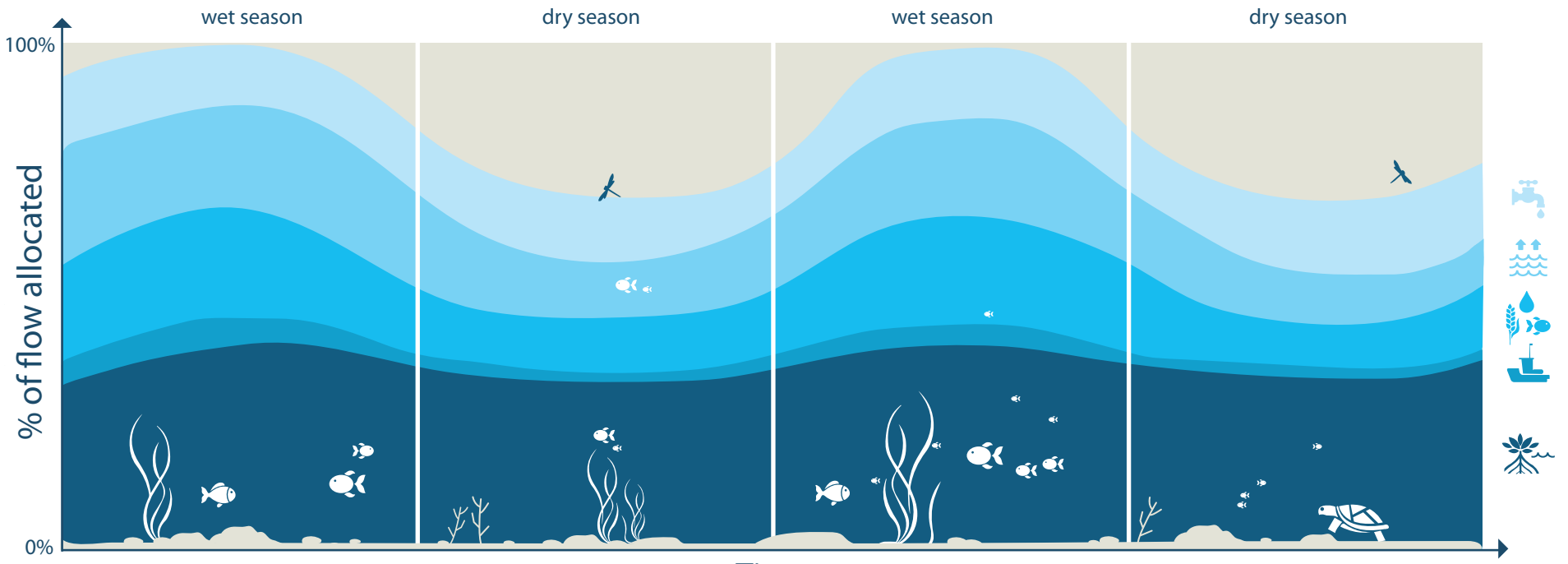
Flow allocations in a river system

Natural and Managed systems

As competition for freshwater increases and climate change affects the flow of water through changes in precipitation, snowmelt, and evaporation, there will be increased pressure on our freshwater systems for societal and environmental needs. The future planning of agricultural, energy, water supply and flood protection infrastructure must recognise the implications of alterations to natural river flows and biophysical processes.

Natural river system



Water for Nature

The quantity, timing and quality of water flows (environmental flows) required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems. Freshwater systems contribute to the regulation of atmospheric processes and weather patterns which creates the local microclimate around rivers, lakes and wetlands. This provides the basis for the animals and plants that live in or near freshwater systems. At larger scale, this forms part of the overall hydrological cycle, and micro-cycles within it. Return flows along rivers through baseflow and surface run-off help keep river systems flowing downstream for other basic riparian and ecological functioning, and maintain habitat for different migratory and non-migratory species (e.g. fish, insects, amphibians, reptiles, mammals, birds and plants).

Water for energy

Water is abstracted from freshwater systems, heated to become steam to drive turbines for electricity generation, and is then cooled and recycled. The majority of the water is withdrawn, recycled, and returned to the river system. Only a small amount of water is consumed. Water can be diverted through channels and penstocks to drive turbines to generate electricity from storage, pumped storage, and run-of-the-river hydropower systems. This often requires regulation of river flows.

Navigation

Non consumptive economic use of freshwater systems for trade and transport. River flows can be controlled to maximise navigational opportunities and improve trade and navigation. Therefore, decisions relating to navigation and trade that use freshwater systems can impact flow allocation (quantity and timing of water).

Water for food

Provision of water for irrigation from commercial to subsistence scale agriculture, as well as freshwater habitat for aquaculture, wild fish and other food catch, fodder and drinking water for cattle and other domestic livestock. Reservoirs can create productive fisheries and provide a stable water supply for year round agricultural water needs.

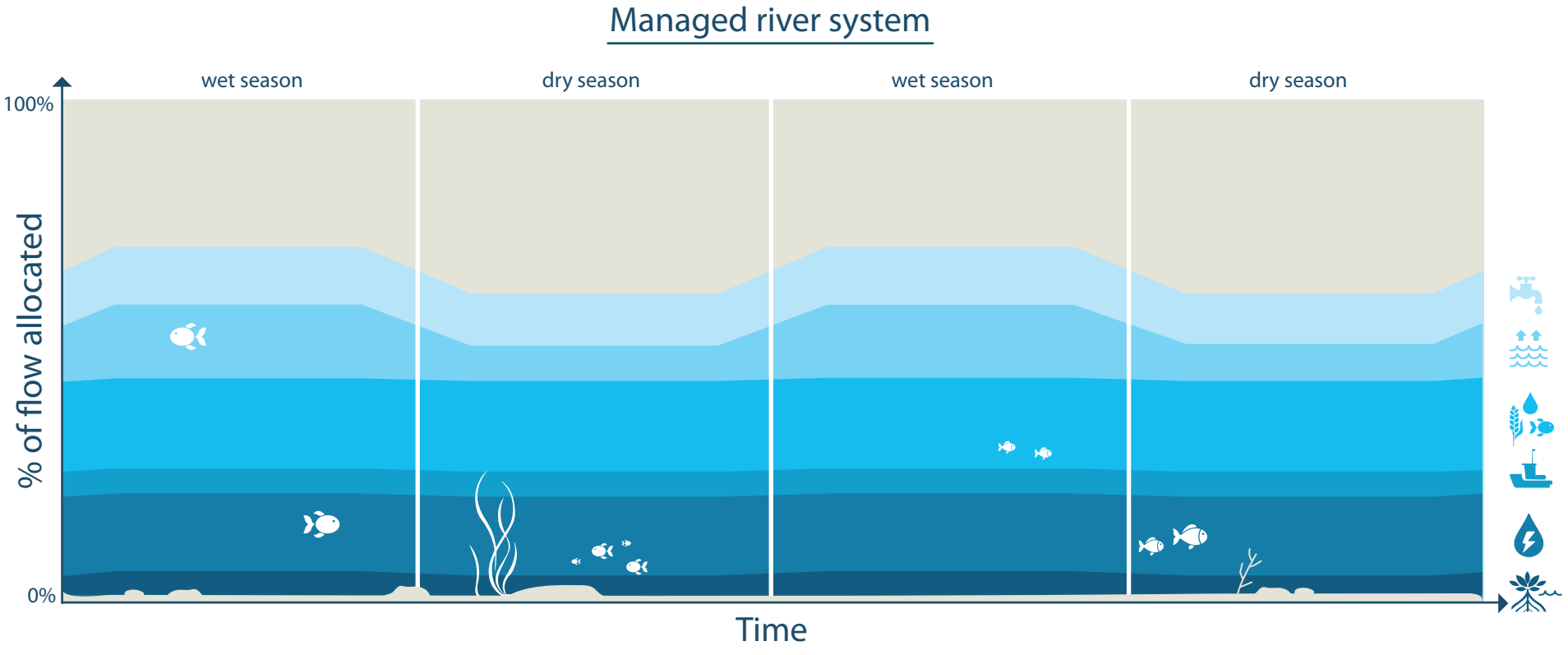
Flood regulation and control

Unregulated freshwater systems are characterised with natural meanders that slow down flood flows and can create lakes and pools, improving biodiversity and riparian habitat. Shallow flooding is important for sediment deposition to maintain soil regeneration and productivity, and provides important biodiversity functions and pasture. Flushing flows (such as in spring from snowmelt) serve as triggers to life cycles. Flooding can also help to recharge groundwater and wetlands. Managed river systems may allow for an increase in the control of high river flows which can help to alleviate flood damage, in particular to downstream urban areas and infrastructure.

Domestic water supply and WASH

Water consumed for cooking, washing and other domestic uses. Water sources for public and private water supply and wastewater treatment utilities and industrial users. Securing safe drinking water and water for sanitation provides essential health benefits for human well-being. Rivers and springs play an important role for recreation as well as in cultural and spiritual rituals, prayers, stories, teachings and meditation.

Managed river system



References: Sadoff & Grey (2002) Beyond the river: the benefits of cooperation on international rivers, Water Policy 4 (2002) 389–403;
Postel & Richter (2003) Rivers for Life: Managing Water for People and Nature, Island Press: Washington, DC;
Opperman,J., G. Grill and J. Hartmann (2015) The Power of Rivers: Finding balance between energy and conservation in hydropower development. The Nature Conservancy:Washington, D.C

We would like to thank the following reviewers for their comments: Rebecca Tharme (Riverfutures), Chris Dickens (IWMI), John Matthews (AGWA), Anna Forsland (SIWI), Michael McClain (UNESCO – IHE), William Darwall (IUCN), Tracy Farrell (Conservation International) and Stefano Barchiesi (IUCN).