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# WATERS OF AOTEAROA - ALIVE OR DEAD?

THE EFFECTS OF HUMANS, ESPECIALLY THOSE FROM COLONIAL SOCIETIES, ON INLAND WATER AND WATER CATCHMENT AREAS IN NEW ZEALAND.

In the Asia-Pacific region the dominant myths and cultural paradigms of pre-European societies displayed profound respect for living waters flowing naturally. From infancy children were taught water ethics by way of myths, legends and community example. To offend is to invoke the wrath of atua, taniwha or bunyip spiritual guardians of living waters. This culture is still alive.

Once the greatest threat to human health from rivers and streams was accidental drowning. How things have changed. These days you are more likely to suffer from drinking their polluted waters.

No longer do our waterways produce clean, fresh water, suitable for drinking, cleaning and bathing. They now produce "raw" water unfit for human consumption, ritual cleansing or body contact. Pesticides and pathogens, urban effluents and agricultural nutrients are poisoning our waterways. Going mostly unnoticed, countless millions of minor offences are gradually turning our streams, rivers and lakes into environmental health hazards. Viewed from a Pacific cultural perspective, our rivers and streams are slowly dying.

In traditional Pacific societies where environmental systems were commonly shared and protected through customary practices akin to modern community title, living waters were protected by mythological guardians and treated with due respect by all "or else". These cultural practices were misconstrued by colonial missionaries to be the pagan beliefs of uncivilised peoples. Colonials made strenuous efforts to replace the indigenous water models with European concepts of private property and "professional" management.

This proved no easy task for cultural myths and legends are usually more durable than those of science and technology. It took two hundred years to superimpose science as the only "knowledge"

really considered in managing water resources, that is until the Resource Management Act 1989 imposed consideration of *wairua* and consultation with local iwi. Historically, traditional myths and legends reflecting cultural and spiritual knowledge received mere lip service on formal occasions.

## DYSFUNCTIONAL WATERSHEDS

Dysfunctional watersheds and waterways have become so common in recent times that it is increasingly difficult to find one in healthy condition operating to its ecological potential. Common symptoms of dysfunctional watersheds are depleted aquifers, empty riverbeds, frequent hazardous floods, extensive stream instability, degraded floodplains, poor water quality and extensive weed invasion. The symptoms have become so widespread they are often considered natural features by Australian and New Zealand colonial cultures. Waterways degraded and left derelict from centuries of human impacts are being glorified mistakenly as wild rivers and proposed for protection as natural areas.

Consider an example from the South Island high country, such as the Waitaki River and its watershed tributaries. Under human occupation, the Tekapo, Pukaki, Ohau, Ahuriri and Waitaki Rivers have gradually degenerated into gravel laden braided rivers exhibiting extreme environmental degradation. Gravel laden glacial rivers are normally found in alpine zones immediately below retreating glaciers. In the case of the Waitaki system however, glacial outwash conditions now extend throughout the lakes and river system to the estuary and ocean.

## AQUIFERS

One of the key elements in the growth and behaviour of aquifers is their ecological role in establishing and developing underground

reservoirs complete with organic films forming bio-hydraulic seals. Reservoirs of ground water containing many years supply at naturally controlled release rates are common in healthy floodplains, talus slopes and colluvial fans in healthy watersheds with functioning ecostructures. Releasing the stored moisture slowly through bogs and flushes, seeps, springs and the vegetated sides of streams helps ensure sustainable yields of clean fresh water through natural processes. When aquifers link and connect with surface waters, as they do in healthy watersheds, the landscape below ground level becomes a large reliable reservoir storing, processing, filtering, and releasing clean fresh water.

Ground water is the general term used to describe the complex suites of water stored in the regolith and bedrock. In most watersheds it amounts to over 90 percent of the total water resources. In healthy watersheds the proportion of water beneath the ground can reach 99%.

Historically, many cultures developed profound knowledge and experience in using ground waters sustainably. Some step-wells and drop-wells in India, Nepal and China relying on near surface aquifers have operated for thousands of years.

When aquifers are breached, degraded, drained or eroded they quickly lose their ability to store and cleanse water efficiently. Degraded and eroded aquifers discharge stored waters at accelerated rates, often loaded with excess sediments, nutrients and pathogens. If the rate of discharge exceeds the rate of recharge, they can dry out completely. When this occurs the aquifer strata can collapse leaving behind land subsidence, tunnel erosion and erosion gullies. Over extensive areas of rural New Zealand and Australia, this process probably occurred for the first time on a massive scale

*Right: Top and Middle: Ohau River. Only a few decades ago, the Ohau River floodplain supported extensive matagouri, muhlenbeckia and willow woodlands on deep terrace soils thousands of years old. A decade of destructive conservation works removed most of it leaving this barren gravel bed. Heralded by its perpetrators as an environmental success story they are seeking to repeat it on the other Waitaki Rivers.*

*Bottom: Twizel River. Thirty years fencing stock out of streams and floodplains resulted in stable stream beds, soil capped gravels, extensive wetlands and clean waters. To reverse this process in three years, simply canalise the stream, restock and spray poisons annually.*

*Bottom left: Top: Ohau River tree plantings for riparian erosion control took over 20 years to establish and a few days to fell.*

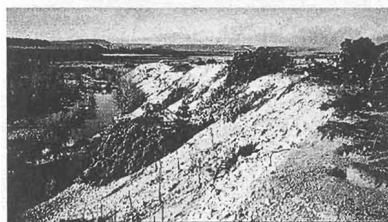
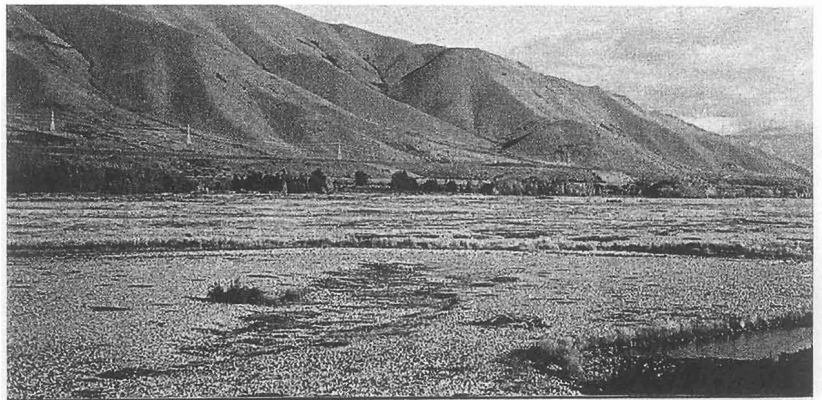
*Middle: Using toxic poisons in waterways to eliminate riparian vegetation communities is contrary to international law for sustainable development - UN Agenda 21.*

*Bottom: Bulldozing and burning riparian communities with regular follow up poisoning are the main methods used by DoC for destabilising the riverine floodplains for recreating barren ice age landscapes.*

*Bottom right: Top: In the Ohau River watershed there are still examples of healthy floodplain meadows, bog-flush fans and terraces, riparian ponds and stable channels once typical of the Waitaki River floodplains.*

*Middle: On the Lower Pukaki riverbed, floodplain chain-of-ponds linked by aquifers and seepage swales recreate the natural ecological potential of Waitaki river floodplains.*

*Bottom: Riparian restoration plantings along the Ohau River demonstrate the ecological benefits of willow plantings in re-establishing native plant communities.*



*Top: A healthy functional river floodplain showing stable terraces with a chain of ponds, seepage swales and wetland meadows interconnecting among the woody rises on the Pukaki River. This area was restored to ecological health and stability through stock-proof fencing, environmental restoration works and riparian plantings as part of the Waitaki Hydro Project in the 1970s. Today they are recognised internationally as outstanding examples of riparian restoration works and measures for rivers and streams in temperate zones.*

*Bottom: Vistas of snow clad mountains in the far distance remind us that glaciers once penetrated well into the Waitaki landscapes some 25,000 years ago. Back then the Waitaki rivers and streams were carrying huge bedloads of glacial gravels creating alpine floodplains with bare braided stream beds frozen solid in winter. Climatic conditions however have been warm and temperate for the past 15,000 years, the glaciers have retreated way back to the highest peaks, and the river floodplains have long stabilised into multiple distributaries. For more than 10,000 years the Waitaki floodplains were naturally and inherently stable with inter-connecting channels separated by well vegetated floodplain terraces.*

*Concerted attempts by Project River Recovery to re-establish ice age bare-braided rivers where warm and temperate climates have long prevailed are sadly misguided. They require massive human disruption to floodplain ecosystems. So far these measures have included extensive bulldozing, burning and repeated poisoning of riparian communities to destabilise the rivers and their floodplains. The intention is to keep the rivers in an unstable condition so that old glacial gravels stored in the floodplain can be reactivated to resemble bare braided riverbeds. From the perspective of a watershed ecologist, Project River Recovery is a classic oxymoron. It is deliberate and intentional degradation of stable floodplain ecosystems to recreate ice-age landscape geologies that are inherently unsustainable.*



with repeated, widespread burning by the first peoples. By the time the first European settlers arrived there was already significant waterway degradation in drier high country basins where firing was easiest. For the most part however, the waterways of New Zealand still carried healthy water suitable for drinking without treatment.

With widespread burning, clearing and draining of land by European immigrants for pastoral grazing, farming and urban settlements, far more serious degradation occurred from which the watersheds and waterways have not yet recovered. For colonial peoples lacking cultural models of watershed ecostructures, draining and grazing the landscape is not linked to aggravated erosion risks and flooding hazards, nor is it recognised that it generates the conditions for distributing pathogens, poisons and pollutants.

## HAZARDOUS FLOODS

Other than episodic floods, events that occur perhaps once in 100 to 1000 years, hazardous and damaging floods are often the result of human impacts and watershed mismanagement.

Like Japan, some 70% of New Zealand landscapes are steep mountain lands dissected by faults and regularly influenced by tectonic forces. Until the 15th century Japan's mountain lands were progressively deforested, resulting in the fertile floodplains prized for cultivation being transformed into broad braided, gravel beds by raging rivers and amplified floods. Visionary leadership in the 16th century reversed the tide and through watershed reforestation, Japan's steep lands were once again covered in mature forests and woodlands managed sustainably. As

a result the rivers and floodplains were restored to health and stability and the braided gravel riverbeds disappeared. In the centuries since, they have sustained arable cropping systems and generated a substantial proportion of Japan's food supply.

Over the past 25 years, geographical comparisons between Japan and New Zealand have repeatedly demonstrated the inadequacy of watershed management in New Zealand. The colonial myth persists that the degraded watersheds and dysfunctional rivers of New Zealand are somehow "wild and natural". Because generations of New Zealanders have grown accustomed to these catastrophic conditions they now accept them as natural and normal. In a perverse twist of events, NZ Government programs now spend substantial

In Auckland at UNITEC - *Te Whare Wananga o Wairaka* - traditional cultural attitudes and practices are actively maintained through teachings at the *Puukenga* (Maori cultural learning centre), through ceremony, songs and chants - *karakia* - at the sacred spring - *Te Wai Unuroa o Wairaka* - and through working to principles agreed in the Partnership between UNITEC and Maori iwi - *to Noho Kotahitanga*.

Calls to safeguard the sacred spring - *Te Woi Unuroa O Wairaka* - came via the arts in painting, poem and song, like the *Waiora* painting of Hare Williams. The call was answered firstly by resuming spiritual rituals and social ceremonies to rebuild respect for living waters at UNITEC. These were followed by formal requests for water professionals to assess the situation.

Recently, water quality sampling undertaken at the Wairaka Spring, painted a rosy picture of clean water well within NZ standards. Superficially, all seemed in order and the results indicated there was no significant threat from the spring water to pumps, pipes and other infrastructure envisaged for future water reticulation.

The underlying assumptions however, point to a far more serious problem. The water quality survey did not test key indicators for sustaining life, like dissolved oxygen or assess environmental risks and public health hazards from water borne pathogens. Typically, the water was treated as a physical resource to be assessed by its chemical properties. The idea of living water as integrated suites of dynamic ecosystems and symbiotic communities is considered a separate issue from water quality and yield. This highlights a serious cultural dilemma.

Why then is the Wairaka Stream subjected to poisons, pesticides, polluted effluents and contaminated storm waters all within a few hundred meters of its source at the sacred spring *Te wai Unuroa o Wairaka*? No, this is not the time for surprise or shame; the situation is so typical of New Zealand watersheds that the Wairaka watershed is just another typical example of waterway misuse and abuse throughout New Zealand.

environmental health are usually straight forward and simply stated

*"to improve and maintain water quality so that it is fit and healthy for human contact and consumption from the source to the sen"*.

Historically, colonial societies are renowned for imposing changes in ignorance, completely at odds with the environment they are seeking to inhabit. The Roman conquest of Europe imposed the concept of private property in things thought natural, like land and water. The privatisation of nature has proceeded to the point today that private corporations beyond the control of nation states are successfully registering private property rights in water resources essential to all life.

Exclusive private property in land or water was unknown or discouraged in the south Pacific before European peoples arrived. Highly productive perennial polycultures called terraquacultures were developed in mimicry of natural landscape ecologies. Measured in terms of total land productivity and sustainable livelihoods per hectare, terraqueous polycultures out perform specialized western agro-industries economically and ecologically. They maintain high levels of sustained productivity, without the need for chemical fertilisers or other poisonous inputs.

In Australia and New Zealand, the dominant European culture views water as a physical resource to be allocated by legal mechanisms for property assignment. Water is primarily a physical resource called H<sub>2</sub>O, captured by drainage catchments and reticulated by engineers. As a result, river managers and catchment scientists remain trapped within the plumbing and drainage model of catchment hydrology. By this model rivers and streams are considered part of the plumbing infrastructure of drainage catchments. Ironically, in assuming watersheds operate as drainage systems, society treats them as drains.

The concept of drainage catchments fundamentally undermines the integrity of sustainable watersheds and their landscape ecostructures: natural suites of connected habitats that stall, store distribute and cleanse living waters sustainably.

In the absence of cultural attitudes that respect living waters, hydrological science and industrial technologies are unable to provide a solution to our dying rivers. They do not have the appropriate cultural and ecological tools for the job. In recent decades water resource R&D in the Oceania realm has gobbled up millions of

resources on preserving these dysfunctional watersheds and protecting them from natural processes of ecological restoration in the name of nature conservation and resource management. No wonder international delegations and visiting watershed scientists observe that we are "light years behind".

Most hazardous and damaging floods are not natural or necessary, far from it. Floods are natural ecological events essential for restoring and maintaining the environmental health of river systems. Periodic floods become hazardous through cultural ignorance of the role of watersheds and functions of floodplains. Historic records from many cultures indicate that watershed and floodplain mismanagement are probably the most common causes of damaging. When watersheds and floodplains are abused and degraded, their ecostructures are disabled and then even relatively small rainfall events can wreak havoc leaving a legacy of unstable streams.

Stream instability includes a range of characteristic features from unstable banks and beds, to gravel-laden distributaries, swales and runnels. While rising landscapes pushed upward by tectonic forces like earthquakes can provoke and maintain stream instability until a new equilibrium is attained, in stable areas like basins east of the main fault blocks of the Australian plate, uplifting landscapes are convenient excuses for mismanaged watersheds and waterways.

## DRAINAGE CATCHMENT CULTURE

I believe the underlying problem is the catchment paradigm. The drainage catchment culture imposed by British immigrants is dysfunctional and unsustainable in the South Pacific.

Restoring the environmental health of watersheds is a multi-disciplinary exercise within social-cultural processes of environmental planning and resource assignment, involving at the very least:

Watershed Geography – Mapping, Modelling, Monitoring  
Landscape Ecology – Diagnosing the Dilemma, Environmental Planning–  
Participatory Watershed Programs  
Sustainable Development– Integrated Resource Management  
Multi-cultural Perspectives – Integrating Culture, Science and Technology

If there is a single indicator of the environmental condition of watershed catchments, it is the health of the water they generate. Health is a cultural term not readily measured by NZ standards for water quality. There is really no need however, for sophisticated sciences to define the health of waterways. Either watersheds or waterways produce clean, fresh water that is safe to drink untreated, or they don't. Policies based on pollution standards operate as licenses to pollute up to the level set. For this reason water quality policies for



*The sacred Wairaka Springs on the foothills of Mt Albert are simultaneously respected and defiled in a clash of Pacific and coloured cultures that symbolises Aotearoa – New Zealand.*

dollars yet still the waterways are polluted and the natural water is unfit to drink. Nowhere in settled New Zealand can you drink natural surface waters without fear of disease, unless you know they come from unpolluted aquifers.

The growing sophistication and costs of purifying water is symptomatic of dysfunctional watersheds and over-reliance on technological "fixes" to environmental problems. The water industry is urgently reassessing measures for reticulated water supplies now that traditional treatment methods have proven unreliable. Ecological management of water supplies mimicking slow filtration through sand beds commonly found in natural floodplains is now recommended for effective control of harmful protozoa.

Clearly, there are important environmental health issues involved in watershed management. Overriding public health and environmental issues in watersheds and waterways need urgent attention. In pursuing the path of sustainable development it is imperative that society eliminates poisons, pathogens and pollutants from watersheds and waterways. As far as possible this should be through developing cultural respect rather than imposing legal

Across the Tasman in Australia, a landmark Australian study of the Billabong watershed in the Murray-Darling Basin highlights similar cultural dilemmas. This multi-disciplinary watershed audit demonstrated that burning, draining and grazing the landscape left a legacy of dysfunctional floodplains and riparian ecosystems. Lacking understanding of the history of burning and land use impacts under historic and pre-historic cultures, the Billabong community today believe that planting native trees will correct land and water degradation. The audit clearly documents and demonstrates how many of the native Eucalypt and wattle species are symptoms of the overall problem. As a result of their phytotoxic, ecotoxic and pyrophytic (fire hazard flora) properties, river red gums long heralded as icons of the outback are in fact environmental health hazards.

The Billabong watershed audit also showed that introduced and naturalised species like willow and blackberry were successfully restoring riparian ecosystems and floodplain streams to ecological functionality through natural processes. This finding is clearly abhorrent to "nativists" who believe in the inherent superiority of native species.

In Canberra, 19th century heritage plantings of weeping willows along the Molonglo River formed riparian habitats that harboured the few remaining colonies of platypus and water dragons in the area. In the late 1990s many of the willows were killed and removed simply for being "introduced species".

There are many examples on both sides of the Tasman showing the dangers of the exotic "pest and weed" mentality. For example, in Tasmania during the 1990s, the Hobart Rivulet was "botanically cleansed" of heritage willows at the repeated request of locals. The results included a new cycle of stream erosion and estuarine deposition jeopardising property and infrastructure. Increased sedimentation in the harbour at the mouth of the Rivulet seriously affected moorage and navigation. The substantial costs for repairs and remedial works were met from the public purse.

mechanisms.

Top priority needs to be given to rebuilding cultural intelligence and related social systems that reflect the fundamental role of watersheds and riparian ecostructures in providing sustainable supplies of healthy water.

As watersheds and waterways mature and evolve their water storage and cleansing capacity, they are also capable of taking into natural aquifer storage more water than runs off in most rainfall events. Commonly two thirds of a rainfall event in healthy watersheds is taken into aquifer storage, while only one-third is discharged to streams and rivers. In eroded and degraded watersheds with dysfunctional aquifers and ecostructures, the opposite is the case. Most of the rainfall runs off quickly - taking with it loads of sediments and nutrients contaminated with pathogens, poisons and pollutants.

Consequently, maintaining the health and integrity of watersheds and waterways has a major bearing on reducing the severity of flooding while simultaneously ensuring sustainable yields of clean fresh water free of contaminants.

## COMMENTS AND CONCLUSIONS

In countries where the dominant culture and spiritual mythology engender respect for living water, sustainable development of watersheds and floodplains is more natural and normal than legislated and regulated. The defining characteristic of these cultures is their belief in "living waters" and the natural ability of

landscape ecostructures and riparian ecosystems to eternally replenish fresh, clean water.

In countries where the dominant spiritual and cultural framework denies respect for waters living in the landscape, where they are ambivalent or antagonistic to living waters, human settlement invariably leads to polluted waters, degraded streams and dysfunctional watershed ecosystems. In New Zealand and Australia, water is considered a physical resource drained from catchments. By this paradigm, society is obliged to accept that drainage catchments are only able to produce "raw" water unfit for human consumption.

Similarly, maximising water yield from catchments without regard to watershed ecosystems or water quality is fraught with environmental risks and public health hazards. Deforested mountains and eroded watersheds with dysfunctional aquifers usually mean highly amplified flood and drought conditions, major stream instability and unhealthy water.

In the circumstances, the critical dilemma facing colonial societies in the South Pacific is how to forge an environmental paradigm and cultural framework that work together for sustainable development of watershed catchments according to the principles of Agenda 21. This is a matter to be resolved democratically through community participation and capacity building, rather than a technical problem for the water industry or scientific research.

*This article is a condensed version - the full version can be found at [www.watershed.net.nz](http://www.watershed.net.nz)*