Title of project	West African rice green revolution by Sawah ecotechnology and the creation of African Satoyama systems
Head Investigator Name	Toshiyuki Wakatsuki, Kinki University, Faculty of Agriculture, Professor
Abstract of Research Project **Number of Researchers: 5** Japanese: T. Wakatsuki, H. Okumura, and T. Masuanga Ghanaian coordinator: M.M.Buri (Soil Research Institute) Nigerian coordinator: E.D. Imolehin (National Cereals Research Institute)	Even 40 years after the green revolution in tropical Asia in 1970s, the green revolution has yet materialized in Sub Sahara West Africa. After the September 11, what clear is north-south problem has to be tackled with global environmental issues simultaneously. The materialization of the rice green revolution is the major target of the millennium development goals of the United Nations. Although high yielding varieties, i.e., biotechnology, were the core technologies in Asian green revolution in 1970s and African Rice Center, WARDA, had innovated NERICA technologies, the successful path to the green revolution is still unclear. This research examines the Sawah hypothesis that the core for West African green revolution is eco-technologies that can improve farmers rice growing environment, such as lowland sawah technologies in Asia. Two benchmark inland valley watersheds, about 10,000ha each, at Guinea savanna zone in Nigeria and forest transitional zone in Ghana were selected for long term action research to test the Sawah hypothesis in collaboration with hundreds of sawah group farmers and local collaborators including postdoctoral fellows trained at Japan and Asia. The two sites will be examined as model African adaptive Satoyama watershed systems to confirm both ecological and socio-economic sustainability, which includes to find out the appropriate local landownership and land use systems to sustain the Sawah development and management.
Term of Project: 2007-2011, and Budget	2007: 84million Yen , 2008: 36million Yen, 2009: 36millionYen, 2010: 36million Yen, 2011: 34million Yen
Key words **Key concepts**	1. Eco-technology, or, Ecological Engineering: Sustainable technology to improve ecological environment of crops, trees and animals. Sawah technology is an example. 2. Sawah hypothesis (I): The core technology to realize the green revolution in West Africa is eco-technology, such as lowland sawah ecotechnology. 3. Sawah hypothesis (II): Sustainable Productivity of lowland Sawah is more than 10 times than upland fields, if appropriate lowlands are selected, developed and managed. 4. African Satoyama systems: Sato means villagers' habitat and Yama means multipurpose forests managed by villagers. Because of intensive sustainability of lowland sawah systems, degraded upland fields can be converted to multipurpose forests, which will eventually contribute to combat the global warming.

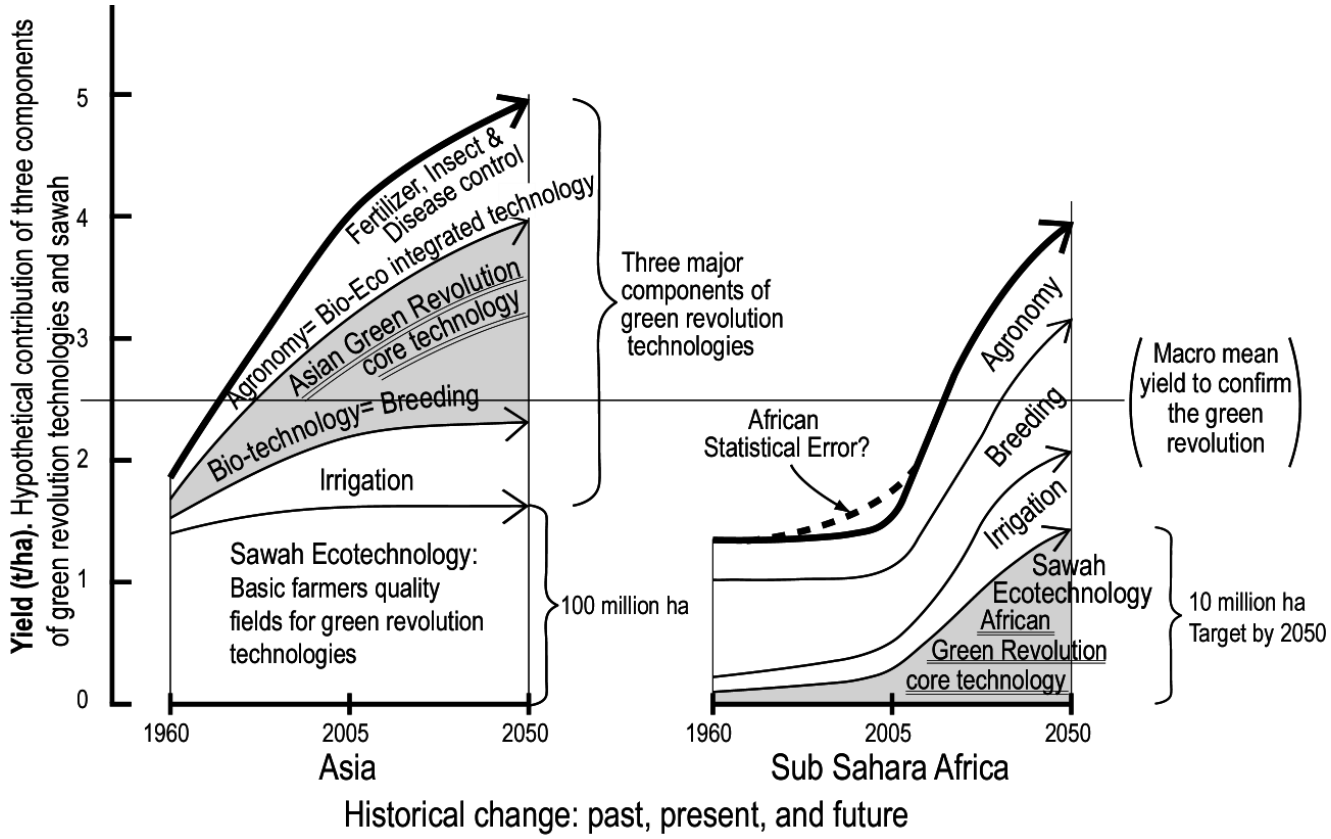
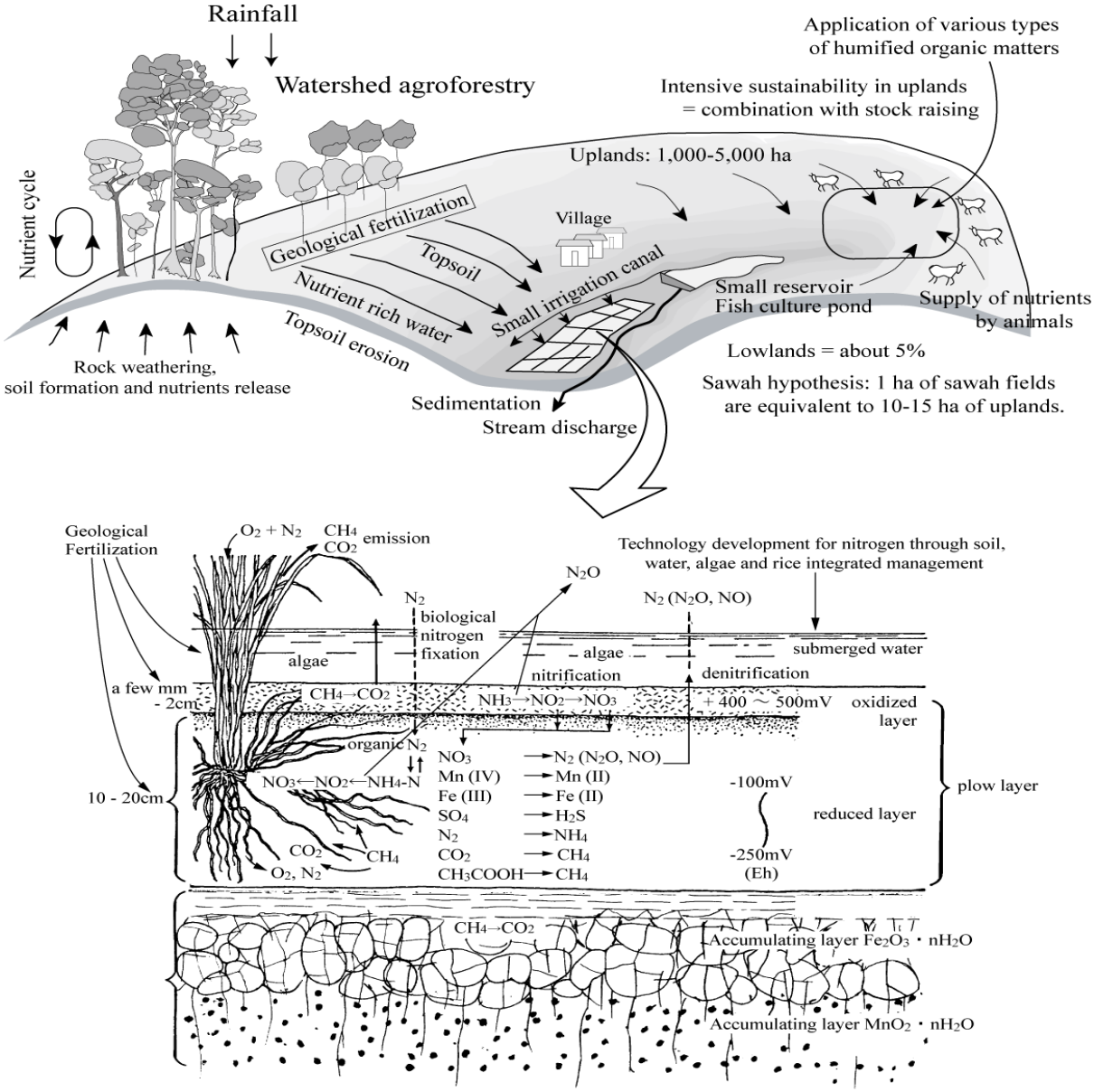


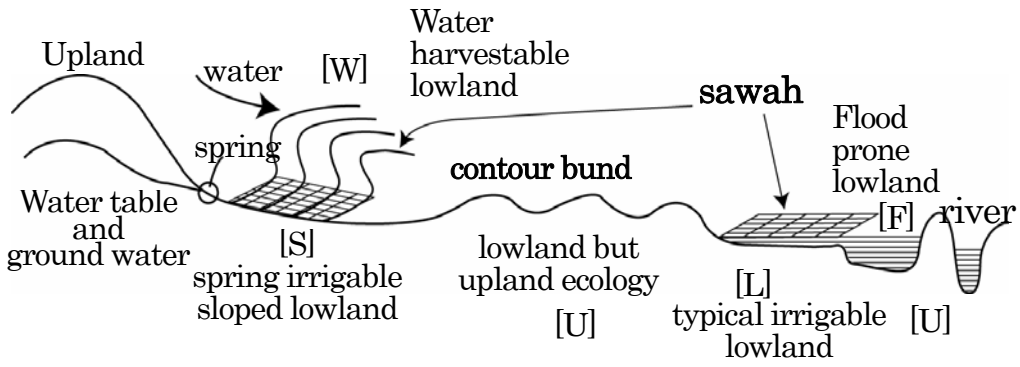
Fig. 1. Sawah hypothesis (I): hypothetical contribution of three green revolution technologies and sawah eco-technology during 1960-2005 and during 2005-2050 in Sub Sahara Africa and Asia. Bold lines during 1960-2005 are based on mean rice yields based on FAOSTAT 2006. Bold lines during 2005-2050 are the expected or target trend based on the sawah hypothesis (I) by the authors.

(1) Concept of "Watershed Ecological Engineering" and "Watershed Agroforestry" to create "African SATO-YAMA" watershed systems, SATO means villargers' habitat, YAMA means forests managed by villages: The optimum landuse pattern and landscape management practices optimize the geological fertilization through the control of optimum hydrology in watershed. Because of geological fertilization, lowland can receive water, nutirents, and fertile topsoils from upland. Sawah system enhances to utilize such geological fertilization flows.



(2) Sawah systems as multi-functional constructed wetlands for enhanced supply of N, P, Si and other nutrients. Technology development for enhance the multi-functionality of wetland sawah in diverse SSA agro-ecologies is a key in IGNRM.

Fig. 2. (1) Macro- and (2) micro-scale eco-technological mechanisms of intensive sustainability of lowland sawah systems in a given watershed, African Satoyama watershed system



Irrigation options: Sawah to sawah / contour bund water harvesting, spring, dyke, river, pump, peripheral canal, interceptor canal, tank

Lowland sawah development priority

[S] > [L] > [F] > [W] > [U]

Fig. 3 Concept of Characterization and quantitative mapping of Lowland diversity for sawah development (bunded, leveled, puddle rice land) depending on the watershed land use, lowland topography, soil, hydrology and Agroecological zones

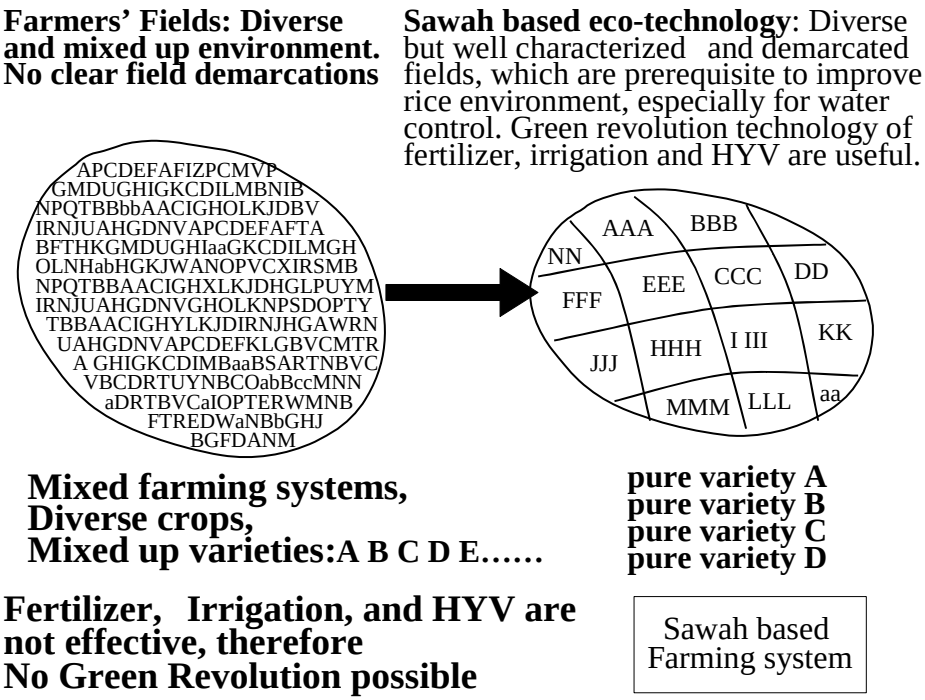


Fig. 4. Successful Integrated Genetic and Natural Resource Management (IGNRM) Needs Classified Demarcated Land Eco-technologically

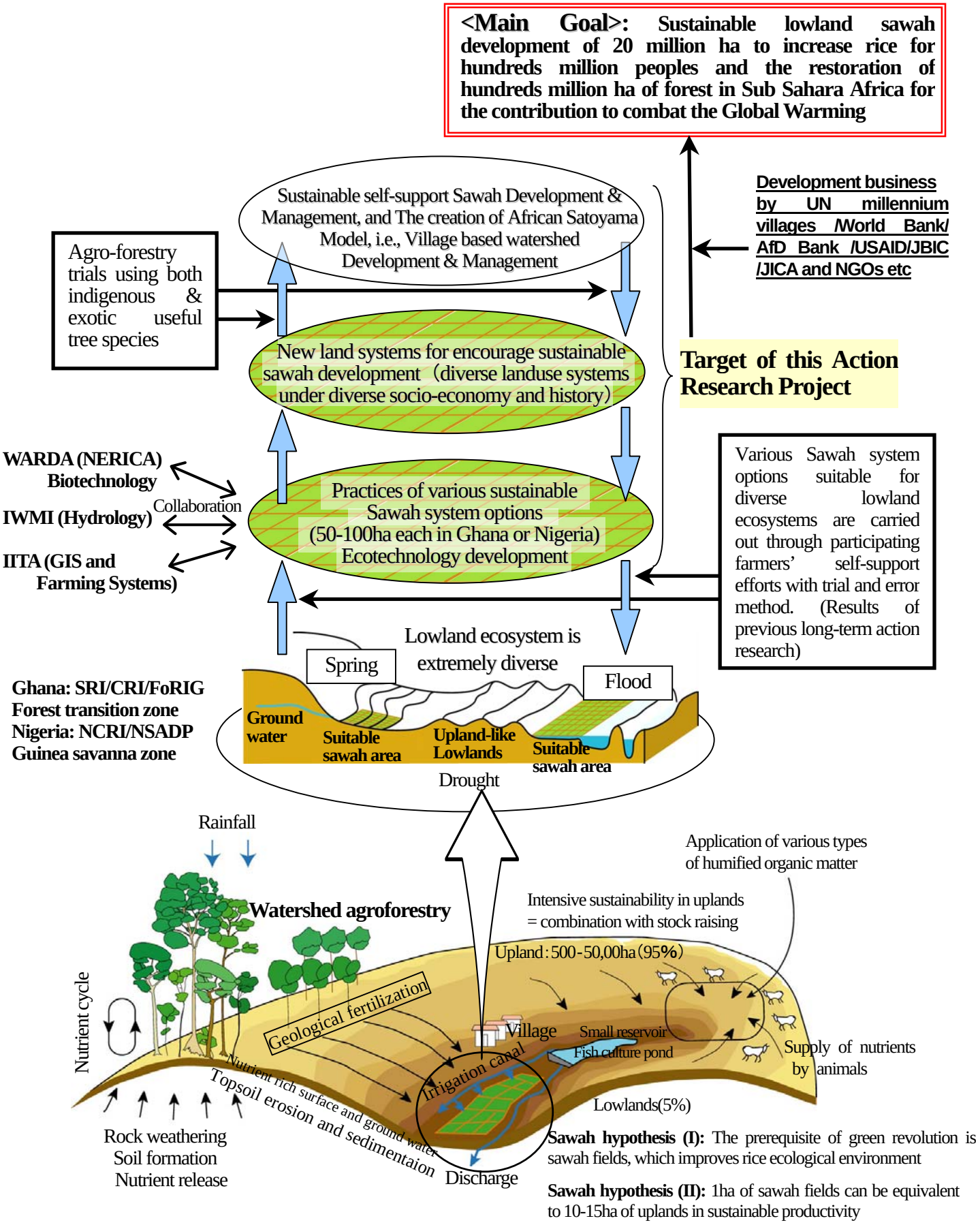


Fig. 5. Materialization of Green Revolution: Execution of action researches and creation of African Satoyama watershed model in collaboration with hundred farmers living in the two benchmark watersheds in Ghana & Nigeria