

Growing more with the same land

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Wheat ready for harvest in New South Wales. But how to increase production using the same areas of land? Flickr/Tim J Keegan, CC BY-SA

There are three main reasons why the productivity of existing farmland will need to dramatically increase in the next 40 years.

1. The world's population is unlikely to stabilise this century and is on course to reach up to 12 billion by 2100. That's double the existing population and a lot of people to feed.

2. The economic growth, urbanisation and rising affluence of developing and emerging economies are driving "nutrition transitions" towards more Western diets rich in sugar, animal fat and protein. Note that it takes 2.5 to 100 times more resources to produce energy and protein from livestock than from grain.
3. There is limited scope for significantly expanding agricultural land after constraints and trade-offs are considered. The incorporation of new lands into production is likely to come with important social and ecological constraints and costs.

So, how are we likely to deal with the challenge?

Improving yield

There is a gap between present farming yields and the increased yields that could be achieved from applying good agronomic management. Closing this gap is called "reducing yield or productivity gaps". We know that reducing productivity gaps alone is likely to help us meet nearly half of the required demand by 2050.

Lifting [agricultural productivity](#) and food supply were listed as key practical actions by the [G20 leaders](#) when they met in Brisbane last year.

Supporting food security and economic growth in low-income countries is a way to generate opportunities for investment and trade globally, such as "[aid for trade](#)".

For example, [economic growth](#) in Africa was set to reach 5.2% in 2014 with rising investment growth in natural resources and infrastructure, and strong household spending.

But increasing land and water productivity should not come at the expense of the environment or people's sources of livelihoods, both

human and natural.

More from the same

The [sustainable intensification of agriculture](#) has been proposed as a possible solution. This is producing more food from existing farmland in a way that the future production potential and livelihoods of rural communities are not undermined and the environment is not affected.

For example, better matching crops, varieties and management to seasonal conditions is likely to increase productivity and reduce risks both in small holder and large scale commercial [agriculture](#).

But targets, time-frames, measurable indicators and methods necessary to achieve sustainable intensification remain loosely defined. This inhibits any informed analyses of emerging trade-offs between the multiple functions of agriculture: food and fibre production, environmental and socio-economic outputs.

It is clear that the quantification and analysis of these trade-offs will require new thinking beyond the traditionally restricted focus upon raising yields.

New thinking

Clearly, the first challenge is breaking down disciplinary silos of knowledge. This will allow a wider range of scientists to work with a wide range of stakeholders further to farmers, including environmentalists, agri-businesses, industry, NGOs and governments.

Also, any practical interventions and technologies required are likely to differ depending on each farming community's circumstances. There is

no silver bullet that could be applied across the myriad of situations.

For example three simple and complementary entry points addressing the multiplicity of production and socioeconomic situations could include:

1. For poorly resourced farmers, it is paramount that production efficiencies of their limited assets is improved. For this group basic information on "best fit" crop agronomy, livestock husbandry and climate risk management should be prioritised.
2. Further increases in productivity can be achieved among the better resourced and skilled farmers by generating the incentives for them to invest into more profitable and risk-efficient practises, and a mix of farm enterprises.
3. Where productivity gaps have been narrowed down already, more significant or transformation changes might be required. This will involve the design of new farming systems that are able to further intensify the use of land and water or add value to existing produce.

All productivity increases will have to be judged against gains in environmental and ecosystem services. This will help us to protect critical factors such as water quality, environmental flows, pollination services, soil quality and natural fisheries.

Sustainable intensification targets should also include nutritional, social, community and gender outcomes.

In low-income countries, rapid changes in cultivated land use are restructuring smallholder farming. Urban and international migration by mostly men looking for work has seen more women working in agriculture and loss of youth.

A public-private sector partnership

Investing in capacity building should remain a priority for the sustainable intensification of agriculture both in Australia and the developing world.

But the responsibility to improve agriculture through R&D can no longer be dominated by the public sector.

Public-private partnerships will be crucial drivers for future technological innovation and capacity building in the agriculture sector globally. Partnerships with NGOs will be crucial to reach high numbers of marginal and smallholder farmers in [emerging economies](#).

Further research within a public-private-civic partnership approach offers the prospect of innovation along the food value chain.

Connecting farmers to markets and private sector services is one agenda being strongly promoted in research for development of the agricultural sectors in Africa and Asia.

Dr Colin Charters from the [Crawford Fund](#) was a co-author on this article.

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