Science and Sustainability: The Emerging Consensus

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Science and Sustainability: The Emerging Consensus

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"Sustainable agriculture" provides policy- and decisionmakers today with the quintessential experience of the elephant and the blind men: While no one in agriculture or forestry disputes that sustainability in agriculture and in our broader society is critical to the planet's future, we are awash in often conflicting definitions of what it means to be sustainable, how we achieve that sustainability, and the role that science and technology will play in fostering it.

It has been immensely more difficult to grapple with the concept of sustainability partly because of the lack of consensus around what sustainability means for different stakeholders—policymakers and decisionmakers of the current administration and on Capitol Hill, those for whom farming and forestry are a way of life, and scientists themselves. The problem isn't the lack of definition: We've had a statutory definition of "sustainable agriculture" since the 1990 Farm Bill. It's in the definition section of chapter 46 of the bill, "Research, Extension, and Teaching," in Title VII, the Agriculture Title of the *United States Code*, which begins by defining sustainable agriculture as "an integrated system of plants and animal production practices having a site-specific application that will, over the long term, accomplish certain things." Note specifically the words "integrated system" and "site-specific application," as they are probably the points around which dialogue is most needed.

The 1990 Farm Bill lists five outcomes of a sustainable agriculture system:

- It should satisfy the human need for food and fiber.
- It should enhance environmental quality and the natural resource base upon which agriculture economy depends.
- It should make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls.
- It should sustain the economic viability of farm operations.
- It should enhance the quality of life for farmers and society as a whole.

These outcomes embrace the notion that sustainable agriculture systems must be productive and profitable, enhance the environment, steward both nonrenewable and ecological resources, and improve the quality of life of both farmers and society.

So why, then, are discussions about sustainability so charged? First, I believe it is because we have framed (or allowed others to frame) sustainability itself as a practice or set of practices. It is not. Sustainability is a goal, and therefore the focus should be on outcomes rather than specific practices. Certainly, both science and field experience are leading to a better understanding of what practices should be followed and under what circumstances, and this should move us closer to sustainability. But, as with any goal, it is important to keep the focus on the long-term objective, and to be open-minded about all the ways to achieve that goal.

Second, by its very nature, sustainability has multiple dimensions—economic, environmental, and social. Each dimension must be addressed simultaneously if we are to truly develop sustainable agriculture. Much of the disagreement about the path to a sustainable future results from developing the practices of economic sustainability, environmental sustainability, or social sustainability in isolation from each other. Environmental practices that do not help create rural wealth and allow farmers to stay on the land are not sustainable. Economic practices that do not preserve clean water, reduce greenhouse gas emissions, and maintain natural biodiversity are not sustainable. Social practices that cede agriculture production to only a few agribusinesses are not sustainable.

Third, agriculture is incredibly diverse, and different operations will pursue different paths to the same sustainability goals. While both science and field experience may reveal that some paths are better than others, we should respect differences and celebrate the coexistence of multiple approaches to sustainability.

The Farm Bill definition of sustainable agriculture does not reference the type of farm—small or large, organic or conventional, serving local or global markets. Practitioners of all types of agriculture need to put greater focus on sustainability (and indeed, many are already). We need to apply the best science to better understanding the ways that sustainability can be improved across the vast diversity of agriculture in the United States and globally.

As a scientist, I recognize that we will achieve greater sustainability in agriculture if we apply the wide range of tools of modern science and technology—genomics, nanotechnology, biotechnology, computer simulations—to the genetics, plant and animal sciences, and social sciences that already have yielded immense benefits for food security, food safety, nutrition, energy security, environmental stewardship, and community well-being.

We cannot afford to ignore the many paths that lead to achievable sustainability. Agriculture production systems today are under pressure as never before. The United Nations Food and Agriculture Organization warns that the combined effects of population growth, strong income growth, and urbanization require a doubling of

food production by 2050. And this doubling of production needs to occur despite climate disruptions, critical water shortages in some parts of the globe, increased salinity of soil, and the necessity to reduce the energy and environmental footprints of agriculture practices.

This is not just a problem in those "other countries." American farmers and foresters already are seeing strong downward pressure on the production system, and many areas of the United States are as vulnerable to climate disruption as any other place on Earth. Our longstanding commitment at the US Department of Agriculture (USDA) is to make absolutely sure that the production systems we have in the United States are sustainable, both in terms of retaining US influence as a major supplier of the world's food, feed, fuel, and fiber, and in nurturing and safeguarding the natural resources that make this production possible—all while ensuring the economic vitality of rural America.

Agricultural practices should embrace the relevant science and technologies that lead to sustainability—and science and technology must engage this challenge head on. The competitive grants portfolio of the National Institute of Food and Agriculture (NIFA) has changed in 2010 to reflect our desire to work at a meaningful scale on a discrete set of overarching scientific issues. Those issues must have great potential to improve lives, as well as agricultural sustainability. We are a small agency compared with the National Institutes of Health, the National Science Foundation, and other research agencies, but we have a secret weapon. Like its predecessor, the Cooperative States Research, Education, and Extension Service, NIFA will ensure that the outcomes of research find their way into the hands of farmers, foresters, consumers, and others through the unique education and extension system that we help to support. We will do this by requiring meaningful linkages between research, education, and extension.

Our partners and stakeholders will prepare themselves to focus on key priority areas for USDA and the Obama administration, such as food production, biofuels, climate change, and the environment; food safety and nutrition; and the reduction of childhood obesity. And, yes, we must pursue multiple scientific strategies—traditional breeding, molecular biology and biotechnology, and the development of new communities of practice—in both our intramural and extramural portfolios.

There is one last barrier to achieving a meaningful consensus on sustainable agriculture. So far, it has been relatively easy for many in the developed world to pay lip service to the goal of sustainability without having to consider what it actually may require of us. For much of the developed world, the necessity to practice sustainability is difficult to conceptualize. Most of us do not experience hunger. In stark contrast to many of our global neighbors, we too often reflect what I have often called the "arrogance of plenty": American farmers and foresters produce an abundance of food that most of us can afford, and it blinds us to the difficulties many of our global neighbors face in bringing food to the table and energy to power their homes and industries. The plentitude of agricultural and forestry commodities in the developed world also hides the unfortunate fact that they often are produced by systems that are neither environmentally nor economically sustainable. Achieving global sustainability in agriculture requires us to share our best practices, achieved through science and technology, with the many developing countries that need to increase production to meet the needs of rising populations.

I have every confidence that the women and men in the research enterprise that undergirds agriculture—those who work daily to unlock the secrets of human, plant, and animal health and well-being—can see beyond our full plates and inexpensive energy and rise to the challenge of building a sustainable future for agriculture and forestry. I am hopeful that we can collectively generate another level of consensus on sustainability: The need to engage science of every stripe and at every level will be required to build a sustainable agricultural future.

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