



Catchment management – relevant in developed and developing countries

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Clean rivers, improved ecology and adequate drinking water quality can be achieved by encouraging farmers and communities to prevent pollutant run-off entering watercourses and groundwater. Voluntary and community-based approaches are necessary to meet the challenge of diffuse pollution at affordable cost, but appropriate institutions, regulations, economic incentives, and technology development are also essential.

Catchments (watersheds or river basins) are one obvious unit upon which we base environmental management. Their conceptual advantage is that they comprise a convenient naturally defined topographic area in which water drains to an identifiable point. In doing so catchments perform functions in terms of ‘integrating’ the flow of water, its quantity and quality, and ecosystem.

Catchments have proved to be useful in protecting water quality for both drinking water supplies and as part of the local environment, as the articles in this issue demonstrate. Water resource issues lend themselves to interdisciplinary research, because the methods used in catchment management include economic incentives, water treatment technologies, land use change, direct engineering interventions, legal framework setting and considerations of governance.

Two of the articles arise from research entitled ‘Building networks for a RELU (Rural Economy and Land Use) capacity building programme: exploiting options from the Eastern US and nearby European continent’. The articles explore innovative ways of raising awareness among farmers and local communities of how they are affecting the quality of water draining in their catchment. The challenge has been to demonstrate that changing behaviours can not only benefit water quality downstream, but also make economic sense to local farmers in the headwaters of the catchment.

Technical ‘fix’ or land-use planning

Simply stated, the time for ‘technocratic’ large organizations dominating water management has now passed. The role for central government in water management is in setting regulation at a distance. The European Union now requires implementation of the Water Framework Directive (WFD) by member states whose governments concern themselves more with resourcing and setting the legislative and planning framework than on-the-ground problem solving. This problem solving is instead taking place at the catchment level, where economic activity takes place, people live and work, drink water and discharge wastewaters. They also pay for the services, and while consumer pressure mounts for clean, efficient services, for local flood protection and for good ecological quality including thriving fisheries, it is also incumbent on individuals to take ownership of their problems and seek solutions. Water management is entering a democratic age, and ‘top-down’ technocratic governance is increasingly matched by ‘bottom-up’ democratic approaches the world over.

These approaches are not mutually exclusive. The optimal governance regime will depend on a range of factors including: catchment physical characteristics and pollutant pathways; the characteristics of farming and other land use; demographics and the distribution of settlement; income levels and

preferences; and the effectiveness of available barriers and protection measures. In principle there will be an optimal ‘mix’ of methods and governance arrangements to achieve given water management objectives.

In developed countries there are relatively plentiful resources for such a ‘mix’. In the EU we might well ask what is the most ‘economic’ option to achieve clean water supplies – land use measures to control diffuse pollution from nitrate or pesticides in water, or water treatment using ion exchange or granular activated carbon. It is interesting to note in passing that the water supply for one of the richest cities in the world is partly protected by catchment management and land-use measures, because this is considered to be a more economic option than a fully technical solution involving filtration (see Box 1). In developed countries we can luxuriate in the debate over where to strike a balance, knowing that sickness and death from our decisions are generally unlikely. Provided the water industry regulators are reasonably happy with the end product and the consumer is not charged too much for water services, we can settle the debate in our own time, even if the discussion is made more urgent by the WFD.

To communities in developing countries the picture is rather different, with stark choices to be made. In most rural areas, water from the handpump or well receives no treatment at all, so the emphasis on well-head protection is all the more vital. Within already stressed

Box 1. Catchment management in the New York City watershed

New York's drinking water supplies are piped by aquaduct from reservoirs in the Catskill and Delaware watershed, New York State. The water from these sources is chlorinated but not filtered. It is estimated that the cost of installing a filtering system for the city's water supply would be around US\$8 billion, and the annual running costs of filtration would exceed \$0.5 billion. Instead of filtering the water, the decision has been made to use catchment management measures to reduce the likelihood of pathogens entering the two main reservoirs.

The New York City Watershed Agricultural programme, supported scientifically by Cornell University, involves a range of technical measures, such as precision feeding of livestock, measures to reduce nutrient-rich run-off from farms, fencing to keep cattle away from water courses, etc. The willing management engagement of farmers and local communities is crucial, so much of the work involves visiting farms, conducting educational and awareness-raising activities and encouraging community involvement. The cost of running this catchment-management programme is considerably less, by an order of magnitude, than installing and running a filtration system.

Key lessons have been the need for realistic and measurable objectives, a common recognition of a shared problem, supportive participation of all stakeholders from the earliest stages, financial support and incentives for adoption of new practices and technologies, and the accountability and legitimacy of the implementing agencies.

watersheds, decisions have to be made that make the average UK or US water professional blanch. If the close proximity of pit latrines to hand pumps is a possible source of contamination, is it better to ban pit latrines near to the pump, thereby encouraging open defecation with all the risks that this poses to public health, or to move the pump? It has been argued that it is better to continue encouraging the use of pit latrines and instead to pipe in water from a distance where well head protection measures are possible. Implicit is the question of whether less disease results from efficient sanitation or from drinking water supplies at risk of contamination.

Another question results from geochemical contamination of supplies. Fluoride in all but minute amounts badly affects teeth and bone development; and arsenic is a poison for which there are few practical treatment options in affected areas. How can communities identify, using simple chemical determinations, which well to avoid? How can you provide even minimal technical expertise in a largely illiterate population?

Finally, available supplies are often fully committed. Water harvesting, conservation and re-allocation may have dominated catchment initiatives to date (and have been discussed in earlier issues of *Waterlines*) but quality concerns must increasingly be integrated with this.

Community involvement

So the articles in this issue cover very different situations. However, the role of community involvement, aided by non-government organizations, in catchment management is a theme that runs through them all. James Curatolo and Weixing Zhu report from the Upper Susquehanna Coalition (USC) in New York State and northern Pennsylvania and they explore the role of watershed management and education in maintaining water quality that affects upstream communities and ultimately the water quality in Chesapeake Bay. USC may be professionally orientated, but it works with community groups in each county, including landowners, and they use students in integrated catchment research, raising awareness through education.

Alex Inman works in an exciting new group of non-governmental organizations, the Rivers Trusts. His own, the West Country Rivers Trust, breaks the mould through direct involvement with communities in the Tamar and other catchments. This trust has an impressive record of working with the farming community to reduce diffuse pollution and to protect the ecological quality of the river, and this is achieved through finding solutions that benefit all parties.

The problems of balancing abstraction and water quality for human consumption, with the imperatives

of sanitation, and the attendant risks of groundwater pollution, is clearly brought out in a thoughtful piece from Richard Taylor. Here the 'drivers' are minimizing risks to human health in a situation of rapid urbanization and limited resources for infrastructure. He explores the options for surface zoning of protection zones in a developing country context, which is highly desirable, but difficult where land is scarce – and he calls for a supportive political and legal framework.

Of course, communities can take some measures to determine for themselves risk from contaminated water. John Butterworth, Y.V. Malla Reddy, B. Renuka and G.V. Reddy describe the problem of fluoride contamination and explore local people's potential involvement in avoiding the problem in rural India, where officialdom is inclined to deny there is a problem in the first place.

It is clear from these articles that many specialisms may be required if we are to understand and find effective solutions to catchment management: hydrogeologists, planners, managers, engineers, economists, modellers, teachers and health professionals. If coordinating the activities of these people and galvanizing the involvement of local people throughout a catchment seems a tall order, it is worth noting the premise behind the New York City Watershed Agricultural Programme, an argument also expressed by Richard Taylor, reflecting on groundwater supplies in East Africa: 'Remediation of contaminated water is more difficult and more expensive than protection.'

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