CGIAR Research Program RICE contributions to the United Nations Sustainable Development Goals
RICE is a CGIAR Research Program on rice-based agri-food systems coordinated by three CGIAR Centers—International Rice Research Institute (IRRI, lead institute), Africa Rice Center (AfricaRice), and International Center for Tropical Agriculture (CIAT)—and three other leading agricultural agencies with an international mandate and a large portfolio on rice—Centre de Cooperation Internationale en Recherche Agronomique pour le Développement (Cirad), L’Institut de Recherche pour le Développement (IRD), and Japan International Research Center for Agricultural Sciences (JIRCAS). These six centers align and bring together consortia, networks, platforms, programs, and collaborative projects, with more than 600 partners from governmental, nongovernmental, public, private, and civil society sectors.

The goals of RICE are to:
• reduce poverty and hunger,
• improve human health and nutrition,
• adapt to climate change and reduce greenhouse gas emissions,
• promote women’s empowerment and youth mobilization,
• reduce rice’s environmental footprint, and
• enhance the climate resilience of rice-based farming systems.

It aims to achieve these goals through fostering high-quality, impact-oriented research and development activities on rice value chains in a global context. Through its work, RICE addresses 9 of the 17 United Nations Sustainable Development Goals (SDG), and 26 of their 169 targets. Figure 1 summarizes main RICE contributions to the 9 SDGs.¹

¹Expected with an annual investment in RICE of around USD 80-100 million per year.
Fig. 1. Contributions of RICE to 9 Sustainable Development Goals by 2030.

**RICE contribution:**
18 million rice producers and consumers assisted out of poverty

**RICE contribution:**
25 million people assisted out of hunger
18 million meeting zinc requirements

**RICE contribution:**
Increased access over assets and resources by women in the rice sector

**RICE contribution:**
10% increase in water use efficiency in rice fields

**RICE contribution:**
Sustainable business models for young entrepreneurs in rice value chains

**RICE contribution:**
Practices and principle for sustainable rice production and rice value chains

**RICE contribution:**
36 million farms use climate-smart rice varieties and management practices
Reduced greenhouse gas emissions from rice fields by 57 megaton CO$_2$ equivalent/year

**RICE contribution:**
Globally conserved and shared rice genetic resources

**RICE contribution:**
A global partnership for rice research and development, consisting of 900 partners from public and private sectors, contributing to the Sustainable Development Goals
Rice is produced by some 144 million farm households, most of them having less than 2 hectares of land, and harvested from 166 million hectares annually. Rice farming is associated with poverty in many areas. About 900 million of the world’s poor depend on rice as producers or consumers. Out of these, some 400 million poor and undernourished people are engaged in growing rice.

Poverty can be decreased by increased agricultural growth through improved productivity and income along food value chains. Growth in agricultural productivity also contributes to the growth of national economies through “growth linkages,” of which an important one is decreased prices of food. Low rice prices disproportionately benefit poor consumers, for example, the urban poor, rural landless, and small rice and nonrice farmers who do not produce enough food to meet home consumption, because rice makes up as much as 70% of their calorie intake. Input intensification associated with yield growth results in greater demand for labor and wages, which contributes to increased farm income. Increased farm productivity can be brought about by intensification and diversification, including diversified enterprise opportunities. Increased crop productivity can be brought about by genetic improvement and/or improved crop and natural resource management. Other pathways to increasing farmers’ income include reducing the costs of production, increasing the value of production, decreasing postharvest losses, and farm diversification. The value of production can be increased by increasing the marketability and value of the products and by-products, and through whole value-chain upgrading. Enhanced overall productivity, more empowered participation in the value chain, and diversification of farm output can protect farmers from decreased farm-gate prices.

RICE research and development contributes to poverty alleviation through the development and delivery of (1) improved rice varieties with higher yield and yield stability, higher quality and market value, and tolerance of drought, floods, extreme temperatures, and pests and diseases; (2) better functioning and upgraded rice value chains that increase income of farmers and other value chain actors; (3) improved rice husbandry and diversified farming systems that increase profits through increased and stable yields, reduced production costs, and/or improved market access.
Goal 2

End hunger, achieve food security and improved nutrition, and promote sustainable agriculture

Rice is the world’s most important food crop and it will continue to be so in the coming decades. Rice is a staple food for some 4 billion people and it provides 27% of the calories in the world’s low- and middle-income countries. In Asia, the poorest of the poor derive up to 70% of their calorie intake from rice. Based on expected population growth, income growth, and decline in rice area, global demand for rice will continue to increase from 479 million tons of milled rice in 2014 to 536–551 million tons in 2030. While rice is an excellent source of calories and some nutrients, human micronutrient deficiencies are prevalent in areas where rice is the major staple.

Pathways to increase rice food security run in parallel with pathways to alleviate poverty. RICE research and development contributes to enhanced food security through the development and delivery of (1) improved rice varieties with higher yield and yield stability, and tolerance of drought, floods, extreme temperatures, and pests and diseases; (2) improved rice husbandry and diversified farming systems that increase and stabilize yields; and (3) reduced postharvest losses along the rice value chain.

Increasing the concentration of minerals and micronutrients in the grains of rice, such as Fe, Zn, and beta-carotene, can help to alleviate these deficiencies. Crop and farm diversification increases diversity of diet. Lowering the glycemic index of rice has the potential to contribute to efforts in reducing the incidence and ongoing treatment costs of type 2 diabetes. Reduced pesticide use through pest- and disease-resistant varieties and integrated pest management/ecological engineering practices help reduce health risks to farmers.
Achieve gender equality and empower all women and girls

Women make significant contributions to rice farming, processing, and marketing, and play a dominant role in buying rice for consumption. Yet, women still face many barriers and inequality in access to and control over resources such as information and inputs (new technologies and finance). Women are also less involved in decision making and have less control over income and assets than men. Such gender inequalities reduce women-managed farm productivity and hinder the progress of other development outcomes such as family planning; maternal, newborn, and child health; nutrition; education; and food security.

RICE research and development products will contribute to gender equity and women’s empowerment by (1) improving women’s access to and control over resources (seed, inputs, technologies, and technical knowledge); (2) increasing women’s productivity and production, thereby increasing their income share and purchasing power; (3) developing labor-saving technologies and farm mechanization equipment especially relevant for women rice farmers who presently provide labor for back-breaking non-mechanized operations; (4) contributing to women’s livelihood opportunities and well-being through the reduction in postharvest losses, improved processing technologies (such as parboiling), and improved marketing; and (5) fostering transformative changes in the enabling environment to support impact pathways leading to gender equity.
Goal 6

Ensure availability and sustainable management of water and sanitation for all

Worldwide, there are about 79 million ha of irrigated lowland rice, which provide 75% of the world’s rice production. Approximately 56% of the world’s irrigated area for all crops, of which rice accounts for 40-46% of the net irrigated area, is in Asia. Because irrigated rice is mostly grown under flooded conditions, rice fields receive up to 2-3 times more water than other irrigated crops. The world’s irrigated rice fields receive an estimated 35% (880 km³/year) of the world’s total irrigation water (2,500 km³/year). Worldwide, water for agriculture is becoming increasingly scarce. By 2025, 15-20 million ha of irrigated rice will suffer some degree of water scarcity. Hence, increases in yield to meet future rice demands need go hand in hand with increases in water productivity.

RICE contributes to sustainable use of water resources in the rice sector by (1) developing and disseminating rice varieties with improved water-use efficiency; (2) developing and disseminating water-saving management technologies and cropping systems; (3) promoting reuse of water in rice-growing environments; and (4) reducing the pollution of water resources with agro-chemicals through improved crop husbandry.
Goal 8

Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all

Youth unemployment has recently emerged as a crisis in agriculture-based economies of low-income countries, especially in Africa. Despite agriculture being the core sector of these economies, youth employment in agriculture has remained very low, mainly as family labor, due to lack of mechanization, high production risks, and low agricultural productivity. Employment opportunities outside agriculture have not been sufficient to absorb the growing youth labor force. In contrast, in fast-developing areas in Asia, outmigration from rural to urban areas is leading to the opposite problem—scarcity of young and able labor.

RICE will engage in strategic research on youth issues, and develop business models and opportunities for young people to be actively involved in rice value chains and earn attractive incomes. Opportunities will be identified to mobilize and employ young people, in particular, through service provision in the rice sector, either as entrepreneurs or as employees. Some youth may find employment in the seed sector, producing quality or certified rice seed for rice farmers. Others may provide machinery-based services such as harvesting or threshing or may start a business by producing and marketing new rice-based products tailored to specific market segments. While still others may provide real-time rural advice, making use of RICE-derived, ICT-based knowledge management tools and services, introducing modern rice farming techniques to rice farmers of all ages.
Given the problem of environmental degradation worldwide, rice will have to be produced, processed, and marketed in more sustainable and environment-friendly ways. With finite land area and diminishing natural resources, ensuring economic, environmental, and social sustainability both on the farm and throughout the rice value chain represents a critical development challenge. While sustainable production and trade have been addressed for a number of higher-value commodities, the rice value chain has generally been neglected despite its critical importance for global food security.

In RICE, IRRI co-convenes with the United Nations Environmental Programme (UNEP) multi-stakeholder partnership, called the Sustainable Rice Platform (SRP), to promote resource efficiency and sustainability both on-farm and throughout the value chain. The SRP pursues public policy development and voluntary market transformation initiatives to provide private, non-profit, and public actors in the global rice sector with sustainable production standards and outreach mechanisms that contribute to increasing the global supply of affordable rice, improved livelihoods for rice producers, and reduced environmental impact of rice production.

RICE will specifically develop and test sustainability guidelines, standards, tools, and outreach models for sustainable rice production and processing, including decision making tools and quantitative sustainability impact indicators. Socioeconomic and biophysical considerations will be integrated and trade-offs or win-win situations using alternative technologies and farming systems will be made explicit. New metrics for socioeconomic and environmental sustainability will be designed and scaled-up.
Global rice production is affected by the declining availability of resources, such as water, energy, and labor, and by natural disasters such as floods, drought, and pest and disease occurrences. Climate change is exacerbating the situation through the effects of higher temperatures (causing sterility), more frequent drought and flooding, as well as sea-level rise. Rice is among the crops most vulnerable to sea level rise because of its importance in low-lying production areas such as mega-deltas and coastal zones, which host the major rice baskets of the world. Rice production also contributes to climate change. Rice-farming areas are responsible for 5% to 10% of global methane emissions. New climate-smart rice varieties and management practices are needed for both adaptation to and mitigation of the effects of climate change along the rice value chain.

RICE assists farmers in adapting to climate change by developing and disseminating (1) climate-smart rice varieties with enhanced adaptation to climate change-induced stresses such as drought, flooding, salinity, high temperatures, and pests and diseases; (2) climate-smart rice management technologies (e.g., water, nutrient, and residue management); (3) diversified farming systems that strengthen the resilience of rice-based farming systems to climatic variability; and (4) climate-informed advisory systems based on combined weather forecasting and climate-smart management practices. To mitigate climate change, RICE will develop and disseminate technologies that reduce GHG emissions, such as (1) water-saving management practices, for example, alternate wetting and drying (that reduce methane emissions by 30-40%); (2) improved straw management, site-specific nutrient management, and adapted tillage with the potential to reduce nitrous oxide emissions; (3) technologies to reduce emissions and pollution from open-field burning; (4) technologies to sequester carbon such as charring and soil incorporation of husk; and (5) more energy-efficient machines.
Goal 15

Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Target 15.6 aims to “promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed.” In accordance with the International Treaty on plant genetic resources for food and agriculture and all relevant biosafety, phytosanitary, import, and export regulations, RICE will supply samples of rice genetic resources to anyone, anywhere for the purposes of research, breeding, and training for food and agriculture, under the terms of the Standard Material Transfer Agreement (SMTA) adopted by the Governing Body of the Treaty.
Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

RICE itself is a global partnership for rice research and development, consisting of 600 partners from the public and private sector, contributing to the Sustainable Development Goals. RICE embeds a large number of consortia, platforms, networks, and other collaborative mechanisms for regional and international cooperation on and access to science, technology, and innovation and enhanced knowledge sharing. It conducts a comprehensive program on capacity development, ranging from vocational training on rice production and postharvest technologies along the rice value chain, to the development of the next generation of rice science leaders through scholarships, and to strengthening institutional capacity for research, innovation, extension, and technology delivery among partner research and development organizations. RICE contributes to the development of indicators, along with partner countries, to monitor progress towards development outcomes and SDG targets.