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## F1.2 Permanent Lowland Rivers

R. T. Kingsford

R. Mac Nally

G. S. Giller

Mark C. Rains

*University of South Florida, mrains@usf.edu*

A. H. Arthington

*See next page for additional authors*

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**Authors**

R. T. Kingsford, R. Mac Nally, G. S. Giller, Mark C. Rains, A. H. Arthington, and D. A. Keith



Rio Carrao, Venezuela.  
Source: David Keith (2012)

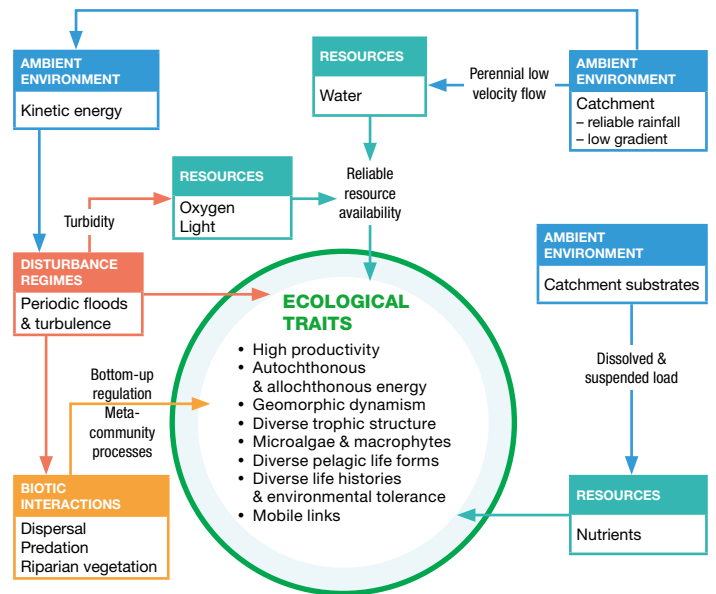
## F1.2 Permanent lowland rivers

BIOME: F1 RIVERS AND STREAMS  
REALM: FRESHWATER

Contributors: R.T. Kingsford, R. Mac Nally, P.S. Giller, M.C. Rains, A.H. Arthington, D.A. Keith

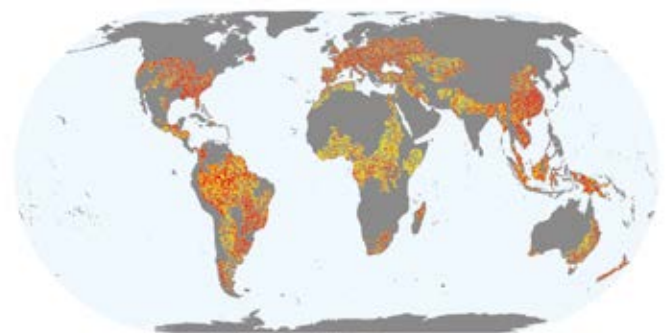
**ECOLOGICAL TRAITS:** Small-medium lowland rivers (stream orders 4-9) are productive depositional ecosystems with trophic webs that are less diverse than large lowland rivers (F1.7). Macrophytes rooted in benthos or along the river margins contribute most primary production, but allochthonous inputs from floodplains and upper catchments generally dominate energy flow in the system. The biota tolerates a range of temperatures, which vary with catchment climate. Aquatic biota have physiological, morphological and even behavioural adaptations to lower oxygen concentrations, which may vary seasonally and diurnally. Zooplankton can be abundant in slower deeper rivers. Sessile (i.e. mussels) and scavenging (i.e. crayfish) macroinvertebrates are associated with the hyporheic zone and structurally complex microhabitats in moderate flow environments, including fine sediment and woody debris. Fish communities are diverse and may contribute to complex trophic networks. They include large predatory fish (i.e. sturgeons), smaller predators of invertebrates, herbivores, and detritivores. The feeding activities and movement of piscivorous birds (i.e. cormorants), diadromous fish (seawater-freshwater migrants), mammals (i.e. otters), and reptiles (i.e. turtles) extend trophic network beyond instream waters. Riparian zones vary in complexity from forested banks to shallow areas where emergent, floating and submerged macrophyte vegetation grows. Intermittently connected oxbow lakes or billabongs increase the complexity of associated habitats, providing more lentic waters for a range of aquatic fauna and flora.

**KEY ECOLOGICAL DRIVERS:** These rivers are distinguished by shallow gradients, low turbulence, low to moderate flow velocity and moderate flow volumes (<10,000m<sup>3</sup>/s). Flows are continuous but may vary seasonally depending on catchment precipitation. This combination of features is most common at low altitudes below 200 m and rarely occurs above 1,500 m. River channels are tens to a few hundred metres wide and up to tens of metres deep with mostly soft sediment substrates. They are dominated by depositional processes. Surface water and groundwater mix in the alluvium in the hyporheic zone,



which plays an important role in nutrient cycling. Overbank flows increase turbulence and turbidity. Locally or temporally important erosional processes redistribute sediment and produce geomorphically dynamic depositional features (e.g. braided channels and point bars). Nutrient levels depend on riparian/floodplain inputs and vary with catchment geochemistry. Oxygen and temperatures also vary with climate and catchment features. For catchments with extensive peatlands, waters may be tannin-rich, poorly oxygenated, acidic and dark, thus reducing productivity and diversity.

**DISTRIBUTION:** Distributed throughout tropical and temperate lowlands but very uncommon in arid zones. They are absent from boreal zones, where they are replaced by F1.3.



**Reference:**

Tockner, K., Malard, F., Ward J.V. (2000). 'An extension of the flood pulse concept'. *Hydrological Processes* 14(16-17): 2861-2883.