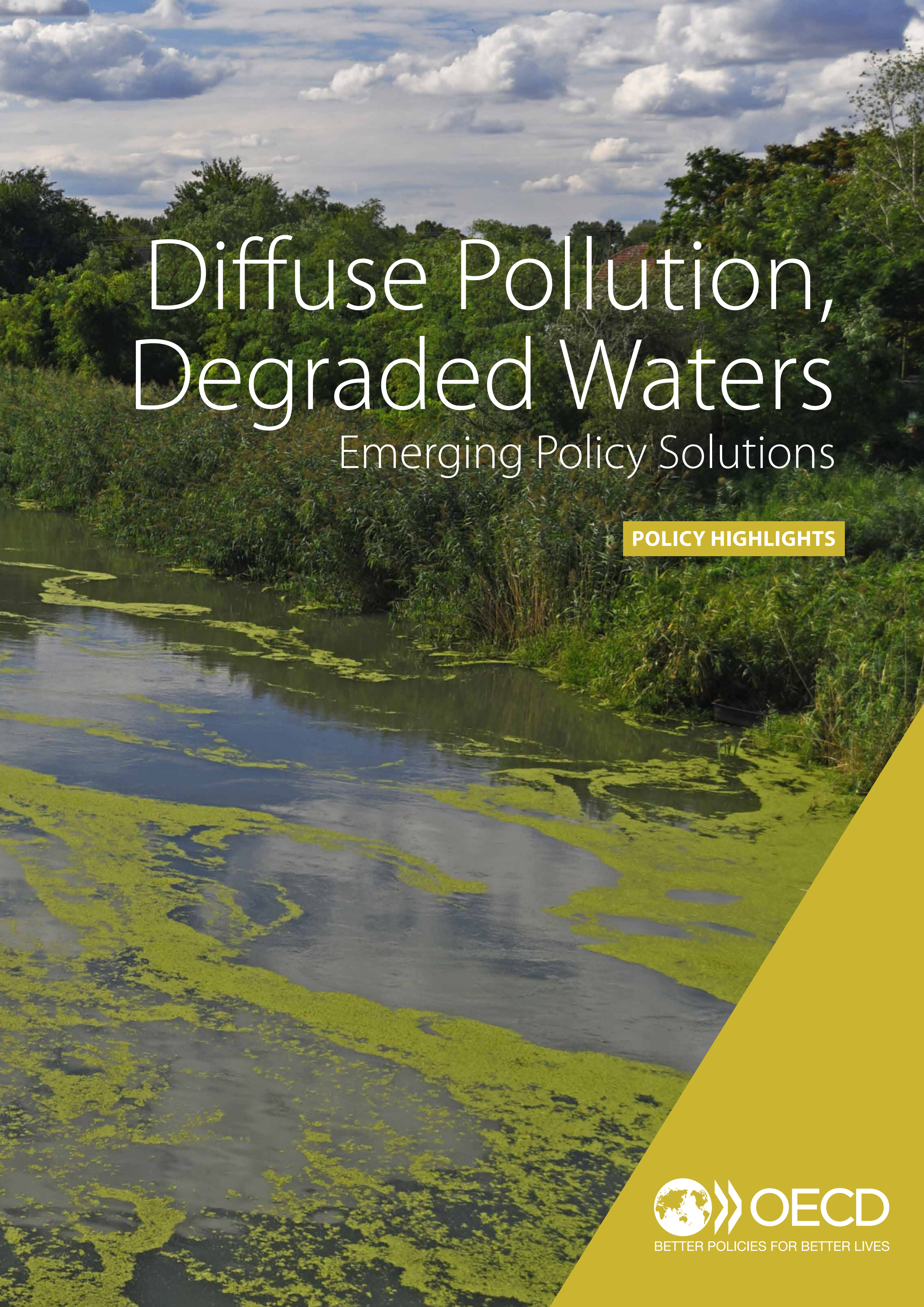


Diffuse Pollution, Degraded Waters

Emerging Policy Solutions

POLICY HIGHLIGHTS

OECD
BETTER POLICIES FOR BETTER LIVES

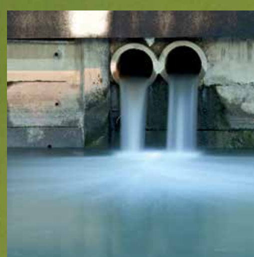
Diffuse Pollution, Degraded Waters

Emerging Policy Solutions

"OECD countries have struggled to adequately address diffuse water pollution. It is much easier to regulate large, point source industrial and municipal polluters than engage with a large number of farmers and other land-users where variable factors like climate, soil and politics come into play. But the cumulative effects of diffuse water pollution can be devastating for human well-being and ecosystem health. Ultimately, they can undermine sustainable economic growth. Many countries are trying innovative policy responses with some measure of success. However, these approaches need to be replicated, adapted and massively scaled-up if they are to have an effect."

Simon Upton – OECD Environment Director

OECD
BETTER POLICIES FOR BETTER LIVES



After decades of regulation and investment to reduce point source water pollution, OECD countries still face water quality challenges (e.g. eutrophication) from diffuse agricultural and urban sources of pollution, i.e. pollution from surface runoff, soil filtration and atmospheric deposition. The relative lack of progress reflects the complexities of controlling multiple pollutants from multiple sources, their high spatial and temporal variability, the associated transactions costs, and limited political acceptability of regulatory measures.

The OECD report ***Diffuse Pollution, Degraded Waters: Emerging Policy Solutions*** (OECD, 2017) outlines the water quality challenges facing OECD countries today. It presents a range of policy instruments and innovative case studies of diffuse pollution control, and concludes with an integrated policy framework to tackle this challenge. An optimal approach will likely entail a mix of policy interventions reflecting the basic OECD principles of water quality management – pollution prevention, treatment at source, the polluter pays and the beneficiary pays principles, equity, and policy coherence.

1 The water quality challenge

>50%

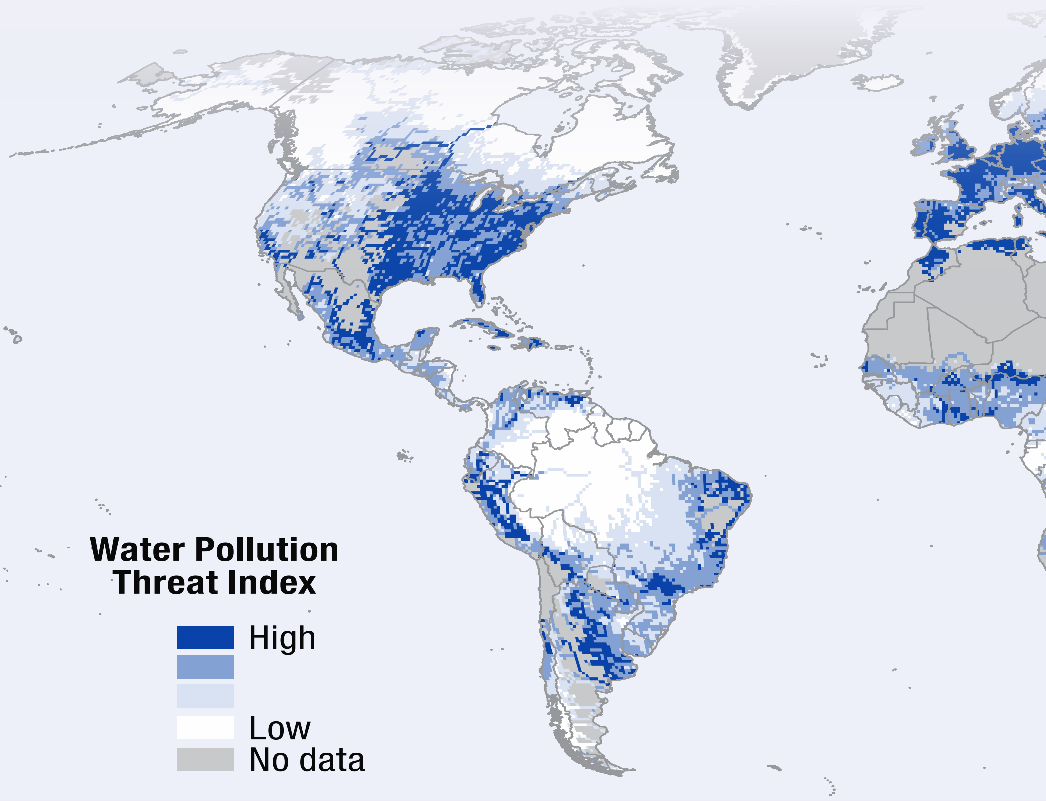
OF POPULATION AFFECTED.
At least half the world's population suffers from polluted water (Jones, 2009).

81%

DECLINE IN FRESHWATER BIODIVERSITY.
The biodiversity of freshwater ecosystems has been degraded more than any other ecosystem. Freshwater biodiversity declined by 81% between 1970 and 2012 due to pollution, over-exploitation and alteration of water bodies (WWF, 2016).

Good water quality is essential for human well-being, for use in agriculture, aquaculture, and industry, and to support freshwater ecosystems and the services they provide. Improving water quality is a critical element of the 2030 Sustainable Development Goals, fulfilling an essential role in reducing poverty and disease and promoting sustainable growth. And yet, pollution hotspots are identified in all regions of the world, including OECD countries.

At least half the world's population suffers from polluted water (Jones, 2009). And the situation is set to worsen. Population growth and climate change are placing increasing pressure on the ability of water bodies to process wastewater, nutrients and contaminants before they lose their life-supporting function. Increases in water pollution are projected in all regions of the world, but will be felt the greatest in upper-middle and lower-middle income countries, particularly Asia. This will, in turn, increase risks to human health, economic development and ecosystems.



Cities face distinct challenges. The impacts of water pollution, whether rural or urban in source, largely fall on cities, where population and the value of assets at risk are concentrated. Future population growth, urbanisation and more stringent water quality standards, will place extra demands on existing systems and mean that significant investments in drinking water and wastewater treatment infrastructure are required in order to prevent water-related disease outbreaks and not place additional nutrient, pathogenic and organic loads in river systems.

Climate change will exacerbate existing water quality challenges, due to altered precipitation and flow regimes, altered thermal regimes, and sea level rise. Many forms of water pollution will be exacerbated – from sediments, nutrients, dissolved organic carbon, pathogens, pesticides and salt, as well as thermal pollution, with possible negative impacts on freshwater ecosystems, human health, and water system reliability and operating costs. Sea-level rise is projected to extend areas of estuaries and increase salt-water intrusion of freshwater aquifers (Bates et al., 2008; IPCC, 2014).

>400

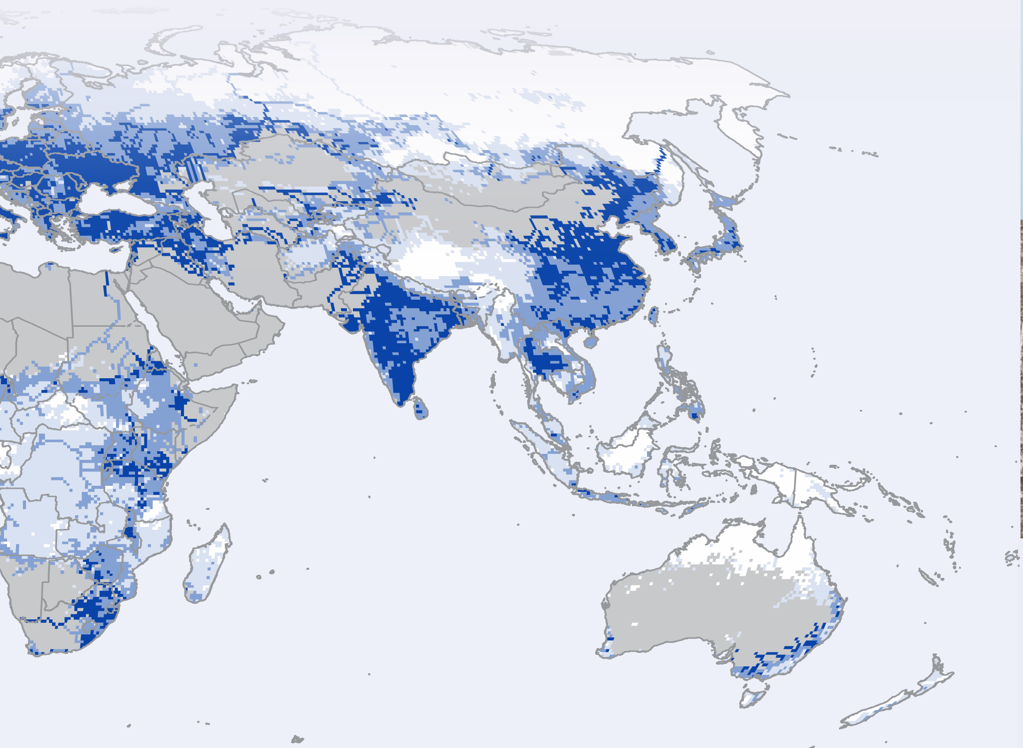
"DEAD ZONES" IN THE OCEANS

More than 400 hypoxic dead zones have been identified in the world's oceans due to eutrophication. Their frequency has approximately doubled each decade since the 1960s (Diaz and Rosenberg, 2008; Robertson and Vitousek, 2009).

35-46%

NITROGEN INCREASE EXPECTED.

Under even the most optimistic economic growth and climate change scenarios, discharges of nitrogen to water bodies is projected to increase by 35 to 46 percent between 2000 and 2050 (IFPRI and Veolia, 2015).



Note: Map includes the effects of nutrient and pesticide loading, mercury deposition, salinisation, acidification, and sediment and organic loading.
Source: Sadoff et al. (2015); based on data from Vörösmarty et al. (2010).

2 A typology for water pollution

Water pollutants are commonly characterised as point or diffuse, according to their source and pathway to the receiving environment. This distinction is an important function of water quality policy and pollution regulation:

- *Point sources* of pollution are directly discharged to receiving water bodies at a discrete location, such as pipes and ditches from sewage treatment plants, industrial sites and confined intensive livestock operations. The most severe water quality impacts from point source pollution typically occur during summer or dry periods, when river flows are low and the capacity for dilution is reduced, and during storm periods when combined sewer overflows operate more frequently.

- *Diffuse sources* of pollution are indirectly discharged to receiving water bodies, via overland and subsurface flow and atmospheric deposition to surface waters and leaching through the soil structure to groundwater during periods of rainfall and irrigation. The most severe water quality impacts from diffuse source pollution occur during storm periods (particularly after a dry spell) when rainfall induces hillslope hydrological processes and runoff of pollutants from the land surface.

Figure 1. **A typology for water pollution**

Pollutant characteristics	Source type and pathways	Receiving body type and characteristics	Environmental conditions
• Toxicity • Concentration • Volume of discharge • Life span • Fate and transport • Ability to treat with current technologies • Chemical reactions (adsorption, dissolution, precipitation, decay) • Stock or Flow pollutant • Ambient or exogenous • Continuous or intermittent	Type • Point source • Diffuse source • Historic pollution Pathways • Pipe discharges • Surface runoff • Subsurface flow • Leaching • Dry and wet deposition (of atmospheric pollutants) • Re-suspension of contaminated sediment	Type • River • Lake • Groundwater • Wetland • Estuary/sea/ocean Characteristics • Physical, biological and chemical properties (ecosystem health) • Biological processes (processing pollutants, plant uptake, nutrient cycling, adsorption, mineralisation) • Natural contaminant background levels • Geographical features (morphology, topography, mountain-fed, glacier-fed, lowland, upstream or downstream) • River channel type (straight, meandering, braided) • Perennial or ephemeral • Surface-groundwater interactions • Water body modifications (e.g. dams, canals, dredging) • Lake stratification and mixing • Flow rate and residence time • Confined or unconfined aquifer • Groundwater recharge rate	• Climate and season • Hydrological conditions (precipitation, runoff, flow, currents, velocity) • Geology and soil characteristics • Drainage characteristics • Temperature • Wind • Sunlight • Catchment area • Groundcover/ vegetation • Land use and management practices

Point sources of pollution are largely under control in OECD countries because they are easier to identify and more cost-effective to quantify, manage and regulate. In comparison, diffuse source pollution and their impacts on human and ecosystem health largely remain under-reported and under-regulated. This is because they are challenging to monitor and regulate due to:

- their high variability, spatially and temporally, making attribution of sources of pollution complex
- the high transaction costs associated with dealing with large numbers of heterogeneous polluters (e.g. farmers, homeowners)
- because pollution control may require co-operation and agreement within catchments, and across sub-national jurisdictions and countries.

There are also ecological and social response time delays. For instance: different ecosystems will respond differently to pollution, and pollution detection, social awareness, policy development and remediation actions will cause further delays depending on local resources and existing institutional and policy mechanisms. The large number of variables that determine the impact of pollution on water bodies are summarised in Figure 1.

The main pollutants that affect water quality are presented in Table 1. The most prevalent water quality challenge globally is eutrophication. This is characterised by oxygen depletion and algal blooms leading to significant loss of freshwater biodiversity and water treatment costs. The primary cause can be traced to excess nutrient losses from agricultural runoff.

Table 1. **Water pollutants and their typical sources**

Pollutant	Type of source[1]	Examples of source
Excess nutrient losses	P, D	Nitrogen and phosphorus fertilisers from agriculture and domestic lawns, livestock manure and slurry, and wastewater treatment plants. Nitrogen deposition from atmospheric sources of nitrogen oxides, ammonia and nitrous oxide.
Microbial contamination	P, D	Pathogenic bacteria and viruses from wastewater treatment plants, combined sewer overflows, animal waste, septic tanks, land application of biosolids.
Acidification	D	Atmospheric pollutants (sulphur, nitrogen oxides, ammonia) and acid mine drainage.
Salinity	D	Irrigation of salt-affected soils, sea level rise and over-abstraction of groundwater in coastal areas, de-icing salts used on roads.
Sedimentation	P, D	Erosion of topsoil and peatlands, livestock manure spreading on pasture, sediment release from dams, wastewater treatment plants, food processing waste.
Toxic contaminants	P, D	Pesticides and herbicides for plant and animal protection in agriculture, roadside and domestic use of herbicides. Heavy metals[2] from urban stormwater runoff, land application of biosolids, mining waste, industrial waste, and aging and corroding infrastructure. Natural arsenic groundwater pollution. Chlorinated solvents and other chemicals from transport, spills, fracking, urban stormwater runoff and leaking storage tanks.
Thermal pollution	P, D	Warm water from urban stormwater runoff, and power plants and industrial manufacturers who use water as a coolant. Cool water from dam releases.
Plastic particle pollution	D	Rubbish dumping by individuals, the plastic production industry, recreational and commercial fishers and urban stormwater runoff.
Contaminants of emerging concern	P	Commonly sourced from the household (through wastewater treatment plants), and to a lesser extent, from agriculture. Examples include pharmaceuticals, antibiotics, hormones, personal care products, cyanotoxins, engineered nanomaterials, anti-microbial cleaning agents and their transformation products.

Notes: 1.Point source (P), Diffuse source (D); 2. The most common heavy metals are cadmium, mercury, lead, arsenic, manganese, chromium, cobalt, nickel, copper, zinc, selenium, silver, antimony and thallium.

3 The economic case for water quality management

Poor water quality has many economic costs associated with it including:

- degradation of ecosystem services
- water treatment and health-related costs
- impacts on economic activities such as agriculture, fisheries, industrial manufacturing and tourism
- reduced property values
- opportunity costs of further development.

Examples of water quality impacts to economic, social and environmental values are presented below.

Impacts of water pollution

Urban and domestic use

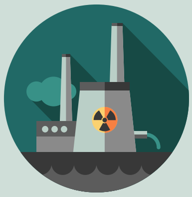
Increased water treatment and inspection costs, maintenance costs from scouring and premature ageing of infrastructure, increased wastewater treatment costs with implementation of more strict regulations. Emergency and clean-up costs from spills/accidents.

Ecosystem health

Damage to freshwater and marine ecosystems (e.g. fish kill, invertebrates, benthic fauna, flora, habitat degradation) and loss of ecosystem services, which may require investment in additional or different grey infrastructure alternatives to replicate these services.

Human health

Polluted water is the world's largest health risk, and continues to threaten both quality of life and public health. Associated with this are health service costs, loss life expectancy, and emergency health costs associated with major pollution events.

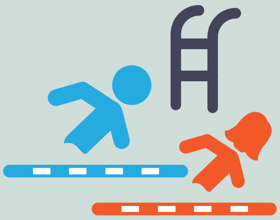


Industrial productivity

Exclusion of contaminated water for industrial use results in increasing water scarcity. Scouring of infrastructure, and clean-up costs from spills/accidents.

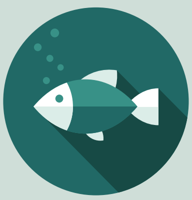
Social values and tourism

Prohibition from recreational use (e.g. swimming, fishing, seafood gathering), beach closure, impacts on aesthetics, cultural and spiritual values. Losses in fishing, boating, rafting and swimming activities to other tourism activities or to other ventures with superior water quality.



Agricultural productivity

Exclusion of contaminated water for irrigation results in increasing water scarcity. Irrigation with contaminated water causes damage to, and reduced productivity of, pasture and crops, soil contamination, impacts to livestock health and production, and scouring of infrastructure.



Commercial fisheries

Direct and indirect fish kill, contamination of shellfish.

Property values

Waterfront property values can decline because of unsightly pollution and odour.

Reducing the costs of diffuse pollution requires much greater attention from policy makers. The cost of current pollution from diffuse sources exceeds billions of dollars each year in OECD countries (Table 2). The scale of these costs means that seeking increasingly marginal reductions in point source pollution is no longer the most cost-effective approach to improving water quality in many OECD countries.

Table 2. **Estimated annual national costs of water pollution: A selection from OECD countries**

Country	Type of water quality impact	Annual cost (millions USD)
Australia	Algal blooms associated with excessive nutrients in freshwater	116 – 155
Belgium	Drinking water treatment costs	167 – 264
France	Eutrophication of coastal waters (loss of tourism revenue and cost of cleaning up algae)	139 – 208
	Agricultural nitrate emissions and pesticides	695 - 1219
Korea	Reducing chemical contamination of drinking water	106
Netherlands	Nitrate and phosphate pollution	371 - 695
Spain	Nitrate and phosphate pollution	208
Sweden	Coastal eutrophication	1257
	Baltic Sea eutrophication	719 - 2143
Switzerland	Agricultural pollution	690
United Kingdom	Drinking water treatment costs, agricultural pollution of surface water, estuaries	458
England	Total cumulative cost of water pollution (point and diffuse sources)	892 - 1656
United States	Freshwater eutrophication	2200
	Protecting aquatic species from nutrient pollution	44
	Lakefront property values from nutrient pollution	300 - 2800
	Recreational use from nutrient pollution	370 - 1160
	Drinking water impacts from nitrogen pollution	19000
	Impacts of nitrogen pollution on freshwater ecosystems	78000
	Drinking water costs of nitrate contaminated wells	12000
	Pesticide contamination of groundwater	2000
	Marine algal blooms	34 - 49
	Cleaning up leaking underground petroleum storage tanks	800 - 2100
	Controlling highway runoff from major highways	2900 -15600
	Freshwater pollution by phosphorus and nitrogen	4300+
	Health benefits of improving drinking water quality	130-2000
	Costs of gastrointestinal illnesses attributed to drinking water	2100-1380
	Health benefits associated with reducing arsenic from 50μg/L to 10 μg/L	140-198
	Health benefits associated with reduction of nitrate exposure to legal safety standards	350
Europe	Human health and ecosystem impacts from nitrogen pollution of rivers and seas	42 - 164
	Health costs of nitrate in drinking water – colon cancer	1062

Note: There are proportionally more studies on the costs of water pollution in the United States because it is a regulatory requirement to provide cost-benefit analyses of new regulations. See full report *Diffuse Pollution, Degraded Waters: Emerging Policy Solutions* for full list of references.

4

Policy instruments to control diffuse pollution

Policy approaches used to date for the management of water pollution have largely focussed on point source pollution control with large investments in wastewater treatment, and a reliance on voluntary participation and compliance measures for diffuse sources of pollution. Political resistance to regulate diffuse pollution and to apply the polluter pays principle have hindered more stringent action. However, there is evidence that voluntary participation may not reach the major polluters and subsidy-based programmes can have limited impact due to public budget constraints and a lack of environmental regulations on diffuse pollution.

Policy experience from OECD countries analysed in this report indicates that it is necessary, and more effective, to use a combination of the available policy mechanisms, including regulatory, economic and voluntary regimes, to improve pollution control (Table 3 below). In particular, economic instruments such as pollution taxes, charges and water quality trading, could be strengthened and used more extensively to increase the cost effectiveness of pollution control and promote innovation. While application to diffuse pollution is challenging, several innovative solutions provide practical solutions and can overcome implementation challenges.

The Polluter Pays Principle should be the first line of defence in securing water quality. It creates conditions to make pollution a costly activity and to either influence behaviour to reduce pollution, or generate revenues to alleviate pollution and compensate for social costs. Examples include pollution charges, taxes on inputs (such as fertilisers and pesticides) and sewer user charges. However, there are several challenges that result in the Polluter Pays Principle not frequently being applied in the control of diffuse pollution (it is more commonly used with the control of point source pollution). Possible ways to overcome these barriers are captured in Table 4.

Table 3. **Policy instruments to address diffuse water pollution and protect freshwater ecosystems**

Water-related risk	Regulatory	Economic	Voluntary or information-based
Water pollution	Water quality standards Mandatory best environmental practices and restrictions on inputs Pollution discharge permits Non-compliance penalties – non-renewal of resource permits or greater restriction on current permits Non-compliance fines	Pollution taxes (on inputs) Pollution charges (on outputs) Water quality trading Payment for ecosystem services	Information and awareness campaigns Farm advisory services for improved farming techniques (to minimise negative impacts on water quality) Contracts/bonds (e.g. land retirement contracts) Best environmental practices (or good management practices) Environmental labelling – products that meet certain environmental standards can be marketed and sold at a premium and/or subsidised.
Risk to the resilience of freshwater ecosystems	Minimum environmental flows (also for pollution dilution) Specification obligations relating to return flows and restrictions on discharges in drought conditions	"Buy-backs" of water pollution allowances to ensure adequate water quality for ecosystem functioning	Information and awareness campaigns Voluntary surrender of pollution discharge allowances

Table 4. **The Polluter Pays Principle for diffuse water pollution: Barriers and solutions**

Barriers	Solutions
Difficulties with identifying and targeting polluters	Computer modelling as a cost-effective alternative to directly observing individual diffuse pollution emissions Taxes on inputs (e.g. fertilisers, pesticides, cleaning products) or land use (e.g. paved urban surfaces, livestock numbers, intensive land use) Collective accountability at catchment level
Difficulties with determining reliable estimates of pollution costs	Economic modelling and scientific monitoring to inform costs and justify action (new data sources are available, see Box 1) Market mechanisms to reveal pollution costs and differentiated abilities to cope with them
Poor enforcement of existing regulations	Computer modelling as a cost-effective alternative to directly observing individual diffuse pollution emissions Taxes on inputs (e.g. fertilisers, pesticides, cleaning products) or land use (e.g. paved urban surfaces, livestock numbers, intensive land use) Collective accountability at catchment level Increased financial and technical support for local authorities to enforce regulations.
Strong political opposition	Economic modelling and scientific monitoring to inform costs and justify action (new data sources are available, see Box 1) Stakeholder engagement Collective accountability at catchment level Connecting with higher-level policy priorities

When developing policy to manage water quality, an important consideration is not only the measurement of the costs and benefits of water pollution reductions, but also on to whom these costs and benefits will fall. Box 1 outlines under which type of policy instrument the costs fall upon.

The following pages list emerging policy solutions that can effectively control diffuse water pollution. While their implementation may require specific conditions or investments, they open avenues for cost-effective responses to an enduring challenge. Some of these solutions build on green infrastructure or technological developments; others on well-designed taxes; more innovative ones rely on modelling pollution sources, or on total pollution load management. Several require active participation of stakeholders.

Box 1. **Who pays for, and who receives the benefits of, water quality improvements?**

Water quality improvements come at a cost, and those benefitting from improvements in water quality are not necessarily those who pay for the cost of pollution reduction, and those that pollute do not necessarily pay damage costs. For example, diffuse pollution from agriculture is loading costs onto other sectors as well as the environment. Who bears the costs and reaps the benefits of water quality improvements typically depends on the policy instrument used:

- Regulations, taxes and markets: improvements in water quality are usually at the cost of the polluter, the costs of which can be passed onto the consumer.
- Economic subsidies and incentives: improvements in water quality are at the cost of the tax payer.
- Environmental labelling and Corporate Social Responsibility: improvements in water quality are at the cost of producers, and corporations who sell and manage commercial goods. The cost is ultimately passed onto the consumer.
- Payment for Ecosystem Services: changes in management practices that improve water quality are at the direct cost of the beneficiaries.

Without effective policy instruments to reduce pollution, the cost of pollution typically falls on drinking water utilities (and subsequently households) and downstream water users, such as downstream industry and agricultural users, eco-tourism operators, recreational users, and waterfront property owners.

A selection of emerging policy solutions to control diffuse pollution

In Canada, Environmental Farm Plans and the Environmental Stewardship Incentive are federal programmes aimed at reducing eutrophication and algal blooms. They are designed and implemented at provincial level, enabling adaptation to local circumstances. For example, buffer strips around surface water bodies and groundwater sources have become a common requirement.

In the United States, the Clean Water and the Drinking Water State Revolving Funds use federal "seed money" from the Congress to capitalise a state-administered financial assistance programme to build and upgrade wastewater treatment plants and drinking water infrastructure, as well as invest in other projects to improve water quality. The Funds provide long-term financing and promote state and local self-sufficiency.

On the east coast of the United States, a total maximum daily load (TMDL) programme is used to reduce nitrogen, phosphorus and sediment loading to Chesapeake Bay. Point sources of pollution face stringent nutrient discharge limits and are expected to achieve limit of technology. Diffuse pollution from agriculture is largely unregulated but is collectively subject to a load allocation under the TMDL. Based on the dramatic price differentials among sectors for nutrient mitigation options, water quality trading has emerged as a market-based mechanism for cost-effectively meeting water quality goals.

In Norway, the pesticides tax was revised in 1999 to better reflect the environmental and health related risks and costs of pesticides. The tax has been successful in encouraging more conservative use of pesticides.

In London, United Kingdom, a novel Government Support Package was developed to attract private financiers and reduce insurance liabilities to deliver the Thames Tideway Tunnel project – a major construction project to intercept London's combined sewer overflows for treatment to improve water quality of the River Thames.

In France, water-related taxes attempt to internalise environmental externalities related to the use and pollution of water resources. Taxes apply to diffuse pollution from livestock (proportional to number, type and age of livestock), domestic pollution, and industrial pollution, amongst others.

In Munich, Germany, the municipal water provider has a voluntary payment scheme to encourage local farmers to adopt more sustainable organic farming practices at low-cost and avoid a high-cost upgrade of water treatment facilities. The Munich area is now considered the largest market for organic farming products in Germany.

In Europe, the Nitrates Directive (1991) aims to protect water quality by preventing nitrates from agricultural sources reaching ground and surface waters. Nitrate vulnerable zones must be identified and within these zones, specific fertiliser, manure, crop and livestock farming practices must be adhered to.

In Korea, the control of diffuse sources of pollution has been the focus of water policy since 2011. The Total Daily Maximum Load Management programme periodically sets phosphorus and biochemical oxygen demand reduction targets and assigns pollution load limits using water quality modelling, considering equity, efficiency and effectiveness of reducing pollution loads.

In Israel, regulations, infrastructure investment and tariffs to incentivise wastewater reuse have been successful at reducing water scarcity risks. Treatment of wastewater to the tertiary level and its use for irrigation has reduced both point and diffuse source pollution.

In New Zealand, some regions have used water quality modelling to identify diffuse source nutrient polluters and to inform policy design. In the Manawatu-Wanganui region, nutrient loss limits have been allocated to every farmer based on the natural capital of the soil and its ability to filter and retain water and nutrients. The Lake Taupo nitrogen market enables farmers within a catchment to exchange nutrient allocations.

5 A framework for diffuse pollution management

A risk-based policy framework can assist policy makers and stakeholders through the myriad of decisions required to establish new or alter existing water quality management regimes. The key elements to successful water quality management policies are outlined in Table 5.

Table 5. **A policy framework to manage diffuse water pollution**

Level	Description
Political ambition	**Know the risks** Identify pollutants, sources, pathways, timing and sensitivity of the receiving environment. Assess the diffuse water pollution risks (environmental, economic and social) taking into account time lags, historical pollution and planned land use change. **Target the risks** Limiting diffuse pollution comes at a cost. Set the appropriate level of risk and ambition and determine priorities informed by thorough assessments, robust knowledge and stakeholder engagement.
Policy principles	Hierarchy of principles for action: • **Principle of Pollution Prevention** - prevention of diffuse pollution is often more cost effective than treatment and restoration options. • **Principle of Treatment at Source** - treatment at the earliest stage possible is generally more effective and less costly than waiting until pollution is widely dispersed. • **Polluter Pays Principle** - makes it costly for those activities that generate diffuse pollution and provides an economic incentive for reducing the pollution. • **Beneficiary Pays Principle** - allows sharing of the financial burden with those who benefit from water quality improvements. Minimum pollution regulations must be meet first to ensure additionality and avoid rewarding polluters. Consider **Equity** with regards to who the costs and benefits of policy reform fall upon and the needs of future generations. Encourage **Policy coherence** across sectors that affect diffuse pollution. Ensure good water governance, with reference to the **OECD Principles on Water Governance**, in particular: geographical scale; data and information; implementation and enforcement; and stakeholder engagement and outcome-oriented contributions to policy design.
Policy instruments	**Manage the risks** Because it is not economical to observe diffuse water pollution directly, the choice and design of policy instruments should build upon one of three alternative management options: • Manage land use practices and inputs as proxies • Reward or penalise polluters collectively • Manage estimated diffuse emissions via modelling. Develop policy responses proportional to the magnitude of the risk. Target adoption of low cost strategies that achieve a high benefit return. Include local differences in the land resource (e.g. their ability to filter and retain water and pollutants) as an integral part of policy development. Consider economic instruments (e.g. pollution charges, product charges, and water quality trading), in combination with regulatory and voluntary mechanisms.

6 A role for central government

Central government has a critical role to play in the transition to more effective management of the risks from diffuse water pollution. Recommendations include:

- **Overarching national policy guidance and a strong direction** on water quality improvements is required to send the right signals to local authorities, stakeholders and investors. Distribute responsibility to achieve minimum water quality standards to local government and communities, which each have unique water quality issues, desired outcomes and capacities to respond.
- National policy guidance should be backed up by **regulatory frameworks and enforced minimum water quality standards** for setting the benchmark for better performance, and initiating innovations and investments in improving water quality. For example, minimum standards provide a benchmark, over and above which economic instruments can be used for water quality trading or payment for ecosystem services. Placing harmful chemicals on a watch list can encourage the innovation of more environmentally-friendly products. The amount of investment needed to meet new regulations should be considered when minimum water quality standards are developed. Without suitable funding, regulations cannot be met and their practical usefulness is limited.
- **Creating a space for stakeholder and community engagement** is necessary to manage perceived and actual risks, and reach solutions in partnership. Box 4.3 outlines some requisites for successful stakeholder engagement. Government transparency, accessibility of government services and information, and the responsiveness of government to new ideas, demands and needs are considered as the three building blocks to support an improved evidence base for policy making, strengthened integrity, lower corruption and higher trust in government (OECD, 2005).
- **Giving notice of policy changes and providing multiple options for implementation** of minimum standards is necessary to pave a way forward and reduce objections from stakeholders.
- **Providing government seed funding and allowing space for experimentation** (by relaxing regulations in such circumstances and distributing responsibility to local governments) can stimulate the diffusion of innovative technical and policy approaches that minimise the cost of water quality management. Examples may include pilots for wastewater reuse, water quality fit for purpose, decentralised systems, new approaches to manage and reduce diffuse pollution (e.g. nitrogen inhibitors, new cultivars, precision agriculture, constructed wetlands), and resource recovery from wastewater (i.e. energy and nutrients).

This Policy Highlights is based on the OECD publication, ***Diffuse Pollution, Degraded Water: Emerging Policy Solutions***.

The OECD has been providing policy guidance to OECD members and non-OECD member countries to meet the water challenge since the early 1970s. With a multi-disciplinary team drawn from across the organisation, the OECD contributes analyses to improve the information base, identify good practice, and provide a forum for exchanging country experiences. Recent work has addressed issues of financing, governance, policy coherence, private sector participation, urban water management, and water and agriculture. Ongoing work also covers the issues of water security, water and green growth, climate change adaptation, water allocation, and water quality management.

In addition to analytical work, the OECD works with selected countries to facilitate the reform of water policies. This confirms our aspiration to make reform happen. The recently adopted OECD Council Recommendation on Water provides a comprehensive source of policy guidance for central and subnational authorities on managing water quantity, improving water quality, managing water risks and disasters, ensuring good water governance, and ensuring sustainable finance, investment and pricing for water and water services.

References:

Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds. (2008), Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 210 pp.

Diaz, R.J. and R. Rosenberg (2008), "Spreading dead zones and consequences for marine ecosystems", Science, Vol. 321, No. 5891, pp. 926-929.

IFPRI and Veolia (2015), "The murky future of global water quality: New global study projects rapid deterioration in water quality", International Food Policy Research Institute (IFPRI), Washington, D.C. and Veolia Water North America, Chicago, IL.

IPCC (2014), Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B. et al. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1132 pp.

Jones, J.A.A. (2009), "Threats to Global Water Security: Population Growth, Terrorism, Climate Change, or Commercialisation?", in: Threats to Global Water Security, Jones, J.A.A., T.G. Vardanian and C. Hakopian (Eds.), NATO Science for Peace and Security Series C: Environmental Security.

OECD (2012), Water Quality and Agriculture: Meeting the Policy Challenge, OECD Studies on Water, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264168060-en.

OECD (2008), "Costs of Inaction with Respect to Air and Water Pollution", in: Costs of Inaction on Key Environmental Challenges, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264045828-4-en.

Robertson, G.P. and P.M Vitousek (2009), "Nitrogen in Agriculture: Balancing the Cost of an Essential Resource", Annual Review of Environment and Resources, Palo Alto, Annual Reviews, pp. 97-125.

Sadoff, C.W. et al. (2015), "Securing Water, Sustaining Growth": Report of the GWP/OECD Task Force on Water Security and Sustainable Growth, University of Oxford, UK, 180pp.

Vörösmarty, C.J. et al. (2010), Global threats to human water security and river biodiversity, Nature, Vol. 467, No. 7315, pp. 555–561.

WWF (2016), "Living Planet Report 2016: Risk and resilience in a new era", WWF International, Gland, Switzerland.

Visit our website:

www.oecd.org/water

Join the discussion:

@OECD_ENV

Image credits:
All images are from shutterstock. Cover: goran cakmazovic. Inside cover: duchy, igorstevanovic, jirapong. P. 1 Rob Fenenga. P. 2 Riccardo Mayer, ason Mintzer. P. 3 Rich Carey, Kim Britten. P. 4 KYTan , Todd Klassy. P. 5 Yuri Kravchenko. P. 6 Decorwithme, LynxVector, Krylovochka, Zaur Rahimov, Rvector, Creative Stall. P. 7 ADragan. P. 8 Wolfilser. P. 12 Slaven. P. 13 Kletr.

OECD
BETTER POLICIES FOR BETTER LIVES

OECD Environment Directorate
March 2017