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Key drivers and pressures of water scarcity at global hotspots

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Although global freshwater resources are vital to the livelihood of humanity and all other life on Earth, 10% of the global population lives in regions with high to critical levels of water stress. In many of these regions the freshwater resources risk depletion of surface water or groundwater resources due to unsustainable use. Such regions are considered as the “hotspots of water scarcity”. Understanding how these hotspots have evolved over time towards their current state of water scarcity, provides important insights for decision-making and implementation of mitigation and water regulation policies.

We present a global intercomparison of the key drivers and pressures causing water scarcity at these hotspots around the world. For our analysis we have applied a Driver-Pressure-State-Impact-Response (DPSIR) framework to a literature search of >175 case studies of the hotspot regions. In this framework natural, social and economic information is combined to identify driving forces and resulting pressures that have deteriorated the state (quality or quantity) of the water resources. The DPSIR literature analysis is supported by observational data analysis to study the temporal evaluation for each hotspot.

We identify the key drivers and pressures to be: hydroclimatic changes (78%), population growth (28%) and agricultural (93%), municipal (54%), and industrial water demand (37%). Subsequent impacts on society are less homogeneous between the hotspots, with damage to ecosystems (25%) and reduced agricultural production (16%) as main impacts. Responses also vary greatly. While some have a positive impact on alleviating water scarcity (e.g. increased storage capacity (25%) or water treatment (23%)), others are ineffective in attempting to alleviate water scarcity or even worsen water scarcity problems (e.g. lack of groundwater regulation policies (12%) or unfair distribution of water rights (12%)).

These outcomes of the DPSIR analysis provide valuable information for constructing causal networks representative to water scarcity problems at the hotspots. Such a causal network will serve as the basis of a conceptual model that represents human-water interactions at the hotspots, thereby providing a better understanding of trade-offs and synergies in different human-water systems around the world.