

# Removing barriers for the benefit of people and nature

*10 reasons why it's a good idea*



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We're living in a new era. Climate change is increasing extreme weather events like floods, droughts and heatwaves. We can no longer rely on 20th-century solutions, we need to adapt and work with nature instead of against it. One effective solution is to break rivers free out of artificial barriers (like weirs and dams) that are obsolete. In Europe, [8,146 barriers have already been removed](#) in 27 countries<sup>1</sup>.

Here are 10 reasons why barrier removal is a proven, effective and affordable way to help local communities, improving public safety and tackling the effects of climate change.

1

## Ageing barriers increase breach risk & economic costs

Climate change has resulted in higher variability and occurrence of extreme weather events, but barriers (especially dams) built 50 to 100 years ago<sup>2</sup> were not designed for such conditions. This entails an increased breach risk that may lead to catastrophic floods, which not only costs millions in damages and property loss but also threatens human safety<sup>3,4</sup>. For example in France a breach of the Malpasset dam resulted in 70 million euro damage and 421 people killed as a result of torrential rains causing massive flooding<sup>5</sup>. While the Whaley Bridge Dam in England where 1,400 people needed emergency evacuation and several others have been seen across Europe in Spain, France, Romania, Italy and other countries<sup>6,7</sup>.

To prevent such incidents, major upgrades are required to remain in or regain compliance with new engineering and environmental standards. However, maintenance of barriers (especially those that are obsolete) is often neglected, due to costs, lack of expertise, or unawareness<sup>8</sup>. Removing unmaintained dams can often be more economically viable than upgrading the dam<sup>9</sup>.

2

## Reservoirs can increase the impacts of droughts

Climate change is intensifying water stress in dry areas, with water availability declining in many parts of Europe<sup>10</sup>. As the situation is expected to worsen, dams are built, and reservoirs are created as a way to store water. Unfortunately, the management of the reservoirs, which alter the natural flow regimes downstream, have been shown to aggravate drought<sup>11</sup> conditions downstream by keeping water back<sup>12,13</sup>.

Also, the "reservoir effect" worsens water consumption, as models have shown that an increased supply increases the demand that is difficult to reduce during drought periods. The dependence on water infrastructure ultimately increases vulnerability and economic damage when water shortages occur<sup>14</sup>.

Water should be stored naturally in the landscape: in healthy watersheds, wetlands, forests and floodplains ultimately replenishing aquifers and nourishing freshwater ecosystems<sup>15</sup>.

# 3

## Reservoirs increase water scarcity through evaporation

Dams that create reservoirs can put further pressure on water availability through losses from evaporation in the reservoir and distribution canals. Particularly in areas with high temperatures, these evaporation rates are elevated. Over the last 30 years, approximately 53% of the world's largest natural lakes and artificial reservoirs have seen water storage declines due to evaporation<sup>16</sup>.

# 4

## Barriers can cause incised channels that disconnect rivers from floodplains and aquifers

Floodplains are important to absorb, filter and store water in the ground, which is particularly important in water-stressed areas. Barriers – especially dams – have a large negative impact on floodplains downstream by trapping sediment behind them. The lack of sediment movement downstream causes: (a) the scouring and deepening of the riverbed, (b) the floodplain to be cut off, and (c) the lowering of groundwater levels<sup>17,18</sup>. These detrimental effects of the disrupted natural sedimentation result in a lower ability of the floodplains to act as natural sponges retaining water, improving water quality, and ensuring healthy soils, while speeding water flowing downstream increases the risk of floods<sup>19</sup>.

Removing dams, while providing for lateral connectivity downstream, can improve floodplain connectivity, recharge groundwater and improve water retention to buffer the impact of both floods and droughts<sup>15</sup>.



# 5

## Barriers affect the resilience of deltas and estuaries to sea level rise, storm surges or salt water intrusion

Barriers trap sediment rather than allowing it to flow naturally downstream where it would be deposited in deltas fertilising fields, nourishing ecosystems, and helping offset sea-level rise<sup>20</sup>. Studies in the Elwha river for example showed how sediment benefited the coastal wetlands and ecosystems started to improve<sup>21,22</sup>.

Because of the expected reduced river discharge in the summer months caused by global warming, scientists predict increases in salt intrusion lengths upstream by 10–30% in European estuaries<sup>23</sup>. Storm surges are also becoming increasingly frequent and intense. Free flowing rivers can build robust deltas to protect against these issues.

# 6

## Reservoirs and ponds can produce greenhouse gases

Many artificial reservoirs and ponds behind barriers can produce greenhouse gases, particularly methane, which has an extremely high global warming potential. Globally, reservoirs contribute 5.7% of all methane emissions<sup>24,25,26</sup>. Thus, many reservoirs behind hydropower dams can't be considered climate neutral. On the contrary, they have the potential to be methane hotspots because of the decomposition of organic matter, especially in warmer climates. This issue has been documented primarily in the tropical zones<sup>27</sup>, but in European rivers<sup>28</sup> as well.



# 7

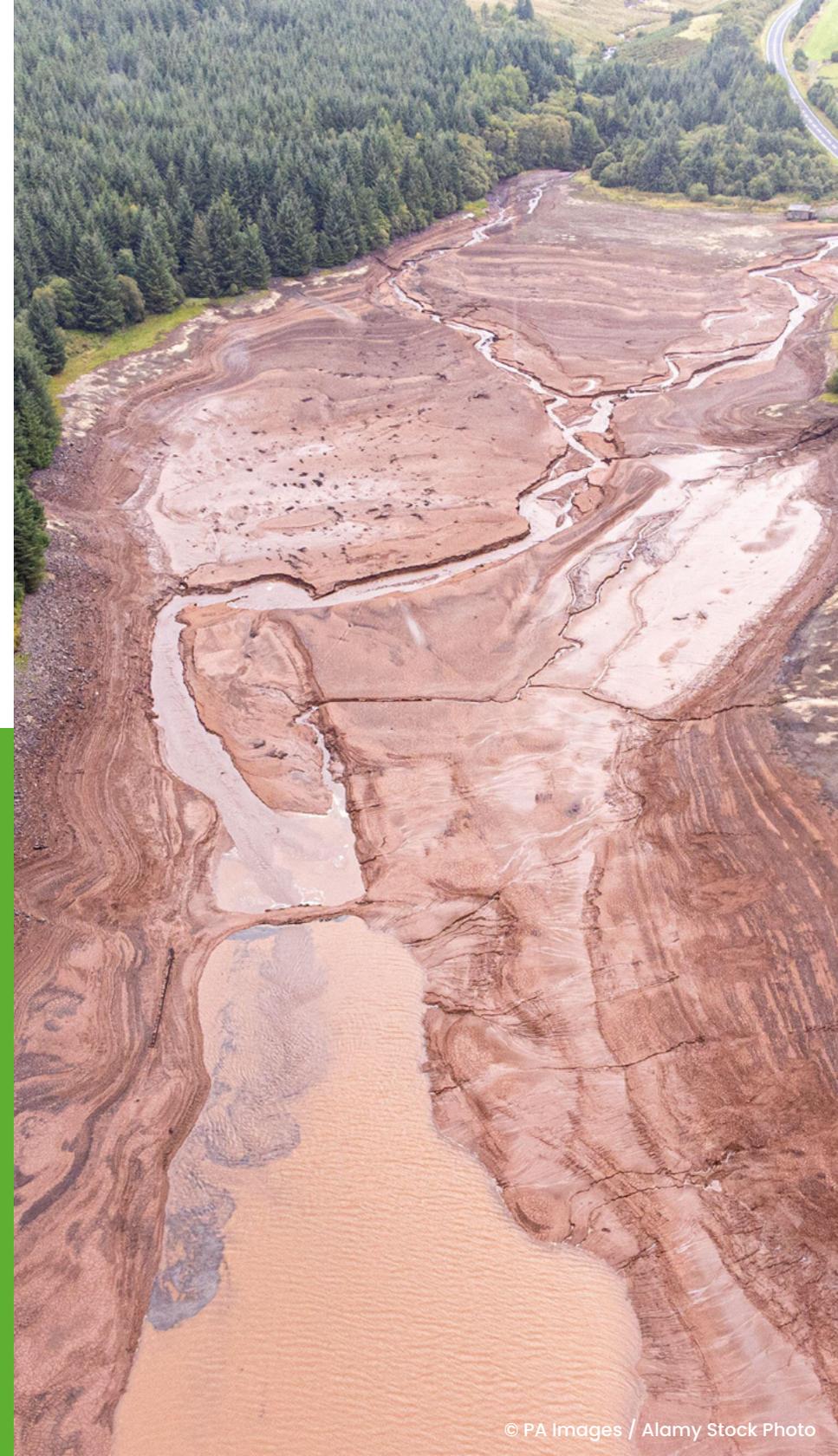
## Barriers remove carbon sinks from the landscape which aggravates climate change

When (large) dams are built, a large portion of the upstream landscape is flooded. This includes forests that can absorb carbon emissions from the atmosphere. When dams are removed, the previously flooded areas can regrow their natural vegetation, and thus reestablish this function which can mitigate climate change effects<sup>29,30</sup>.

# 8

## Barriers degrade water quality and disrupt ecosystem functions

Barriers create significant environmental impacts by influencing water quality<sup>31,32</sup>, which can be characterised by oxygen depletion, faster organic decomposition and nutrient imbalances<sup>33</sup>. These conditions can create toxic algal blooms that are unsafe for people and wildlife, and changes in the ecosystem food chain<sup>8</sup>. With rising temperatures and lower water levels in drier regions due to climate change, the impacts of barriers on water quality are further exacerbated<sup>34</sup>.



# 9

## The combination of barriers and climate change seriously impact threatened and endangered freshwater species and migratory fish

Habitat alteration/degradation due to barriers can lead to decreased biodiversity, altered biological functions and even loss of rare and endemic species. Freshwater ecosystems currently have the highest extinction rates in the world<sup>35</sup> largely due to cumulative impacts from barriers (as well as river engineering, habitat loss and pollution). Migratory fish like sturgeon, eels and salmon suffer the most, with population declines of 75% in Europe since the 1970s<sup>36</sup>.

Removing barriers can help reverse this trend and restore once thriving fish populations, for the benefit of ecosystems and local economies, recreational activities and subsistence of future generations<sup>37</sup>.

## Now is the time for action!

With over 1.2 million barriers across Europe, including 150,000 obsolete dams<sup>32</sup>, the imperative to act is clear. Start removing barriers in your region. Join a network of thousands of people who are working toward freeing our rivers, learn more about how you can get started at [www.damremoval.eu](http://www.damremoval.eu) and get support from our helpdesk.

# 10

## Only 26% of dams are designed and managed for flood protection

Many barriers are not designed to protect against flooding. According to the World Register of Dams from ICOLD, 8% of single-purpose dams and 18% of the multiple-purpose dams are used for flood control<sup>38</sup>. While dams and reservoirs can regulate river levels by temporarily storing and releasing floodwaters, effective flood control requires an integrated water management plan. This involves lowering reservoir levels before the rainy season to create more storage and thus eliminating flooding risk.



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