

Primary anthro. threats to streams & rivers (adapted from Allan & Castillo 2007. *Stream Ecology*, 2nd ed.)

	Proximate causes	Abiotic effects	Biotic effects
Habitat alteration	Damming, water diversions	↓ natural flow variability Altered habitat Sever up/downstream linkages	↓ dispersal & migration Δs in water quality Δs in spp composition
	Channelization	↓ habitat & substrate complexity Lower base flows	↓ biological diversity, favor tolerant species
	Land use changes: deforestation, intensive agriculture, urban development	Altered energy inputs ↑ delivery sediment & contaminants Flashy flows	Δs spp composition Δs trophic dynamics Facilitate spp invasions
Invasive species	Aquaculture Sports fishing Pet trade Ornamental plants	Invasive spp Δ habitats Few other effects	↓ native spp Biotic homogenization Ecosystem-level effects
Contaminants	Nutrient enrichment: ag., sewage treatment Atmospheric deposition	↑ [N], [P] Δ nutrient ratios	↑ productivity, algal blooms, Δ spp composition
	Acidification (SO ₂ , NO _x)	↓ pH, ↑ [Al ⁺]	Physiological & food chain effects
	Toxic metals: mining, industrial emissions, waste disposal	↑ [trace metals] (e.g., Hg,Cu,Zn,Pb,Cd)	Toxic effects: biomagnification
	Organic toxins	↑ [PCB], endocrine disruptors, pesticides	Physiol. & toxic effects
Overexploitation	Commercial harvest: food, pet trade, recreational fisheries	Usually none	Δ spp composition Δ trophic dynamics Facilitate invasions
Climate change	Temperature changes	Milder winters Δ evapotransp. & flows	Range shifts: physiol. tolerances Increased productivity
	Precipitation changes	Δ flow regimes Greater flashiness	Disturbance impacts