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WHICH WATER QUALITY FOR WHICH USES? OVERCOMING OVER-ZEALOUS USE OF THE PRECAUTIONARY PRINCIPLE TO RECLAIM WASTE WATER FOR APPROPRIATE IRRIGATION USES[Ψ]

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Abstract

The growing conflicts over water resources looks set to worsen in the context of climate change. High quality groundwater resources ideally reserved for domestic uses are diminishing especially where urban centres are growing, as treatment facilities cannot always keep up. The farming sector could better manage water quality and quantity to produce food sustainably, keeping economic activity in rural areas. Purification techniques are progressing in efficiency at growing cost, removing the polluting load from effluent which is potentially useful for agriculture. Competing domestic and agricultural water uses can in fact be complementary as can be seen in green belt of megacities.

Policy making based on the precautionary principle are developed from existing regulations and guidelines. Because of the lack of scientific results, most often policies confuse prevention and precaution. A balanced application of the precautionary principle would enable a rational development of reuse schemes, preserving good quality resources and taking benefit from disposed minerals for crops. An economic approach along with risk assessment would avoid disproportionate costs to gain security. Consistent information and training should be organised to enhance public and worker awareness of risk management.

KEY WORDS: water management; water scarcity; waste water reuse

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[Ψ] Quelle qualité de l'eau pour quels usages? Surmonter les excès de zèle utilisation du principe de précaution pour récupérer les eaux usées pour l'irrigation appropriée utilise.

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RÉSUMÉ

Les conflits atour des ressources d'eau semblent résolus à empirer dans le contexte du changement climatique. Les ressources d'eau souterraine de bonne qualité réservées pour des utilisations domestiques diminuent alors que les centres urbains grandissent et que les équipements de traitement d'effluents ne peuvent pas toujours suivre. Le secteur agricole pourrait mieux gérer la qualité et la quantité d'eau qu'il utilise pour produire une alimentation durablement, maintenant une activité économique dans les espaces ruraux. L'efficacité des techniques de traitement progresse à des coûts croissants, alors qu'une partie de la charge de pollution de l'effluent serait potentiellement utile pour l'agriculture. Les utilisations domestiques et agricoles de l'eau qui sont concurrentes pourraient en fait être complémentaires comme on peut le voir dans les ceintures vertes des mégapoles.

Les politiques de gestion des effluents fondées sur le principe de précaution sont développées à partir de règlements existants et autres guidelines. À cause du manque de données scientifiques, le plus souvent ces politiques confondent prévention et précaution. Une application équilibrée du principe de précaution permettrait un développement raisonnable d'accords des pratiques de réutilisation, préservant les ressources de bonne qualité et bénéficiant des minéraux normalement rejetés pour les cultures. L'approche économique et d'évaluation du risque éviterait des dépenses disproportionnées pour gagner en sécurité. Une information cohérente et la formation des acteurs impliqués devraient permettre d'augmenter la capacité du public et des ouvriers à gérer une part du risque.

MOTS CLES: gestion de l'eau; pénurie, réutilisation d'eaux usées

INTRODUCTION

Conflict over water resources is a recurring theme in the media, backed up by scientific observations (Pachauri, 2011). Clashes over water use look set to worsen in the light of climate change forecasts, with increasing variability expected, especially in Africa (Dai, 2011).

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WATER RESOURCES

Surface water provides three quarters of the world's domestic water. As low levels of water drop to severe levels, the polluting load on surface water increases (Pachauri, 2011). While Mediterranean countries are particularly affected, the phenomenon is being increasingly observed in northern areas which are experiencing unusual periods of drought, as seen in spring 2011 in Belgium, western France, the UK and Ireland, and in the unforgettable fires in Russia in 2010[1].

Higher quality groundwater resources, which should ideally be reserved for domestic uses, can become extremely strained when used for irrigation. Tension on supply quantities can result in a dramatic drop in groundwater levels. Additionally, the quality of groundwater resources may be threatened by exposure to agricultural or industrial pollution, which spreads directly beneath the aquifer. Tensions may concern both the quantity and quality of the supply of water in coastal areas, where a drop in groundwater levels can lead to intrusion of brackish or salt water (Green et al., 2011).

WATER USES

The steady growth of urban centres, often located on the shores of rivers or lakes, increases demand for high quality water along with output of wastewater. Since treatment facilities cannot always keep up with the pace of change, urban growth can cause acute strain on water intake and outflow, making it difficult to provide a high quality water supply that can be made suitable for drinking at acceptable cost over the long term.

The failings behind industrial disasters which receive high-profile media coverage have contributed to negative stereotypes of industry. Despite the efforts of many sectors to minimise their environmental impact – through measures that can be very costly due to a lack of purpose-designed technical solutions approved by regulations – society is inclined to view industry as a source of chemical and thermal pollution. Due to the wide ranging quality requirements for industrial water supplies, industries that incorporate their own specific water treatment processes into their activities are thus more conscientious about maintaining water quality.

Across the board, agriculture puts the greatest pressure on water resources in terms of

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[1] Europe is facing the worst drought in century, April 2011, http://crisisboom.com/2011/04/26/europe-is-facing-the-worst-drought-in-century/

volume. The farming sector is often accused – sometimes rightly – of mismanaging water quality and quantity and causing directly or inducing indirectly pollution. However, agriculture has made tangible advances in technological, social and organisational terms, in both North and South. While further progress is needed, focus must stay centred on the purpose of irrigation, which is to secure sustainable food production. It is important to remember that in most cases, agriculture is a crucial activity in rural areas. In developing countries, life without farming triggers an influx of rural migration to urban areas which is unmanageable in social, economic and public health terms.

Irrigated farming creates opportunities thanks to its capacity to cope with water of mediocre quality, especially for non-food crops. As an alternative to the standard approach of trying to curb pollution by making purification techniques more efficient – at spiralling cost – irrigation can make do with, and even reuse, part of the polluting load extracted from wastewater or released into the environment.

Notwithstanding crisis situations – which can often be resolved only through hard-hitting restrictions – it would seem that competing water uses can in fact be seen as complementary.

QUALITATIVELY MATCHING RESOURCES TO USES

Optimising the allocation of water to different uses according to corresponding quality requirements appears to be an appropriate way to tackle the burden on the water cycle. A number of factors need to be taken into consideration to ensure optimal management of supply volume and quality:

- requirements specific to each type of use (domestic, irrigation, bathing, industry, ecosystems);
- regional factors (especially given that environmental, economic and social balances are at stake), which should be considered individually as well as in relation to one another at territorial level;
- social acceptability, especially regarding reuse of treated wastewater;
- public health, which is of course a pre-requisite.

One method of optimisation is to reallocate groundwater to domestic use and surface water to and agricultural use, for example by setting up agreements within a region. This method is used to allocate groundwater in the Perpignan region of the Roussillon plain in southern France[2].

Another method of optimisation is to channel poor quality water into suitable uses. To optimise the water cycle, water uses should be ranked in a hierarchy of quality requirements, from the most demanding (drinking water, fish farming) at the top, to the least demanding (biofuels, farming, fire fighting, etc.) at the end of the cycle. This method must be supported by a suitable technical and legislative framework. Such re-prioritising can reduce the polluting load (a waste product from one level can be used as input for the next level) while maintaining the environment's natural purification capacity.

Numerous examples of treated wastewater reuse are reported (firewood, timber, cereals, etc.). Regions suffering from water scarcity (Spain, Israel, Cyprus, Tunisia, Australia, California, etc.) have a history of using treated wastewater directly to maintain golf courses and landscapes on the outskirts of cities, or parks like in Madrid, and Palma de Majorca, as well as storing treated wastewater in contained aquifers. France has a relatively established track record in this area: for more than 15 years, 700 ha of cereal crops including seed production[3] have been irrigated with recycled urban wastewater from Clermont-Ferrand, along with the effluent from a sugar processing plant.

However, it is important to account for the diversity of approaches. In southern countries, where the quantity of supply remains a problem, there is a political consensus on the reuse of treated wastewater, and readier acceptance of the associated risks. Conversely, in more temperate countries where the tension is felt less, or at least is highly variable, over-zealous application of the precautionary principle – now enshrined in European law (Maastricht treaty, 2005) – precludes policymakers from taking the least risk. Such risk aversion persists despite the lack of accurate, reliable scientific arguments. For example, Spanish regulations stipulate that wastewater reused for irrigation purposes must be analysed for Legionella; this requirement is founded on data from cooling towers, where conditions differ vastly from those of irrigation. Californian regulations require reused wastewater to present a minimum residual chlorine content of 1 ppm.

The 2009 French report of 'Parliamentary Office to review scientific and technical decisions'[4] found that adoption of the precautionary principle in the constitution had disconnected policy thinking from scientific thinking and prompted a number of adverse effects:

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[2] SAGE Nappes plio-quaternaires de la plaine du Roussillon, 2011. http://gesteau.eaufrance.fr/sage/nappes-plio-quaternaires-de-la-plaine-du-roussillon

[3] L'irrigation au service de la gestion de l'eau, http://www.waternunc.com/fr/Horizons_Limagne.htm#ir-rig

[4] Le principe de précaution : bilan de son application quatre ans après sa constitutionnalisation, http://www.senat.fr/notice-rapport/2009/r09-025-notice.html

confusion between prevention and precaution; use of the precautionary principle for proven risks whose scope is unknown, and invoking the precautionary principle to address 'concerns considered as legitimate on the part of certain communities' which result from a legal precedent by which 'the mere presence of equipment[5] now constitutes damage'.

This article highlights a number of scientific considerations which can help improve management of water resources through the use of treated wastewater. The precautionary principle, whose diverse interpretations are discussed in UNESCO's (Comest, 2005) report, should be applied strictly and in a well thought-out manner.

GUIDELINES AND REGULATIONS

World Health Organisation (WHO) Guidelines: A basis for regulation

The quality of water used for drinking, irrigation and recreational purposes exerts a significant influence on health throughout the world. Individual countries have consequently developed standards to protect public health. The water section of the World Health Organisation (WHO, 2006) has published a series of Guidelines which include an authoritative recognised assessment of health risks associated with water, as well as assessing the effectiveness of techniques to control these risks. Use of the term 'guidelines' is deliberate; these are not international standards, and the recommended values are not mandatory limits. The aim is to provide a reasonable scientific basis for developing national standards. To date, the guidelines have served as the cornerstone for various national and regional directives, as well as more advanced legislation such as in California, which seeks to address specific constraints while tailoring regulations to local environmental, cultural, economic and social factors.

The WHO has designed an integrated approach (Figure 1) known as the Stockholm Framework, which combines risk assessment and risk management to tackle water-related diseases. Although the framework was developed for infectious diseases, it is equally applicable to diseases caused by water-related exposure to toxic chemicals. This model sets the assessment of health risks as the basis for defining health targets and determining guideline values. Such values may then be used for basic checks and to assess the combined impact of these practices on public health.

[5] The equipment in question was a mobile telephone relay antenna

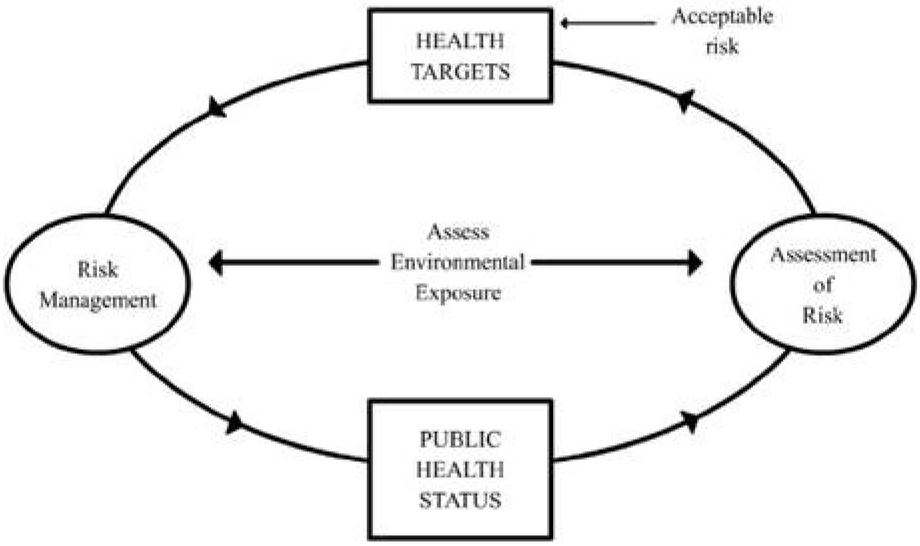

Figure 1. A simplified integrated framework – repeat cycle (Bartram et al. 2001)

UN Food and Agriculture Organisation (FAO) Guidelines

The FAO has published numerous guidelines on water quality in the production of food (crops, livestock and aquaculture), fibre and energy. These guidelines cover three main issues: use of water in farming; the impact of agriculture on aqueous environments, and levels of quality throughout the food chain, from farm to fork. A number of different outcomes are sought:

- maximise yield by not hindering production with water of non-compliant quality;
- improve agricultural yield by reaping the benefits of nutrients (N and P) and organic matter present in treated wastewater;
- recommend specific practices to cope with poor quality water (crop types; irrigation techniques, and sanitary practices to minimise contamination of crops);
- uphold the productive capacity of the soil (crop growing practices, amendment, etc.);
- minimise or reduce the environmental impact further on in the cycle, and prevent contamination and the spread of contagious disease.

Each outcome is covered by technical guidelines and recommendations; in some cases specific standards are also referenced. The WHO and FAO have worked in close collaboration to jointly produce a reference document designed to help set health standards relating to reuse of wastewater and excreta in agriculture. This guide (UN Water Development Report, 2003) may serve as a reference document for government in drawing up regulations in these areas.

National regulations

An extremely diverse range of regulatory frameworks can be found at national level (Huertas et al., 2006). Some examples are listed below.

At European level, there is no standard regulation governing the use of treated wastewater in irrigation. In France, the use of treated urban wastewater to irrigate crops and landscapes is regulated by the Law Decree of 2 August 2010. This decree sets out the health and technical conditions allowing for the use of treated wastewater for the purposes of irrigating crops and landscapes only. It describes four health quality levels, and stipulates restrictions on usage, distance and soil characteristics. The overriding goal of this regulation is to govern methods of sprinkler irrigation – the most common type of irrigation in France – in order to minimise risk of drift[6] and transport[7].

Tunisia first set out conditions allowing for the use of treated wastewater in a Law Decree[8] passed in 1989. The quality standards applicable to use of this water for irrigation purposes were modelled on WHO guidelines.

The Australian Guidelines for Water Recycling (AGWR, 2006) are not based on the findings of any post-treatment tests; these guidelines are instead modelled on a generic risk management framework which is applicable to any system for recycling treated wastewater, grey water or run-off.

In Israel, where the pressure on water resources has propelled the reuse of treated wastewater to the level of national priority, there is a policy to progressively substitute freshwater with treated wastewater in irrigation. In 2010, the Israeli parliament adopted a stringent new regulation that prescribes 38 biological and chemical parameters[9].

Expertise and Standardisation Initiatives: The Road to International Consensus

The reuse of poor quality water entails complex interactions of environmental, social and health issues. International standards in this area can only be established by mobilising specialist expertise. Yet with the exception of security standards, ISO and other standards are merely reference documents whose application is voluntary. Such standards reflect international consensus reached by experts designated by participating countries. Israel, the world's most experienced country in this field, is currently convening the ISO PC253 project, 'Treated Wastewater Reuse for Irrigation'. In the course of discussions, a string of gaps in the scientific literature has come to light. There is a dearth of data on health risks and choice of technology.

[6] Displacement of the wetted surface by the wind

[7] Displacement of water beyond the wetted area in the form of small droplets which may produce aerosols

[8] Law Decree No. 89 –1047 dated 1989, amended by Law Decree No. 93 – 2447 dated 1993

[9] Government Decision on Upgrading Effluent Quality Cabinet Decision of May 5, 2005: Upgrading Effluents for Unrestricted Irrigation and Discharge to Rivers Updated: 16/12/2007

Such knowledge gaps may encourage legislators to apply the precautionary principle over-zealously although existing long-term practices may well turn out to be harmless.

DRAWBACKS OF THE PRECAUTIONARY PRINCIPLE: EXCLUSIVE HARDLINE APPLICATION

Tertiary treatment facilities feeding into a wastewater reuse area are often scaled disproportionately due to the lack of recognised methods for risk assessment, risk of malfunction of treatment facilities (technical flaws, separation of networks, maintenance, etc.) and over-restrictive legislation. This unsuitable scale leads to the loss of a large proportion of potentially beneficial nutrients, minerals and complex molecules which could be extracted from wastewater. Yet heavy metals, nitrogen, phosphorus and many other elements that are considered pollutants when released into the environment, may in fact be inputs for other activities. One potential course of action is to foster Green Economy practices that seek to draw maximum benefit from alternative sources of water and materials such as heavy metals, complex molecules such as polyphenols, and minerals[10]. The payoff from harnessing these unexploited resources would help the 2.6 billion people living on untreated water to be connected to treatment facilities. This may contribute to reducing the number of people without access to drinking water (900 million in 2009), thus moving closer to achieving the Millenium Development Goals (MDG). Progress remains to be made in researching separation techniques to develop methods for selective purification of wastewater. Agricultural reuse of treated wastewater is an effective ready solution despite the lingering presence of risks related to managing wastewater quality.

Understandably, politicians are hypersensitive to public opinion. Health alerts and scandals over the past two decades – asbestos, Escherichia coli, bird flu, HIV-infected blood, dioxins from incinerators and BSE – have prompted highly conservative application of the precautionary principle among the political class. The situation is compounded by the fearful reluctance of decision makers and state agents to expose themselves to liability proceedings. The end product of such fears is an extremely prudent body of legislation and regulations. As stated in the French parliamentary report cited above: ‘The State can no longer merely manage risk; it has to manage social relations. […] The precautionary principle is becoming a tool to manage public opinion. This interpretation of the precautionary principle ultimately serves to

[10] Toward a green economy, Water, Investing in natural capital, 2011.
http://www.unep.org/greeneconomy/Portals/88/documents/ger/4.0_Water.pdf

disqualify scientific expertise.'

Although the precautionary principle has rightly prevailed and been incorporated into law, it has failed to prevent the recent health crises listed above. The principle alone is not enough to prevent an accident from re-occurring. Instead, the system-based, sector-based or process-based approaches of quality management should be adopted, at least on a regional level (FAO, 2010). Risk assessment should be 'balanced' and 'reasonable' to counteract the irrational fears that can far too easily take hold in a society or community. A solid economic, or even macro-economic, approach should be taken in risk assessment, and there must be real political will to match disproportionate costs to the perceived security gain through analysis of suitable values.

In this respect, the European Commission is reluctant to regulate the use of treated wastewater for irrigation purposes. Despite a patent need for such regulation in southern regions, such a need is not felt in the majority of EU member states. It is equally surprising that the Commission has not produced a regulatory framework linked to the Water Framework Directive (WFD), which sets out a quality scale for environments receiving outflow of wastewater from treatment plants, although no quality constraints exist for irrigation water sourced from such environments. However, certain aspects of the WFD have an influence on the potential for reuse of treated wastewater, namely, the introduction of municipal plans to conserve water resources; rollout of financial incentives by governments to reduce domestic water consumption, and a water pricing policy that approaches the real cost of water supply and treatment, while bearing in mind the positive externalities.

Perceptions of treated wastewater as a resource reflect the widely divergent approaches in different countries. In arid climates, the overriding challenges are to manage the water resource and control the risk of soil degradation (primarily salinity). Conversely, the key challenge in temperate climates is protection of the environment. Alternative water resources are only sought at local level, where landscapes or farmland are located close to a treatment facility, and adequate winter leaching means that any risk to the soil is minimal. It is extremely risky to attempt a single approach to managing and reclaiming wastewater without accounting for local climatic conditions, not to mention social and environmental conditions.

Potential Responses

The responsibility lies with research to overcome reluctance and overly cautious reactions by tailoring risk assessment methods from the fields of industry and public health to this particular purpose. But first, greater insight is needed into the mechanisms at work in the interactions between the environment and methods of wastewater reuse. Gaps persist in many areas of specialised research, physical (transport, run-off, drift or aerosols), chemical (solar activity, soil degradation, leaching) and biological (growth of biofilms in which pathogens may survive). These knowledge gaps stem from the use of raw data from other fields which is applied indiscriminately to the area of wastewater reuse.

In this regard, the approach adopted by Israeli legislation merits particular attention. Every element and stage in the reuse cycle is weighted for its protective capacities, in other words, the number of barriers to contamination. Under this system, tertiary treatment may score the same as a watering system that inhibits contact with produce. The risk prevention score is boosted by factors such as inedible peel on fruit, or cooking or any other form of processing.

Monitoring policy must remain reasonable at the risk of prohibiting all wastewater reuse due to costs. Flexible procedures, by which initially intensive monitoring could be gradually tapered down in the absence of alerts, would generate substantial cost savings in the area of analyses. Such savings should increase over time provided wastewater quality levels remain stable overall (except for daily or seasonal fluctuations), and insofar as the associated activities also remain stable. Elsewhere there is a greater safety gain to be achieved from training operators and automating monitoring processes than from increasing the number of analyses.

No real progress can be made unless a solid scientific communications strategy can win out over the media's often sensational and indeed anxiety-inducing portrayal. Such a strategy should aim to dispel preconceived ideas and shed new light on figures, backed up by solid data supplied by transparent monitoring. It should help people, if not to reach a consensus, at least to grasp the challenges and risks involved, and understand the processes under the joint control of the health and food sector, administrations, consumer associations and Non Governmental Organisations (NGO).

PROSPECTS FOR REDUCING/RECYCLING POLLUTANTS AND VIABLE TECHNIQUES: INTEGRATING IRRIGATION INTO THE TREATMENT CYCLE

The reuse of poor quality water offers prospects from both an economic and environmental point of view, since a waste product from one type of use can be an input for the next stage. Proper insight into this cycle of reuse is needed to make it workable. However to date, wastewater treatment methods have been primarily designed to eliminate pollutants with no view to recycling. One intriguing example is phosphorus: this element is costly to remove from wastewater and has a significant impact on the environment. Yet only an estimated 70 years of accessible reserves of this essentially non-renewable, mined resource are left. A total of 75% of the world's degradable phosphorus is sourced from two countries, Morocco and Mauritania.

Exports are banned in China and other countries. The demand for phosphorus is growing in line with the spiralling demand for food; poor countries are experiencing a shortfall, while in rich countries excessive quantities are applied and blocked by the soil. There is an urgent need to recover this element which is essential to food production which, when released into the environment through wastewater, exacerbates the incidence of eutrophication in aqueous environments. At present, 'chemical' recovery is costly, and plant reuse from wastewater is tricky since levels present in reclaimed waters are constant whereas the needs of plants are not.

Advances in analysis and toxicology have revealed the impact on the environment and on human health of low doses of by-products from the processing of chemical consumer goods. Fish are feminised by hormone derivatives, pesticide breakdown products are genotoxic, and many other chemicals are released in industry and household waste. The spread of these pollutants can lead to photodegradation, or exposure to biological and chemical oxidation in the soil (Petrovic et al., 2007; Escher et al., 2011). A refined level of water treatment is therefore needed to ensure treated wastewater is suitable for agricultural purposes. Refined treatment will eliminate pollutants capable of passing through standard treatment cycles. However, certain chemicals, such as hormones used in animal health, may not be caught even by this soil-based filter (Liqa and Priyantha, 2008).

Treated wastewater contains nutrients that may be beneficial to plants, often substantially improving the energy balance scoring of crops. For example, if we look at fertilisation in an irrigated potato crop, its energy balance scoring varies from 60 - 75% of the total scoring for the activity (Ginoux, 2010), and at least two-thirds of this value is for nitrogen. Although methods for extracting nutrients still need to be refined and made affordable, there is enormous potential at stake. Wastewater also offers a source of organic matter for impoverished 'modern' agricultural soils that receive little plant residues. Despite its rapid fermentation, wastewater organic content can help to improve soil quality toward greater salt tolerance and stimulate biological activity.

Project analysis is continually hampered by the relatively long distances between sites of production and potential consumption of treated wastewater. Green belts offer exciting potential for urban wastewater recycling by the small-scale crop growers who supply urban markets. Quality requirements for fruit and vegetable irrigation are of course much more stringent but tend to be lower for landscapes and forests. Yet both offer viable opportunities for wastewater reuse, as is frequently prescribed in water management strategy plans such as the WFD.

Small-scale green belt crop growing presents a considerable health risk for both farmers and consumers in many sprawling southern cities where open sewers are commonplace. The solution is certainly not to abandon these methods of farming, which cater to real demand, but instead to determine the technologies and practices required to render wastewater suitable for use. This technical approach should be accompanied by consumer education and training for farmers.

In rural areas with scattered habitats, such as Sub-Saharan Africa, irrigation affords opportunities to reuse wastewater treated in suitable decentralised treatment facilities, again with proper education and training.

We have highlighted above the paradox of the regulatory limitations in the use of treated wastewater in irrigation, despite the absence of any regulation on water quality for irrigation purposes. Even in northern countries, it is not unusual to find agricultural effluent pumped into rivers whose low water levels are sustained by outflow from treatment plants. A strict risk analysis would undoubtedly conclude, in spite of treatment plant monitoring regulations, that the health risk is no higher than if treated wastewater were converted into irrigation water via a defined, fully scaled and tested process. If only because crops irrigated with treated wastewater would be subject to monitoring, as would irrigation management, which is not the case in direct pumping from the river.

At the top of the cycle, urban wastewater is available in copious quantities and proves easiest to reuse in view of the fairly precise locations of outlets that could be fitted out for the purpose. Further down the cycle, the same urban centres consume farm produce such as fruits and vegetables, while green areas and forests, either in the city or its outskirts, are needed to balance out the urban environment and the lives of city dwellers.

Town planning schemes should therefore incorporate the city, its demand for water, food, materials and energy, need for recreational areas, generation of waste, and reuse of waste to satisfy demand, all at a ‘proportionate’ overall cost that is affordable in the long term. There is no reason why the principle of ‘polluter pays’ should not be upheld, which would make the treated wastewater resource free of charge at the source, at the stage of output from the treatment facility. The user of this water should cover the cost of the service, i.e. conveyance to the point of consumption at the required pressure and flow rate. However, this straightforward approach does not determine how to equally split overall costs, which can be more complex (FAO, 2010). The scientific approach must be combined with technical solutions based on socio-economic analyses.

SOCIAL HURDLES AND CONSENSUS AMONG STAKEHOLDERS

While the reuse of treated wastewater is generally accepted as a logical solution to alleviating the burden on water resources, surveys produce varying results depending on the level of water scarcity experienced locally (Brown and Davis, 2007) and where people are more closely affected by water reuse[11]. Individuals are prepared to reuse their own grey water, but not that of their neighbour. Agri-food businesses unwilling to stake their image prefer to implement a blanket ban on water reuse in specifications for their suppliers, dismissing the notion of checking procedures.

Groundwater recharge is a technique used to offset salt water intrusion or to generate an emergency water reserve; any immediate risk of contamination with treated wastewater may be curbed by leaching through the soil matrix. However, the practice of topping up groundwater recharge is severely frowned upon. Negative attitudes can only be changed over time by engaging the public and highlighting positive data without glossing over the risks (Jeffrey and Seaton, 2004).

By 2008 (Liqa and Priyantha, 2008), 70% of cities in developing countries were using some wastewater, in many cases untreated. This helped to maintain nearly half of their green belt land, representing almost 20 million hectares of rice and vegetables, 70% of which was harvested and sold by women thus enhancing their emancipation. Consumers in these cities report that they prefer not to eat food produced with wastewater, but are generally unaware of the fact when they do so. These unofficially tolerated practices tend to evade detection even in countries with appropriate regulations. However, farmers themselves employ risk prevention strategies such as drip irrigation, washing produce, and selecting water according to 'intuitive quality criteria' such as smell and occasionally taste.

We are seeing a growing number of examples of water sharing or concerted water management adapted to quantity and quality requirements. In Jordan, where the King Abdullah Canal is the main source of freshwater for the city of Amman and for farmers in the Jordan Valley, this highly interdependent situation is the subject of historic negotiations within the country itself and with neighbouring Israel. Change is expected to continue in the short term due to spiralling urban populations, costs of water supply (conveyance and treatment), uncertainty about climate change and the continued drop in groundwater levels. Collectively, these factors will force the farming sector to adapt once again to using less water more efficiently (Courcier et al., 2005).

[11] http://www.raeng.org.uk/news/releases/shownews.htm?NewsID=685

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CONCLUSION

Effective management of water resources must address concerns of both quality and quantity. Higher quality water should be reserved for human consumption and domestic use; poorer quality water can be allocated to less demanding uses. The water cycle can also be extended by reusing certain organic and mineral pollutants in crop growing. In this way, treated wastewater is reclaimed as a resource and a source of nutrients for plants, and no longer seen strictly as waste.

This approach comes naturally to countries where water resources are scarce, such as the southern and eastern Mediterranean, Australia, Spain and the south-western United States. Consequently these countries present the greatest number of examples of organised reuse of treated wastewater. In northern countries, reliance on the precautionary principle gives rise to over-zealous and at times contradictory stipulations regarding the reclamation of treated wastewater in irrigation. For example systematically requiring that samples be analysed for Legionella irrespective of the techniques used for distribution, or for residual chlorine content, even though the presence of bacteria would be entirely acceptable.

Even in countries less vulnerable to water scarcity, where the urban sector needs a high quality water supply, it could make economic sense – to diminish reliance on faraway resources and costly treatment processes – to reserve the high quality water supply for the potable use. Treated wastewater would then be used to meet the needs of agriculture, landscapes, recreational areas and sports grounds. Such re-allocation would also delay the onset of water stress in certain regions and help refine the treatment of outflow from treatment plants.

Such an exchange of services presents a major challenge in economic, environmental, social and scientific terms, and as such must be evaluated, financially and otherwise, by all stakeholders concerned. The additional costs incurred by substituting resources must be absorbed on a pro rata basis in relation to services rendered. As a matter of priority, costs of treatment must be equally distributed among effluent users and producers, with an exhaustive analysis of the environmental benefits.

Coherent regional policies incorporating use of this alternative resource should be brought into force. These policies should be based on a strict, reasonable approach to risk analysis and equitable distribution of all costs, justified by:

- the need for the water supply to be fit for the purpose in terms of quality; it follows that high quality water resources should be set aside for more demanding uses;
- the finding that certain sources of irrigation water in the environment are of inferior quality to wastewater that has been appropriately treated.

Such policies could be bolstered by conditioning public subsidies to encourage beneficiaries to extend the water cycle by applying a cascade of uses (communities and farmers), and by promoting water reuse to minimise risk to the environment while preserving soils. Research efforts must continue to seek insight into the challenges in terms of risks and solutions, in order to drive financial and environmental costs down to an acceptable level.

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