

PRESCRIPTIVE MATRIX

CHEMICAL POLLUTION

Externality: Contamination of water and soil

Scale of externality: LOCAL

Example novel entity: plastic pollution

Marine plastic pollution is the result of both land and sea-based pollution, and the effects of plastic pollution transcend national borders. Effective responses will need to involve and link both state and non-state actors as well as business and civil society. Plastics have boosted our economy because they are versatile, cheap, and durable. Yet, thanks to these same traits, in the course of establishing a US\$750 billion global industry, we have also created a massive problem. Rivers are filled with plastic garbage. Plastic bottles soil beaches. Masses of plastic are floating in the ocean. Birds become entangled in plastic pieces, and whales' stomachs fill with plastic debris. Plastics can harm humans by releasing toxic additives.

GOVERNANCE

	Developed	Developing	All
Local	See Incentives.		
Regional			
Global	<ul style="list-style-type: none"> ● Global governance of marine plastic pollution is uneven, fragmented, and failing. ● Durability and dispersal of microplastics make governance particularly difficult. ● Globalization of the plastics industry is increasing the difficulty of governance. ● Governance reflects industry resistance to reforms and advocacy of self-regulation. ● Findings demonstrate the need for stronger regulation and a global plastics treaty. <p>Precedence shows that international ocean governance could adapt to address the current plastic challenge. For example, 50 years ago concerns about uncontrolled exploitation of the ocean led to the Third United Nations Conference on the Law of the Sea (UNCLOS) and the development of the United Nations Law of the Sea Convention. An international agreement to address marine plastics could be pursued in a similar manner, but would necessitate a more integrated and broad-based approach of the type followed when the Montreal Protocol addressed chlorofluorocarbons that were depleting the ozone layer.</p> <p>The United Nations Environment Assembly meeting in Kenya in December 2017, under the auspices of the UN Environment Program, was the most recent gathering to address the plastic problem. A key starting point for further action would be to build on commitments made in Nairobi, reaffirming the principles contained in the Rio Declaration on Environment and Development in 1992 as well as commitments made in 2015 by world leaders in adopting the 2030 Agenda for Sustainable Development.</p> <p>Solving the problem of plastic pollution may not be a simple or quick process, but there is reason to be optimistic that international governance frameworks can adapt to address an issue that affects every corner of the world's oceans. Oceans-based agreements just don't have what it takes to tackle the main sources of plastic pollution. It</p>		

is time to step up the game by negotiating a global treaty aimed at reducing plastic pollution that goes beyond marine pollution and tackles the roots of the problem. Two options seem most viable for crafting a binding international agreement to deal with plastics:

1. First, a stand-alone treaty could be negotiated, a multilateral environmental agreement dealing specifically with the production, use and disposal of plastics. It would not have to be built entirely from scratch because the UN already has a cluster of treaties dealing with a range of chemicals (which plastics are) and waste (which most plastics become). This chemicals and waste cluster is built by the Basel, Rotterdam and Stockholm conventions, which deal with the shipment and treatment of hazardous waste, international trade of toxic chemicals, and persistent organic pollutants, respectively. This cluster was recently joined by the Minamata Convention, restricting the use and trade of mercury and dealing with its disposal. Any of these conventions could be a model for a plastics treaty that would be far more appropriate than a marine agreement because they contain provisions on how to deal with harmful substances from a life-cycle perspective, ban the most hazardous ones, and offer a framework through which countries in need can receive assistance.
2. Second, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal could be amended to specifically address plastic throughout its life cycle. In 2002, the Basel Convention's member states passed technical guidelines on how to deal with plastic waste. These guidelines could serve as the basis for negotiating an amendment that, once ratified, would make sustainable management of plastics mandatory to its members. For example, so-called emerging policy issues like nanoparticles or lead in paint are tackled under the Strategic Approach to International Chemicals Management. SAICM is a voluntary multi-stakeholder policy framework for managing chemicals sustainably. It could be used to launch a plastics-based program, to raise awareness among governmental and non-governmental actors alike, and to prepare negotiations on a treaty. In addition, land- and oceans-based approaches could be combined to build on their respective strengths. The former could be covered in a stand-alone treaty or a treaty amendment as described above, whereas the latter could be tackled under the U.N. Convention on the Law of the Sea, MARPOL or the various regional seas agreements to focus on waste dumping at sea or lost fishing gear.

MONITORING

	Developed	Developing	All
Local	<p>As conditions change over time, it is important to monitor the progress and effectiveness of the policy introduced and adjust the policy accordingly. It is important for governments to keep the public updated on the progress and benefits achieved, to continue building consensus and demonstrate accountability. Progress could be monitored in several ways, including through audits, surveys, impact assessments and focus-group interviews. It would be advisable to review the policy instruments on a regular basis (for instance with a yearly frequency for the first three to five years, and afterwards every five years or as deemed necessary).</p> <p>In Ireland, thanks to a regulatory impact assessment the government learned that the consumption of plastic bags increased a few years after a levy was introduced as people became used to it. As a result, the levy was revised upward.</p> <p>In the Northern Territory of Australia, five years after a ban on thin plastic bags (below 35 microns) was introduced, a survey revealed that plastic litter increased, as people had begun paying for thicker bags but continued to treat them as single-use items.</p> <p>In the case of total bans, law enforcement and monitoring of compliance are critical to ensure that the prohibited items are not illegally produced or imported from neighbouring countries.</p> <p>To gather data on effectiveness, governments may consider including in the legislation a reporting obligation (providing a standard template to allow for comparability across years) to estimate the reduction in consumption. Once progress and effectiveness have been estimated, these would inform and form part of the new baseline scenario. The steps presented in a roadmap for policymakers could then be reviewed and refreshed to ensure that the measures in place continue to be the most effective and appropriate for the country or local context.</p>		
Regional			
Global	<p>Ongoing scientific research is needed to help define the scale and scope of the problem while linking business and industry to such issues. This could be facilitated by the work of the World Ocean Council as a global industry alliance committed to Corporate Ocean Responsibility.</p>		

INCENTIVES

	Developed	Developing	All
Local	<p><u>Bans/Levies</u></p> <p>To date, regulations on plastic bags and Styrofoam products have been introduced at the national level in more than 60 countries, and more will follow.</p> <p>Of the bans and levies (on suppliers, retailers, and/or consumers) analysed which have entered into force (over 140 regulations at the national and local levels), there is not yet sufficient information to draw robust conclusions on the environmental or health impacts achieved by levies and bans on plastic bags. In 50% of cases, there is no information on impact: partially this is due to lack of monitoring and reporting systems, and partially, it is due to the fact that many of the measures analysed have been implemented only recently, and therefore they are too recent to have robust data on achieved impacts.</p> <ul style="list-style-type: none"> • Roughly 30% of cases have registered dramatic drops in plastic pollution and the consumption of plastic bags within one year from the entry into force of the national ban or levy, while the remaining 20% have reported no to little impact. • Of the countries that have introduced national bans on plastic bags and have reported no to little impact, the main issues seem to be (i) lack of enforcement and (ii) lack of affordable alternatives. • The latter has led to cases of smuggling (development of black markets for plastic bags) or to shifts towards the use of thicker plastic bags (which is not regulated), a transition that has in some instances worsened environmental concerns. • Strategies to minimize the use of and phaseout single-use plastics, other than bags and Styrofoam, have recently started to be considered in several countries <p>Bans on single-use plastics can be a step towards more comprehensive policies aiming at reducing the generation of plastic waste and at replacing single-use plastics with more sustainable, environmentally friendly alternatives. For example, the plastic bag ban in Antigua and Barbuda has led to the introduction of further measures to forbid the import of food plastic containers and the use of plastic utensils. Bans on single-use plastics are considered by small and medium 'green' businesses as opportunities to prosper by marketing innovative, environmentally sound alternatives.</p> <p>When introducing a levy on single-use plastic products, consideration should be given to how revenues from that economic instrument will be used. To maximize public benefits, the revenues from the levy could be ringfenced and reinvested to: Support specific environmental projects; Boost the local recycling industry (end-use markets); Create job opportunities in the plastic recycling industry (through seed funding); Finance awareness initiatives which promote waste minimization</p> <p>Given that the main objective of the levy is to be dissuasive, it is important that the levy's revenues are ringfenced for activities that are time-bound. If the levy is successful, people will be dissuaded from continuing to use single-use plastic bags, and revenues should be expected to gradually decrease and eventually stop. To ensure a transparent process and maximize public support, it is important to widely communicate the chosen purpose for which the revenues will be utilized. It has been reported that in South Africa, consumers'</p>		

	<p>acceptance of the plastic bag levy decreased partly due to the unclear administration of the revenues and poor results in terms of recycling and green jobs creation.</p> <p><u>PPPs</u></p> <p>Public-private partnerships (PPP) and voluntary agreements can be valid alternatives to bans and can achieve reductions in the consumption of single-use plastics, like in the case of Austria. The progressive introduction of voluntary reduction strategies can be a great way to successfully allow enough time for the population to begin changing consumption patterns and for affordable and ecofriendly alternatives to become available in the market. Social pressure can trigger changes among both policymakers and manufacturers and eventually help to reduce plastic pollution. Public awareness is a common denominator for the success of any of the above-mentioned initiatives aiming at having a broader social impact (whether dictated by law or engaged in voluntary). Similarly, awareness raising, monitoring, and continued communication of progress to the public will help to build confidence and strengthen commitment to the cause.</p>
Regional	
Global	<p>When wanting to regulate the production and consumption of single-use plastics, governments are likely to face resistance from the plastic industry as well as from packaging importers and distributors. To limit resistance and gain as much support as possible, governments may wish to consider providing incentives to industry. It may be beneficial to introduce the incentives long before the new legislation is put into effect in order to guarantee enough time for plastic manufactures, distributors and retailers to adapt to the new stipulations. Such measures might include:</p> <ul style="list-style-type: none"> • Provisions to allow time to adapt to the transition (for instance provide enough time for retailers to deplete existing plastic bags stocks, begin alerting consumers of the upcoming change and purchase new alternatives). • Tax rebates and financial incentives to stimulate production of cost-effective alternatives to plastic bags (for instance make provisions to keep tax free the importation of certain materials/products that are to be used to manufacture ecofriendly and fit-for-purpose alternatives, as in Antigua and Barbuda). <p>Furthermore:</p> <ul style="list-style-type: none"> • A global plastics treaty should demand (and support) building effective national collection and recycling systems, because they are the most effective means of preventing plastic littering. Extended producer responsibility schemes and multi-stakeholder partnerships could be fostered to further extend collection where governments lack capacities. When this doesn't suffice, plastic manufacturers could be charged to provide revenues for establishing recycling systems. • A treaty should create conditions for a more circular plastic economy. Chemical and other companies must be pushed toward innovation for more sustainable products, including plastics that more easily degrade in the environment. This is a huge innovation challenge for the industry, yet it can elicit a race to the top just as provisions to safeguard the ozone layer through the Montreal Protocol did 30 years ago. The companies moving first will have the biggest advantages in the years to come. • To get a plastics treaty to work, it must provide funds for implementation. These days, raising money for multilateral agreements is a really tough job. But there is a strong economic argument for taking on the plastics challenge: Not only are environmental and health damages of untreated plastic pollution

	<p>extremely costly, there is also huge savings potential (for example, the Ellen MacArthur Foundation estimates that 95 percent of the value of plastic packaging — some US\$80 billion to US\$120 billion — is lost each year when the material is discarded).</p>
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ATMOSPHERIC AEROSOLS

Externality: Air pollution

Scale of externality: LOCAL

GOVERNANCE

	Developed	Developing	All
Local	<p>In Southern California, various policies and programs were put into use including electric cars, ship at-port electrification, cleaner fuel for trucks, ships and trains and mandatory installation of newer and cleaner engines. Despite a 38% increase in traffic, 30% increase in population and 160% increase in port activity from the year 1994 to 2011, the policies and programs led to drastic decreases in pollution levels, with a 54% fall in NO_x, 65% fall in reactive organic gases, 40% fall in SO_x, 21% decrease in PM 2.5 and 15% decrease in PM 10.</p> <p>In Singapore, standards on vehicular emissions have become increasingly stringent over the years. The emissions standard for all new diesel vehicles had been revised from Euro IV standard to the Euro V standard on 1 January 2014. The emissions standard for petrol vehicles were revised to Euro IV standards from 1 April 2014. National Environment Agency also carries out regular enforcement against smoky vehicles. Fines are issued to owners of smoky vehicles. In addition, drivers who leave their engines idling are taken to task.</p> <p>Seoul, South Korea, piloted an LPG engine retrofit program on 135 2.5-ton cleaning trucks used by local governments to pursue lower emissions from diesel vehicles, a project launched by both the city and the surrounding areas in 2003. From 2005, the project was expanded to cover city buses and business vehicles, introducing LPG engine retrofits, and early termination of vehicle registration for vehicles failing to</p>	<p>In 1992, the United Nations declared Mexico City the most polluted on the planet. High ozone levels were thought to cause 1,000 deaths and 35,000 hospitalizations a year. Mexico was forced to act. It replaced the city's soot-belching old cars, removed lead from gasoline, embraced natural gas, and expanded public transportation, and relocated refineries and factories. The presence of lead in the air has dropped by 90 percent since 1990. Suspended particles - pieces of dust, soot or chemicals that lodge in lungs and cause asthma, emphysema or cancer - have been cut 70 percent. Carbon monoxide and other pollutants also have been drastically reduced. Much of the improvement can be attributed to a requirement that Mexico-based auto manufacturers put catalytic converters on cars produced for the Mexican market. Now Mexico must require all diesel vehicles to be retrofitted with a filter that is the equivalent of a catalytic converter.</p> <p>In China, air quality was improved drastically by reducing production of steel and coal-fired electricity, and heavy investments into wind and solar power. Chinese cities are pressing residents to give up coal stoves and furnaces at home. Officials have required higher-quality gasoline and diesel for vehicles. Car emissions standards set to take effect in 2020 will be comparable to European and American ones. But the focus remains on heavy industry. In March 2017, the national government announced the closure or cancellation of 103 coal-fired power plants, capable of generating a total of more than 50</p>	<p>Best practices identified from case studies:</p> <ul style="list-style-type: none"> Utilize technology and data to both accurately identify the sources of pollution and also respond appropriately. Cleaner energy sources are key to reducing air pollution and improving the health of cities. Get ahead of the curve and take advantage of cleaner energy sources now. Los Angeles' and China's concerted efforts to eliminate its dependence on fossil fuels provides examples that many can follow.

	<p>meet the emissions requirements. Seoul is also interested in encouraging the use of electric cars as a fundamental solution to air pollution, and has distributed such “green” cars since 2009 and built charging stations to test-run for wider use of electric cars. The city is a leader in “green” car projects, starting with electric bicycles, low-speed/retrofitted/high-speed electric cars, electric buses, hydrogen-powered cars, and online electric car, etc. Beginning in 2009, Seoul has built charging stations at City Hall, local district offices, parks and other public facilities, and developed a “smart payment” system to meet potential demand for easy payment.</p>	<p>gigawatts of power. It said it would also cut steel production capacity by another 50 million tons. The country also created citizen watchdogs, by making air quality data from monitoring stations public, and allowing anyone with a smart-phone to detect air-quality and report violations.</p>	
Regional			
Global			

MONITORING

	Developed	Developing	All
Local	<p>The National Environment Agency keeps a close eye on air pollution in Singapore through fourteen air monitoring stations around the island, sensors installed in the chimneys of factories, and video cameras trained on smoke stacks in industrial parks. This continuous monitoring allows NEA to detect any deterioration of air quality and respond immediately and provides evidence for acts of non-compliance when it comes to enforcement against culprits.</p> <p>To ensure air quality control is systematic, Seoul operates monitoring stations across the city. Following the ozone alert system in 1995, a particulate matter alert system was introduced in 2005 to help protect city residents.</p>	<p>The answers to standard air quality questions are severely hampered by a lack of data as well as poor regulation and laws in developing countries. For example, the only country on the African continent that has ambient air quality standards enforced by air quality laws and regulations is South Africa. Other countries have either ambient air quality standards or air quality laws and regulations, or none at all. Monitoring is sparse or patchwork at best.</p>	

	<p>From July 2018 onwards, more than a hundred low-cost air quality sensors will be attached to lampposts and buildings in the worst-affected and most sensitive locations in London. These fixed sensors will be deployed alongside mobile sensors carried by Google Street View cars taking readings every 30 metres. It is hoped that the resulting 'hyperlocal' network of sensors will create the world's most sophisticated air monitoring system. Improving the monitoring of London air quality in this way should help identify those initiatives that make the biggest contributions to cutting air pollution. Findings from the project will be shared with other cities across the UK and globally, including the C40 Cities Climate Leadership Group. According to the Mayor's office, London already has one of the best networks of air quality monitors of any city. However, it does not cover enough of the capital. More sensors and more data are needed to say for sure which actions to tackle pollution are working best. A clear output of the project will be a revolutionary air monitoring model and intervention approach that can be replicated cost-effectively across other UK cities and globally.</p>		
Regional			
Global			

INCENTIVES

	Developed	Developing	All
Local	<p>Paris bans cars in many historic central districts at weekends, imposes odd-even bans on vehicles, makes public transport free during major pollution events and encourages car- and bike-sharing</p>	<p>Reports that pollution levels in Delhi matched those in Beijing spurred the city to ban all new large diesel cars and SUVs with engines of more than 2,000CC and to phase out tens of thousands of diesel taxis. The</p>	<p>Best practices: Emphasis is on cutting pollutants off at the source, rather than investing in schemes that remove the pollutants already there.</p>

	<p>programmes. A long section of the Right Bank of the river Seine is now car-free and a monthly ban on cars has come into force along the Champs-Élysées. Politicians want to ban the sale of all petrol and diesel cars from 2025, allowing only electric or hydrogen vehicles. The proposed new law would allow anyone who already owns a petrol or diesel car to continue using it.</p> <p>Freiburg in Germany has 500km of bike routes, tramways, and a cheap and efficient public transport system. One suburb, Vauban, forbids people to park near their homes and makes car-owners pay €18,000 for a space on the edge of town. In return for living without a car, people are offered cheaper housing, free public transport, and plentiful bicycle spaces.</p> <p>Copenhagen prioritises bikes over cars and now has more cycles than people. The city calculates that one mile on a bike is worth \$0.42 to society, while one mile in a car is a 15p (\$0.20) loss. Large parts of the Danish capital have been closed to vehicles for decades and the city plans to become carbon neutral by 2025.</p> <p>Oslo plans to halve its climate emissions by 2020 and proposes a large no-car zone, the building of 40 miles of new bike lanes, steep congestion charges, a rush-hour fee for motorists, and the removal of many parking spaces.</p> <p>The Finnish capital plans to drastically reduce the number of cars on its streets by investing heavily in better public transport, imposing higher parking fees, encouraging bikes and walking and converting inner city ring roads into residential and walking areas. The idea is to make the city's public transport so good that no one will want a car by 2050.</p>	<p>city has experimented with alternately banning cars with odd/even plates and is now encouraging Uber-style minibuses on demand.</p> <p>The southern Brazilian city of Curitiba, population 2 million people, has one of the biggest and lowest cost bus systems in the world. Nearly 70% of the city goes to work by public transport and the result is pollution-free air and traffic-free streets.</p> <p>The Indian city of Bangalore is converting its 6,000 buses to compressed natural gas and discouraging the car. So far, says the city, it has reduced traffic pollution by about 20% in a few years and one in four people who used to travel by car now use public transport.</p>	<p>That means cutting down on fossil fuels, investing in electrical power and keeping high-polluting vehicles away from cities.</p>
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	Zurich has capped the number of parking spaces in the city, only allows a certain number of cars into the city at any one time, and is building more car-free areas, plazas, tram lines and pedestrianized streets. The result has been a dramatic reduction in traffic jams, and less pollution.		
Regional			
Global			

FRESHWATER

Externality: Scarcity of freshwater

Scale of externality: LOCAL / REGIONAL

GOVERNANCE

	Developed	Developing	All
Local	<p>Building good water management systems is a multi-decadal effort, and the pathway to improving governance will vary according to specific local conditions. The following strategies are applicable across many geographies:</p> <p>Strengthening community management and other participatory systems: In many cases, community empowerment can bolster good governance without any changes to policies, regulations, or government capacity. There are many ways to empower communities to take a greater role in water basin management: linking national-level management with existing community structures, allowing community participation in basin- and national- level dialogues, and developing strong water user associations at the local level. There are also strong examples of community management in traditional forms of water governance. For example, the traditional aflaj water allocation system used by Omani farmers and the subak system in Balinese rice paddies have allowed for complex water management for millennia. Though traditional systems have been stressed by modern pressures, they can often be adapted, reformed, and built upon rather than being discarded wholesale, particularly in places where centralizing decision-making means making allocations more opaque and prone to undue political influence or even outright corruption.</p> <p>See Incentives for other strategies.</p>		
Regional	<p>Since 2010, the OECD has provided evidence on the main governance gaps hindering water policy design and implementation, and suggested a set of policy responses and good practices for overcoming them. The “OECD Multi-level Governance Framework: Mind the Gaps, Bridge the Gaps” was developed as an analytical framework and tool for policymakers to identify and bridge governance challenges that affect, to a greater or lesser extent, all countries, regardless of their institutional setting, water availability or degree of decentralization.</p> <p>OECD evidence shows that there is not a one-size-fits-all solution to water challenges worldwide, but rather a large diversity of situations within and across countries. Governance responses should therefore be adapted to territorial specificities, and recognizing that governance is highly context-dependent and important to fit water policies to places.</p> <p>The Principles are rooted in broader principles of good governance: legitimacy, transparency, accountability, human rights, rule of law and inclusiveness. As such, they consider water governance as a means to an end rather than an end in itself, i.e. the range of political, institutional and administrative rules, practices and processes (formal and informal) through which decisions are taken and implemented, stakeholders can articulate their interests and have their concerns considered, and decision-makers are held accountable for water management. The Principles aim to enhance water governance systems that help manage “too much”, “too little” and “too polluted” water in a sustainable, integrated and inclusive way, at an acceptable cost, and in a reasonable time-frame. They consider that governance is good if it can help to solve key water challenges, using a combination of bottom-up and top-down processes while fostering constructive state-society relations. It is bad if it generates undue transaction costs and does not respond to place-based needs. The Principles consider that water governance systems (more or less formal, complex, and costly) should be designed according to the challenges they are required to address. This problem-solving approach means that “forms” of water governance should follow “functions” of water governance. Structuring, institutionalising, and/or formalising institutions should not</p>		

	<p>detract from the ultimate objective of delivering sufficient water of good quality, while maintaining or improving the ecological integrity of water bodies.</p> <p>Principle 1. Clearly allocate and distinguish roles and responsibilities for water policymaking, policy implementation, operational management and regulation, and foster co-ordination across these responsible authorities.</p> <p>Principle 2. Manage water at the appropriate scale(s) within integrated basin governance systems to reflect local conditions, and foster co-ordination between the different scales</p> <p>Principle 3. Encourage policy coherence through effective cross-sectoral co-ordination, especially between policies for water and the environment, health, energy, agriculture, industry, spatial planning and land use</p> <p>Principle 4. Adapt the level of capacity of responsible authorities to the complexity of water challenges to be met, and to the set of competencies required to carry out their duties</p> <p>Principle 5. Produce, update, and share timely, consistent, comparable and policy-relevant water and water-related data and information, and use it to guide, assess and improve water policy</p> <p>Principle 6. Ensure that governance arrangements help mobilise water finance and allocate financial resources in an efficient, transparent and timely manner</p> <p>Principle 7. Ensure that sound water management regulatory frameworks are effectively implemented and enforced in pursuit of the public interest</p> <p>Principle 8. Promote the adoption and implementation of innovative water governance practices across responsible authorities, levels of government and relevant stakeholders</p> <p>Principle 9. Mainstream integrity and transparency practices across water policies, water institutions and water governance frameworks for greater accountability and trust in decision-making</p> <p>Principle 10. Promote stakeholder engagement for informed and outcome-oriented contributions to water policy design and implementation</p> <p>Principle 11. Encourage water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations</p> <p>Principle 12. Promote regular monitoring and evaluation of water policy and governance where appropriate, share the results with the public and make adjustments when needed</p>
Global	<p>In spite of differences in detail, best practices are related across several broad categories for “good” water governance. These are: environmental protection; transparency and public participation; science-based decision-making; consultation; human rights; and dispute avoidance and settlement. All of the regional and basin regimes examined demonstrated good practices relating to many of these categories, though one regime did not satisfy all categories.</p> <p>Water management has been resistant to reform for a long time, but a number of solutions are starting to get traction. It remains to be</p>

seen whether the increasing presence of water issues on the international agenda will catalyze reform at scale, or whether successful projects will be limited to the scope of isolated pilots.

Nonetheless, as the risks of inaction rise, a wide range of stakeholders are mobilizing resources to address the water management issue and are embracing innovative approaches to the problem. Corporations are becoming more engaged. Increasingly, companies view water as an area where they are exposed to both material and reputational risk. Particularly those companies with water-intensive supply chains see the necessity of reducing their demand for freshwater. Corporate engagement is evolving from investments along individual supply chains, to engagement within river basins and communities in which they operate. The next frontier for corporate engagement is policy work, an area that the 2030 Water Resources Group, a prominent public-private platform for collaborative water management, is beginning to address.

Some governments are making large-scale investments in water management reform. Most governments are attacking the water scarcity problem with large-scale investments in infrastructure. A few are making policy and management reforms, which are more promising for the long term. A primary example is Australia's multibillion dollar investment in a high-functioning water rights trading system, including government purchase of environmental rights.

Nexus thinking is gaining traction. Governments, businesses, academics, think tanks, journalists, entrepreneurs, and civil society across both the developed and developing world are embracing the water-energy- food nexus concept to frame thinking on the interconnectedness of resources and growing demands. The nexus concept is headlining key conferences across sectors and gathering policy attention, elevating the issue on the global agenda.

MONITORING

	Developed	Developing	All
Local	<p>Although insufficient to lead to better water management on their own, valuation, data, technological, and financial tools can enable improved management. For example, water planning is impossible if the quantity of water available is not known, payments for ecosystem services markets cannot survive without the means to quantify benefits, and water users cannot make efficiency improvements if the necessary technology does not exist. At the same time, users will not apply efficiency improvements if there are not sufficient incentives to do so. In short, these tools work best when coupled with or complemented by broader efforts to improve governance. That said, the stronger the stable of tools and technologies available for deployment, the more ground can be covered when small changes to incentives and water management are won.</p> <p>Improved application of data and technology: Increasingly, satellites are making data available about the state of surface and groundwater resources that had previously been difficult or impossible to obtain. Online platforms and GIS are making surface and groundwater flows, and related data, increasingly accessible to users, allowing for preemptive management of water crises, better corporate water management, and more effective community participation in water decision-making processes.</p> <p>New water-saving and delivery technologies: While continued innovation in scalable technology remains important, in many cases transformative technology exists but has yet to be widely applied because there is not sufficient economic incentive. For example, desalination, wastewater reuse, water-efficient irrigation and appliances, dry lubrication, and a variety of other technologies all have the potential to improve water efficiency but are rarely used because water is cheap. With regard to water purification, SODIS (leaving water out in plastic bottles to be disinfected by UV rays), ceramic filters, sand filtration systems, and other methods are helping to serve areas where municipal service falls short, but expanding municipal supply continues to represent the most viable long-term</p>		
Regional			
Global			

	<p>solution.</p> <p>Improved environmental assessments: Academic institutions, NGOs, and even private companies and governments have made long-standing investments in improving our collective ability to value ecosystem services. While much of this capacity is housed in institutions in developed countries, the knowledge base is getting large enough and valuation practices are getting standardized enough that ecosystem valuation services are becoming more readily available globally, although data is often a limiting factor. The ability to conduct such valuations efficiently and effectively is fundamental to any management effort that requires payment transfers or investments in ecosystem services. This capacity also enables better integration of ecosystems into water management systems. To date, efforts have been primarily focused on advancing the science of ecosystem valuation. The trajectory of this field will thus depend on translating this information to decision-makers and promoting uptake in integrated water resources planning.</p>
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INCENTIVES

	Developed	Developing	All
Local	<p>Water management systems are chronically weak. As demand for water increases, freshwater water allocation and management systems are strained. Allocation decisions are politically difficult and often lack transparency and equity. In many places, water allocation systems also lack sufficient (or sufficiently trusted) information and data, flexibility, adequate infrastructure, institutional capacity, and enforcement capacity. Because of the weak nature of these water allocation and management systems, individual actors have no incentives, or even have disincentives, to behave in accordance with the needs of all users or even in their own long-term interest. Often, those actors with the strongest political power, financial resources, and/or proximity to the water resource take more than their fair share.</p> <p>Water is consistently underpriced, which leads to underinvestment and overuse. In part because water is typically viewed as a fundamental right more than as a commodity, governments tend to keep water rates low, if it is priced at all. Often water consumption is not even measured; this is especially true with groundwater. Thus, there is little incentive for individual water users to increase their efficiency and the cost savings are insufficient to support investments in water savings technologies. Furthermore, ecosystems that provide essential freshwater services are usually not valued, given water rights, or included in the economic equation at all.</p> <p>BEST PRACTICES:</p> <p>Water markets: Formal water markets, which allow water to be physically traded within a certain geography, are lauded by many as an effective method of water management, and have been successfully piloted in Australia and elsewhere in the past ten years. Although there are some risks inherent in formal water markets, notably insufficient protections to poor populations and ecosystems, they can offer an economically rational way to distribute water resources, keep water basins from being over-exploited, and help individual users benefit financially from increasing their water use efficiency (thus remedying the problem of underpricing). Water markets are only possible where governance is strong as they require established rights, clear trading rules and mechanisms, monitoring, and enforcement. However, many foundational elements of markets can be established slowly, in tandem with improvements in governance systems. For example, establishing water rights registries is a necessary precursor to transferable water rights. And there are a number of ways to establish flexible allocation mechanisms that can be responsive to variable supply and demand, without allowing for an open exchange of rights. Among the potential risks of water markets, is the possibility of negatively affecting food security and livelihoods when raising water prices or establishing water markets. These considerations are particularly important given that markets, by default, tend to transfer water from low value but potentially critical uses like agriculture or pastoral activities to more profitable uses such as industry. Flows to the environment must likewise be protected. These key elements have often been left out of existing water markets. For example, Chile has been plagued by problems of inequity and speculation, with</p>		
Regional			
Global			

companies sometimes buying up water rights to the detriment of local residents.

Indirect pricing signals: Raising water prices is a good way to help water users adjust their levels of consumption. Prices can be raised directly, through water rate increases, or dynamically, through markets. However, the idea of pricing water is often politically fraught. Instead, prices can be raised indirectly in places where directly raising prices is not politically feasible. For example, in India, electricity is heavily subsidized, making it cheap to operate groundwater pumps, causing greater demand for energy than systems can handle, and leading to shortages. Directly raising water and electricity prices is not tenable in India, so instead, one region opted to create two separate electricity systems, one for domestic use and one for agricultural use. Domestic electricity is priced at metered rates, whereas electricity for agricultural use remains free, but only operates for 8 hours per day rather than 24. By restricting the availability of groundwater, the program has also indirectly raised prices on the informal market by 30-50 percent. This system, which has been selected as a priority pilot in the new government's five-year plan, has also increased the regularity of power supply for critical municipal uses such as hospitals.

Subsidies reform and agricultural policies: Holistic water management, or integrated water resource management (IWRM), in which multiple stakeholders have a voice in water resource planning and allocations, may be the holy grail. However, reforms to individual policies can go a long way towards improved water management without reform of the governing systems. For example, reductions in water or energy subsidies will have an immediate effect on water prices, although such changes may be politically untenable. Another example is crop zoning, whereby national or provincial governments proscribe which crops can be grown in which agricultural areas. This kind of zoning helps avoid irrational cropping decisions, such as growing thirsty crops like rice, cotton, or alfalfa in dry regions, decisions that are possible because of artificially low water prices.

LAND-USE

Externality: *Disruption of land-based ecosystems*

Scale of externality: *LOCAL / REGIONAL*

GOVERNANCE

	Developed	Developing	All
Local	See Incentives.	<p>Best practices target issues around land tenure reform, first and foremost:</p> <p>Rwanda's low-cost land registration system, for example, helped foster investment. Ethiopia's reform allowed widows to secure their land rights. India's computerization of land registries expanded credit disbursements in urban areas. In China, amid an urban expansion, the government awards rights to farmers, so they will gain, rather than lose out, in the process.</p> <p>The principles are simple. There should be laws – and institutions – that recognize existing rights, and land policies should be clear, equitable and inclusive. Land-use planning and taxation should provide benefits to the public at large, and state land should be acquired – or disposed of – in a transparent process that protects existing rights. Land ownership information should be comprehensive, accessible and reliable. Interested parties should have access to institutions that effectively manage conflicts and disputes. Large-scale land transfers should benefit the local economy.</p> <p>Decentralization has made local governments the heart of much actual land governance. Grassroots efforts for local solutions are multiplying, from Kenya's Kibera to Brazil's favelas. Many governments (e.g., Brazil, Indonesia, Tanzania) are making national attempts at pragmatic solutions to land governance</p>	<p>Development challenges call for new paradigms of land resource management and tenure which take into account whole ecosystems and generate public goods.</p> <p>The demand for new approaches and tools from across the globe and the political spectrum is strong. Calls come from all groups and sectors, for secure and sovereign rural livelihoods, for responsible agricultural investment, for corporations to ensure land governance along their entire supply chain, for agroecology, for community-management of forests, for better timber management and carbon storage, for indigenous self-determination, and for the inclusion of informal settlements into the central life of cities.</p>

		which balance social and environmental goals with growth and investment aims. New streams of finance from urban value capture, agribusiness investment, ecosystem services and forest carbon payments create new opportunities for negotiating solutions about land tenure and use and achieving triple wins for livelihoods, productivity, and sustainability.	
Regional			<p>While the issues are regional, there is not a strong institutional base for dealing with governance at a regional level. Unlike water, land does not have a regional institution such as the river basin agreements that are devoted to regional governance.</p> <p>On the other hand, awareness of the regional issues in land governance can be dealt with in domestic legislation, civil society initiatives, partnering arrangements across borders, knowledge sharing, etc. It is likely that most of the governance initiatives in recognition of customary land, corporate engagement and corporate accountability, formalization of land holding and other priority areas will operate outside the bounds of a formalized regional governance framework.</p>
Global			

MONITORING

	Developed	Developing	All
Local	<p>So far, the World Bank has partnered with over 40 countries to use the Land Governance Assessment Framework (LGAF) as the basis for broad-based assessment of issues of land governance. The LGAF employs a participatory process that draws on local expertise and brings together representatives of government, academia, civil society, and the private sector. The process aims to identify good practice and reach consensus on priority areas for reform and for the testing, evaluation, and roll-out of new approaches to address key gaps in land governance. In many cases this process has pushed land issues higher up on a country's agenda and created a broad-</p>		

	<p>based consensus on key reforms that supports continued multi-stakeholder dialogue based on progress monitoring at the national or sub-national level.</p> <p>Conversions to and from cropland are the most extensive anthropogenic land cover changes globally (including conversions of natural and semi-natural land to cropland and conversions from cropland to artificial surfaces). Also of relevance are “built-up area change” and “surface water change.”</p> <p>Loss of biospheric integrity and pressures on ecosystem services are among the most pressing global environmental challenges. Changes in land cover and land use are the leading contributors to terrestrial biodiversity loss. Therefore, loss of natural and semi-natural vegetated land is presented as a high-level proxy for pressures on biodiversity and ecosystems.</p> <p>The monitoring and evaluation of land use and land use regulations should be improved. Too little is known about how land is used and how it is regulated. This includes particular land use regulations that are under the control of local governments. At present, the lack of monitoring and evaluation makes it difficult to identify which policies work well at the local level and which do not. Furthermore, the aggregate effects of such land use regulations on regions or even countries are almost impossible to estimate because no systematic information exists about the characteristics of regulations at the local level. Better monitoring and evaluation is especially important if land use policies focus more strongly on providing incentives and less strongly on setting restrictions. While such a policy shift can improve the effectiveness of land use governance, it also creates greater uncertainty about how land use is affected by policies. Compared to traditional land use planning instruments, incentive-based instruments give individuals greater responsibility, which makes the consequences of policies more difficult to predict. In order to ensure that land use policies achieve their objectives, any shift towards more flexible and incentive-based instruments should be accompanied by better monitoring and evaluation.</p>		
Regional			
Global			

INCENTIVES

	Developed	Developing	All
Local	<p>Currently, fiscal instruments are used too little to influence land use. Take for example transport policies. The most important cause for the emergence of suburban sprawl in the 20th century has been the declining cost of car use. Public policy has played a major role in this decline and still influences the cost of using cars through a complex system of taxes and subsidies. Reducing the subsidies to car use and increasing taxes on it—for example by implementing</p>	<p>Local governments have weak tax bases, as a large proportion of their residents cannot be taxed because they are not registered and recovery of existing taxes is poor. As a result, they are desperately short of the money they need to fulfil their obligations and meet local people’s expectations. Urban land registers (ULRs) can improve municipal tax receipts when used as a tool to identify all local land assets and create a broad but moderately priced tax base, thereby generating</p>	<p>Public policy primarily uses spatial and land use plans and environmental and building code regulations to affect land use. These instruments restrict how land can be used, but cannot influence how individuals and businesses would like to use land. They can also take a long time to elaborate and even longer to effect change. Often, they leave little scope for efficient, community and market driven land use patterns to emerge. Many other policy instruments—beyond those within</p>

	<p>congestion charges in large urban areas—can go a long way towards fostering more compact patterns of development. To provide the right incentives, a broader range of policies and, in particular, fiscal policies, needs be used to affect land use. This requires greater efforts to coordinate policies between sectors and levels of government.</p> <p>Already today, land use policies are often coordinated across policy fields, such as environment, transport and housing. In the future, this coordination will have to intensify and should include finance ministries. Further, all levels of government, from national to local, have to work more closely to develop effective land use policies.</p> <p>Some best practices learned from OECD countries (Poland, France, The Netherlands, and Israel):</p> <ol style="list-style-type: none"> 1. Land use planning (LUP) needs to balance public and private interests - Whether positive or negative, land owners tend to not consider externalities in their decisions. The consequences of each land use decision are very context specific and it is impossible to develop a general system of taxes and subsidies that would provide the desired incentives in each case. Instead, case-based regulatory decisions have to be made that weigh the interest of land owners in developing their plots against the desire of the general public for developments that are beneficial to surrounding areas. 	<p>significant tax revenues that cost relatively little to collect.</p> <p>The ULR consists of a register and a basic map, which allow the municipality to determine how much tax each occupant should pay and to issue tax demands. As it is based on occupancy, the ULR avoids any problems associated with the parcels' legal status; in fact, receipt of payment constitutes proof of occupation that residents can use to secure their occupancy rights with third parties, the municipality or the State. Therefore, taxpayers benefit by gaining recognition of their occupancy. Although this has no legal value, it helps consolidate their status as occupants, and an annual tax also encourages the productive use or assignment of unused lands. Therefore, land tax can be used a tool to consolidate land rights 'from the bottom up'. Finalised in Benin, and disseminated in many large cities in developing countries, ULRs have led to a significant growth in tax receipts and municipal revenues. However, their implementation to date has been over-dependent on external agencies and insufficiently appropriated by municipal teams.</p>	<p>the domain of land use planning systems—create incentives to use land in specific ways. Frequently, these incentives do not correspond to the objectives of the land use planning system. For example, many countries aim to limit urban sprawl, but provide financial incentives for the construction of single-family homes. Consequently, much more restrictive planning regulations are necessary to reduce sprawl. In many cases, planning systems simply fail to achieve their objectives due to overwhelming pressures from contradicting land developments.</p> <ol style="list-style-type: none"> 1. Instruments designed to affect land use rely primarily on restrictions on how land can be used 2. Greater attention should be paid to policies outside the domain of spatial and land use planning (tax policies, fiscal and intergovernmental transfers, agricultural policies, energy policies). Ideally, countries should use the potential of public policies – in particular tax policies – to provide incentives as a tool to steer land use 3. Well-designed tax policies are crucial for achieving spatial objectives. For example, high fuel taxes make it costlier to use land in locations that necessitate a long commute and thereby provide incentives for more compact and transport-oriented patterns of development. 4. Transport taxes should be used to encourage compact development 5. Property taxes can be effective instruments to steer land use
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	<ol style="list-style-type: none"> 2. LUP must ensure efficient patterns of Spatial Development. Planning is also needed to co-ordinate public and private investment decisions. Since it is difficult to change land use once land is built-up, development needs to be coordinated in advance. Otherwise, inefficient patterns of development may occur. 3. Land use planning is generally decentralised to local governments - land use planning requires a high level of information on local conditions. Higher levels of government often do not have this information to the degree that local governments do. 4. Land is governed by formal and informal institutions - In some places, there is a wide range of informal partnerships between the many actors involved in the governance of land use, while in others, there is a distinct hierarchy between levels of planning, and the institutions involved operate on the basis of statutorily defined roles. 5. Flexible approaches are needed in order to react in a timely and creative way to emerging challenges 6. Restrictive zoning regulation and single-use zoning should be avoided 7. Land use regulations should not restrict competition between businesses 		
Regional			
Global			

Even though land use planning is primarily a local task and concerns local issues, it has consequences for issues of national and global importance: the long-term stability of ecosystems, **biodiversity**, social justice, food and energy security, long-term economic growth, housing costs, and the mitigation of and adaptation to climate change. Planning also has a crucial role to play to accomplish six of the 17 UN Sustainable Development Goals. They include calls for access to energy, the construction of resilient infrastructure, inclusive cities, climate change mitigation, sustainable use of oceans, and protection of ecosystems/biodiversity.

BIOGEOCHEMICAL FLOWS

Externality: Overabundance of nitrogen and phosphorus in soil which drains into and pollutes water bodies

Scale of externality: LOCAL

GOVERNANCE

	Developed	Developing	All
Local	Information on local-level fertilizer governance is sparse. Governance is largely enacted through economic tools - e.g. taxes.	Information on local-level fertilizer governance is sparse (even more so). Governance is largely enacted through economic tools - e.g. subsidies.	<p>Intensive collaboration between different scientific disciplines and, most importantly, among key stakeholders, including industry, farmers and government agencies is needed.</p> <ul style="list-style-type: none"> • Government: Strong leadership is needed to promote green fiscal reforms, and to ensure that ministries across government understand their importance for human health and the environment. • Regulatory entity/ies: the Ministry of Finance or the government authority responsible for the management of tax revenues drafts the relevant bill for approval in the national/regional assembly. • Revenue collection entity/ies: The tax is collected by the revenue authority, from importers, producers, wholesalers and/or retailers. The revenue might be transferred to the Treasury or allocated to a specified budget (e.g. health promotion programs, agricultural research, etc.). • Tax base/payer: the tax base is the sales of fertilizers. The tax liability is typically borne by manufacturers or importers, with costs transferred to farmers, commercial agriculture companies and/or final consumers.
Regional	Regional initiatives may show how to establish effective mechanisms for promoting	The record of environmental policy innovation in developing countries clearly indicates that	These efforts may point the way forward for collaborative knowledge-creation, target-

	<p>coordination and collaboration among stakeholders. For example:</p> <ul style="list-style-type: none"> • In Japan the Phosphorus Recycling Promotion Council was established in December 2008 - with experts from academia, industry, and the government - to design and implement national strategies for socially robust phosphorus recycling. • The Dutch Nutrient Platform was founded in January 2011, which eventually contributed to launching the European Phosphorus Platform in March 2013 to facilitate dialogue, raise awareness and trigger actions to address the phosphorus challenge. It emphasizes the implications for ensuring food security, geopolitical stability and environmental sustainability in the context of a resource-efficient Europe. • In North America, the Phosphorus Sustainability Research Coordination Network has been established since 2013 to share knowledge and expertise on various dimensions of the global phosphorus system. It includes farmers and growers, food processors, fertilizer producers, waste managers, water quality managers, regulators, and legislators. 	<p>cutting-edge policies, by themselves, are not a panacea. With the possible exception of well-designed public disclosure programs, the success of environmental management initiatives generally has less to do with the particular type of policy used than the institutional context in which it is implemented.</p>	<p>design, and process-implementation for sustainability innovation, all in a transdisciplinary framework. There still remain serious challenges, including how to facilitate serious engagement and fruitful collaboration among stakeholders, what types of joint initiatives and networking contribute to identifying desirable goals and targets and developing complementary skills and capacities, and what factors promote their successful implementation. But from their different starting points each of these initiatives offers something to build on.</p>
<p>Global</p>	<p>Nitrogen and phosphorus are not yet addressed successfully through a policy framework. There is no equivalent of the United Nations Framework Convention on Climate Change, the Montreal Protocol, or the Convention on Biodiversity. That is partly because various stakeholders with different views and interests are involved in the phosphorus/nitrogen supply chain, ranging from exploration, mining, and shipping to use and recycling. That would make it particularly difficult to establish a system for collecting and sharing knowledge concerning natural and social systems, and coordinating responses among the stakeholders. Some attempts at global management include:</p> <ul style="list-style-type: none"> • The Global Partnership on Nutrient Management (GPNM). GPNM provides a platform for governments, UN agencies, scientists and the private sector to forge a common agenda, mainstreaming best practices and integrated assessments in the context of nutrients. • The International Nitrogen Initiative (INI) has been founded to explore and to tackle the “nitrogen paradox”: nitrogen is a key element to allow plant growth, essential for food production. Yet the use of fertilizer to support crop growth – as well as the impacts of other compounds of chemically fixed nitrogen (“reactive nitrogen”, Nr) – may lead to different types of environmental damage. Moreover, as 		

	<p>Nr is “cascading” between environmental pools, it may contribute to environmental impacts at several scales.</p> <ul style="list-style-type: none"> Those involved in these regional initiatives have started to communicate with each other through international conferences such as the Sustainable Phosphorus Summit held in Montpellier, France in September 2014, and the Sustainability Science Congress in Copenhagen as an opportunity to discuss this pressing challenge at the global level.
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MONITORING

	Developed	Developing	All
Local	<p>Developed countries are monitoring nutrients in a variety of ways. Some key takeaways:</p> <ul style="list-style-type: none"> Prioritize watersheds on a statewide/municipality basis for nitrogen and phosphorus loading reductions and set watershed load reduction goals based upon best available information <p>And examples:</p> <ul style="list-style-type: none"> Technologies already exist to recycle phosphorus from different sources. In Japan, for example, a variety of potential phosphorus resources - including food waste, sewage sludge, steelmaking slag, and other industrial wastes - could provide approximately 240 kt per year, which is comparable to the phosphorus demand for fertilizer of around 284 kt per year. Therefore, an appropriate nationwide recycling strategy could potentially provide the majority of phosphorus required for agricultural production within the country. However, only a small percentage of recoverable phosphorus is recycled at the moment, while a significant proportion dissipates to the environment. The reasons include 	<p>Within the framework of WHO and local in-country standards, many countries have put surveillance of water quality high on their list of national priorities. They have introduced different ways of managing and monitoring their water quality. For example:</p> <ul style="list-style-type: none"> Central laboratories - many countries have established their own national water quality laboratories (e.g. Zimbabwe). However, this may require a great deal of resources and a large source of skilled manpower. Governments need to give a firm commitment on such a project for it to be sustainable. For resource-limited countries, on-site field testing is cost-effective for analyzing water quality (e.g. Myanmar). Though less financially burdensome, this still requires an extensive pool of skilled technicians to carry out sampling/analysis. And for both strategies, reliable equipment is vital. Adequate after-sales support in the form of commissioning, training, troubleshooting, and supply of spares and consumables is needed. Additionally, a range of chemical and biological methods are currently used to ensure the safety of water for 	<p>Water quality monitoring is a fundamental tool in the management of freshwater resources, especially when looking at contamination from N and P.</p> <p>A sustained research and modelling effort, supported by water-quality monitoring, is needed to better understand pollutant pathways and the links between pollution causes and effects.</p>

	<p>weak economic incentives, insufficient regulation, technical obstacles and poor anticipation of unintended impacts.</p>	<p>consumption. These methods however suffer from high costs, complexity of use and inability to function onsite and in real time. The microbial fuel cell (MFC) technology has great potential for the rapid and simple testing of the quality of water sources. MFCs have the advantages of high simplicity and possibility for onsite and real time monitoring. Depending on the choice of manufacturing materials, this technology can also be highly cost effective.</p>	
Regional	<p>Regional attempts at monitoring N and P include:</p> <ul style="list-style-type: none"> Regional N budgets and N pathways/emissions. These aim to create regional nitrogen budgets and assess/quantify the respective flows (distinguishing farm, soil, land and total N budgets) The rationale extends from the European Nitrogen Assessment (ENA), budgets on different scales intend to identify intervention points to regulate and abate N flows. 	<p>Information on regional attempts at monitoring N and P in developing countries was sparse.</p>	<p>Further monitoring suggestions include:</p> <ul style="list-style-type: none"> Establishing a nutrient health reporting card for and overview of nutrient flows in key watersheds Developing a shareable nutrient management database with key monitoring data
Global	<p>Global monitoring system does not exist.</p> <p>Quantifying changes in stocks of N and P in agricultural soils is important not only for managing these soils sustainably as required to feed a growing human population, but for N, it is also important for understanding fluxes of greenhouse gases from the soil environment.</p>		

INCENTIVES

	Developed	Developing	All
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<p>Local</p>	<ul style="list-style-type: none"> • Nutrient run-off from farmland which pollutes waterways is too costly or just impossible to monitor at the farm (source) level, therefore one cannot tax actual emissions • tax the inputs (such as fertilizers), which contribute to this non-point source pollution • Taxes on certain pesticides and chemical fertilizers can mobilize fiscal revenues while mitigating the negative effects associated with pesticide/fertilizers application and promoting sustainable agriculture practices. • Input taxes may pose problems when input substitution occurs if the substitute input has adverse environmental effects 	<ul style="list-style-type: none"> • In developing countries, governments are more likely to subsidize fertilizer production or consumption to increase productivity in agriculture rather than to tax them • A few countries, however, are starting to review their support to the sector considering the increasing negative effects on health and the environment and diminishing productivity gains. • Vietnam has, for example, started to consider increasing taxes and other duties on pesticide imports/use to discourage farmers from (over)consumption. However, earlier attempts to impose a 5 % tax on pesticides in the mid-1990s failed due to strong opposition. • In another example, as a condition for project lending, the World Bank succeeded in having Egypt reduce substantially its subsidies for agricultural fertilizers and pesticides 	<p>Input or output charges, taxes, and fees work best when:</p> <ul style="list-style-type: none"> • there are numerous pollution sources • there is little to no monitoring data • damage caused by pollution is directly proportional to the amount of pollution • and there are clear linkages between input or output and the environment
<p>Regional</p>	<ul style="list-style-type: none"> • Organize nutrient management cooperatives in each basin where agriculture is a primary source of pollution • Producers/farmers know the specifics of their basins best. The cooperatives could fund whatever nutrient management strategies they want. They might subsidize the use of phytase in feeds, precision agriculture technologies, or they could negotiate exports to other basins, or establish vegetative buffers in riparian zones--whatever mix of strategies is most cost-effective for them. • The nutrient management 		

	<p>cooperatives could be financed with public funds, or they could be self-financed. Self-financing would give cooperatives more autonomy than government financing, and many farmers are already familiar with voluntary commodity check-off programs.</p> <ul style="list-style-type: none"> • The most efficient tax to incentivize cooperatives would be indexed to nutrient concentrations at basin outlets, and would vary by basin. Tax rates would be adjusted periodically to reflect changes in water quality. The tax revenues generated from each basin would finance the basin's nutrient management cooperative. The most polluted basins would get the most funds to control their nutrients. Producers in those basins would have the strongest incentives to cooperate in minimizing aggregate nutrient loadings in order to minimize their taxes and remain competitive with producers in other basins. A basin's tax would be eliminated when the basin achieves some realistically attainable water quality target. 		
Global			