This Ph.D. thesis focuses on the ecotoxicity and bioavailability of ZnO nanoparticles (ZnO-NP) for a soil-dwelling organism, the springtail *Folsomia candida*. Different fate and effect studies were performed in natural soils to unravel the contribution of particulate and dissolved Zn to ZnO-NP toxicity. This study shows that the release of toxic Zn$^{2+}$ ions from ZnO-NP continues for at least one year, but that this does not lead to increased toxicity. This research suggests that ZnO-NP can be evaluated using the current risk assessment of Zn. The studies performed during this Ph.D. project were part of the European project NanoFATE (Nanoparticle Fate Assessment and Toxicity in the Environment).