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Conceptualizing World-Earth System resilience: Exploring transformation pathways towards a safe and just operating space for humanity

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We develop a framework within which to conceptualize World-Earth System resilience. Our notion of World-Earth System resilience emphasizes the need to move beyond the basin of attraction notion of resilience as we are not in a basin we can stay in. We are on a trajectory to a new basin and we have to avoid falling into undesirable basins. We thus focus on 'pathway resilience', i.e. the relative number of paths that allow us to move from the transitional operating space we occupy now as we leave the Holocene basin to a safe and just operating space in the Anthropocene. We develop a mathematical model to formalize this conceptualization and demonstrate how interactions between earth system resilience (biophysical processes) and world system resilience (social processes) impact pathway resilience. Our findings show that building earth system resilience is probably our only chance to reach a safe and just operating space. We also illustrate the importance of world system dynamics by showing how the notion of fairness coupled with regional inequality affects pathway resilience.