ECOLOGICAL APPLICATIONS

Appendix S1: SUPPLEMENTAL MATERIALS

Diversifying and Perennializing Plants in Agroecosystems Alters Retention of New C and N from Crop Residues

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Table S1. Soil CO_2 efflux stepwise multiple linear regression model output†

Coefficient	Estimate	Std. Error	t value	*p* value‡
Intercept	-3.551	0.564	-6.294	< 0.0001*
Year	-0.176	0.959	-0.183	0.855
Temperature (Temp.)	0.168	0.025	6.731	< 0.0001*
Gravimetric water content (GWC)	11.428	4.539	2.518	0.013*
Year ×Temp.	-0.059	0.043	-1.378	0.169
Year × GWC	0.310	6.843	0.045	0.964
Temp.× GWC	-0.399	0.195	-2.047	0.042*
Year ×Temp. × GWC	0.092	0.311	0.295	0.768

† Overall model: Used $\ln CO_2$, $R^2 = 0.52$, Adjusted $R^2 = 0.69$, $p < 0.0001$

‡ If significant(*), used in final model (Fig. S2)

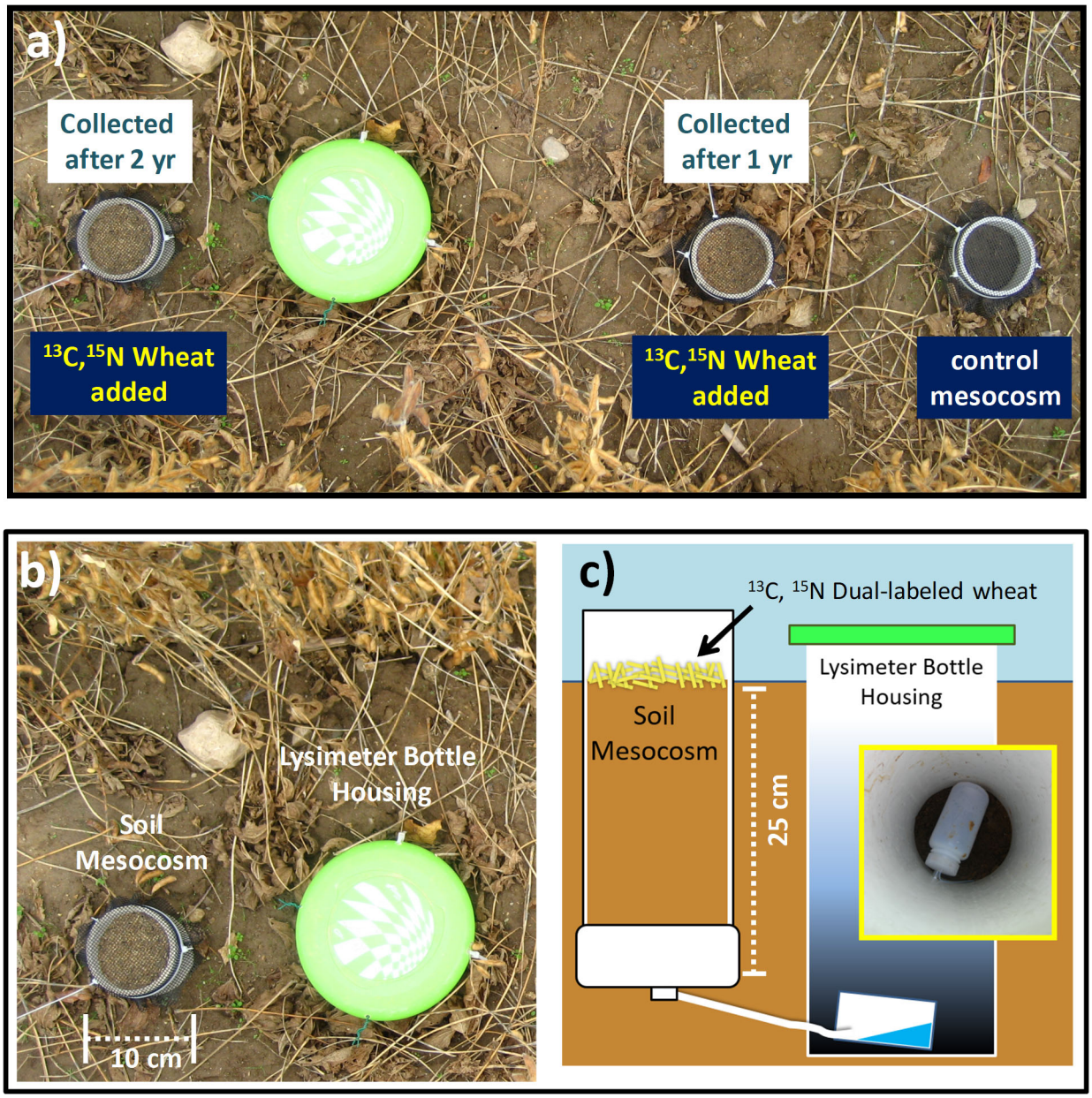

Figure S1. Overhead photos showing mesocosm layout in each plot (*a*, *b*) and vertical cross section of (*b*) showing the experimental design (*c*). Photo Credits: Marshall McDaniel.

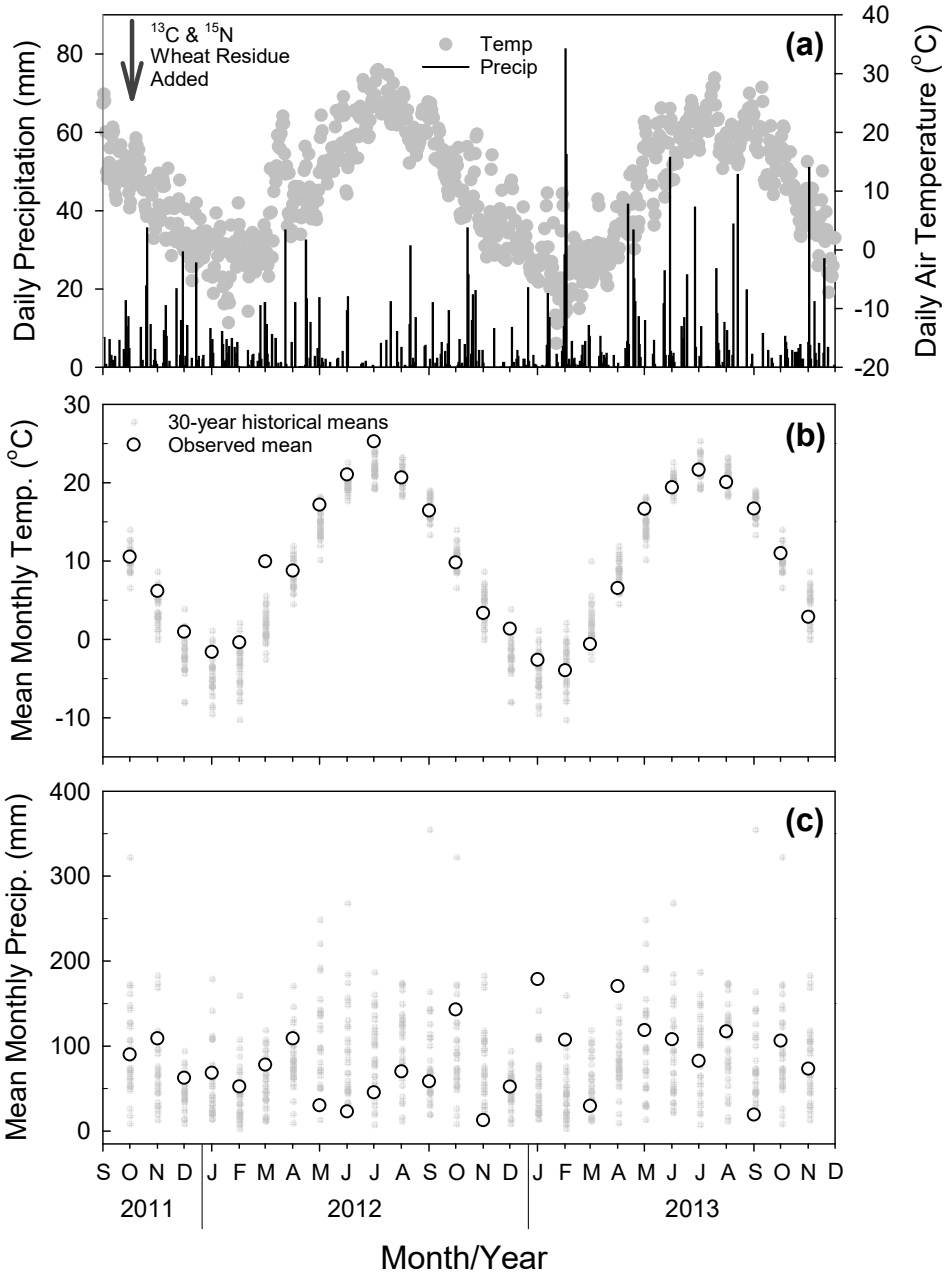

Figure S2. Precipitation and air temperature over the duration of the two-year experiment. (*a*) Daily precipitation and air temperature for over two years. Gray circles are temperature, and black bars precipitation. Downward arrow showing dual-labeled wheat residue addition. (*b*) Observed and historical (1988-2018) mean monthly temperatures. (*c*) Observed and historical (1988-2018) mean monthly precipitation. For (*b*) and (*c*), gray circles are historical annual means and open circles are observed for that month/year. From nearby weather station at Kellogg Biological Station Long-term Ecological Research site.

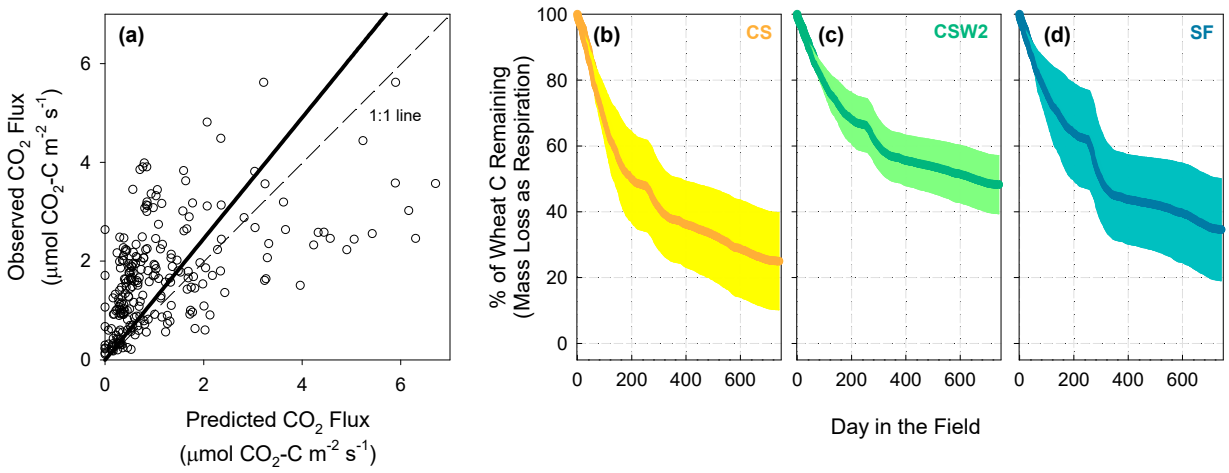

Figure S3. (*a*) Observed versus modeled (or predicted) CO_2 flux from mesocosms using soil temperature and moisture (5 and 10 cm depth). (*b*, *c*, *d*) Modeled residue loss (*solid lines*) with standard errors (*lighter area*). Treatment abbreviations are: CS = Maize-Soybean, CSW2 = Maize-Soybean-Wheat + Red Clover and Rye Cover Crops, SF = Spring fallow or tilled in spring and naturally regenerated seed bank (7-10 species).

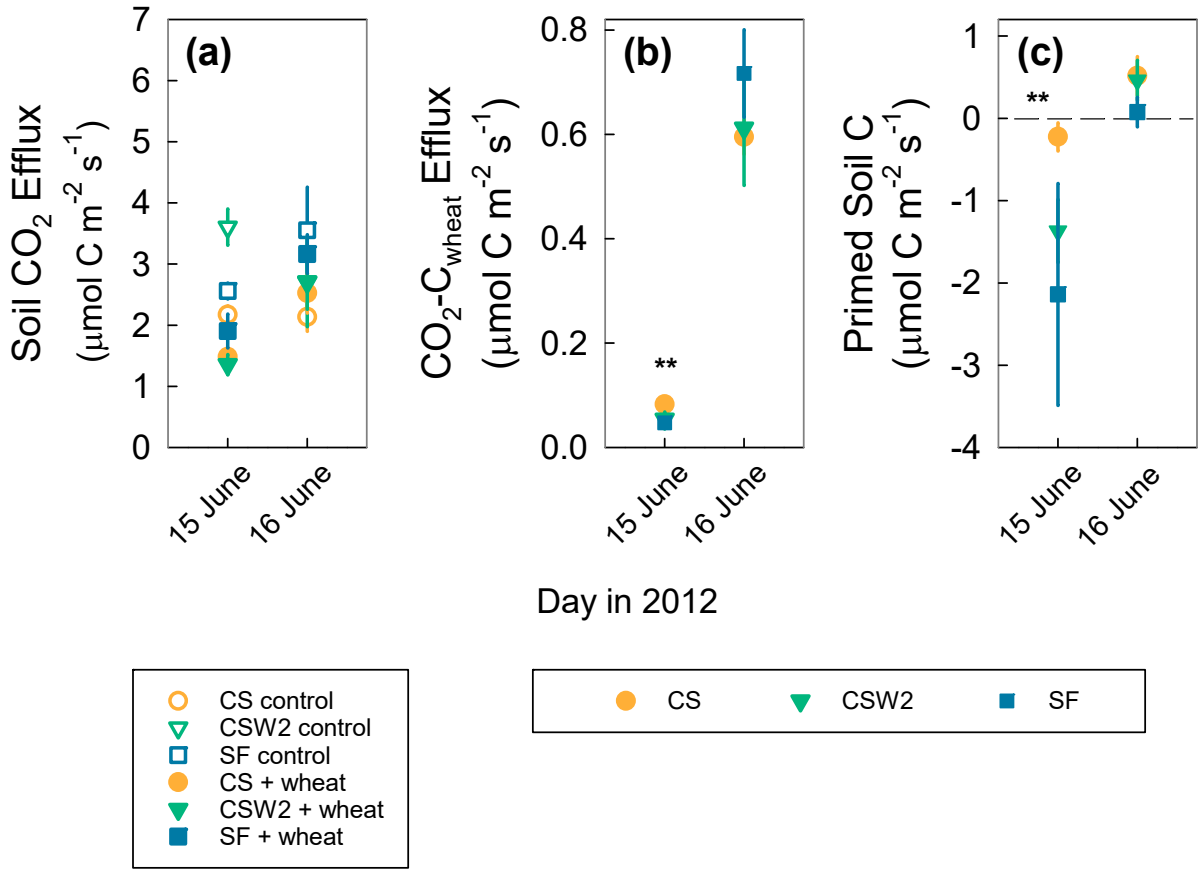

Figure S4. Soil CO_2 dynamics before (15 June) and after (16 June) manipulated wetting event in 2012 (from Figure 1 in main manuscript). Soil respiration was measured at 8:00 to 13:00 on 15 June. Then 2.5 cm of water was added to all soil mesocosms at 13:30. CO_2 was measured again 16 June between 8:00 to 13:00. (*a*) Total CO_2 flux measurements from both the control (no residue) and wheat residue added. (*b*) Residue-derived CO_2-C (C_{wheat}) flux emitted from mesocosms. (*c*) Native soil organic carbon lost, via priming, from residue addition.

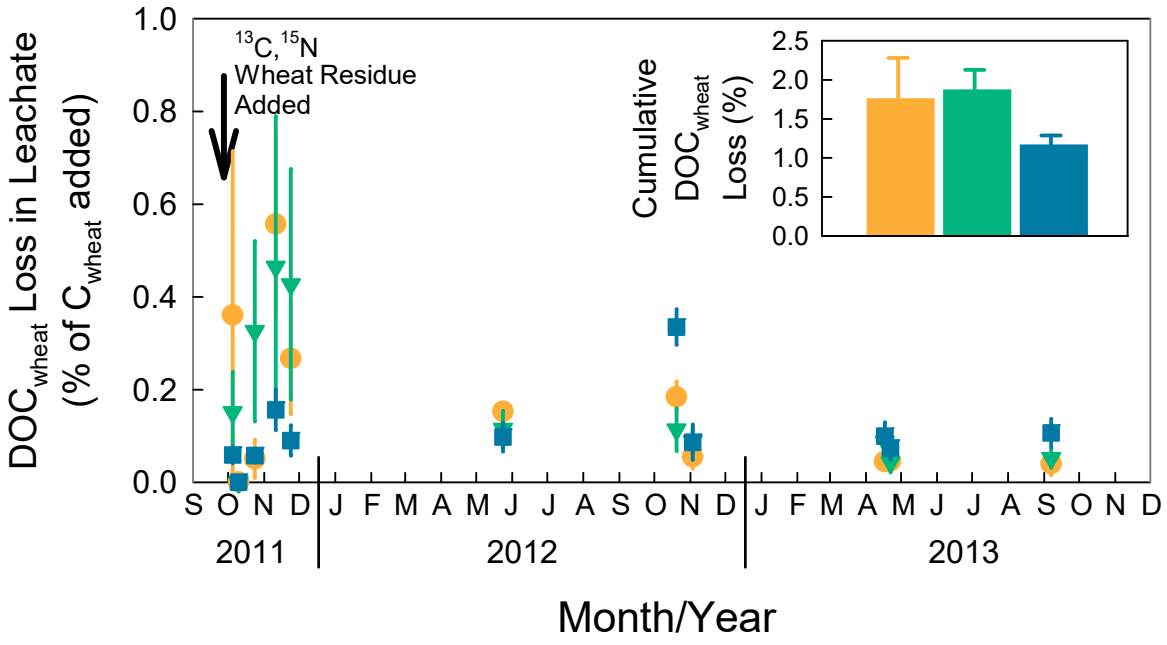

Figure S5. Percent of wheat carbon (C) lost as dissolved organic C (DOC) leached through soil profile and into zero-tension lysimeter (Fig. S1). *Inset* shows cumulative losses as % wheat C.