

Table S6 Outer model loadings of latent variables in partial least squares path model (PLS-PM), including **(a)** HONO, **(b)** NO_x, **(c)** N₂O, and **(d)** NH₃

(a)

Latent variable	Indicator	Loading
Soil R ² = 0.789	pH	0.937
	NH ₄ ⁺	0.957
	NO ₂ ⁻	0.881
	NO ₃ ⁻	0.932
	MBC	0.829
Genes related to N R ² = 0.932	<i>amoA</i>	0.997
	<i>napA</i>	0.933
	<i>hao</i>	-0.604
	<i>nirK</i>	0.965
	<i>narG</i>	0.700
	<i>nirS</i>	0.906
	<i>nosZ</i>	0.979

(b)

Latent variable	Indicator	Loading
Soil R ² = 0.703	pH	0.972
	EC	-0.683
	NH ₄ ⁺	0.962
	NO ₂ ⁻	0.843
	NO ₃ ⁻	-0.967
	MBN	0.606
	MBC	0.758
Genes related to N R ² = 0.925	<i>amoA</i>	0.997
	<i>napA</i>	0.932
	<i>hao</i>	-0.519
	<i>nirK</i>	0.962
	<i>narG</i>	0.707
	<i>nirS</i>	0.941
	<i>nosZ</i>	0.979

(c)

Latent variable	Indicator	Loading
Soil R ² = 0.699	pH	0.983
	NO ₂ ⁻	0.694
	NO ₃ ⁻	-0.846
	MBN	0.882
	MBC	0.870
Genes related to N R ² = 0.683	<i>amoA</i>	0.995
	<i>napA</i>	0.954
	<i>hao</i>	-0.714
	<i>nirK</i>	0.994
	<i>narG</i>	0.991
	<i>nirS</i>	0.865
	<i>nosZ</i>	0.993

(d)

Latent variable	Indicator	Loading
Soil R ² = 0.483	pH	0.885
	EC	-0.620
	TN	0.535
	NH ₄ ⁺	0.699
	NO ₂ ⁻	0.743
	NO ₃ ⁻	-0.882
	MBN	0.815
Genes related to N R ² = 0.827	MBC	0.944
	<i>amoA</i>	0.971
	<i>napA</i>	0.839
	<i>hao</i>	-0.860
	<i>nirK</i>	0.994
	<i>narG</i>	0.997
	<i>nirS</i>	0.884
	<i>nosZ</i>	0.997

All indicators exhibited satisfactory loadings (> 0.5), which was retained for theoretical relevance.