Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Figure S1. Schematic diagram of the anatomy of a developed taproot of carrot (*Daucus carota*). The increase in diameter of the carrot taproot during development is due to secondary growth from the mitotic activity of the cambium cell layers. There are two cambium cell layers, an inner vascular cambium layer and an outer cork cambium layer. At the center of the carrot taproot is a very small pithlike area (Figure S1). Surrounding the central pith are (in order moving radially outwards) the layers of the secondary xylem, the vascular cambium and the secondary phloem. The vascular cambium layer produces secondary xylem to the inside of cambium and secondary phloem to the outside. The secondary xylem and pith form the core of the carrot taproot. The secondary xylem and the secondary phloem together account for the vast majority of the taproot diameter, with the latter the larger of the two cell layers. Most of the carrot "flesh" in this study would be comprised of the secondary xylem and phloem. Xylem rays, if present, are additional secondary xylem cells organized radially across the taproot.

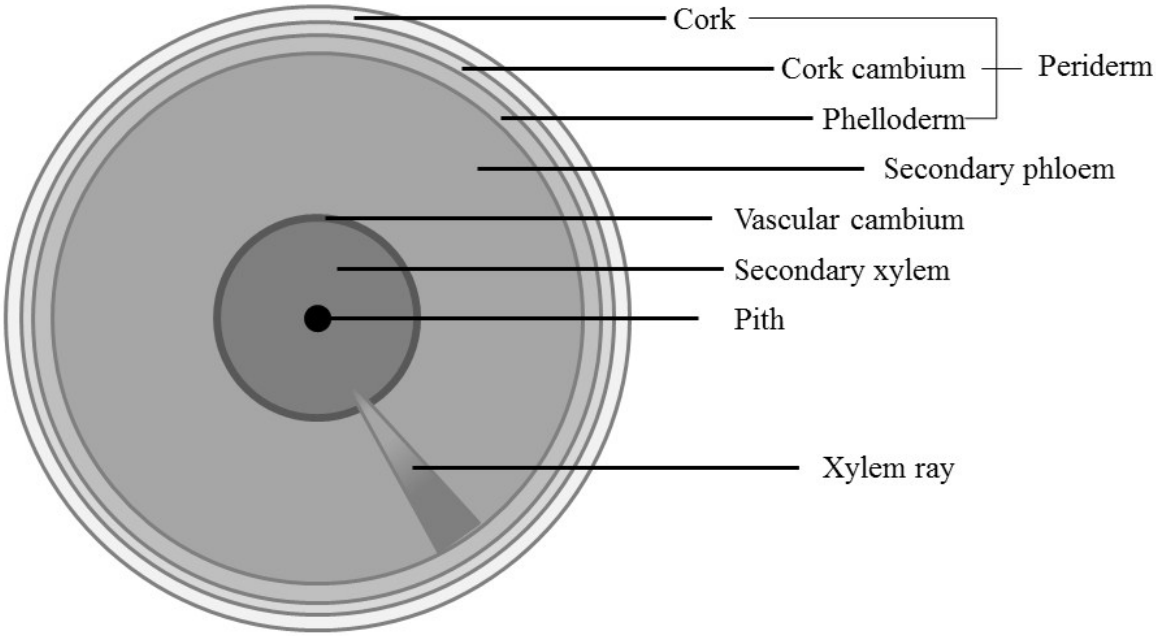
Cork
Cork cambium
Phelloderm
Periderm
Secondary phloem
Vascular cambium
Secondary xylem
Pith
Xylem ray

Figure S1

Table S1. Hydrodynamic size for the ZnO, CuO, or CeO_2 nanoparticle suspensions prepared at 1, 10, 100, or 1,000 mg L^{-1} of total Zn, Cu, or Ce respectively. Date represent the mean and standard error (*n*=3).

Nanoparticle	Concentration (mg L^{-1})	Hydrodynamic size
ZnO	1	1,162.7 ± 347.1
	10	2,140.0 ± 241.5
	100	1,519.7 ± 64.8
	1,000	1,694.0 ± 75.5
CuO	1	402.0 ± 20.5
	10	407.0 ± 8.6
	100	339.4 ± 2.1
	1,000	1,267.3 ± 121.2
CeO_2	1	280.3 ± 16.0
	10	259.8 ± 17.9
	100	255.9 ± 1.4
	1,000	250.2 ± 4.7

Table S2. The p-vales for the two-way ANOVA analysis of the measured biomass parameters and root:shoot ratios.

Element and parameter	Form	Concentration	Form x Concentration
Zinc			
Shoot mass	n.s.	n.s.	n.s.
Root mass	n.s.	**0.020**	n.s.
Total mass	n.s.	**0.028**	n.s.
Root:shoot ratio	n.s.	n.s.	n.s.
Copper			
Shoot mass	**0.037**	**0.015**	n.s.
Root mass	n.s.	n.s.	n.s.
Total mass	n.s.	**0.014**	**0.037**
Root:shoot ratio	n.s.	n.s.	n.s.
Cerium			
Shoot mass	**0.006**	**<0.001**	**<0.001**
Root mass	n.s.	n.s.	n.s.
Total mass	n.s.	**0.039**	n.s.
Root:shoot ratio	**0.020**	n.s.	**0.010**

n.s. = not significant

Table S3. The p-vales for the three-way ANOVA analysis of taproot tissue concentration and bioconcentration factor (BCF) and the two-way ANOVA analysis of shoot tissue concentration, bioconcentration factor, transfer factor (TF), and whole plant total metal removal. Tissue was included as a main effect for taproots because the peel and flesh tissues were analyzed separately.

Element and parameter	**Form**	**Concentration**	**Tissue**	**Form x Concentration**	**Form x Tissue**	**Tissue x Concentration**	**Form x Tissue x Concentration**
Zinc							
Root tissue concentration	n.s.	**<0.001**	**0.001**	**0.023**	**0.027**	**<0.001**	**0.005**
Root tissue BCF	**0.01**	**<0.001**	**0.002**	**0.003**	n.s.	**<0.001**	**0.017**
Shoot tissue concentration	**<0.001**	**<0.001**	--	**<0.001**	--	--	--
Shoot tissue BCF	**0.04**	**<0.001**	--	n.s.	--	--	--
Shoot tissue TF	**<0.001**	**<0.001**	--	**<0.001**	--	--	--
Total metal removal	**<0.001**	**0.004**	--	**0.006**			
Copper							
Root tissue concentration	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**
Root tissue BCF	**0.038**	**<0.001**	**<0.001**	n.s.	n.s.	**<0.001**	n.s.
Shoot tissue concentration	**<0.001**	**<0.001**	--	**<0.001**	--	--	--
Shoot tissue BCF	**0.012**	**<0.001**	--	**0.044**	--	--	--
Shoot tissue TF	n.s.	n.s.	--	n.s.	--	--	--
Total metal removal	n.s.	**<0.001**	--	n.s.	--	--	--
Cerium							
Root tissue concentration	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**
Root tissue BCF	**<0.001**	**<0.001**	**<0.001**	n.s.	**<0.001**	**<0.001**	n.s.
Shoot tissue concentration	**<0.001**	**<0.001**	--	**<0.001**	--	--	--
Shoot tissue BCF	**<0.001**	**<0.001**	--	n.s.	--	--	--
Shoot tissue TF	n.s.	n.s.	--	**0.047**	--	--	--
Total metal removal	**<0.001**	**<0.001**	--	n.s.	--	--	--

n.s. = not significant