

**Table S1.** The significance testing for the effects of N addition, Cd and Mn pollution and their interaction on morphological growth, biomass accumulation, and allocation.

Index	F <sub>N</sub>	F <sub>Cd</sub>	F <sub>Mn</sub>	F <sub>N×Cd</sub>	F <sub>N×Mn</sub>	F <sub>Cd×Mn</sub>	F <sub>N×Cd×Mn</sub>
Basal diameter	ns	ns	***	ns	ns	ns	ns
Plant height	ns	***	***	***	ns	***	**
Leaf area	ns	ns	***	*	ns	*	ns
Specific leaf area	ns	ns	ns	ns	*	**	ns
Leaf biomass	ns	*	***	ns	ns	ns	ns
Stem biomass	***	***	***	ns	***	*	ns
Root biomass	**	ns	***	ns	*	ns	ns
Total biomass	***	***	***	ns	***	ns	ns
Root-shoot ratio	ns	**	***	ns	*	*	ns

Note: ns, not significant; \* $P < 0.05$ , \*\*  $0.01 \leq P < 0.01$ , and \*\*\*  $P \leq 0.001$ . The significance of ANOVA: F<sub>N</sub>, the effect of N deposition; F<sub>Cd</sub>, the effect of Cd pollution; F<sub>Mn</sub>, the effect of Mn pollution; F<sub>N×Cd</sub>, the interactive effect of N deposition and Cd pollution; F<sub>N×Mn</sub>, the interactive effect of N deposition and Mn pollution; F<sub>Cd×Mn</sub>, the interactive effect of Cd pollution and Mn pollution; F<sub>N×Cd×Mn</sub>, the interactive effect of N deposition, Cd pollution, and Mn pollution. The same applies below.

**Table S2.** The significance testing for the effects of N addition, Cd and Mn pollution and their interaction on the concentrations of low-molecular-weight organic acids in the 1<sup>st</sup>-2<sup>nd</sup> order roots of *Populus deltoides*.

Index	F <sub>N</sub>	F <sub>Cd</sub>	F <sub>Mn</sub>	F <sub>N*Cd</sub>	F <sub>N*Mn</sub>	F <sub>Cd*Mn</sub>	F <sub>N*Cd*Mn</sub>
Lactic acid	***	***	***	***	ns	***	***
Succinic acid	*	***	***	ns	***	***	**
Fumaric acid	**	***	***	***	***	ns	**
Malic acid	***	***	***	***	***	***	ns
Citric acid	***	***	***	***	***	***	***
Malonic acid	**	ns	**	ns	***	***	ns
Glucuronic acid	***	***	***	ns	***	**	ns
Pantothenic acid	***	***	***	**	***	***	***
Niacin	ns	ns	***	**	ns	*	ns
<i>L</i> -Pyroglutamic acid	ns	***	***	*	***	*	***
3-hydroxy-3-methylglutamic acid	***	***	***	***	***	***	**

**Table S3.** The significance testing for the effects of N addition, Cd and Mn pollution and their interaction on Cd and Mn concentrations, as well as their amount accumulated in various root orders, stems and leaves.

Index	F <sub>N</sub>	F <sub>Cd</sub>	F <sub>Mn</sub>	F <sub>N*Cd</sub>	F <sub>N*Mn</sub>	F <sub>Cd*Mn</sub>	F <sub>N*Cd*Mn</sub>
Cd conc. in the 1 <sup>st</sup> -2 <sup>rd</sup> root order	***	/	ns	/	***	/	/
Cd accum. in the 1 <sup>st</sup> -2 <sup>rd</sup> root order	ns	/	ns	/	*	/	/
Cd conc. in the 3 <sup>rd</sup> root order	***	/	***	/	***	/	/
Cd accum. in the 3 <sup>rd</sup> root order	ns	/	**	/	ns	/	/
Cd conc. in the 4 <sup>th</sup> root order	***	/	***	/	***	/	/
Cd accum. in the 4 <sup>th</sup> root order	ns	/	ns	/	ns	/	/
Cd conc. in the 5 <sup>th</sup> root order	***	/	***	/	***	/	/
Cd accum. in the 5 <sup>th</sup> root order	ns	/	ns	/	ns	/	/
Cd conc. in the stems	***	/	***	/	ns	/	/
Cd accum. in the stems	***	/	ns	/	***	/	/
Cd conc. in the leaves	***	/	***	/	***	/	/
Cd accum. in the leaves	ns	/	ns	/	***	/	/
Mn conc. in the 1 <sup>st</sup> -2 <sup>rd</sup> root order	***	ns	***	***	***	***	ns
Mn accum. in the 1 <sup>st</sup> -2 <sup>rd</sup> root order	***	*	***	ns	*	***	ns
Mn conc. in the 3 <sup>rd</sup> root order	***	***	***	ns	***	***	***
Mn accum. in the 3 <sup>rd</sup> root order	**	ns	***	ns	ns	**	ns
Mn conc. in the 4 <sup>th</sup> root order	***	***	***	***	***	***	***
Mn accum. in the 4 <sup>th</sup> root order	ns	*	***	ns	ns	ns	ns
Mn conc. in the 5 <sup>th</sup> root order	***	ns	***	***	***	***	***
Mn accum. in the 5 <sup>th</sup> root order	ns	*	***	ns	**	*	*
Mn conc. in the stems	ns	***	***	***	***	***	***
Mn accum. in the stems	***	ns	***	ns	***	ns	*
Mn conc. in the leaves	***	***	***	***	***	***	***
Mn accum. in the leaves	***	**	***	ns	***	***	ns

Note: "conc." and "accum." are abbreviations for concentration and accumulation, respectively. "/" indicates that impact of Cd alone or its relative interactions with other factors on parameters was not analyzed. This is because, for the treatments without externally added Cd, Cd was not detected in any part of the poplar plants. The same applies below.

**Table S4.** The significance testing for the effects of N addition, Cd and Mn pollution and their interaction on BCF<sub>Cd</sub> and TF<sub>Cd</sub> in *Populus deltoides*.

Index	F <sub>N</sub>	F <sub>Cd</sub>	F <sub>Mn</sub>	F <sub>N*Cd</sub>	F <sub>N*Mn</sub>	F <sub>Cd*Mn</sub>	F <sub>N*Cd*Mn</sub>
BCF <sub>Cd</sub>	ns	/	***	/	ns	/	/
TF <sub>Cd</sub>	ns	/	***	/	*	/	/
BCF <sub>Mn</sub>	ns	ns	***	ns	**	***	ns
TF <sub>Mn</sub>	***	***	***	ns	***	*	*

Note: BCF<sub>Cd</sub> and TF<sub>Cd</sub> represent the enrichment capacity of Cd in *Populus deltoides* and the transfer capacity of Cd to the shoots, respectively. BCF<sub>Mn</sub> and TF<sub>Mn</sub> represent the enrichment capacity of Mn in *Populus deltoides* and the transfer capacity of Mn to the shoots, respectively.