable dealing with agriculture in the field than conceptually. Environmentalists have an instinctive focus on potential threats to ecosystem integrity linked to agriculture, and history is rich in examples of those threats translating into catastrophic damage to whole ecological systems, from the collapse of the Mayan Empire to more recent environmental disasters linked to agricultural malpractice on an enormous scale in the ex-Soviet empire. Less dramatically, we are all familiar with the issues around water consumption, chemical use and habitat conversion inherent to many agricultural systems across the world.

At the same time, history records many examples of extraordinarily ancient and resilient agricultural systems which have been part of landscapes for millennia. One of the great revelations around the discovery of an ice-age body in an Alpine glacier in the late 1990s was the surprising similarity between life-patterns in Bronze Age Europe and today. Then, as now, we see farming on valley floors up to a certain altitude, livestock pasturing in higher elevations, and a transhumant settlement pattern linking the two. There are other agricultural landscapes in Western Europe, China, India and South East Asia which have been under continuous cultivation for many centuries, many aspects of which, including the physical appearance of the land, would be familiar to our ancestors.

There is continuity as well as dramatic change in agricultural landscapes across the world, even with the unprecedented level of change modernity brings. Longevity is the surest indicator of sustainability; using that filter, there are agricultural landscapes across the world we could call sustainable already. It is a useful mental exercise to consider how we would define sustainability in such a stable, historically established landscape, rather than the much more recent agricultural systems around which sustainability debates usually revolve.

This is not to deny the central premise of this paper, — that we need to define and measure sustainability in agriculture. But it does point to a conceptual issue. At the landscape level, we must admit the *possibility* of sustainable agriculture, and, by extension, that there could be such a thing as a sustainable *agricultural* landscape.

Here, it seems to me, is the central conceptual problem of the paper. In order to measure sustainability as it pertains to agriculture, it is impossible to ignore agronomy, as the authors effectively do. Only a sentence is devoted to agronomic variables such as yield and output, and that sentence is a rather airy assertion that such data is easily available. Actually, depending on where and to what scale, it usually isn't, and that data gap it is the single biggest obstacle to designing effective *environmental* strategies for agriculture, since those strategies often depend upon adoption by farmers, and adoption, at the farm level, depends upon the implications for yields and output.

The conceptual heart of sustainable intensification is the assertion that sustainability is not about environmental variables alone. It is about the *relationship* between environmental and agronomic outcomes. Both sets of outcomes need to be heading in a desirable direction in order for us to say that sustainable intensification is happening. Rising yields in the US corn belt combined with an expanding dead zone in the Gulf of Mexico, fuelled by nutrient run-off? Intensification, clearly. But certainly not sustainable. Falling levels of grassland conversion in the Brazilian Cerrado combined with rising soy and beef production? Well, perhaps that could be called sustainable intensification, and it would merit further investigation.

Given the macro-context with which the authors rightly begin — the need to increase global food production while minimizing the environmental impacts of agriculture — it follows that we cannot measure sustainability using environmental variables alone. Let us say, hypothetically, in a perfect world with no data gaps, a given landscape is returning positive results in all the variables identified by the authors. But at the same time, unrecorded by our measuring framework, agricultural productivity is declining. That decline could happen over an extended period. Throughout that period the landscape would show up as sustainable — until the time when it wasn't, when every environmental outcome would shift direction as a direct result of the pressures generated by declining agricultural productivity.

A broader conceptual framing of sustainability than that given in this paper is a strategic imperative.

There are other issues which merit further discussion, which can be briefly mentioned:

- The environmental outcomes the authors identify, with which we broadly agree, are not necessarily interdependent. For example, it is perfectly possible to have accelerating levels of habitat conversion in a landscape while maintaining or improving soil health, as measured by soil organic content. How should we deal with situations where sustainability indicators contradict each other?
- Resilience is not considered by the authors, yet it seems a central component of sustainability in agricultural landscapes. It is certainly the one most on the mind of policymakers at present, and there is a strong argument that the resilience of agricultural systems may be the best way of creating a broader political coalition around the importance of addressing climate change. Given the clear evidence that climate change in many areas is already having an impact on agriculture — as shown most recently in the IPCC report published in March 2014 — the absence of a discussion of resilience indicators and frameworks from this paper is regrettable.

- The data sources suggested by the authors are strongly skewed geographically towards the developed world. This is entirely understandable, but it raises the important question of how to measure sustainability in data-poor settings, especially considering that it is in precisely such settings — much of the tropical world, for example — that sustainability measures are most urgently needed, as agriculture expands.
- The biodiversity indicators put forward by the authors would be very expensive to elucidate at the local level, and potentially inaccurate or outdated at larger scales, given the time-lags involved in the compilation of higher level data and the rapidity of change on the ground in some settings. It may be more practical to use the measures of landscape integrity — amount of native habitat, connectivity etc. — as a proxy measure.