



Running **Pure**

The importance of forest protected areas to drinking water

arbor*vitæ*

IUCN
The World Conservation Union



Making the links: **Why water**

An affordable supply of uncontaminated drinking water is one of the most basic measures of development, yet today it is denied to over a billion city dwellers, who are still living without ready access to either potable water or adequate sanitation. Even for those of us who are luckier, the cost of keeping pure water running from our taps is rising all the time. In the past century the world's population tripled, but water use rose six times. Increasing pollution, rising demand, exhaustion of groundwater sources, an unstable climate and political disputes have made water an increasingly threatened resource. And because it is a natural product, from natural ecosystems, there is only a certain amount that technology can do to fix the problems. Ultimately a good supply of water relies on a balanced ecology.

This report looks at one particular link in the chain between rainfall and drinking water – the role that forests can play in helping to provide clean water supplies to people living in the world's largest cities.

This link is not simple. Forests and freshwater systems interact in many different ways: these relationships are complex and their precise nature and significance remains the subject of debate between hydrologists, natural resource economists and ecologists. We try to sort out the facts from the myths and to explain where uncertainties still exist. But we also go beyond

the academic debates to look at how city dwellers are benefiting from water from forests – and in some cases where failure to recognise the role that forests play in the hydrological cycle has led to problems downstream.

There are already some well known examples of cities protecting watersheds to help maintain supplies of high quality drinking water. We wanted to find out if these were exceptions or part of a more general trend and therefore analysed how many of the world's top hundred cities drew some or all of their drinking water from protected forests*. The text draws on a research project carried out for the World Bank/WWF Alliance for Forest Conservation and Sustainable Use, which included detailed case studies and looked at some of the hydrological, social and economic implications of the links that exist between forests, protected areas and drinking water.

Celebrating water and protected areas

It is a good time to look at the links between water and protected areas. The United Nations has proclaimed 2003 as the International Year of Freshwater, to help promote new and existing water resource initiatives. IUCN's World Parks

This *arborvitæ* special is a summary of a research report by the World Bank / WWF Alliance for Forest Conservation and Sustainable Use

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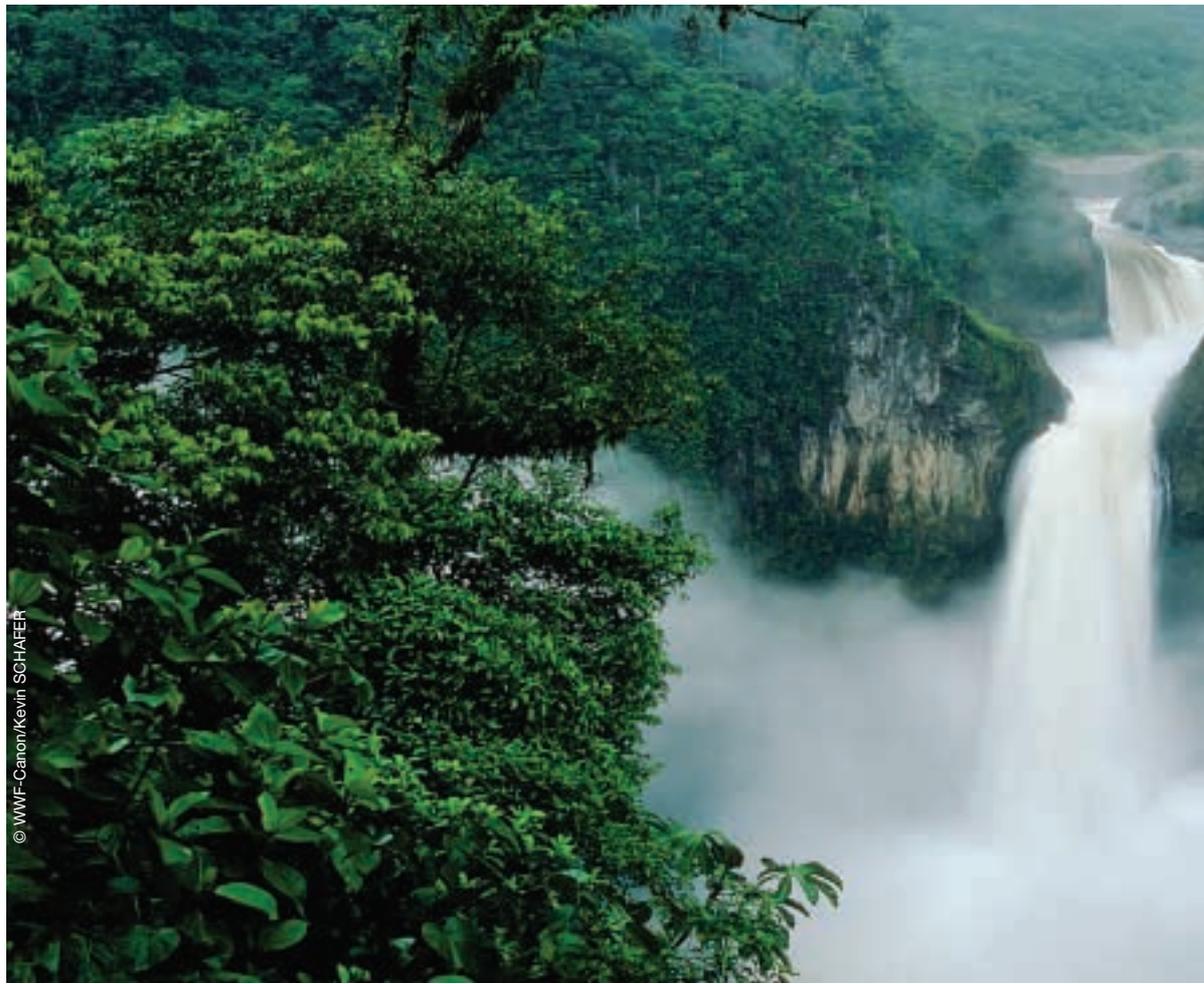
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& forests?

Congress in September 2003 provides a once-in-a-decade global focus on protected areas and their importance. The role, definitions, boundaries and management of protected areas are receiving particular attention from governments and non-governmental organisations, corporate bodies and development agencies. Two key issues have been prominent in the discussions leading up to the WPC: the need to extend the arguments for protected areas away from a narrow focus on biodiversity into other values (the congress is named *Benefits beyond Boundaries*) and the importance of securing enough money to manage protected areas effectively. The links between protected areas and drinking water thus touches on some of the most central natural resource management issues in the world today.

Water, as we shall show, provides a powerful argument for protection. Through payment for environmental services it can also help to defray the costs of managing protected areas if, as is increasingly the case, governments introduce charges for pure water coming from forests protected by the state. ■

* Actually 105 cities chosen by population level: 25 from the Americas, 25 from Europe and the Russian Federation, 25 from Africa, 25 from Asia and 5 from Australia



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Cities, water and protection

Water is, in theory, the most renewable of resources. Most of the planet's surface is covered in water and over much of the world it falls, unbidden and with great regularity, from the skies. Yet, the carelessness and profligacy with which water resources have been used, the speed of human population growth and the increasing per capita demands all mean that provision of adequate, safe supplies of water is now a major source of concern, expense and even international tension.

Overall, the greatest human requirement for freshwater is for crop irrigation, particularly for farming in arid regions and in the great paddy fields of Asia; municipal water accounts for less than a tenth of human water use but clean drinking water is of critical importance. Today, half of the world's population lives in towns and cities and one third of this urban population live without clean water. These billion have-nots are unevenly distributed: 700 million city dwellers in Asia, 150 million in Africa and 120 million in Latin America and the Caribbean.



▶ Although considerable progress has been made in building the infrastructure to supply drinking water, the rapid processes of population growth and urbanisation continue to increase pressure on supplies. Most current estimates suggest that the world's population will grow by 2 billion people over the next 30 years and another billion in the following 20 years. Virtually, all of this growth will be in developing countries, and mainly in cities. One consequence is that average annual per capita availability of renewable water resources is projected to fall from 6,600 cubic metres today to 4,800 cubic metres by 2025.

Cities therefore face many immediate problems of access to clean water and mounting problems of supply that are likely to increase in the future. Governments and city councils are faced with the need for massive investments in the infrastructure and maintenance costs needed to collect, purify and distribute water. In recent years, there has been increasing interest in the opportunities for offsetting or reducing some of the costs of maintaining urban water supplies (and perhaps even more importantly water quality) through management of natural resources and particularly forests.

The concrete jungles of our cities often feel a very long way from the forest jungles with their spectacular wildlife and low human populations, but most of the world's population live downstream from forested watersheds and are therefore susceptible to any impacts of watershed degradation.

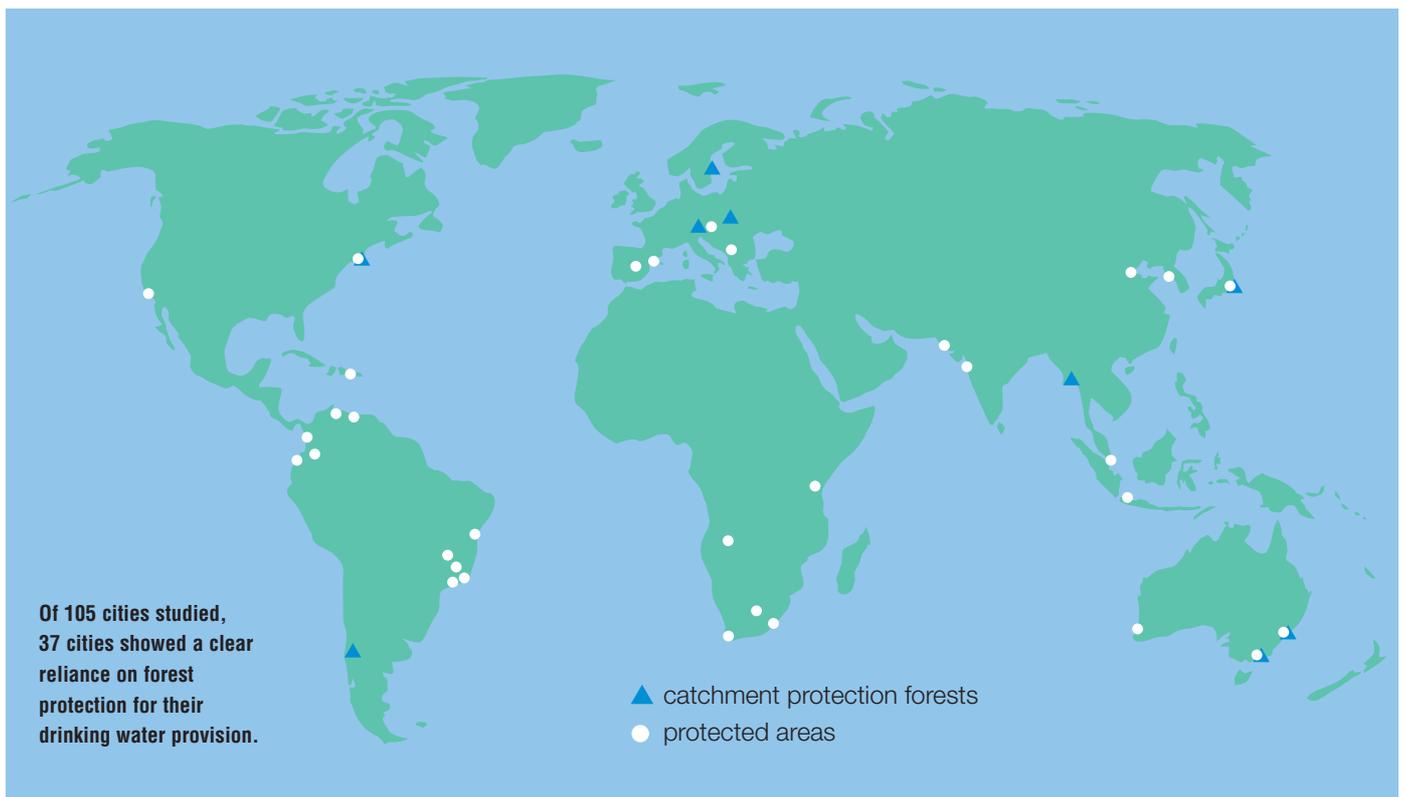


Image Courtesy of SRTM Team
NASA/JPL/NIMA

Los Angeles, USA: The Angeles National Forest (Category VI) is one of 18 national forests in California that cover only 20 per cent of the land but produce almost half the State's water.

At the same time, 28 per cent of the world's forests are in mountains, and mountains are the source of some 60 to 80 per cent of the world's freshwater resources.

The links between forests and watersheds are complicated and vary with geography, weather patterns and management. Forests in catchments generally result in cleaner water downstream, thus massively reducing the costs of purification – although this depends to some extent on the level and type of contamination: at the very least the absence of industry and intensive agriculture reduces pollution. In particular cases, such as



tropical moist cloud forests and some eucalypt forests, it appears that forests are capable of increasing flow into catchments. Presence of forests can also have a local impact in ameliorating flooding. These issues are examined in more detail on page 9.

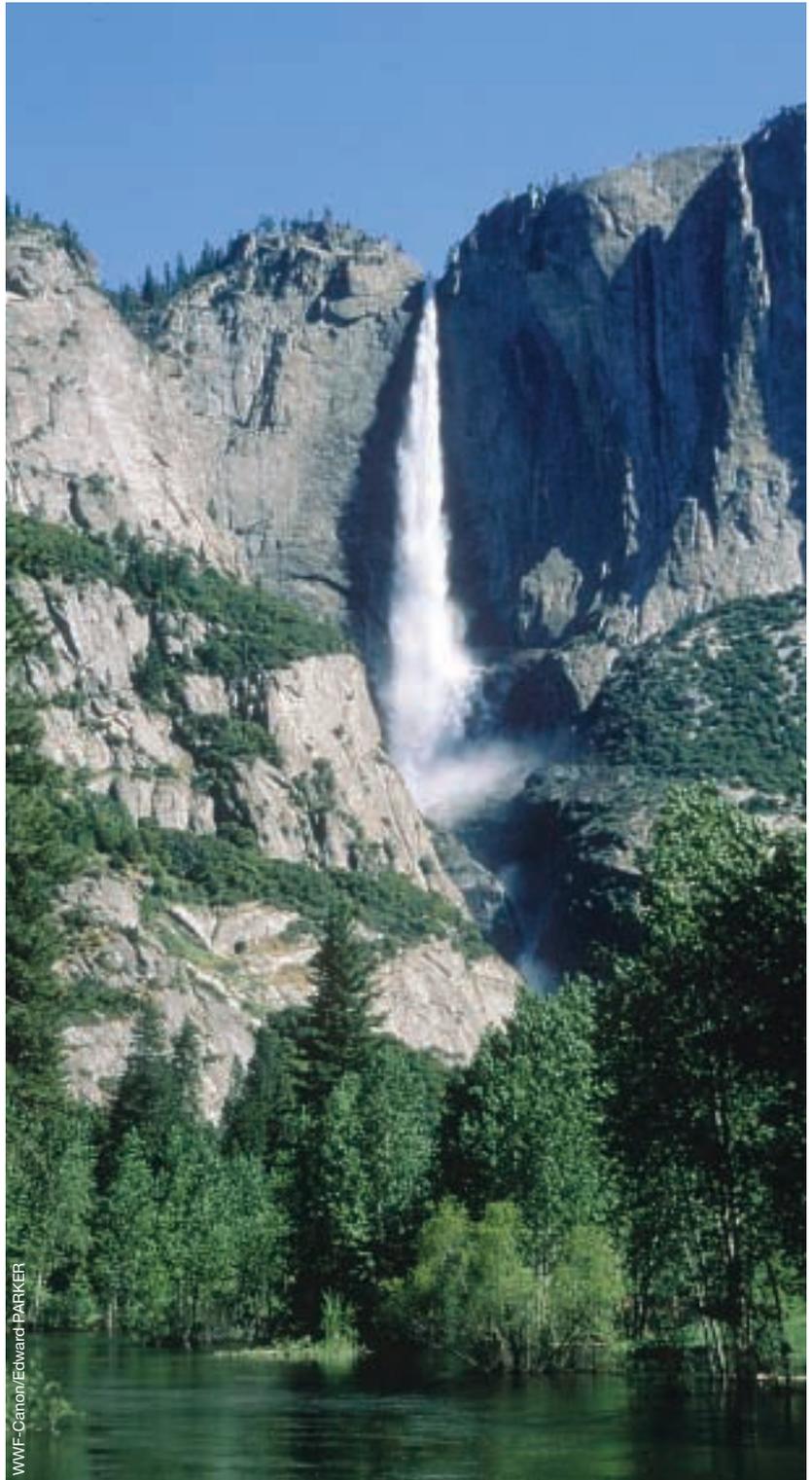
Cities and forests

All over the world, economic and land use decisions are being made in favour of protecting forested watersheds to help safeguard water supply. Our research suggests that over a third of the world's largest cities take some or all of their drinking water from catchments with protected forests (see map). Many of these protected forests are in 'official protected areas' with an IUCN protected area management category (I-VI) – national parks, nature reserves or wilderness areas. In others, forests are protected but outside official protected areas: not every forest set aside for catchment protection also has high biodiversity values. In other cases "protection" actually entails integrated management, with special controls on the type of farming and other land uses rather than on protecting forests. In some situations, active restoration is taking place where forests have been degraded or lost, for the benefit of drinking water supplies. Cities are therefore utilising a mixture of protection, careful management and restoration to maintain their drinking water supplies.

Amongst the world's large cities with some or all of their drinking water coming from protected forests are Jakarta, Mumbai (formerly Bombay), Karachi, Tokyo, Singapore, New York, Bogota, Rio de Janeiro, Los Angeles, Cali, Brasilia, Vienna, Barcelona, Dar Es Salaam, Johannesburg, Sydney and Melbourne. Other major cities, like Beijing, have multiple-use management zones and in Stockholm, management in forest surrounding the watershed has been subject to Forest Stewardship Council certification for environmental management in part to ensure that water supplies are protected.

Of course, it is not just the world's biggest hundred cities that need protected watersheds or use natural ecosystems to help maintain water supply. Half of Puerto Rico's drinking water comes from the last sizeable area of tropical forest on the island, which is in the Puerto Rico National Park. Quito, the capital of Ecuador, draws its water from a system of protected areas. Amsterdam has for years filtered its drinking water through a protected dune system, thus incidentally preserving a unique system of coastal sand dunes that have disappeared in many other parts of the coast.

On the next two pages, we look at some very different examples of how cities have approached the management of forested watersheds; we then summarise some of the debates regarding the science, the social science and the economics of protecting forests for water. ■



WWF-Cannon/Edward PARKER

Eighty-five percent of San Francisco's drinking water comes from the Hetch Hetchy watershed, located in Yosemite National Park (Category II).

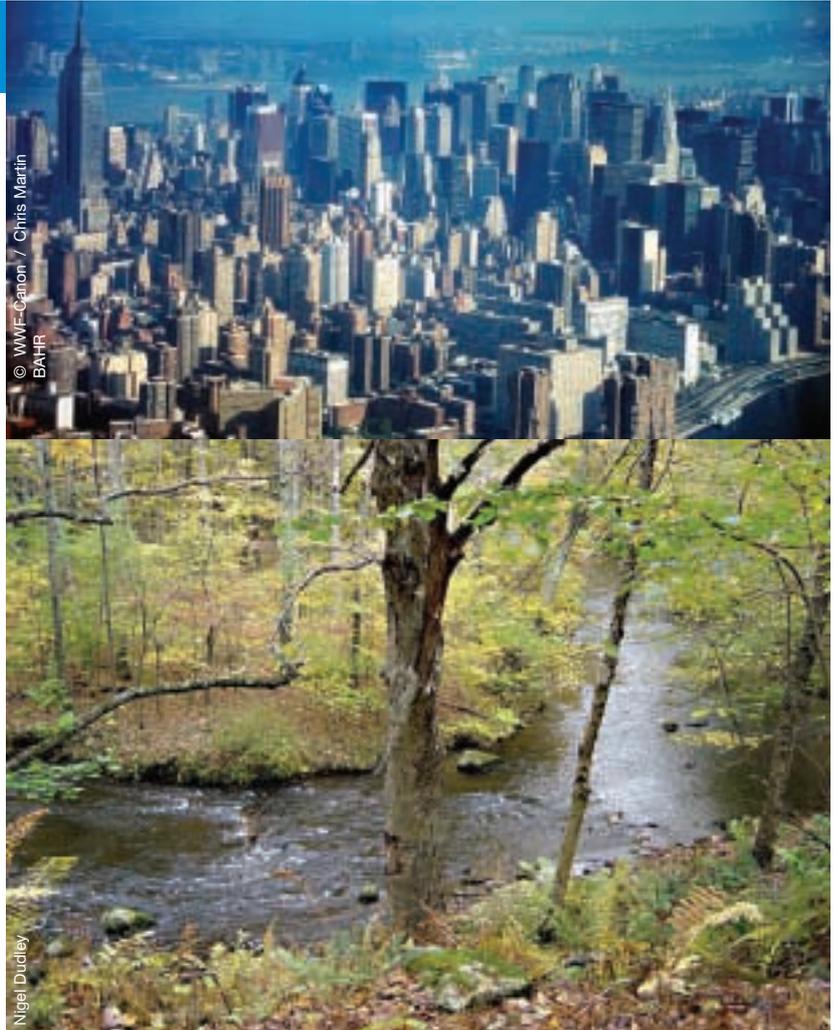
New York

An hour's drive north of Manhattan, the woods are so dense that you could imagine the metropolis is a thousand miles away. How do forests survive so close to one of the most densely populated cities on the planet?

The Catskill, Delaware and Croton watersheds together deliver 1.3 billion gallons of water per day to the nine million residents of New York City and the metropolitan area. Decades ago, as concerns about water quality were raised and water treatment requirements toughened, the City of New York calculated that it was cheaper to purify drinking water by draining it through forested catchments than by building a new treatment plant.

Forests make up 75 per cent of the total land area in New York's three watersheds, but land ownership is diverse – New York City owns less than 10 per cent of the watersheds for instance. The City's watershed management improvement programme therefore has to work with a whole range of owners, management regimes and stakeholder needs, and in consequence a number of different management approaches. New York residents agreed to increased water bills to fund the programme (other alternatives were even more expensive), issuing bonds and introducing trust funds – the US\$60 million Catskill Fund for the Future provides loans and grants for environmentally sustainable projects in the Catskill watershed for instance. Various forms of compensation have been introduced, such as US\$40 million for dairy farmers and foresters who adopted best management practices, additional logging permits for timber companies who improve forest management practices and reduced taxes for forest landowners who commit to ten-year forest management plans. The City is also acquiring hydrologically sensitive land where possible by purchasing development rights from owners of land that is important for water quality and, through the federal Conservation Reserve Enhancement Program, entering into contracts with farmers and forest landowners to remove environmentally sensitive lands from production. Some of the forests are already in protected areas.

If all goes to plan, taking a forest protection strategy will result in substantial savings for the City – with start-up costs for the programme estimated at between US\$1 to US\$1.5 billion over ten years, as opposed to US\$6-8 billion, plus an annual US\$300-500 million operating costs, for a treatment plant. As a result the forests around New York have been protected, with less of the controversy that so often surrounds land conservation, and New Yorkers enjoy fine drinking water supplies. ■



Istanbul

Straddling Europe and Asia, Istanbul has been one of the world's most important cities for millennia. Water is ever important for the city's rapidly rising population, which is why WWF is advocating that forests in the watershed are protected to provide additional security to the city's supplies.

Istanbul is Turkey's largest city with a current population of over 12 million and is growing at an average rate of 3.5 per cent per annum. This population increase has led to an increasing demand for potable water. In the last decade alone water consumption has tripled. There are several water reservoirs in the forests on both peninsulas of Istanbul which have been providing the city with water for centuries. The major water resources are on the periphery of Istanbul and are owned by the Ministry of Forests. At one time all the drinking water in Istanbul came from Belgrad forest, on the European side of the city. Today, the requirement for water has forced the city to look further a field for its supply, with water coming from ten different sources. Recently, six new dams have been built to bring water from the Istranca forest, an important site for conservation, near the Bulgarian border 200 km west of the city while the existing reservoirs are threatened by increasing pollution and illegal development.

There is significant urbanisation pressure on Belgrad and other forests surrounding the city. Although forests are the most widespread habitat in the province, the lack of concerted action to protect these areas means that many are likely to be destroyed or altered beyond all recognition in the coming years.

Melbourne

The effects of several years of drought in Australia have resulted in news stories of raging fires and the plight of rural communities. Just as newsworthy, but far less reported, has been the uninterrupted delivery of some of the best quality water in the world to the three million residents of Melbourne.

Ninety per cent of Melbourne's water supply comes from uninhabited mountainous catchments to the north and east of Melbourne. The Mountain Ash (*Eucalyptus regnans*) forests are the predominant water producing forests in these catchments. The government owned company Melbourne Water manages the water collection from these forests and has some legislative backing to protect water resources. About forty nine per cent of the catchments fall within the Yarra Ranges, Kinglake and Baw Baw National Parks, with much of the remaining area being in State forests. In these areas the Department of Sustainability and Environment and Parks Victoria work closely with Melbourne Water in managing catchments and thus water quality.

The management of Melbourne's water catchment has been guided by a programme of research, in particular on the importance of the links between water yield and forest disturbance. Studies of rainfall and runoff data, collected from large forested catchments in the Melbourne area that were burnt by a large-scale wildfire in 1939,

concluded that the amount of water yield from forested catchments is related to the forest age. It was found that forest disturbance can reduce the mean annual runoff by up to 50 per cent compared to that of a mature forest, and can take as long as 150 years to recover fully.

Melbourne Water's reliance on protected forest catchments to maintain its water supply is a clear example of how urban needs can be linked with forest protection. Many of these catchments are in designated protected areas so that there is also a clear link between maintaining water supply and maintaining other protected area values including biodiversity. However, fifty one per cent of the water catchments are not within protected areas, and some of these forests are subject to forestry operations. WWF-Australia is therefore concerned that forest areas of high conservation value and areas important for water management, are not being adequately protected. Given the likely future deleterious impacts of global warming on rainfall in Victoria, WWF believes the societal value of the water foregone may well be greater than the value of any timber harvested. ■



The likelihood of such protection taking place is however hampered by the actions of both the national and local government, whose policies are directed more at supporting urbanisation, even when these developments are carried out illegally, than at the protection of vital resources and recreational green areas.

The forests around Istanbul have been selected by WWF as one of the 'forest hotspots' in Turkey and WWF-Turkey is lobbying the authorities to declare the forests as official protected areas. Ten areas have been identified as being exceptional due to their high biodiversity and are thus the focus of the campaign. Most of these areas are also important water reservoirs: i.e. Terkos Lake and forests (also identified an Important Plant Area – IPA); Büyükçekmece Lake (also identified an Important Bird Area – IBA) ; Küçükçekmece Lake (an IBA) and Ömerli Lake and forests (an IPA). The campaign started in 1999, with a project titled 'Istanbul Greenspace', which aimed to increase the understanding of the value of Istanbul's unique habitats, lobby for the development, introduction and implementation of effective planning and other land management policies to protect valued wildlife and, working with other NGOs, authorities, and individuals, secure formal protection for the most valued areas.

In 2002, WWF-Turkey started the process of declaring a new protected area with Terkos Lake as its core. Stakeholder workshops have been organised and a justification report was submitted to the Ministry of Forestry. The process has, however, yet to be completed due to unstable political conditions in the country. ■





Pure Equity

Careful management of natural sources of urban water – to enhance quality, supply and reliability – is a critical governance challenge. Considerations of social impact should be a central factor in determining the most appropriate watershed conservation strategies.

Because urban interests are more politically powerful than rural interests, watershed protection has often ignored rural people’s rights, with negative impacts for millions of people, including:

- Transferring ownership or use rights to land from local people
- Denying rights of access to public or community land, forest, or water
- Offering payments for watershed services that encourage more powerful actors to appropriate land or water resources
- Establishing forest plantations on common lands valuable for livestock, wild foods and fuel
- Forcibly resettling people
- Forcing farmers to make high-cost conservation investments
- Damaging or denying access to cultural or religious sites
- Reducing employment due to closing farming, forestry or processing activities
- Diverting water to urban users

At worst, watershed protection has been a thinly disguised excuse for resettlement or social control of politically and culturally marginal groups. This has caused resentment and many programmes that established strict forest reserves or attempted to reforest farm and grazing lands have failed to achieve watershed objectives.

This has led to new approaches that seek to work with local people as watershed stewards. These recognise rights and management capacity, encourage negotiation, and provide technical and financial support for communities to invest in land management. When designed explicitly for local co-benefits, improved watershed protection may:

- Enhance the supply and quality of local water
- Restore depleted fisheries
- Increase availability of non-timber forest products

Rapid population growth and uncontrolled urban development is putting pressure on services to Caracas, Venezuela. The city’s water supply is sourced from three protected areas, but poor water management is leading to water shortages.

- Increase income and employment from enterprises compatible with watershed management
- Protect forest resources from invasion by outside settlers
- Reduce local health problems from contaminated water
- Validate the role of rural people as watershed stewards
- Pay local people for their role in protecting, managing or restoring watersheds
- Provide investment resources

Involving people in watershed management: in some urban watersheds, protecting or expanding forest cover will be essential for water management. Here, every effort should be made to embed biodiversity conservation and livelihood benefits into forest protection. Multiple-use community forestry can provide local income and communities and landowners can be paid to conserve resources and monitor water quality. Planting or regeneration can focus on the most critical sites for watershed services. Local people can identify sites producing unusual levels of sediment or contamination, or areas of compacted soil or barriers to water flow, that may not show up through remote sensing. They can also identify areas where there are strong community motivations to increase forest, such as around local water sources or cultural sites.

Alternatives to strict forest protection: completely undisturbed forest is not necessarily essential for good watershed management. While natural forest can often provide these functions most effectively and at a low cost, well-designed mosaics of other land uses may also do much the same. Where the “opportunity cost” of protection is very high for local people, alternatives should be explored. Timber and non-timber forest products can be produced commercially, under standards of certification. Crops may be produced using good erosion control or in agroforestry or organic systems. Rules can require wide strips of natural vegetation be left at intervals on contours on steep slopes. Financial credit, technical assistance, and marketing support can help to facilitate these changes, financed from urban water budgets or consumer charges. Critical sites for hydrological function (or biodiversity conservation) can be zoned for non-productive use, or farmers and landowners compensated for easements. Landscape mosaics that intersperse natural forest with crops, pastures or production forest can protect critical watershed sites. Upstream riparian systems can be linked to urban wetlands and larger protected areas through corridors of natural vegetation.

Strong public demand for water security can drive responses that seriously harm vulnerable populations living in and near water resources and catchment areas. However, serious attention to addressing potential social costs and impacts can result in greater net social benefits and greater sustainability of watershed and ecosystem services. ■



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Running Pure

Forests impact on downstream water quality and quantity in many ways depending on forest type, climate and management. Hydrologists have found it hard to agree about these relationships and the hypotheses that forests always increase total water or decrease flooding have been criticised. Today, a shaky consensus is starting to emerge: forests often substantially increase the purity of water – a conclusion that has enormous health and economic implications – and in some cases (for example cloud forests and some eucalyptus forests in their natural environment) also increase the quantity of water.

In addition, the undisturbed forest with its understory, leaf litter and organically enriched soil is the best watershed land cover for minimizing erosion by water. Any activity – such as litter collection, fire, grazing or scraping in logging – that removes this protection increases erosion. In minimizing water erosion, forests reduce the problem of sedimentation: the carrying or deposition of soil particles in water courses. Suspended soil in water supplies can render potable or irrigation water unfit for use, or greatly increase costs to make it useful.

Most land uses that replace forests also have a greater likelihood of impairing water quality through the addition of 'pollutants' to the watershed. Excess fertiliser on agricultural or grazing lands and pesticides applied to horticultural or agricultural crops, can both find their way into ground water aquifers or surface streams and rivers and have a direct impact on human health. In areas of the



world where salt accumulates in the subsoil, forest removal can result in the groundwater levels rising and bringing salt closer to the surface.

Forested (or other naturally vegetated) strips of land along streams are also significant and these riparian zones are probably the most critical of all for needing protection in a water supply catchment. This is especially true if there are non-forest land uses beyond the riparian zone which are a source of sediment, fertiliser, pesticides or other water contaminants. Intact forests along streams at a minimum of 20-30 metres wide (wider if the land is steeply sloping) can filter and immobilize sediment and these compounds, thus reducing water pollution. ■

The Drakensberg is regarded as the most important mountain catchment in South Africa because of the high water yield and good quality water which help supply Johannesburg and Durban with water.

Cloud forests

Cloud forests, with their abundant mosses, lichens and other epiphytes, capture water from horizontally moving cloud or fog. Since trees with foliage wetted from above ground do not need to take up water from the soil, overall water use by cloud forests is typically much lower than that of other forest types. This two-fold gain in water means that the streamflow from cloud forest areas tends to be larger than for land receiving the same amount of rainfall in other areas, and the flow is more dependable during dry periods. The extra water is particularly important in places with low rainfall, with water gains from cloud forest being 100 per cent or more than from ordinary rainfall.

But cloud forests are disappearing fast – particularly through conversion to grazing land. It has been estimated that as much as 90 per cent of the cloud forest in the northern Andes of Colombia has been lost, mainly to agriculture. If protected, however, cloud forests have a proven record in providing and maintaining supplies of freshwater. The cloud forests in La Tigra National Park in Honduras for instance sustain a well-regulated, high quality water flow throughout the year, providing over 40 per cent of the water supply for the 850,000 people in the capital city Tegucigalpa.





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Valuing Purity

One major reason that it has proved so difficult to halt and reverse global forest loss is that those who manage forests typically receive little or no compensation for the services that these forests generate for others and hence have little incentive to conserve them. Recognition of this has encouraged the development of systems in which land users are paid for the environmental services that they generate through their management. The central principles of the “payment for environmental services” (PES) approach are that those who provide environmental services should be compensated for doing so and that those who receive the services should pay for their provision. From our perspective here, this means that if particular management systems are needed in

About 80 per cent of Quito's 1.5 million people receive drinking water from two Category 1a protected areas: Antisana and Cayambe-Coca Ecological Reserves

watersheds to maintain the quantity or quality of water supply downstream, users – such as drinking water or hydropower companies – should pay for these.

PES approaches have been most thoroughly developed in Latin America, but interest is quickening throughout the world. In Costa Rica, for example, the government has developed a nationwide PES scheme through which users such as hydropower companies can pay land users to maintain forest cover in watersheds. In Quito, Ecuador, water companies are helping to pay for the management of protected areas that are the source for much of the capital's drinking water.

Payment schemes only have a chance of working when conditions are right. An ideal combination would be when particular land management regimes result in major economic benefits to a small group of users – like a water company. In these cases it is relatively easy to identify reasonable payments and to negotiate amongst the buyers (the water users) and sellers (the land users) of the environmental service. However, there are many possible complications. There are still disagreements about the likely downstream impacts of land management regimes and in any case these are likely to differ from place to place, making it sometimes hard to predict the costs and benefits of particular management approaches. Users have different needs; for example a hydropower company will be interested in quantity and freedom from sediment while a water company will have much wider quality interests. It may be difficult to identify and hence negotiate with the people using the land upstream (or with dispersed user groups). There are risks of a few users paying for services enjoyed by many. Clumsy use of payment schemes can create perverse incentives for example by raising hopes of payment in other areas and hence blocking other ways of reforming management.

Nonetheless, such schemes are already working in several places and are receiving a high level of attention from governments and from donor agencies. For example, the World Bank is currently supporting the development or implementation of PES systems in Costa Rica, Guatemala, Venezuela, Mexico, Colombia, Nicaragua, Dominican Republic, Ecuador, El Salvador and South Africa. Many of these look specifically at the impacts of protected areas, for example a project financed by the Global Environmental Facility is under preparation in Venezuela's Canaima National Park, with significant co-financing from hydropower producer CVG-EDELCA.

Payment for environmental services is not a panacea or a universally-applicable solution to forest loss: rather it should be regarded as one of many tools in a toolbox. If used well, however, it can provide concrete support for both good forest management and forest protection. ■

What is a protected area?

IUCN The World Conservation Union defines a protected area as: *an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means*, and subdivides protected areas into six categories: 1a: Strict nature reserve/wilderness protection area; 1b: Wilderness area; II: National park; III: Natural monument; IV: Habitat/Species management area; V: Protected landscape/seascape; VI: Managed resource protected area. Other forms of protection exist, including forests that are protected specifically because of their drinking water value, which fall outside protected areas. Here we are looking at all kinds of forest protected areas and other forms of protected forests, although we are particularly interested in the cases where protected areas like national parks also have value in protecting watersheds for drinking water.

Staying Pure

Cities need more drinking water: throughout the world, municipal authorities are looking up into the hills towards the forested watersheds that supply their precious drinking water. Our study focused on the world's largest cities, but all urban areas, irrespective of their size, are concerned with maintaining and paying for high quality drinking water. The world's population is likely to grow from 6 billion to around 8 billion in 2050 and urbanisation is also likely to increase, putting a huge strain on existing infrastructure. Many people are already denied access to regular, safe supplies of water.

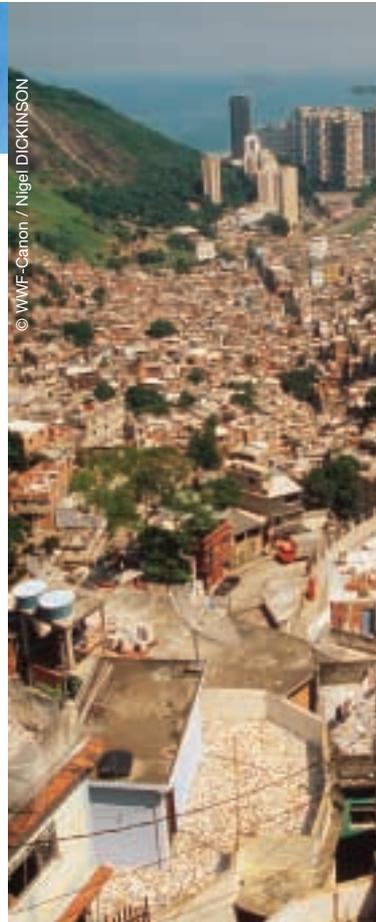
Protecting forests can help to provide high quality water: city authorities need cleaner, cheaper and more secure water supplies, now and in the future. This means conserving critical watersheds, including protecting and where necessary restoring the forests and other natural habitats that they contain. We have shown that well managed protected areas can be a cost effective way of helping to keep pure water flowing from our taps. Many cities are already using protected areas to secure their water supply; others are using forest protection outside formal protected areas, or integrating protection with other forms of land use.

Protected areas must be integrated into the landscape: as urbanisation increases, so too will pressure on nearby forests, with the risk that water supplies will be undermined at the time when even more people are dependent upon them. When space is short, creating new protected areas will be controversial and will need careful negotiation, but the alternative means bringing water longer

distances and raising costs, which will in turn impact hardest on the poorest people. In reality, there is seldom only one beneficiary from any area of land, and protected areas are no exception. Benefits to drinking water will often be one reason for protection amongst many. But a protected area providing multiple benefits is likely to be in a strong position to provide genuine, long-term benefits. It is hoped that by highlighting the role of protected areas in this *arborvitæ* special and the more detailed report, the World Bank/WWF Alliance will add some analysis from the perspective of water provision, to the growing literature on the benefits of long-term protection to some of the world's most precious places.

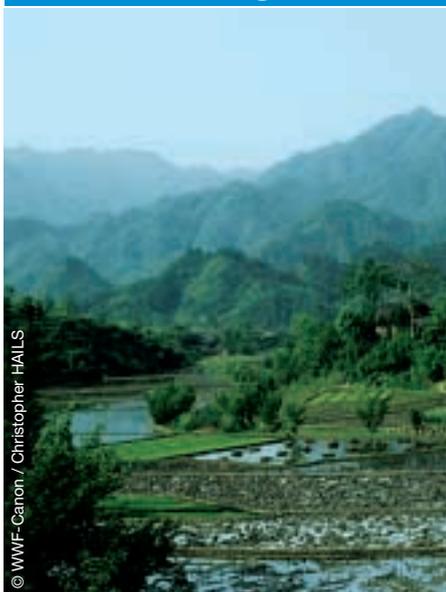
WWF, IUCN and the World Bank are integrating forest protected areas with good forest management and, where necessary, forest landscape restoration at a broad scale. The WWF/IUCN Forests for Life strategy provides a comprehensive framework through which the world can attain more diverse and higher quality forest landscapes to meet human needs and aspirations in an equitable manner while conserving biodiversity. The World Bank/WWF Alliance targets (see back page) cover both protection and good management. The WWF Living Waters campaign and IUCN Water and Nature Initiative are working to develop integrate watershed management plans for many of the world's most important freshwaters. Managing watersheds for water quality provides an excellent example of how conservation can be integrated with human needs. ■

© WWF-Canon / Nigel Dickinson



Although well protected at source, Rio de Janeiro's major water supplies require expensive treatment due to soil erosion.

Protecting the water and the pandas of the Yangtze



© WWF-Canon / Christopher Hails

The Qinling Mountains are the natural division between north and south China and are extremely biologically diverse, with important populations of giant panda, golden monkey, takin, crested ibis and clouded leopard. Qinling is also the catchment for the country's two most important rivers: the Yangtze and the Hwang He (Yellow) rivers, and is the chief water source for Xi'an, China's ancient capital, which has a population of over seven million people.

A survey of the world's major watersheds carried out in 1998 highlighted serious deforestation and little protection in the watersheds of the Yangtze and Hwang He. The Yangtze watershed has lost 85 per cent of its forest and only 2 per cent of the watershed was protected while the Hwang He watershed had lost 78 per cent of its forests and only 1 per cent was protected.

In 2003 the Shaanxi Provincial Government agreed to greatly expand the total protected area in Qinling. Initially a series of panda reserves and corridors will increase protected areas by 180,000 ha from the existing 330,000 ha, with an additional proposal for seven more areas, adding approximately 225,000 ha to the protected area network. It is hoped that the reserves will also have substantial benefits for the drinking water of Xi'an and the surrounding area.

The efforts to increase protected area coverage in Shaanxi Provincial Government have been celebrated by WWF as 'A Gift to the Earth' - a public celebration of a conservation action which is both a demonstration of environmental leadership and a globally significant contribution to the protection of the natural world.

arborvitæ

arborvitæ Specials are published jointly by IUCN and WWF as occasional supplements to their arborvitæ newsletter in order to focus on specific opportunities and threats that impact on the conservation and sustainable use of forest resources that cannot be dealt with adequately in the main newsletter.

Published August 2003 Jointly by WWF – World Wide Fund for Nature, Gland, Switzerland (also known as World Wildlife Fund in Canada and the USA) and IUCN – The World Conservation Union, Gland, Switzerland.
© WWF International/IUCN The World Conservation Union, 2003
ISBN: 2-8317-0748-X
Design: HMD, UK

For the full length and fully referenced version of the report *Running Pure: The importance of forest protected areas to drinking water* please visit: www.panda.org/forests4life or contact us: Forest4Life@wwfint.org

WWF and IUCN feature comprehensive freshwater programmes. WWF's Living Waters Programme takes action so that healthy freshwater ecosystems around the world enhance the quality of life and people value nature as the source of water. Please visit our website www.panda.org/livingwaters.

IUCN's Water and Nature Initiative demonstrates that ecosystem-based management and participation of stakeholders can bring rivers back to life and maintain their capacity to produce the natural resources on which so many people depend. Please visit our website: <http://www.waterandnature.org>.

Edited by Sue Stolton and Nigel Dudley, with thanks to Leonardo Lacerda, Jamie Pittock, Biksham Gujja, Christian Peter, Rachel Asante Owusu, Jose Courrau, David Cassells, Lawrence Hamilton, Stefano Pagiola, Sara Scherr, Wang Luan Keng, Ahmet Birsal, Sedat Kalem, Yildiray Lise, Claudio Sericchio, Andrew Rouse, Frank Lawless, Geoff Vincent and David Tobias.

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The World Bank/ WWF Alliance

for Forest Conservation and Sustainable Use ('the Alliance') was formed in April 1998 as a response to a crisis – the

continued depletion of the world's forest biodiversity and of the forest-based goods and services essential for sustainable development.

The Alliance partner organisations share a strong commitment to finding solutions to this crisis. By combining the Bank's access to policy dialogue, convening power, analytical capacity and financing operations with WWF's field presence, private sector partnerships and forest conservation expertise the Alliance can address forest management issues on a broad front.

The Alliance is working towards the achievement of three targets by 2005:

- 50 million ha of new protected areas
- 50 million ha of existing but highly threatened forest protected areas secured under effective management
- 200 million ha of production forests under independently certified sustainable management

With the commitment to working towards the achievements of its targets the Alliance is now seeking to build on the accomplishments of the past five years, by refocusing its efforts on key forested countries and those activities that maximize the comparative advantages of the partners. In addition, through closer integration with the broader missions of WWF and the World Bank, and more extensive outreach with a wide-range of potential partners, the Alliance hopes to amplify the impact of its activities around the world.

The Alliance will continue to focus its work according to two main thrusts:

- 1 Target driven activities with the potential to bring significant benefits in terms of on-the-ground field realities, and,
- 2 Activities oriented toward shaping the attitudes and agendas of institutions with a major stake in the way that the world's forests are both governed and managed.

IUCN

The World Conservation Union

Founded in 1948,

The World Conservation Union brings together States, government agencies and a diverse range of non-

governmental organizations in a unique world partnership: nearly 1000 members in all, spread across some 140 countries.

As a Union, IUCN seeks to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.

The World Conservation Union builds on the strengths of its members, networks and partners to enhance their capacity and to support global alliances to safeguard natural resources at local, regional and global levels.