Soil carbon sequestration and GHGs mitigation in the agriculture sector

Experience in paddy rice cultivation

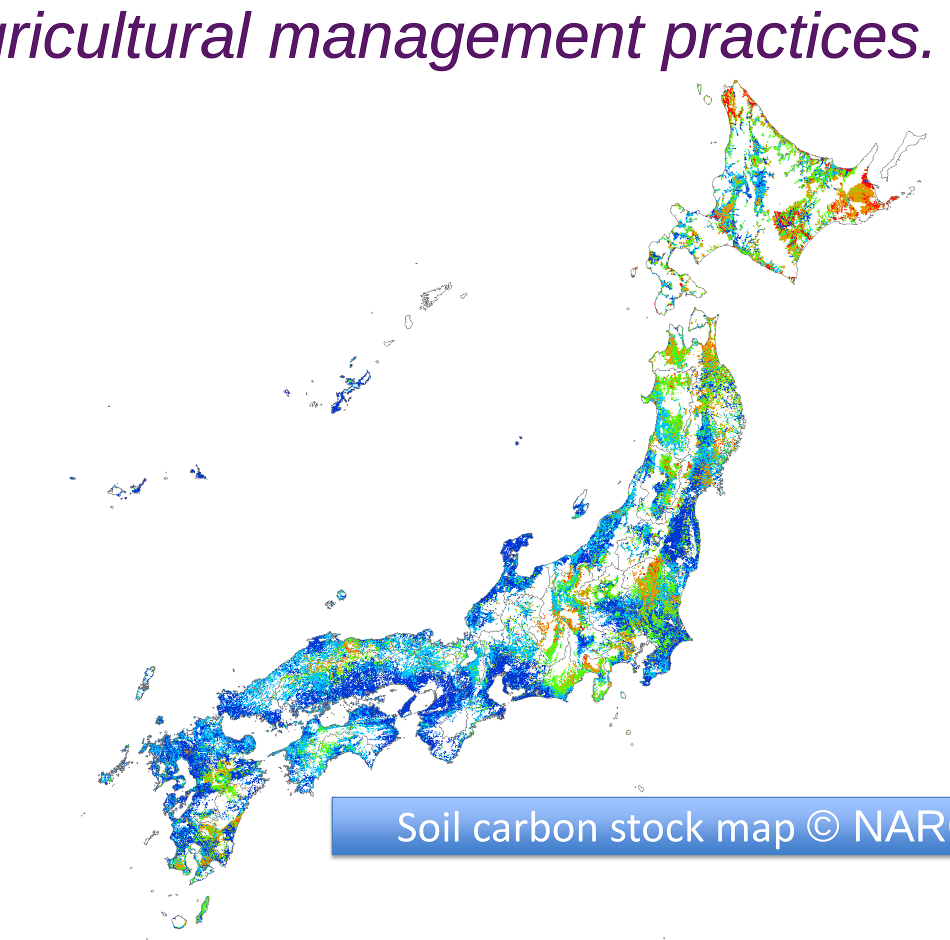
Manage agricultural soils to achieve both sustainable food production and climate change mitigation

Based on long term soil monitoring, we have developed models for evaluating the effects of paddy-agricultural management on soil carbon sequestration and greenhouse gasses (GHGs) emissions at country-scale. We are using this calculation system for national GHGs inventory report as well as future projection of soil C and GHGs emission with changing climate and agricultural management practices.

❑ Soil Carbon Calculation System in Japanese National Inventory Report; IPCC Tier 3 Approach

➢ Agricultural Soil Monitoring

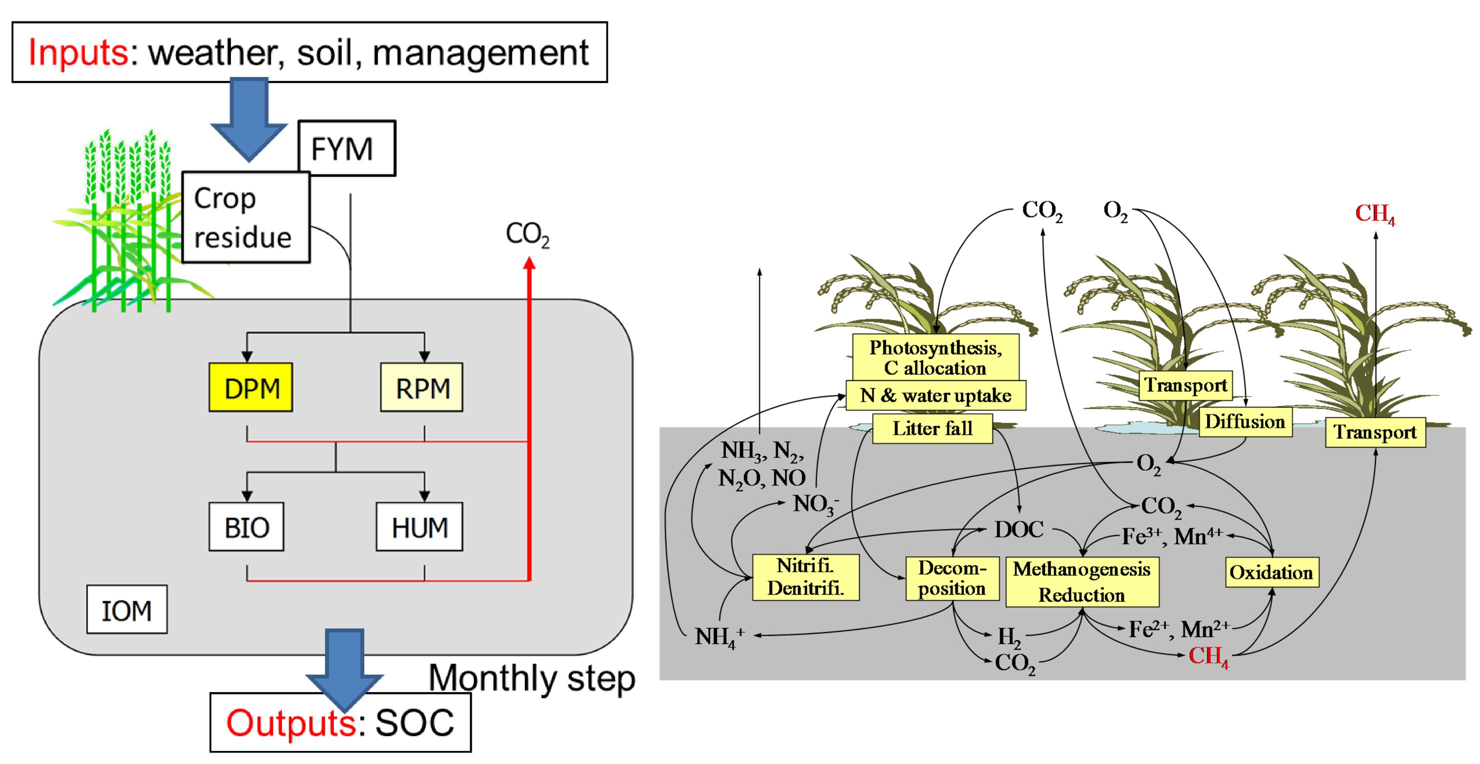
National program has been conducted since 1979. Physico-chemical properties and soil management records are surveyed at 4000 – 20,000 sites, to develop Soil C stock map.



Soil carbon stock map © NARO

➢ Modified RothC Model for Soil Carbon and DNDC-Rice for CH4 from rice paddies

The Rothamsted Carbon (RothC) model, a leading soil carbon turnover model, was validated and modified for Japanese agricultural soils, particularly for paddy rice soils and Andosols. DNDC-Rice model simulates rice growth and GHG emissions. It is used to predict CH_4 emissions under different climate, water and organic matter managements.



Modified RothC model (left) and DNDC-Rice model (right) © NARO

❑ Future Projection of GHG Emissions

➢ Trade-off between soil C sequestration and other GHGs emissions

These models were used to estimate GHG emissions under different agriculture management scenarios in Japan.

Similar stories are expected in other countries where intensive rice cultivation is conducted. Scientific findings in Japan are shared through cooperation with international projects; e.g. MIRSA (Greenhouse Gas Mitigation in Irrigated Rice Paddies in Southeast Asia) by International Rice Research Institute.

Scenario	C input	Paddy water management	N fertilizer	Mitigation potential vs. BAU (kt CO_2-eq./yr : minus: mitigation)				
				CO_2 (Soil C)	CH_4	N_2O	CO_2 (Fossil fuel)	Total emissions
BAU	conventional	conventional	conventional	939	18,052	3,857	15,699	38,547
Mitigation1	+10%	conventional	conventional	-903	+1,637	+471		+1,205
Mitigation2	+10%	Extend MSD*	conventional	-903	-1,316	+471		-1,748
Mitigation3	+10%	Extend MSD*	-10%	-903	-1,316	+234		-1,985

*MSD: Mid-season drainage

Average of 2014-2050（per year）
Average of two climate change scenarios

Future projection of agricultural soil GHG emissions © NARO

- Increasing C input to soils can decrease CO_2 emission but increase CH_4 and N_2O.
- It is therefore necessary to combine mitigation options for CH_4 and N_2O to those for soil C.

Contact

Akiko Nagano
Deputy Director, Environment Policy Office, Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan
http://www.maff.go.jp/e/index.html

Yasuhito Shirato
Head, Soil Biogeochemistry and modeling Unit, Institute for Garo-Environmental Sciences, National Agriculture and Food Research Organization (NARO), Japan
http://www.naro.affrc.go.jp/english/index.html

Initiative 4pour1000
◆
Montpellier (France)
◆
Juin 2017