Supporting Information

First Eco-Compensation Demonstration for Crossing Provinces of Downstream and Upstream in China: A Successful Approach

S1 Description of the Eco-Compensation program

Guaranteed System. To strengthen the protection of the ecological construction in the XRB and innovate the administrative management mode, the XRB Ecological Construction Protection Bureau was set up specially. The Bureau of Finance was managed to improve the operation mechanism coordinated with the departments of Environmental Protection, Water Conservancy, and Agriculture. What's more, Environmental Monitoring station of Zhejiang province and Anhui province were making joint effort to sample and analysis the water quality in Jiekou Section, which is the border of two provinces.

Diversified Funding.

In the past 2012-2017 years, the total amount of 146.32 hundred million yuan was allocated to XRB for ecological environmental managements (Figure S1). The central financial funds (abbreviated to CFF, the same below) remained the same in XAJ1, while decreasing year by year in XAJ2. The local financial funds (abbreviated to LFF, the same below) had been raised in XAJ2, while just the opposite in social funds (abbreviated to SF, the same below).

Sufficient preliminary investigation was made to determine the main direction of compensation funds. Each stage summarizes the achievements of each stage. The system ensures that the compensation funds are specifically used for the industrial structure adjustment and industrial layout optimization of the XRB, comprehensive river basin management, water environment protection, water pollution control and ecological protection.

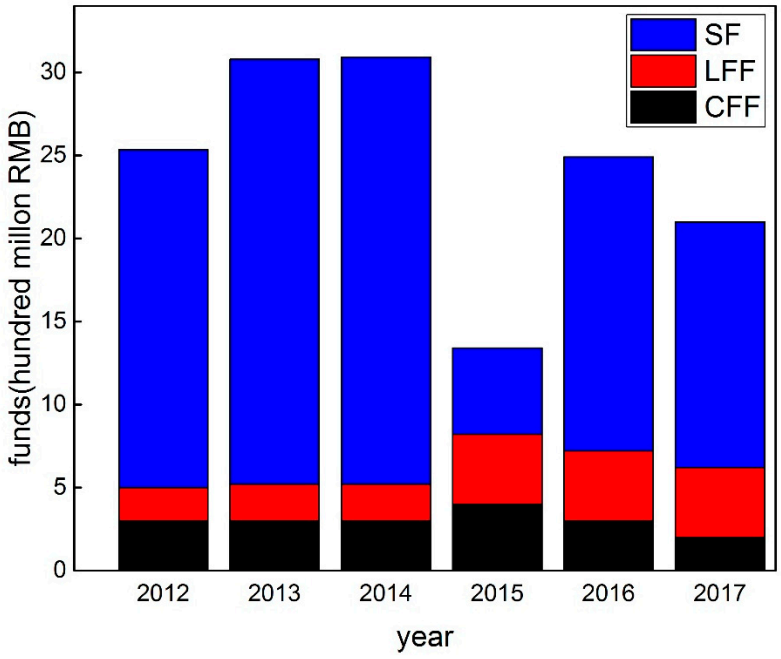

Figure S1. Composition of compensation funds in XRB in 2012-2017

Basis of Compensation.

Taking the chemical oxygen demand, ammonia nitrogen, total phosphorus and total nitrogen four indicators (choice of indicators were limited by local environmental monitoring capability) , the compensation index P was calculated as:

$$\mathrm{P} = K_o \times \sum_{i=1}^{4} K_i \frac{C_i}{C_{io}} \quad (1)$$

Where K_0 is water stable index (0.85 and 0.89 in XAJ1 and XAJ2, respectively), K_i is index weight coefficient (take value to 0.25), c_i is the annual average concentration of factor i, c_{i0} is the average annual concentration of previous three years (2008-2010 and 2012-2015 in XAJ1 and XAJ2, respectively). If P value is less than or equal to 1, LFF would be allocated to the Anhui province; If P value is greater than 1, or major water pollution accident happens, LFF would be allocated to the Zhejiang province. In either case, the CFF are all allocated to Anhui province. During the period of 2012-2017, the P values are less than 1, thus CFF and LFF are all allocated to Anhui province.

S2 p values of SPARROW models parameters estimation

Table S1. *p* values of SPARROW TN model coefficients calibrated on 60 stations in XRB Models

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Pollution sources	Point sources	<0.01	<0.01	<0.01	<0.01	<0.01	0.19	<0.01	<0.01	0.17	<0.01	<0.01
	Fertilizer application	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Livestock and poultry raising sources	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Domestic pollution sources	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Land delivery factor	Slope	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Precipitation	<0.01	<0.01	0.07	<0.01	0.08	0.01	<0.01	<0.01	0.02	<0.01	<0.01
	Temperature	0.24	<0.01	0.23	<0.01	0.11	0.15	<0.01	0.04	0.20	0.07	0.03
Water delivery factor	k_1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	k_2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table S2. *p* values of SPARROW TP model coefficients calibrated on 60 stations in XRB Models

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Pollution sources	Point sources	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	0.02	<0.01
	Fertilizer application	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Livestock and poultry raising sources	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Domestic pollution sources	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Land delivery factor	Precipitation	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Slope	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Drainage density	0.04	0.19	0.04	0.30	<0.01	<0.01	0.33	<0.01	<0.01	<0.01	<0.01
Water delivery factor	k_1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	k_2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table S3. *p* values of SPARROW COD_{Mn} model coefficients calibrated on 60 stations in XRB Models

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Pollution sources	Point sources	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Fertilizer application	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Livestock and poultry raising sources	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Domestic pollution sources	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Land delivery factor	Precipitation	0.14	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
	Slope	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Temperature	0.02	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01
Water delivery factor	k_1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	k_2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

S3 Sensitivity of individual parameter expressed as the deviation between the cumulative likelihood distribution curves of the posterior and prior parameters

Table S4. Sensitivity of individual parameter of SPARROW TN models

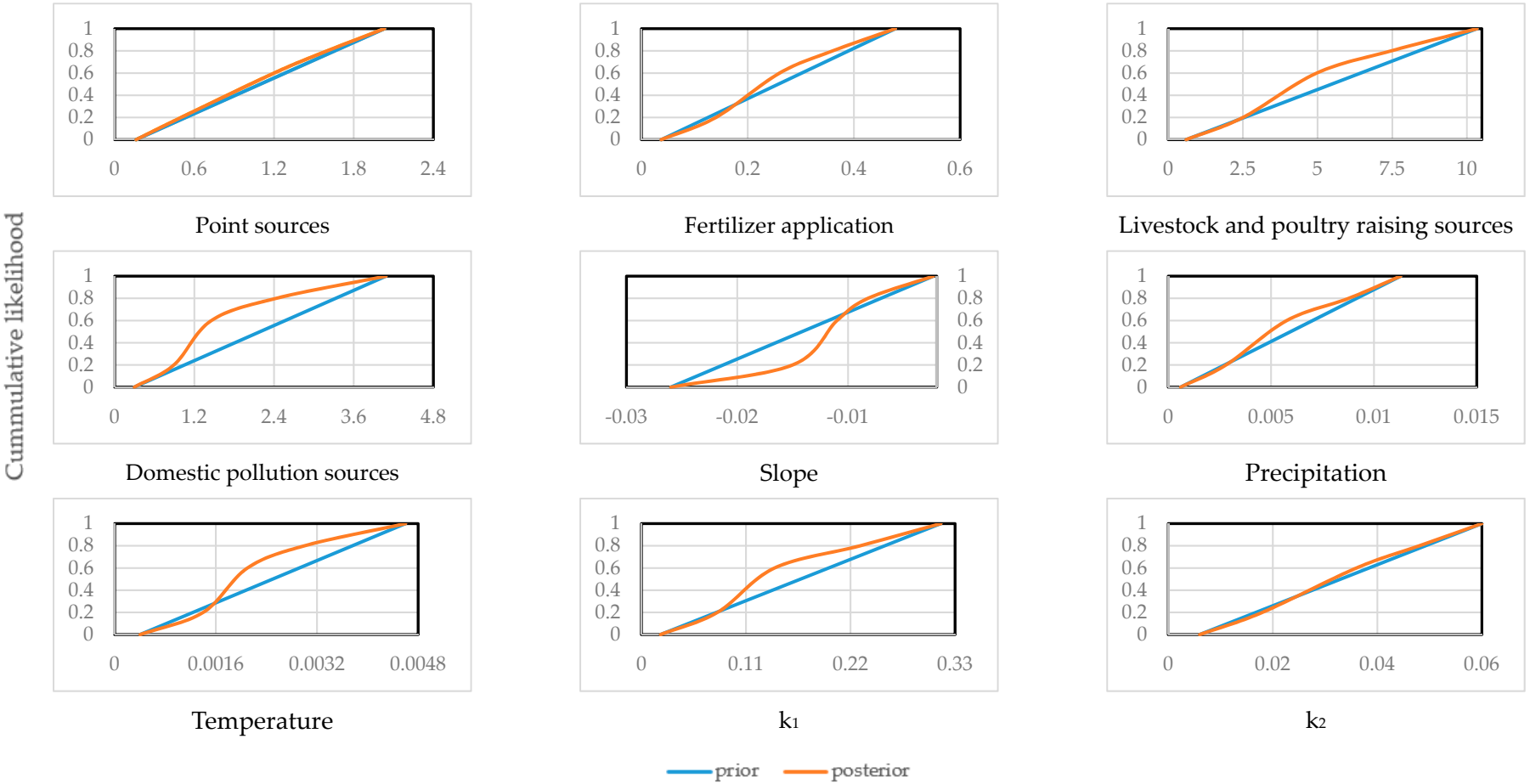

Table S5. Sensitivity of individual parameter of SPARROW TP models

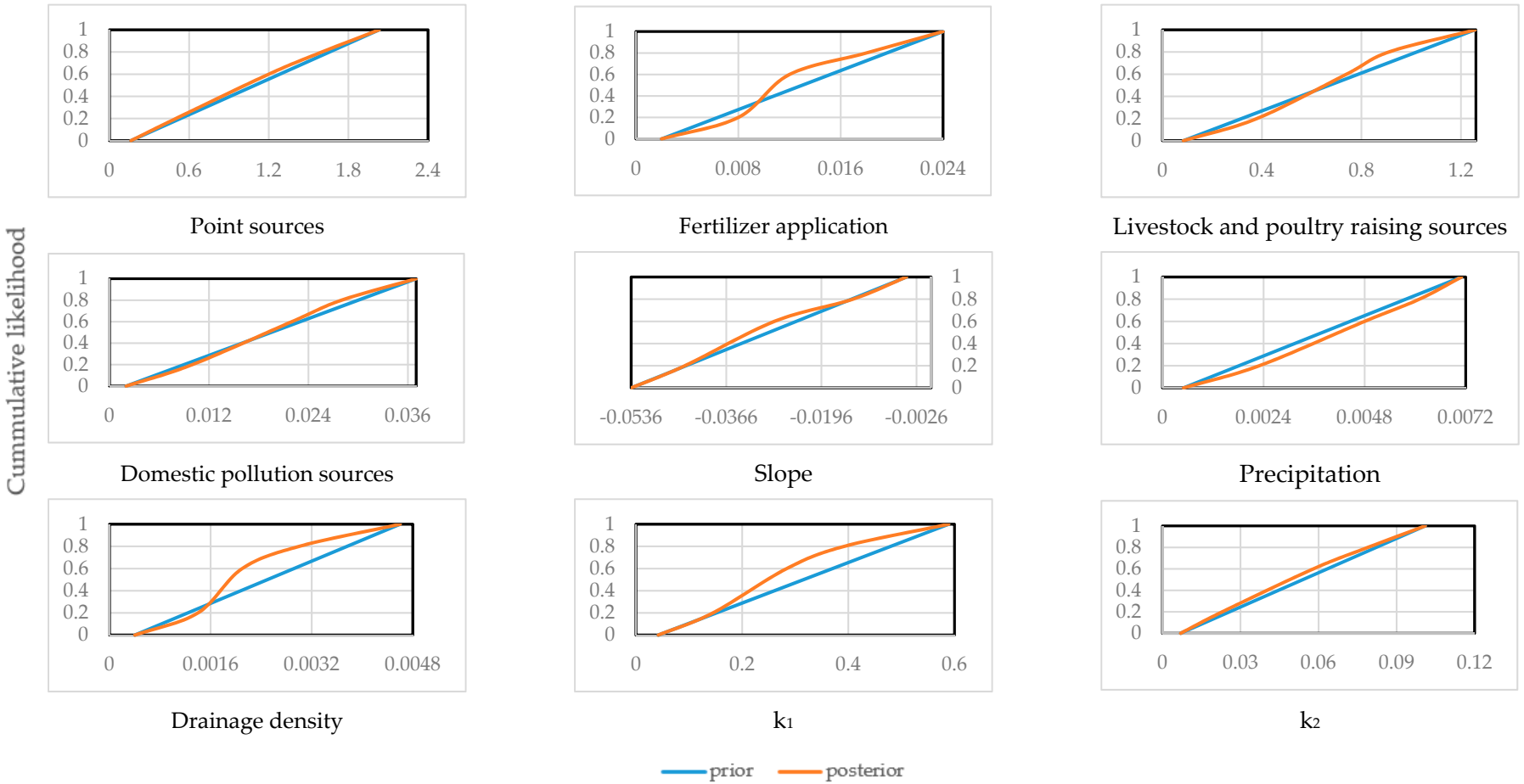

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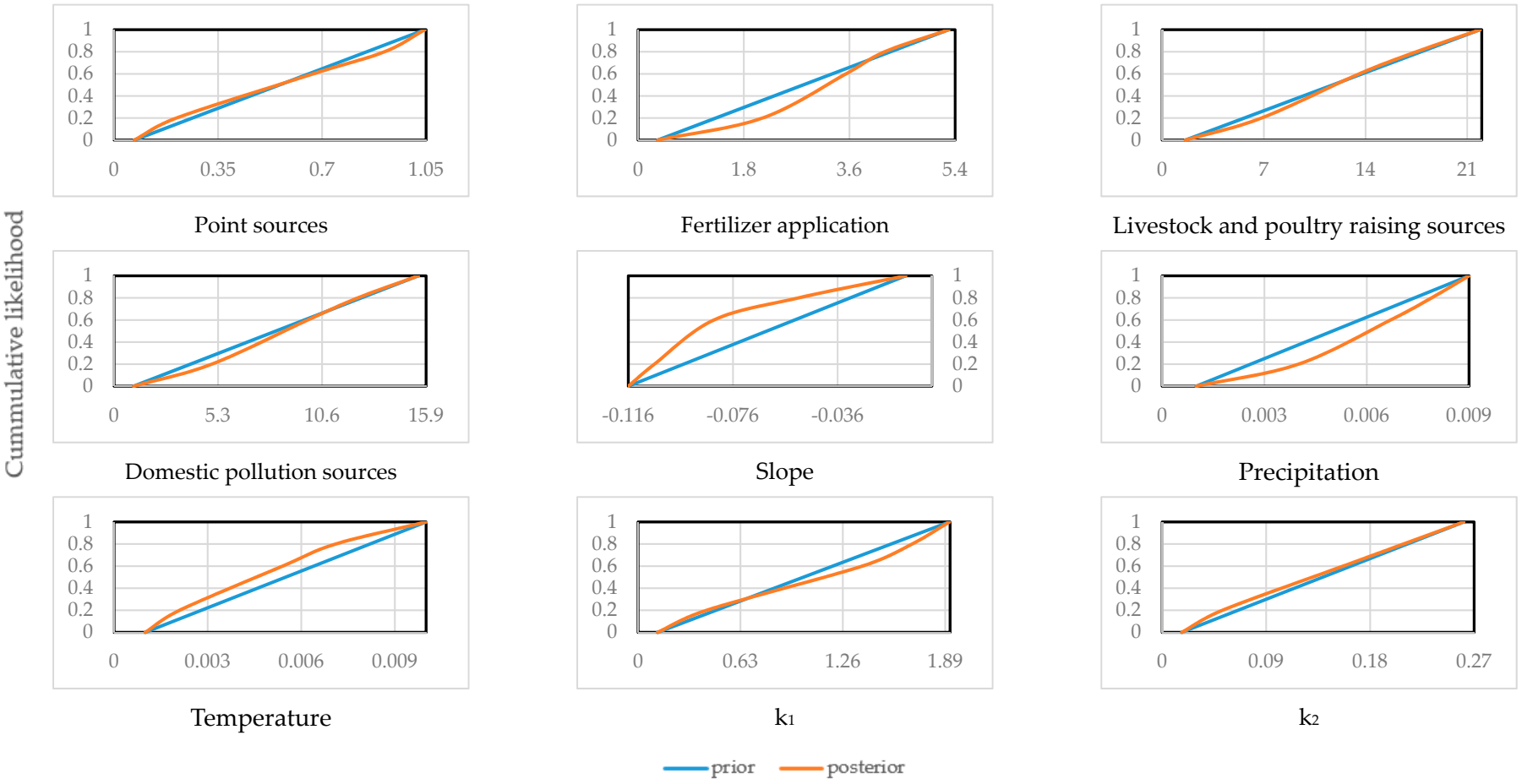
Table S6. Sensitivity of individual parameter of SPARROW COD_{Mn} models



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