The Impact Of Extreme Events On Freshwater Ecosystems: executive summary and policy brief

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Overview

Extreme weather events – such as major floods, prolonged droughts and intense heatwaves – affect people and properties directly. The disruption caused to society makes immediate media headlines but, in the longer term, policy-makers need to understand the full implications of more frequent and more extreme events as our climate changes.

The impact of extreme events on the ecological health of our freshwater systems is less obvious but, nevertheless, very important. Freshwater ecosystems provide a wide range of benefits to society. These include water purification, water supply, food, and flood control. Crucially, we need these 'services' more than ever during extreme events, but degraded or disrupted freshwater ecosystems are less able to provide them. This will mean that the effects on society are magnified.

The *Impact of Extreme Events on Freshwater Ecosystems* summarises current knowledge about the physical and biological effects of extreme weather patterns, and outlines a range of land management strategies that can be used to mitigate these effects. Many of our rivers and lakes have been greatly modified in the past and, in places, this has made the effects of floods and droughts worse. However, there are practical steps that can, and are, being taken to manage land and water more wisely to the benefit of both society and ecosystems. Improving habitat structure and encouraging natural processes in the landscape can result in a 'win-win' situation by creating more refuges for wildlife while reducing the consequences of extreme floods and drought.

Key messages

Extreme weather is likely to become more common as a result of climate change – especially periods of intensive rainfall and prolonged dry spells.

Freshwater systems are particularly susceptible to these changes. Ecosystem services are seriously disrupted when conditions go beyond normal bounds.

Human activities influence the severity of these impacts by reducing the ability of freshwater ecosystems to withstand and recover from extreme events.

Flooding and drying out are natural features of freshwater ecosystems, but when these become more frequent and more intense, aquatic plants and animals are less able to recover.

Effects of extreme events on freshwater ecosystems

The amount and quality of water can be greatly affected and habitats for wildlife may become seriously degraded.

Some species may be lost locally, especially where extreme events disrupt breeding; non-native invasive species are often able to take advantage of this, so extreme events can cause the type of animals and plants to change.

Major floods will increase inputs of domestic, agricultural and industrial pollution to rivers and lakes and reduce water quality. Erosion will re-shape river channels and affect the movement of sediment.

Droughts will increase levels of pollution, hinder fish movement, and expose water plants to damage, ultraviolet light, heat stress or frost; many species will become stranded; the physical structure and chemical composition of river and lake beds will change as they dry out.

Policy implications

To maximise benefits to Society, we need to ensure that freshwater ecosystems are resilient to extreme events.

The European Union Water Framework Directive (2000/60/EC) is helping to increase the ecological quality of lakes and rivers; the EU Floods Directive (2007/60/EC) provides a mechanism for balancing ecological impacts alongside direct human effects by taking advantage of nature's own capacity to absorb excess water.

Wise use of land and effective water management can provide multiple benefits; these include providing refuges for wildlife and reducing soil erosion and pollution.

Natural Flood Management and Sustainable Drainage Systems (see below) at the landscape scale can provide a more sustainable, longer term solution to pollution events and flooding than traditional 'end-of-pipe' solutions and 'hard engineering' fixes.

The three principles of Natural Flood Management and Sustainable Drainage Systems are: slow water down, encourage infiltration and encourage natural processes.

Wiser use of water for industrial, agricultural and domestic purposes will reduce the effects of drought.

Water-friendly farming can be used to improve the natural water retention capacity of land, reducing the need for abstraction.

Best practice in the construction industry can be used to reduce water demand and storm water run-off, reducing flooding and pollution.

Policy tools (e.g. best practice guidance, agri-environment schemes, urban planning) should be used to incorporate resilience to extreme events into the natural and built environments.

Natural Flood Management

Natural Flood Management (NFM) harnesses natural ecological and hydrological processes to reduce flooding. Most of the techniques employed are already components of existing best practice in farming, forestry, river restoration and natural habitat management.

Techniques include:

Reforesting hill slopes

Planting dense woodlands in gullies

Modifying agricultural practices

Restoring river channel meanders

Allowing target low-lying areas to flood

Controlling excessive erosion

Managing large woody debris in watercourses

This approach enables most current land uses to continue, while introducing controls in key areas. Incorporating NFM into the Floods Directive has ensured that its aims are closely aligned with those of the EU Water Framework Directive.

Sustainable Drainage Systems (SuDS)

Sustainable Drainage Systems apply a similar approach to NFM, but in urban areas. Water flow is managed above ground rather than being drained from urban areas through a combined sewerage or storm water system. Relatively low-cost techniques can be used to slow down runoff, including:

Increased use of permeable surfaces, including permeable asphalt and paving

More ponds and wetlands

Greater recycling of roof runoff and grey water

Increased use of swales and infiltration trenches in low-lying tracts of land next to impermeable surfaces

Setting any necessary hard flood defenses back from the channel.

The overall effect is reduced runoff rates and increased groundwater recharge. However, SuDS provide additional benefits by increasing pollutant retention and reducing storm-water discharge. Similar approaches can be used in rural areas to reduce diffuse pollution from agriculture and provide on-farm water resources.

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