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An economic case for restoring rivers and their ecosystem services

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Restoring the natural conditions of rivers and streams by intentionally adding forest deadwood boosts key ecosystem services, new research suggests. By calculating the value of these services, the researchers were able to show that increasing the amount of deadwood in rivers and streams in a Basque Country reservoir basin was economically profitable and that returns on investment could be realised within 20 years.

Unless they are sustainably managed, commercial timber forests generally have low amounts of deadwood on the forest floor, as timber is harvested before it falls. However, this can affect local ecosystem services provided by forest streams. Naturally fallen logs can help purify stream water and prevent erosion by trapping sediment as well as providing habitat for freshwater organisms.

In this study, part-funded by the EU's LIFE progamme[1], researchers investigated whether the cost of adding deadwood to streams was outweighed by the economic benefits of boosted ecosystem services. In the Añarbe reservoir basin in the Basque Country in Spain, researchers examined key services provided by streams, including increased numbers of fish, opportunities for recreation and tourism, water purification and erosion control.

Four streams and rivers were chosen in the basin and were monitored for three years: a year before any wood was added and two years after. Changes in the amount of sediment and the number and weight of fish were both measured during this time. To measure the exact effect of the logs, a stretch of stream upriver from where the logs had been added was also monitored. Short-term nutrients were also added to in order to measure the water purification of the studied stretches of stream.

To assign a value to ecosystem services, the researchers considered the market value of the fish, the value of fishing permits sold for recreation, the cost of artificial water purification and, in terms of erosion control, the cost of dredging the reservoir to remove sediment. They then carried out cost-benefit analyses, considering the costs of 'active restoration' (intentionally adding and maintaining deadwood) and 'passive restoration', where riverside trees are allowed to mature and fall naturally. Numbers of fish increased in streams containing deadwood, leading to a predicted total economic gain of € 111,312 during the period between 2010 and 2050 at the basin scale. Streams with deadwood also trapped more sediment providing dual services of water purification and erosion control. The monitored stretches without restoration averaged 280g of sediment per square metre, but this increased to 1080g per square metre with deadwood. Purification and erosion services collectively resulted in an economic gain of €906,180 at the basin scale over the period between 2010 and 2050.

Overall, the analysis shows active restoration of small to medium streams of this basin, including follow-up maintenance, will begin to provide a return on investment within 20 years. Passive restoration, although initially cheaper, is also a much slower process and does not provide a return on investment for approximately 60 years. However, the best results were obtained by performing active restoration of small to medium streams and allowing passive restoration to account for maintenance of the necessary amount of wood in the streambed. The advantage of combining these two methods was that biodiversity was enhanced in both aquatic and terrestrial environments.

The researchers note that their analysis does not account for climate change's effects, which may affect the delivery of ecosystem services. They also accounted for only a selection of ecosystem services, excluding aspects such as biodiversity. However, this is likely increase the value of restoration, reaffirming the conclusion that such restoration activities are economically profitable.

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1.LIFE Aiako Harria - Conservation and restoration of Aiako Harria is supported by the EU under the LIFE programme. See: http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=2924