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A Call to Rebuild U.S. Leadership in Food and Agricultural R&D



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FOREWORD

Agricultural research has done so much for the United States and for the world over such a long period of time, that it's easy to take it for granted or not notice it at all.

I am not so ancient, but I recall in the mid-1950s when the first tractor came to my family's West Tennessee farm, and half the mules left the same day. Corn yields were less than a third of what they are today, but already twice what they were in the old USSR when Nikita Khrushchev visited the Garst farm in Iowa that same decade. I also recall sitting on the front porch of the old farmhouse mid-summer, wondering whether the boll weevils would destroy the cotton crop in the front field. It was the main source of my grandmother's income. Were it not for agricultural R&D, all of us would still be living in that world. And frankly, the United States would be unrecognizable. The advances we see in so many facets of life – as well as our power and influence abroad and our outsized contributions to global food security – would not have occurred. We'd be substantially poorer and weaker.

Progress such as this was never inevitable and is never permanent.

Investments in agricultural R&D pay enormous returns – higher than in just about any other field. The benefits flow not just to farmers but to all of society. We can rejoice that what happened on the Garst farm didn't stay on the Garst farm, and that its impact was both domestic and global.

Today, we face a new combination of challenges: population growth, soil degradation, water limitation, extreme weather events, conflict – and a rickety innovation pipeline, the result of decades of underinvestment in agricultural R&D, of taking our own progress and leadership for granted. Bigger challenges, more danger, and more risk at all points along the food chain require more from us – more foresight and planning, more resolve, and more leadership.

While the Food Security Leadership Council is focused on global food security, we recognize particularly in the case of R&D that our domestic policy and programs are critical to us first, but also to all of humanity. If we don't get this right and soon, very little else that we can do will allow us to recover. The path to prosperity and global food security leadership begins with American ingenuity, and with bold and smart investments in agricultural R&D.

Dr. Cary Fowler
President

The United States should launch a once-in-a-generation, nonpartisan effort to boost sustainable productivity and profitability— in service of American farmers and consumers and the larger humanitarian and national security imperative of achieving a food-secure world.

To achieve this, we should supercharge public food and agricultural innovation with no less than \$100 billion in new strategic public R&D investments over ten years.

Key Points

- There are few investments the United States can make with as great an impact nationally and globally as public agricultural R&D. The **returns on investment** are estimated to be eighteen-to-one.
- There are **urgent reasons to accelerate** our commitment to agricultural innovation: U.S. agricultural productivity growth is declining and global productivity growth is far lower than it needs to be; the United States risks losing its edge in agricultural innovation, particularly to China; and innovation can position the United States to help feed the world as the population grows by another 1.5 billion.
- Agricultural innovation can buttress many **global and national objectives**:
 - It is an investment in shared prosperity and peace.
 - It provides a path to feeding the world in a manner that protects our natural resources.
 - It helps keep food costs low while reinforcing the United States' position as a leading agricultural exporter.
 - It strengthens U.S. preparedness against biological threats and reduces U.S. reliance on vulnerable foreign supply chains.
 - It is a powerful engine for revitalizing rural America and making healthy foods more accessible.
- A visionary investment in innovation to tackle one of history's most intractable problems **affirms American leadership** in the world.
- We should establish a clear **mandate to orient U.S. food and agricultural R&D towards increasing sustainable productivity**, with the goal of pushing annual U.S. total factor productivity growth to 2 percent by 2040.
- We should align new investments with an **ambitious national strategy** to re-orient the U.S. agricultural R&D system towards this goal and reform its institutions to achieve it.
- The strategy should include:
 - An overarching commitment to science-driven decision making.
 - Operationalization of the Agriculture Advanced Research and Development Authority (AgARDA) to catalyze bold investments in breakthrough science.
 - An ambitious workforce development agenda to build a lasting pipeline of talent.

Agricultural R&D as an Engine for Change

There are few investments the United States can make with as great an impact nationally and globally as public agricultural R&D. The returns on investment of agricultural R&D are estimated to be eighteen-to-one. Such investments allowed the United States to more than double domestic productivity between 1960 and 2000. As a result, the U.S. food and agriculture sector directly supports over 24 million jobs—approximately 15% of U.S. employment—and drives \$9.5 trillion in economic activity. Beyond underpinning our own economy and security, public agricultural R&D also helps countries around the world feed themselves, as innovations spread and accumulate.

U.S. innovation is a cornerstone of global food security.

Looking forward, strategic investments in food and agricultural R&D must be the foundation for more productive, more nutritious, and more sustainable agriculture. R&D can produce innovations that not only increase yields but also diversify and increase the nutritional value of our food supplies, rebuild soil health, recharge our water supplies, and enable production with fewer risks to human and environmental health. At the same time, R&D is a critical means of mitigating vulnerabilities to the domestic food system and the geopolitical instability that can stem from food insecurity abroad.

To achieve these goals, we must achieve continuous sustainable productivity growth: increasing every year the agricultural production we obtain from a given amount of land, labor, capital, and other inputs—while ensuring that growth is sustainable for our natural resources and our societies. We should orient our national investments towards this vision, aiming for an annual domestic total factor productivity growth rate of no less than 2 percent by 2040. The research infrastructure we build at home to achieve this will underpin advances around the world, strengthening global food security.



The Imperative of Now



U.S. agricultural productivity growth is declining, and global productivity growth is far lower than it needs to be. Our only viable option for sustainably feeding the world in the future is to increase productivity—the measure of output achieved for a given level of inputs such as land, labor, machinery, fertilizer, and seed. However, global agricultural productivity growth is increasing at less than half the amount needed per year to sustainably meet the demands of our food systems. In the United States, annual productivity has decreased in recent years, with an average annual productivity “growth” rate of -0.23% in the last decade.

The United States risks losing its edge in agricultural innovation. Backed by strong investments in food and agricultural R&D, the United States led the world in agricultural innovation through the 20th century. But over several decades, the United States has stepped back and begun to cede its leadership role. By 2002, federal investments in agricultural R&D started declining in real terms, and China soon surpassed us in public R&D spending.

In 2025, China announced a ten-year initiative to strengthen its national food security by increasing national output—the “Plan for Accelerating the Construction of China into an Agricultural Powerhouse”—with research as a core pillar of its plan. Today, China’s spending is double that of the United States. As a result, the U.S. share of global public agricultural R&D spending dropped from 20.2% in 1960 to just 11.5% by 2011.

While the United States still maintains the most patents for agricultural technology in absolute terms since 2004, in that period China has posted an annual growth rate in patent filings of 8.5%. The United States’ rate is decreasing by 4.25%. Further, in 2019, China was awarded 2,007 agricultural patents to the United States’ 526—though U.S. patents are still assessed to be more impactful individually.

China is also leading the United States in the number of peer-reviewed scientific papers it publishes in the agricultural sciences—and has more highly-cited papers, an indicator of impact. In 2022, China published 29,336 scientific papers to the United States' 5,551—more than five times as many. In 2003, the proportions were nearly reversed. Without action, we will continue to fall behind at an accelerating rate.

Innovation can position the United States to help feed the world as the population grows by another 1.5 billion over the next 25 years. Global food demand has been predicted to increase by up to 60 percent from 2019 to 2050, particularly for resource-intensive meat and dairy. Innovation can help the world, including the United States, address this growing demand —while advancing our sustainability goals.

“R&D spending is analogous to investments in capital infrastructure. Agricultural R&D spending creates a stock of knowledge capital—...an accumulation of useful new ideas embodied in professional publications, patents, and tacit technical and scientific know-how—that drives agricultural innovation and the subsequent stream of benefits.”

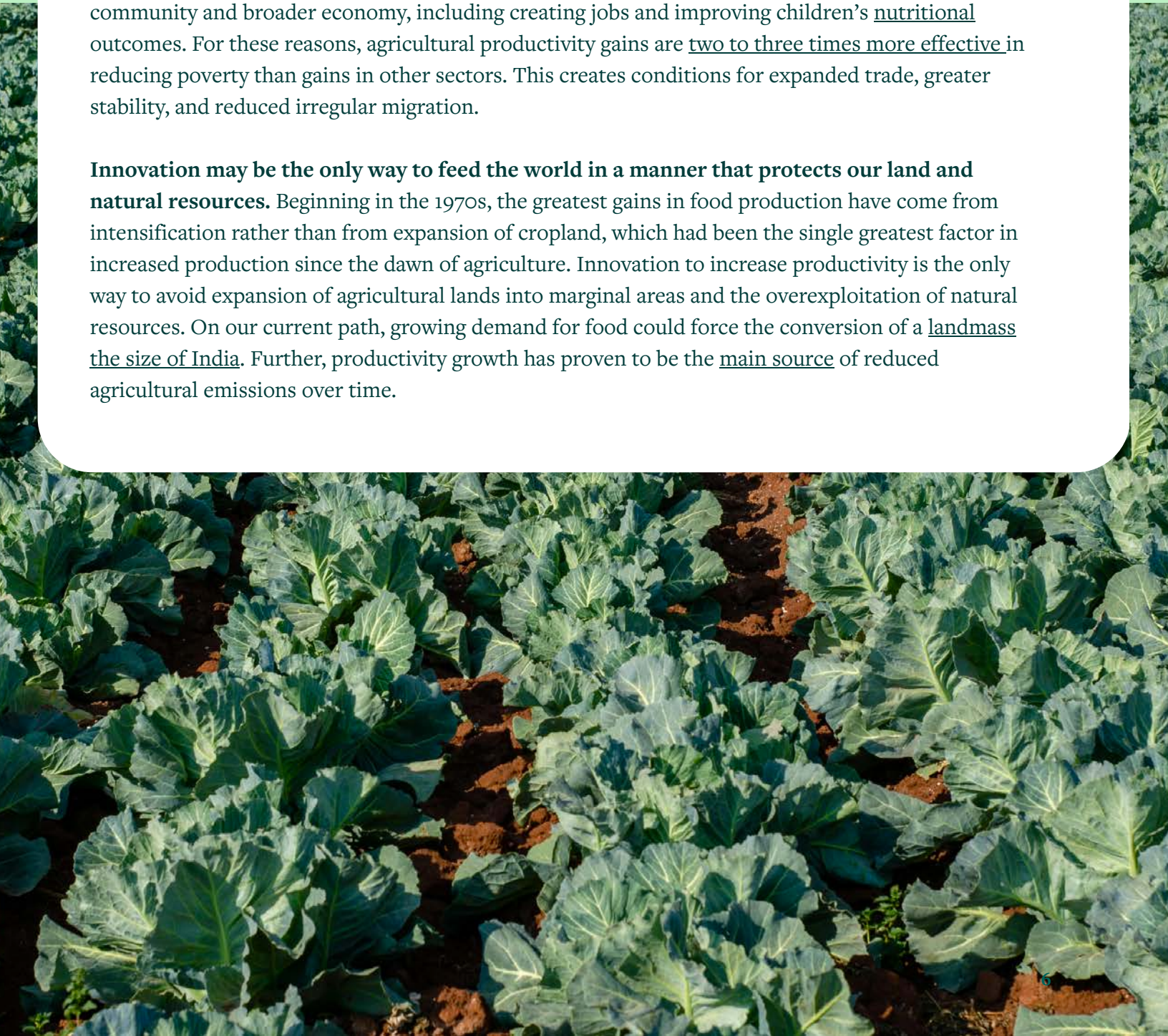
PHILIP PARDEY, 2023



Driving Progress in Agriculture and Beyond

An investment in sustainable agricultural productivity is an investment in shared prosperity and peace. Productivity gains do more than increase food supply. They lower food prices, raise wages, and free up labor, generating more disposable income. This has widespread benefits for the community and broader economy, including creating jobs and improving children's nutritional outcomes. For these reasons, agricultural productivity gains are two to three times more effective in reducing poverty than gains in other sectors. This creates conditions for expanded trade, greater stability, and reduced irregular migration.

Innovation may be the only way to feed the world in a manner that protects our land and natural resources. Beginning in the 1970s, the greatest gains in food production have come from intensification rather than from expansion of cropland, which had been the single greatest factor in increased production since the dawn of agriculture. Innovation to increase productivity is the only way to avoid expansion of agricultural lands into marginal areas and the overexploitation of natural resources. On our current path, growing demand for food could force the conversion of a landmass the size of India. Further, productivity growth has proven to be the main source of reduced agricultural emissions over time.



Innovation can help keep food costs low while reinforcing the United States' position as a leading agricultural exporter. In a time of rising costs, productivity gains driven by innovation can lower unit production costs, enabling higher output, increased producer margins, and reduced prices. This is sorely needed; since 1970, inflation-adjusted farm production expenses have increased more than 70% in the United States. Doubling U.S. agricultural R&D spending could lead to price reductions of 30% in commodity crops by 2050; with targeted investment, they could lower the price of other food crops, too, while maintaining farmer incomes. These efficiencies make food more affordable for consumers and strengthen the competitiveness of U.S. exports in global markets.

Innovation can strengthen U.S. preparedness against biological threats. Crop pests, pathogens, and diseases can decimate production and even transfer to humans. The development of resistant crop varieties, novel mitigation measures, and other controls have repeatedly forestalled the worst fall-out from new threats. These measures depend on R&D, much of it public. For example, the outbreak of a new strain of wheat rust (Ug99)—which was successfully contained by the research community before it reached the United States—was calculated to have had the potential to cost U.S. producers up to \$11.6 billion over 4 years. As new environmental conditions drive pathogens into new geographies, proactive innovation can minimize our vulnerabilities and create significant return on investment.

Innovation can reduce U.S. reliance on vulnerable foreign supply chains. The United States is highly dependent on foreign supply chains for certain critical agricultural inputs—particularly fertilizer and pesticide ingredients. Some of these supply chains are highly concentrated and dependent on countries with whom the United States has unstable partnerships, such as Russia (fertilizer) and China (agrochemicals). R&D can diversify input markets and create economic opportunities at home by offering alternatives to these products.

Innovation can be a powerful engine for revitalizing rural America. Investments in agricultural R&D lower production costs, boost productivity, and enhance the resilience of farming operations, while fostering the development of new products that strengthen rural incomes. By accelerating the adoption of technology across agriculture, R&D also creates more skilled job opportunities and helps diversify livelihoods in rural communities.

Innovation can make healthy foods more accessible by lowering their production costs. The majority of calories come from a limited number of major staple crops. Globally, most of us get 75% of our calories from only eight foods: rice, wheat, corn, potatoes, barley, palm oil, soya and sugar. Micronutrient deficiencies are a widespread challenge; two thirds of the global population do not consume enough iodine, vitamin E, calcium, and iron. Nutritious foods are more expensive, and many households would need to more than double food expenditures to secure a healthy diet. By investing in the productivity of healthy foods, we can help address malnutrition.

A visionary investment in innovation to tackle one of history's most intractable problems affirms American leadership in the world. Investing in sustainable agricultural productivity to address global hunger highlights to the world our strength, ambition, and ingenuity. It builds our soft power and recalls the United States' historic leadership in feeding the world with its unparalleled agricultural advantage and scientific prowess. It makes clear the United States will continue to lead in these areas and beyond.

A NEW, VISIONARY R&D AGENDA CAN ADVANCE THESE OUTCOMES.



The Essential Role of Public Funding

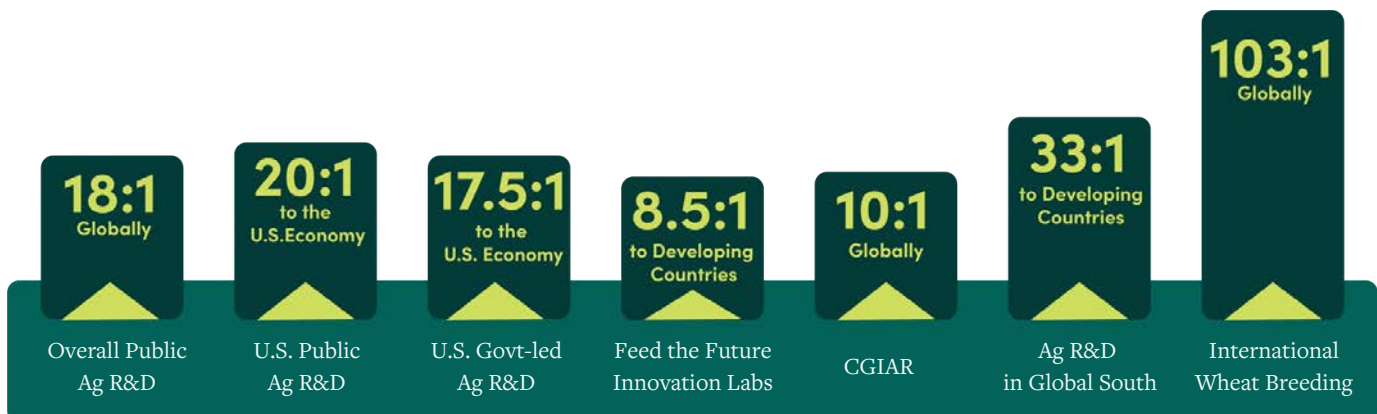
The private sector is responsible for the majority of all food and agricultural R&D spending, a share that has grown substantially in recent decades. It's logical to wonder why the private sector can't take over agricultural innovation from the taxpayers.

The public and private sectors prioritize innovation differently. The private sector generally focuses on innovations 1) in established, large, commercial markets 2) with near-term gains and 3) in high profit margin areas. A large portion of private R&D budgets goes to food processing; only minimal amounts of private funding are intended to advance environmental and human health outcomes. And the vast majority of private crop breeding funding is devoted to just a couple of commodity crops, not all of which are used for food.

The public sector can take a longer and broader view. It is the primary means of pursuing innovations that target socially desirable though less profitable outcomes, such as those relating to small farms, most specialty crops, nutrition, and the environment.

Public funding is also the primary means of conducting research in basic science. Basic research provides the building blocks for technology development and application for the private sector, but is too long-term and high-risk for the private sector to prioritize. Further, public R&D outcomes are publicly available, and contribute cumulatively to further discovery conducted by both private and public actors.

CONSISTENT DOUBLE-DIGIT ECONOMIC RETURNS



Transformative Investments

The United States cannot afford to lose its leadership position in global food and agricultural production and technology. Starving the goose that laid the golden egg will never be a winning strategy. Prolonged underinvestment has weakened the innovation pipeline for several decades now. It cannot continue.

The United States should pursue a once-in-a-generation effort to supercharge public food and agricultural R&D through a nonpartisan effort – no less than \$100B over ten years in new strategic R&D investments beyond regular annual appropriations. This would represent an approximately threefold increase in federally funded agricultural R&D and would lay the foundation for transformative innovation, not just catching up.

- To achieve the total factor productivity growth rate we need —2%, up from -.05%—we need an additional \$6.4 billion per year. But this does not necessarily provide the gains in sustainability we seek.
- To simply maintain production in the face of climate change, we need up to an additional \$3.8 billion in public agricultural R&D per year through 2050, for a total of up to \$113 billion over that period. But this investment level does not necessarily allow us to increase production to meet intensifying demand or enhance the sustainability of our production systems.
- To simply catch up with China's investments, we need an additional \$5 billion per year – half the total we are suggesting. This assumes no funding increase by China.
- To reclaim our peak market share of global public agricultural R&D spending—23% between 1990 and 2006— we need an additional \$5.7 billion per year, assuming no increases by other funders such as China.

As a comparison, the CHIPS Act provided \$280 billion over 5 years – more than five times as much per year - to re-energize the U.S. semiconductor industry. The Inflation Reduction Act provided \$500 billion over 10 years to address climate change. In 2018-2019 alone, USDA provided \$23 billion in supplemental funding to farms affected by the trade war with China.





Elements of a New Commitment

INCREASED INVESTMENT IN FOOD AND AGRICULTURAL R&D REQUIRES CLEAR STRATEGIC DIRECTION AND TARGETED INSTITUTIONAL REFORM.

01

A commitment to at least \$100 billion in new, additional public food and agricultural R&D funding over ten years.

02

A mandate to orient U.S. food and agricultural R&D towards increasing sustainable productivity, with the goal of pushing annual U.S. total factor productivity growth to 2 percent by 2040.

03

A national strategy to re-orient the U.S. agricultural R&D system towards this goal and reform its institutions to achieve it.

04

An overarching commitment to science-driven decision-making and expert discretion in funding allocations in accordance with the national strategy.

05

Immediate operationalization of the Agriculture Advanced Research and Development Authority (AgARDA)—an agency modelled on DARPA intended to catalyze bold investments in breakthrough science.

06

An ambitious workforce development agenda to build a lasting pipeline of talent.