

## Anthropogenic Threats To Intermittent Rivers and Ephemeral Streams

Ming-Chih Chiu<sup>1,2</sup>, Catherine Leigh<sup>3,4,5</sup>, Raphael Mazor<sup>6</sup>, Nuria Cid<sup>7</sup>, Vincent Resh<sup>1</sup>

<sup>1</sup>University of California, Berkeley, Berkeley, CA

<sup>2</sup>National Chung Hsing University, Taichung City, Taiwan

<sup>3</sup>Irstea, UR ALY, Centre de Lyon-Villeurbanne, Villeurbanne, France

<sup>4</sup>CESAB-FRB, Immeuble Henri Poincare, Aix-en-Provence, France

<sup>5</sup>Griffith University, Nathan, QLD, Australia

<sup>6</sup>Southern California Coastal Water Research Project, Costa Mesa, CA

<sup>7</sup>Universitat de Barcelona, Barcelona, Spain

### ABSTRACT

Intermittent rivers and ephemeral streams (IRES) occur worldwide and make important contributions to freshwater biodiversity and biogeochemical cycles at local, catchment, regional, and global scales (Chapters in Sections 1–4; Datry et al., 2014). IRES in all parts of the world are subject to many of the same human-induced threats as perennial rivers and streams. However, most IRES have far less legal protection than their perennial counterparts (Nikolaidis et al., 2013; Acuña et al., 2014; Chapter 5.3), reflecting the low value that society places on their ecological attributes and ecosystem services (Chapter 5.2). Given this lack of appreciation, IRES are probably under greater threat of degradation than perennial systems. They can serve as sites for the dumping of trash and dredging of sediment or as conduits for waste water disposal and road traffic (Fig. 5.1.1). Furthermore, the natural variability of their flow regimes and hydrological phases, which can result in extended and unpredictable periods of zero flow (Chapters 2.2 and 2.3), means that these activities, along with anthropogenic changes to their hydrology induced by artificial dewatering or augmented flows (Fig. 5.1.1), may be wrongly dismissed as unproblematic.

Flow intermittence and the shifting aquatic-terrestrial habitat dynamics of IRES (Chapter 4.9) present challenges to both the aquatic and terrestrial biota inhabiting these systems. The biota must either withstand the episodic unfavorable conditions such as dry habitat for aquatic biota or flooded habitat for terrestrial biota in situ (i.e., exhibit resistance) or escape them to return later when conditions again become favorable (i.e., exhibit resilience). Many taxa that inhabit IRES thus possess adaptive traits of resistance and/or resilience to flow extremes, including drying and flooding (e.g., Bêche et al., 2006; Leigh et al., 2016a; Chapter 4.8). However, anthropogenic activities that alter the natural flow regimes, geomorphology, and water quality of IRES, and even the composition of biotic communities (e.g., via introductions of alien species or clearing of vegetation) may push these ecosystems and biota beyond their adaptation thresholds. In this chapter, we review anthropogenic threats to IRES and their biota, broadly classified into the following (Fig. 5.1.2): hydrological alterations, including withdrawals or additions of water that change inundation durations and the

dynamic interplay of aquatic vs terrestrial habitat (as well as altering other ecologically relevant aspects of the flow regime (Poff et al., 2010)); physical and chemical alterations, including sedimentation, sediment mining, and water pollution that degrade aquatic and terrestrial habitats in IRES; and biological alterations, in particular the introduction or invasion of species that can threaten native communities. We discuss these threats and their individual and interactive effects on IRES, both those that undergo natural flow intermittence and those once-perennial rivers that now undergo anthropogenically induced intermittence and their adjacent ecosystems. Furthermore, we consider how climate change may interact with these threats or even induce hydrological, physical, chemical, and biological alterations directly (Box 5.1.1). Finally, we consider future needs and challenges for research and management to effectively prevent, reduce, or mitigate the impacts of anthropogenic alterations to IRES ecosystems.

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