



Massive SOC accumulation from organic paddy rice supports Taiwan on the way to the goal of “4 per 1000 Initiative”



□ The high resolution map of Taiwan’s SOC

Estimation and mapping carbon storage in the soil is important for Net-Zero Emissions strategies for a country. Therefore, we used digital soil mapping technique to model (random forest algorithm) and predict the spatial distribution of carbon storage in surface soils (0-30 cm) of Taiwan. The results showed that the average carbon storage content is 9.26 kg m⁻², and those in forest area was significant higher than crop production area. In total, the soils stored approximately 335 Mt carbon within the top 30 cm.

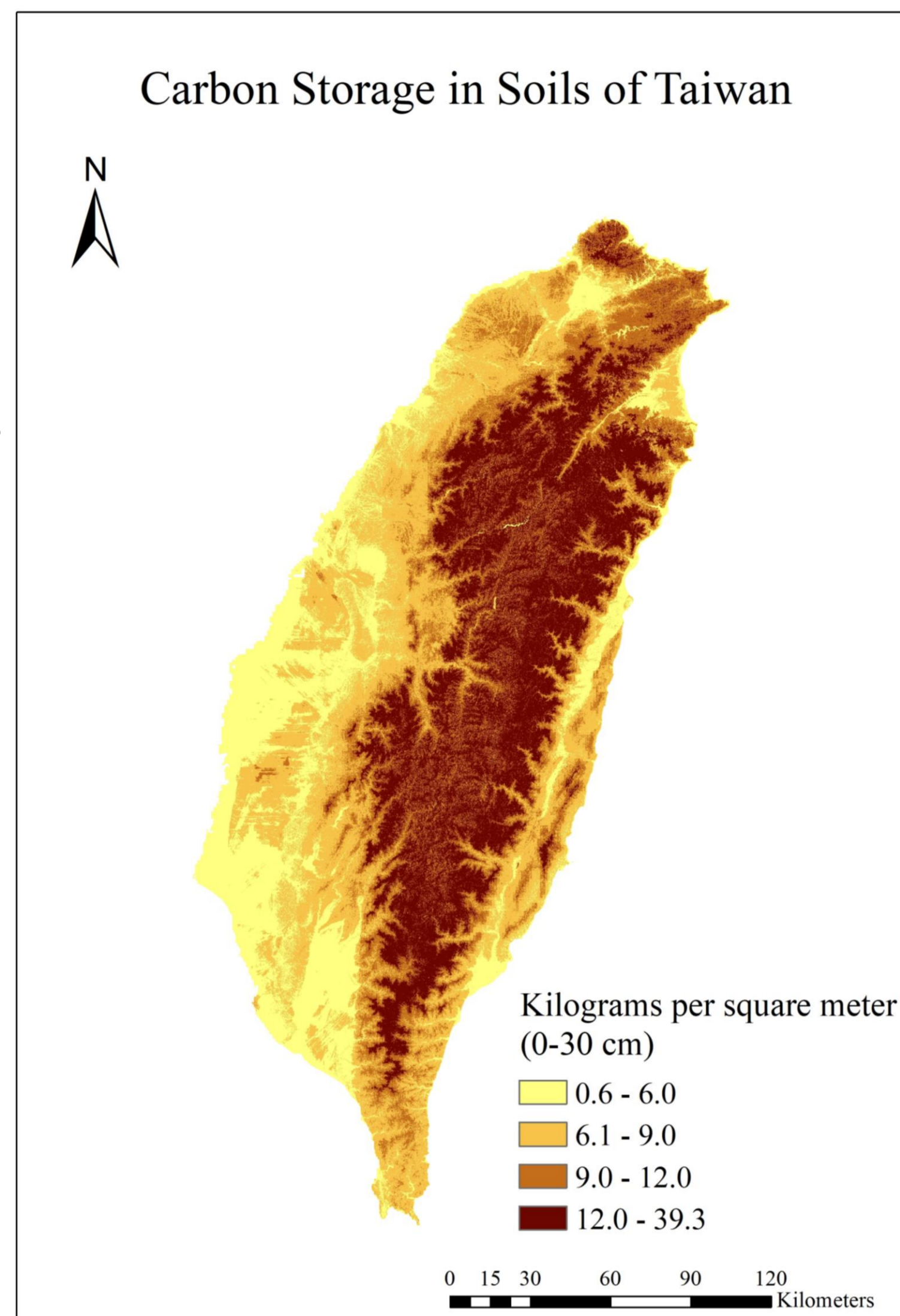


Figure 1. Estimation of carbon storage in soils of Taiwan.

For more information:
Dr. Chein-Hui Syu* & Bo-Jiun Yang
*e-mail: CHSyu@tari.gov.tw

□ Organic farming

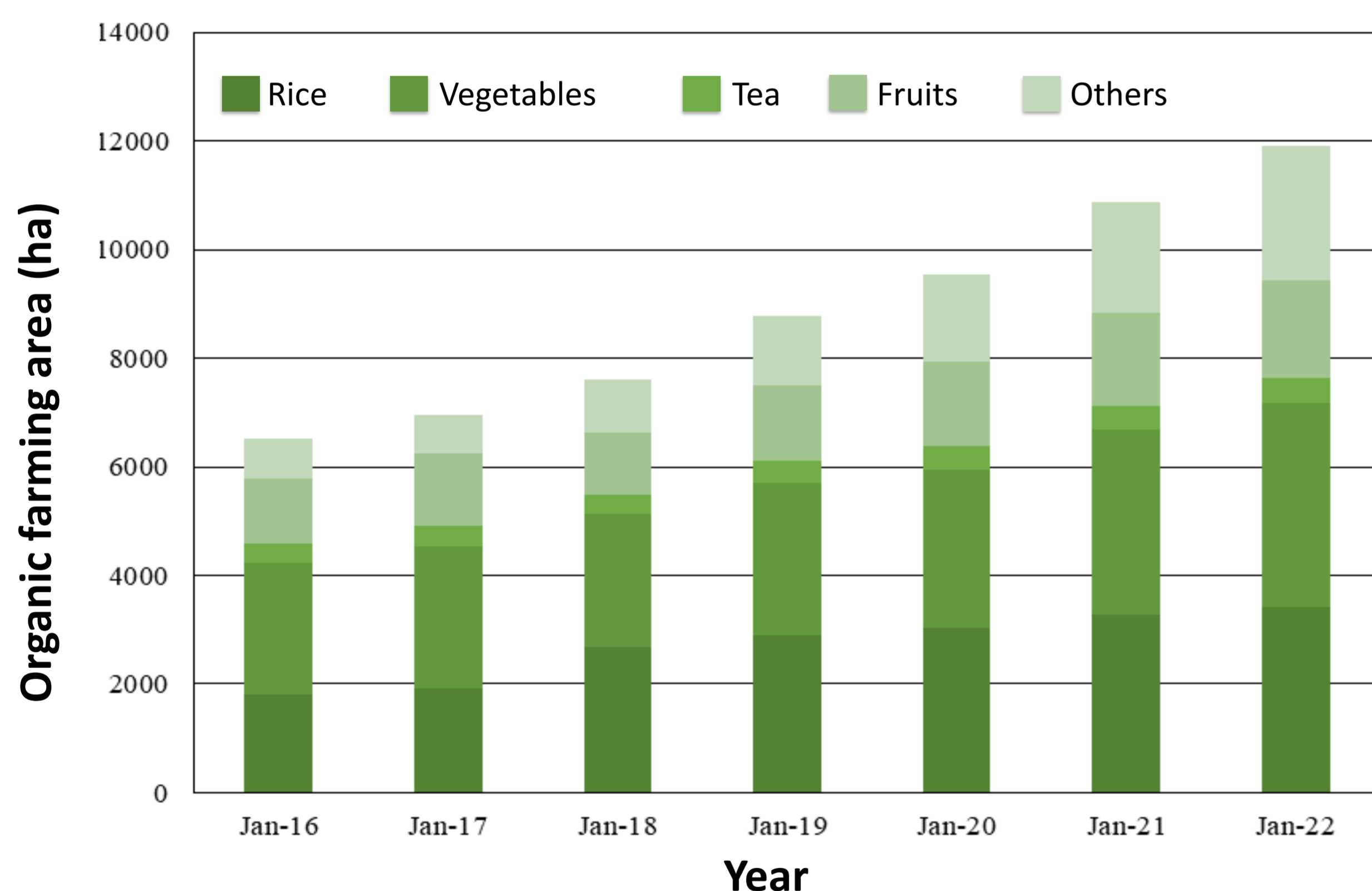


Figure 2. Organic farming area with different cropping in Taiwan during 2016-2022.

Organic farming is one of effective methods to promote carbon sequestration in crop land. In Taiwan, Agricultural and Food Agency (AFA), COA kept on promotion of the environmental friendly production and, more than 12,000 ha agricultural land are utilized by organic farming practices up to date. Rice is the main crop with 3,400 ha (c.a. 30 %) area. AFA anticipated 1,500 ha y⁻¹ increase in organic farming and environmental friendly farming systems in following years to meet the COA’s goal of 45,000 ha area before 2040.

Find more data on AFA website:
<https://www.afa.gov.tw/cht/index.php?code=list&ids=563>

Contact

Coordination Author:
Dr. Chi-Ling Chen
Taiwan Agricultural Research Institution
(TARI), Taiwan R.O.C.
Chiling@tari.gov.tw
+886-4-2331-7407

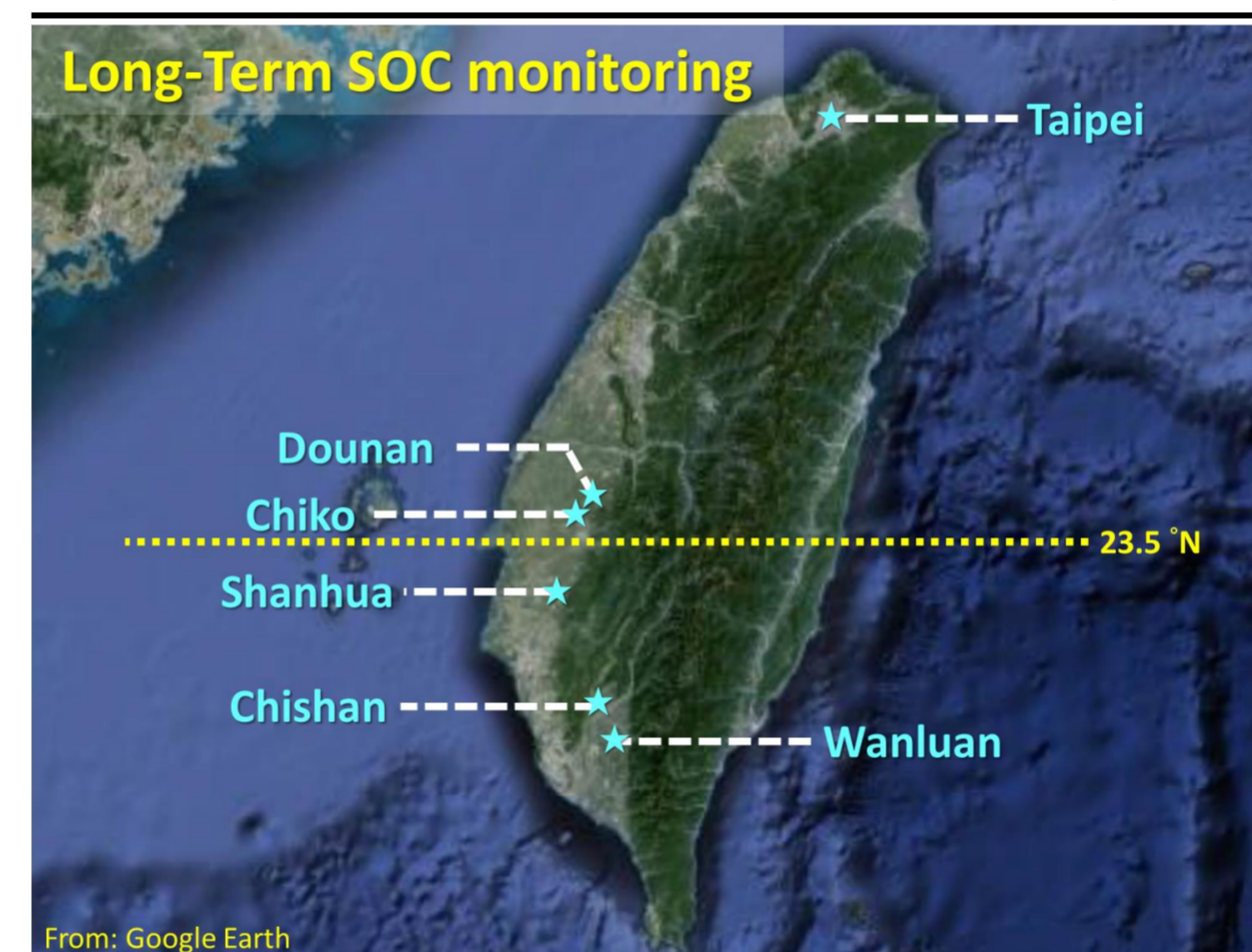
□ Conclusion

- According to the estimation and mapping carbon storage, the soils stored approximately 335 Mt carbon within the top 30 cm.
- Long-term SOC monitoring can be used for model simulating and estimating SOC eq as a basis for future policy formulation.
- We estimate that organic and eco-friendly rice paddy farming systems can contribute about 187.0 kt SOC in 2040. These results point out the critical role of organic farming of paddy rice on SOC accumulation, as Taiwan keeps going to approach the goal of the “4 per 1000 Initiative”.

□ Long-term trials

Table 1. Annual increasing rate & equilibrium contents of SOC with different crop systems among six sites in Taiwan.

Location	Years	Crop System	Trt	Crop residue / Organic manure	C (Mg/ha/yr)	SOC eq (%)
Taipei, Taiwan	1924-1972	Rice-rice	NoF	Rice stubble & root	0.60	2.2
			IF	Rice stubble & root	1.00	2.4
			GM	Rice stubble & root	1.00	2.5
				Green manure(soybean)	2.50	-
			OF	Rice stubble & root	1.10	2.8
				Farm yard manure	2.80	-
Wanluan, Pingtung, Taiwan	1974-1988	Rice-rice-soybean	IF	Rice stubble & root	2.30	2.0
				Root	1.60	2.1
			IF+res.	Rice straw	2.2-2.9	0.4
				Soybean residue	0-0.7	-
				Root	0.3-0.5	-
Shanhua, Tainan, Taiwan	1984-1992	Soybean-soybean-soybean	IF	Crop residue	8.6-0	-
				Bagasse-filter cake compost	1.5-0	-
				Root	0.3-0.5	1.9
			IF+OF	Crop residue	8.6-0	-
				Bagasse-filter cake compost	8.8-1.5	-
Chiko, Chiayi, Taiwan	2006-	Rice-rice	IF1	Rice residue	6.47	1.5
			IF2	Rice residue	5.68	1.4
		Rice-peanut	IF1	Rice & peanut residue	8.56	1.3
			IF2	Rice & peanut residue	6.42	0.9
Dounan, Yunlin, Taiwan	2006-	Rice-rice	IF1	Rice residue	6.58	0.8
			IF2	Rice residue	6.41	0.7
		Rice-peanut	IF1	Rice & peanut residue	5.05	0.6
			IF2	Rice & peanut residue	5.66	0.6
Chishan, Kaohsiung, Taiwan	1988-2003	Rice-Sesbania or rice-vegetable	IF	Root	2.50	1.1
			IF+OF	Root & compost	6.92	2.3
			OF	Root & compost & organic fertility	11.33	3.5
			IF	Root	2.50	1.3
2004-	Corn-Sesbania-vegetable	IF+OF	Root & compost	6.92	1.7	
		OF	Root & compost & organic fertility	11.33	2.0	



Note: NoF-no fertilizer input, IF-inorganic fertilizer, GM-green manure, OF-organic fertilizer, res.-residue, IF1-inorganic fertilizer with conventional input, IF2-inorganic fertilizer with 50%-80% of conventional input.

Figure 3. Long-term SOC monitoring in Taiwan.

□ SOC decomposition model

- The contents of SOC under rice-peanut (lowland-upland) rotation was lower (0.3 %) than those under rice-rice (lowland-lowland) cultivation in both Chiko Branch Farm and Yunlin Branch Station
- Continuous organic farming reinforced about 1.5% SOC in soils under the paddy rice-upland crop rotation system after 12 years compared with conventional management in Chinan Branch Station

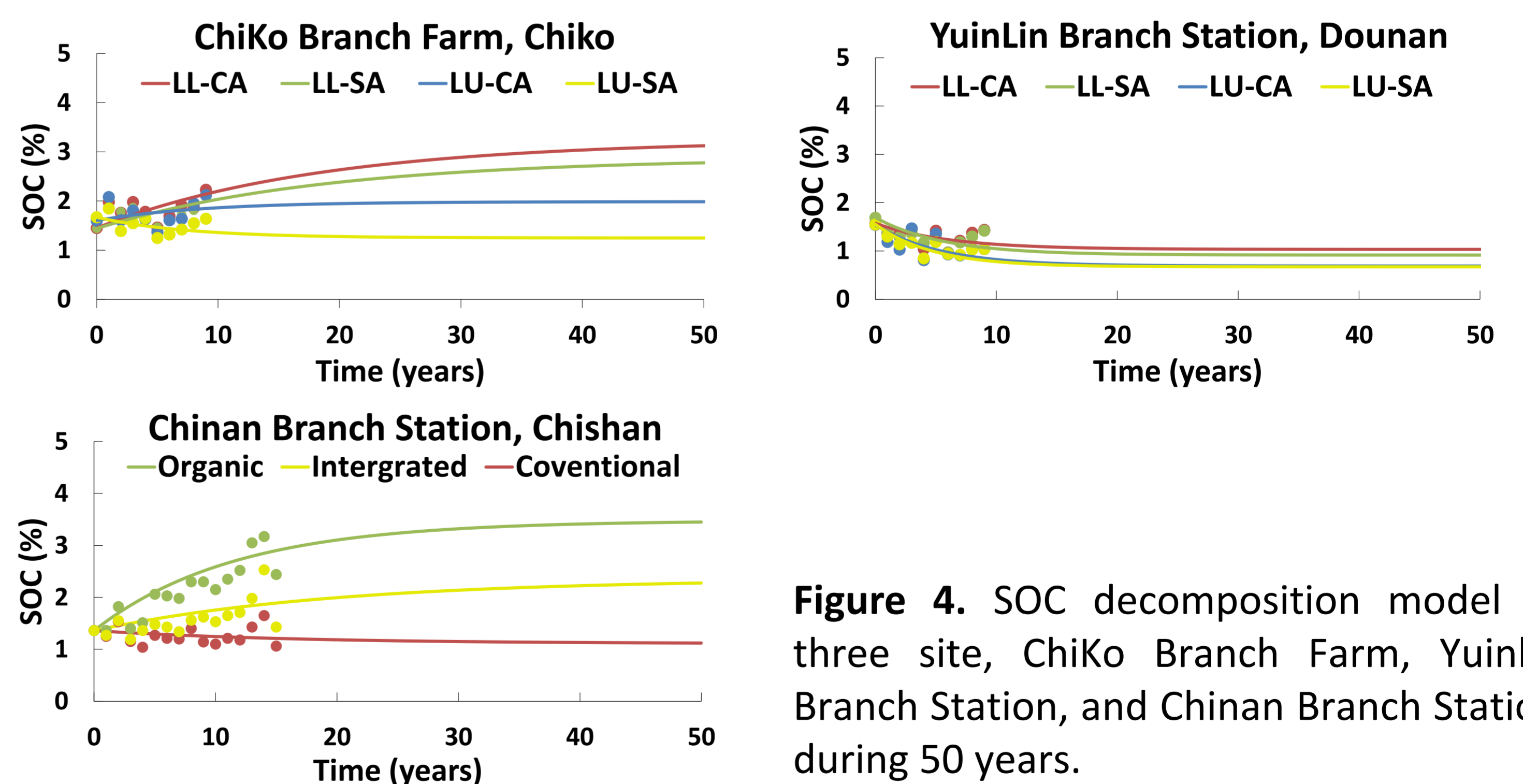


Figure 4. SOC decomposition model in three site, ChiKo Branch Farm, Yunlin Branch Station, and Chinan Branch Station during 50 years.