**Managing agricultural nitrogen for synergies of UN 2030 Sustainable Development Goals**

**Abstract:** Nitrogen fertilizer contributes to about half of global food production, however, nitrogen loss during food production and subsequent consumption has led to severe air and water pollution, biodiversity loss, and climate change. More than half of the UN 2030 Sustainable Development Goals (SDGs) are directly related to nitrogen use and loss, yet global nitrogen distribution patterns are highly uneven: China consumes about 30% of the world's nitrogen fertilizer and over-fertilization heavily; Africa accounts for only 3% of the world's nitrogen fertilizer and is severely under-fertilization. How to manage agricultural nitrogen to promote balanced development among countries and achieve synergy among SDGs is a global challenge. This project intends to use model simulations, spatial statistical and econometric analysis, environmental effect assessment, and other multidisciplinary research approaches to: 1) elucidate the driving mechanism of nitrogen cycle on SDGs; 2) quantify the contribution of nitrogen in global SDGs; 3) dissect the synergy or trade-off mechanism of nitrogen management among different SDGs; and 4) explore ways to achieve synergy among multiple global SDGs through nitrogen management. The project is important for countries that are facing challenges such as hunger, poverty, environmental and climate threats, reducing the imbalance of nitrogen use at national scales, and providing policy support for the implementation of sustainable nitrogen management resolution of UNEP.

**Key words:** Soil nitrogen, Soil nitrogen cycle and transformation, Influencing factor, Model simulation, Regulation mechanism

**Research objectives**

The overall objectives of this project are to identify synergistic mechanisms between agricultural nitrogen management and the UN 2030 SDGs, to explore what measures different regions should take to address food security, environmental and climate threats, to reduce country-scale imbalances, and to provide policy support for the UN Environment Programme's sustainable nitrogen management resolution. The specific objectives are: (1) to elucidate the driving mechanism of the nitrogen cycle on SDGs; (2) to quantify the contribution of nitrogen in global SDGs; (3) to dissect the synergistic or trade-off mechanism of nitrogen management in different SDGs; (4) to explore effective pathways to achieve synergy of multiple global SDGs through nitrogen management

**Key members**

**Prof. Baojing Gu,** is from Zhejiang University and a recipient of the Outstanding Youth Fund of Zhejiang Province and the National Excellent Youth Fund. He is mainly engaged in the intersection of ecology and economics, and has made some research results in the construction of regional nitrogen cycle model, resource and environmental effect assessment, cost-benefit analysis and its regulation, etc. He has been working with UNEP through the GEF funded project International Nitrogen Management System (INMS) since 2016. He innovatively introduced the functional groups of ecology into the regional nitrogen cycle analysis, and constructed the CHANS model containing 14 subsystems, which is listed by the International Nitrogen Management System (INMS) as one of the important models of global nitrogen budget. One of the important models of global nitrogen budget by INMS. He is also a member of the Asian Working Committee of the International Nitrogen Initiative (INI), an editorial board member of Earth's Future, The Innovation and Environmental Science and Pollution Research, and an editorial board member of Agricultural Science and Pollution Research. Pollution Research, Guest Editor of Agriculture, Ecosystems & Environment. He has published more than 100 papers in national and international journals, including more than 90 SCI/SSCI indexed papers, including first/corresponding authors in important journals such as Science, Nature, PNAS, Nature Sustainability, Nature Food, Nature Communications. This will provide important theoretical and technical support for the research of this project in large-scale nitrogen flow and analysis, environmental effects and cost analysis.

**Dr Mahesh Pradhan** has over 25 years of experience with the United Nations Environment Programme (UNEP) and is currently based at UNEP HQs in Nairobi. From 2016 onwards, Mahesh was working on holistic waste management issues at UNEP’s International Environmental Technology Centre in Osaka, prior to returning to Nairobi in 2019 to take up the coordinating role of the Global Partnership on Nutrient Management. Mahesh currently serves as the focal point of the UN Environment Resolution on Sustainable Nitrogen Management, where he is also actively engaged in the development of a global UN campaign on Nitrogen.

**Dr. Cargele Masso,** principal of the IITA organization, has research interests in soil fertility management and agricultural resource utilization, including biofertilizers, pesticides, and soil conditioners, as well as leading IITA's projects on institutionalizing quality assurance mechanisms and disseminating quality commercial products to increase crop yields and improve food security for smallholder farmers in sub-Saharan Africa. He has a unique research perspective and extensive local agro-social knowledge on sustainable intensification and smallholder economies in Africa. He also serves as the African member of the International Nitrogen Organization (INI), coordinating INI's activities and research in Africa, including the implementation of the International Nitrogen Management System (INMS) demonstration site in East Africa, and is a member of the Canadian Society of Soil Science (CSSS), exploring solutions to integrated soil fertility management and environmental challenges in Canada. Prior to joining IITA, he worked as a postdoctoral fellow in soil fertility at the Canadian Food Inspection Agency and Agriculture and Agri-Food Canada. He has published numerous articles in Frontiers in Agronomy, Agriculture, Ecosystems and Environment, International Journal of Agricultural Sustainability, Frontiers in Plant Science.

**Budget**

The budget of this NSFC project is around 420,000 USD, plus contribution in kind from IITA estimated of 500,000 USD, with project duration from 2023. Jan to 2027 Dec.