Across the world rivers are screaming. What will it take to listen to and learn from them?

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Key points

- Mindsets underpin societal relations to rivers and how rivers are known – attempts to 'control' rivers generate outcomes that are unjust, inequitable and unsustainable
- An alternative, more-than-human approach that 'works with the river' is needed, framed here through a Māori lens in Aotearoa New Zealand that 'Lets the Rivers Speak'
- The multidecadal record of satellite imagery, Big Data and machine learning applications provide an incredible information base with which to listen to what rivers are saying
- Lessons learnt to date emphasize the imperative to Know your Catchment: Rivers are idiosyncratic, unhappy and emergent
- Pedagogies of hope that embrace rivers at the heart of ecological civilization are exemplified using an example from China

Abstract

Societal relations to rivers shape how they are managed and the outcomes that ensue. Interventionist, one-size-fits-all approaches to command-and-control engineering practices generate unjust and unsustainable outcomes. An alternative mindset, knowledge structure and institutional framing is required. A more-than-human lens moves beyond management practices that assert human authority over rivers. Working with the rights of the river supports efforts to live generatively with living rivers – and each other. In Aotearoa New Zealand, the Te Awa Tupua (Whanganui River Claims Settlement) Act 2017 granted rights to the Whanganui River as a living and indivisible entity. This potentially represents a critical stepping-stone with which to reconceptualize and enact new societal relations to rivers.

Here I demonstrate the importance of listening to rivers and learning from them. Building on a collaborative project that 'Lets the Rivers Speak', I highlight relations between digital abstractions and grounded realities in an age of Big Data and machine learning applications. Although systematic insights into river diversity, behaviour and evolutionary traits now underpin foundation understandings of river responses to changing boundary conditions (climate change, anthropogenic activities), management responses are yet to deal effectively with what rivers are saying. I use an example from China to show how pedagogies of hope that embed more-than-human relations to rivers at the heart of ecological civilization can generate healthier outcomes.

Keywords

Mindset, more-than-human, nature-based Solutions, Big Data, geomorphology, river sovereignty, just sustainability, Ecological Civilization

Introduction. Positionality

A few years ago, I wrote a book entitled: Finding the Voice of the River (Brierley, 2020). The book was inspired by collaborations with colleagues in Aotearoa New Zealand that seek to embed Māori conceptualizations in which "I am the river and the river is me" at the heart of societal relationships to rivers, and each other (Hikuroa et al., 2021). This builds directly on convergent understandings in western science and matauranga Māori (Wilkinson et al., 2020), wherein floods are considered part of the 'natural' regime of a river – they form alluvial soils, they (re)create the dynamic physical habitat mosaic of the river, they are the driving force of restoration activities (Florsheim et al., 2008; Kondolf,

2011; Williams et al., 2020). Working with the river respects the sovereignty and agency of the river, listening to and learning from it. After all, the river simply wants to be a river (Hikuroa et al., 2021).

My research as an applied fluvial geomorphologist has always focused on 'working with the river' (Fryirs and Brierley, 2021). The scope of my work shifted significantly when I moved to New Zealand (Brierley, 2025). Collaborations as part of a project entitled 'Te Awaroa' (an aspirational call to restore 1000 rivers in Aotearoa) evolved into a Marsden Project led by Dame Professor Anne Salmond and A. Professor Dan Hikuroa called 'Let the Rivers Speak' (Salmond et al., 2019). Te ao Māori (Māori ways of being) express ancestrally grounded relations to rivers as living and indivisible entities, conceiving humans as part of nature and the health (ora) of rivers as intrinsically tied to the health of society. In this worldview, rivers and society are ontologically the same thing. Māori ways of knowing underpinned the emergence of Te Awa Tupua – the legal expression of the rights of the Whanganui River (Brierley et al., 2019). My growing (as yet embarrassingly under-developed) understanding of these matters prompted the provocative subtitle for my 2020 book: Beyond Management and Restoration (there are so many things that I would now say and do differently in this book). I now limit my use of the term 'management' as it asserts human authority over rivers, favouring the virtues of 'living generatively with living rivers'. In an Australian context, scientific principles that work with the river have informed approaches to looking after rivers for several decades – notions of repair, self-healing, working with recovery, a conservation first ethos, etc (Russell et al., 2023).

My experiences in Aotearoa New Zealand now situate scientific understandings in a different context, as shown on Figure 1. This framing defines my positionality in writing this paper, exemplified by recent collaborative work on more-than-human geomorphologies (Thomas et al., 2026). Such ways of knowing and being resonate with the theme of this 12ASM conference: "Living and evolving with change", highlighting prospects that the Australian stream management community and industry are open to doing things differently.

In practical terms, the message to river managers, planners and policy makers is to listen and respond to what rivers are saying, recognizing that existing approaches to controlling rivers generate outcomes that are neither desirable nor sustainable. Locked-in reactive management practices are expensive and unjust, creating path dependencies that restrict the range of viable options that are available to future generations. Proactive practices that work with the river generate healthier, cost-effective and equitable outcomes (Brierley & Fryirs, 2022).

Figure 1 Conceptual representation of rivers at the heart of society (and ecological civilization). Scientific principles that work with the river are operationalized through practices that reflect healthy societal relationships to rivers. In turn, notions of river rights conceive rivers as living and indivisible entities. In theory (and hopefully in practice), the heart is pulsing!

I start the paper with a few comments on what it means to 'Let the Rivers Speak'. I then summarize key messages on what rivers are telling us from analyses of the decades-long record of river adjustments derived from satellite imagery. Building on this, I highlight the aspirational potential and ethical implications of pedagogies of hope (Freire, 1994) in the conduct of a river ethnography (use of multiple knowledges to allow a river to tell its own story). Finally, I explore prospective uptake of principles outlined in this paper as part of emerging moves towards ecological civilization in China.

What does it mean to 'Let Rivers Speak'? Rivers are screaming. What are they telling us?

Catastrophic flooding and other disasters are an increasing part of contemporary life. Across the world, rivers are screaming. Disheartening socio-economic, environmental and cultural tragedies prompt critical questions regarding existing management practices, decision-making processes and institutional arrangements. Unsustainable and inequitable outcomes attest to a fundamental imbalance in societal relations to river systems. Reactive, command-and-control practices and interventionist 'one-size-fits-all' solutions continue to make the same mistakes. The language and rhetoric of 'defence', 'protection', 'security', 're-engineering', indeed, the very word 'management', create a false and misleading sense of societal 'control' over nature and river systems (Brierley & Fryirs, 2022). Hard infrastructure 'solutions' set path dependencies that are difficult or impossible to revoke, expensive to maintain (or expand) and limit the range of viable options into the future. Managed retreat is increasingly inevitable in the face of impending disasters and uninsurable properties.

Recurrent investment in practices that do not work wastes money, time, resources and opportunities, undermining societal trust and further compromising hope. Fighting against rivers does not work (Brierley & Fryirs, 2022). Technocentric approaches disrespect rivers and the societies and cultures that live with (as a part of) them (Parsons & Fisher, 2022). What will it take to learn from what's gone before and avoid repeating ineffective management practices? Not allowing unconscionable land use planning decisions that fail to learn from past experience is a key imperative. A shift in mindset is required – one that recognizes humans as part of nature, and designs and implements proactive, adaptive and mitigative responses that listen to, learn from and work with rivers. Recommendation 1 of the Russell et al. (2023) paper indicates that the Australian stream management community has already identified this as an imperative: "the industry and society must work holistically to restore the relationship between humans and nature".

Each river has its own story to tell. Appropriately contextualized understandings explain geographical and historical controls on how rivers look, adjust and evolve, at site, reach and catchment scales. This knowledge base underpins reliable predictions of what is realistically achievable for any given system in the future. Unfortunately, we are not doing a very good job at listening to, learning from and living generatively with rivers. We continue to make ineffective use of our collective knowledge, failing to generate healthier rivers and healthier societies (ways of being). In many cases, repeated and recurrent recommendations to preserve what we know better, to work with the river not against it, to be proactive not reactive, fall on deaf ears (Brierley and Fryirs, 2022; Russell et al., 2023). Management practices that we know will not engender sustainable outcomes continue to be applied. Regardless of whether this is a conscious or subconscious decision, wasting time, money and resources discourages societal confidence in the process of notional recovery and repair.

Sadly, the same situation is evident in Aotearoa New Zealand (Brierley et al., 2023). This is exemplified by recent lessons learnt from the focal river for the Let the Rivers Speak project – the Waimatā River in Gisborne, Tairāwhiti (Salmond et al., 2019). The East Coast region of Aotearoa is globally renowned for sediment yields per unit area that are among the highest in the world. Extensive research documents catchment-scale (source to sink) landscape responses to deforestation. Impacts of Cyclone Bola in 1988 highlighted marked differences in primary sediment sources and conveyance (connectivity) relationships from catchment to catchment (termed geomorphic river stories by Fuller et al., 2023). Unfortunately, evidence-based understandings of process-based approaches to reforestation and riparian zone management at the catchment scale were pushed aside and a blanket, one-size-fits-all

approach to pine plantation forestry was adopted (Fuller et al., 2023). Devastating responses to Cyclones Hale and Gabrielle in early 2023, and a series of subsequent high intensity storm events, attest to the failings of restoration and forestry harvesting practices. Slash-laden rivers literally bulldozed channel margins, stripping riparian vegetation remnants and revegetated corridors. Dishearteningly, management practices exacerbated the restoration and recovery challenge, making it more difficult and increasingly expensive.

The Waimatā River has spoken, and it does so recurrently. It isn't happy. As yet, we are not respecting diversity, failing to learn from what each river is telling us. But, the potential to do so is already in-hand…

What rivers are telling us from the multi-decadal satellite imagery record

What key messages and implications should be heeded in letting rivers speak and learning from them? The multi-decadal record of satellite imagery, alongside the catalogue of aerial photography and mapping resources from earlier decades and centuries, provide a systematic base to track and interpret forms and rates of geomorphic adjustment and the associated evolutionary trajectory of each and every river. Technical capacity to support practices that work with the river is already in-hand. Big Data and machine learning applications already present incredible prospect to learn from what rivers are saying.

Here I highlight three principles or lessons that have been demonstrated (perhaps reinforced, rather than revealed) through analyses of this rapidly growing database.

1. **Rivers are individualistic and idiosyncratic entities.** While theoretical principles of flow and sediment transfer, and relations between impelling and resisting forces, play out in universal ways for all rivers everywhere, forms and rates of geomorphic adjustment demonstrate individual, idiosyncratic traits of rivers as living entities (Boothroyd et al., 2025). Different types of river adjust in different ways and at differing rates. They have variable capacity for adjustment and ranges of variability (i.e., sensitivity/resilience; Brierley & Friyrs, 2024). Some rivers are equilibrium systems, others are not (e.g., cut-and-fill rivers). Each river has individual characteristics, traits and needs. Hence the imperative to "know your catchment" (Brierley and Fryirs, 2005).
2. **Rivers are not happy.** Loss of life and livelihoods are devastating human consequences of unprecedented river responses to increasingly extreme and increasingly recurrent disturbance events (and sequences (concatenations) of events). Damage to assets and infrastructure in urban and rural areas, biodiversity loss and physical and psychological distress attest to failures of command-and-control management practices (Brierley & Fryirs, 2022). Regardless of challenges faced in assessing geomorphic river condition (Fryirs, 2015; Fryirs & Brierley, 2022), and despite some notable examples of system-wide river recovery (Fryirs et al., 2018), impacts of recent floods and other disasters document declining river health (in biophysical and sociocultural terms) and increasing vulnerability. Hopefully, river happiness indices can track more positive stories into the future (Ju et al., 2022).
3. **Rivers are emergent entities.** Trajectories of geomorphic adjustment are not always linear and predictable. Rather, rivers are prone to complex response, with little evidence that regime or equilibrium principles provide an appropriate synthesis of contemporary river behaviour over decadal timescales (Brierley & Fryirs, 2022). Rivers do not necessarily respond in uniform ways to events of a given magnitude and frequency. Changing boundary conditions and contingent properties shape system-specific responses to particular sequences of disturbance events. In this light, the past does not necessarily provide reliable insight into the future. Hence, future options should be viewed as moving targets (Brierley and Fryirs, 2016), recognizing rivers as emergent entities. As change as the only constant, it pays to 'expect the unexpected' and recognize that 'surprises are inevitable'.

Effective approaches to the design and implementation of nature-based solutions build upon catchment-specific understandings of processes that form, recreate and rework river landforms, explaining their patterns and evolutionary traits. This includes analysis of where each river gets its sediments from (erosion processes, sediment sources, rates of supply), how this has changed over time, and how landscape (dis)connectivity determines patterns and consequences of sediment redistribution at the catchment scale (Fuller et al., 2023; Poeppl et al., 2022). Prospect is increasingly in-hand to conduct catchment-specific analyses that unravel 'Time, Space and Causality in Applied Fluvial Geomorphology' (relabeling the foundation paper by Schumm and Lichty, 1965). The rapid development and increasing reliability of Digital Twins reflect major advances in the sophistication with which digital records are being used to track river adjustments and predict prospective responses to changing boundary conditions and disturbance events (e.g., Yang et al., 2024). These key learning tools now provide enormous promise to guide practices that live generatively with living rivers.

But, this is only part of a river's story. A holistic approach is needed if rivers are to be conceived, and lived with, as living and indivisible entities.

Multiple knowledges and pedagogies of hope: The conduct of a river ethnography

Despite technological developments and increasing availability of catchment-specific scientific information, systematic improvements in river health are yet to eventuate in biophysical or sociocultural terms. A different approach and set of actions are required. Various sources of optimism indicate more hopeful prospects. First, awareness is growing, sadly fueled by recurrent tragedies. Second, the design and uptake of nature-based solutions reflect increasing acknowledgement that prevailing practices are not working. Third, green technologies are an increasing part of day-to-day lives. Fourth, greater familiarity with traditional and indigenous mindsets that embed different relations to nature (and each other) prompt heightened consideration of multiple ways of knowing. Holistic conceptualizations of rivers as living, indivisible and emergent entities mark a significant step beyond prescriptive, top-down, one-size-fits-all management practices. Integrative, linked-up thinking moves beyond a singular focus on technocentric, discipline-bound (fragmented) understandings (constructively pull together, rather than competitively pulling apart). Careful use of evidence-based, catchment-specific understandings that work with the river is increasingly recognized as 'best practice'. This entails enacting proactive adaptive management, rather than just saying adaptive management is happening (Russell et al., 2023). Fifth, increasing familiarity with the rights of nature and the rights of the river promote awareness and consideration of more-than-human relations that extend beyond a sole emphasis on anthropocentric concerns. Sixth, recurrent institutional restructuring highlights the imperative for change - it's time to imagine, envisage and enact generative policies and institutions that work with (as a part of) river systems.

In meeting this challenge (and opportunity), how can we generatively inter-relate understandings derived from digital abstractions of rivers with grounded realities of lived relationships to (as a part of) rivers? It pays to recognize, respect, and apply multiple ways of knowing rivers, incorporating oral traditions and narratives, spiritual connections to rivers, and approaches to storytelling and storylistening (Hikuroa et al., 2021; Stevens et al., 2026). Locally engaged, locally owned, locally enacted plans and actions build upon coherent, readily accessible (open source) and accurate information – living databases from which practitioners and communities learn and respond together in river co-learning arenas (de Souza et al., 2025) and communities of river practitioners (Brierley et al., 2025a).

Inclusive approaches to collective wellbeing and learning are expressions of pedagogies of hope – practices conducted with respect, humility and open-mindedness in which agency accompanies hope (Freire, 1994). Significant work remains to be done in crafting approaches to the design and conduct of river ethnographies – more-than-human framings that allow rivers to tell their own stories. Profound geoethical implications accompany deliberations that respect the rights of nature and the rights of the river (Sharp et al., 2022). Different institutional and governance arrangements must be envisaged and

enacted to make this happen. Ecological civilization presents an intriguing platform to consider such prospects.

Rivers at the heart of moves towards ecological civilization in China

> *"In wending its way thither and thereby achieving a destination proper to its nature, it (the river) simultaneously assists others in achieving their ends, sustaining the entire landscape with its waters, giving life to all things. 'Doing nothing' then, the river ensures that everything is done, that its work of sustaining the world is accomplished."*
>
> Freya Mathews, 2023, p52

Living in the midst of political, economic, sociocultural and environmental crises, it is increasingly evident that "The planet itself is bringing modern civilization to an end" (Clayton & Schwartz, 2019, p24). A different mindset is required – one that learns from what's gone before, but envisages and enacts sustainable ways of being on Planet Earth. Ecological civilization envisages and enacts harmonious coexistence of humanity and nature (Zhou, 2021). Prospectively, this presents a source of hope in moves to Let the Rivers Speak, listen to them, and act generatively on these understandings.

Building on a decades-long history of environmental protection programmes that manage at source and at scale (Bryan et al., 2018), managing the land to manage the rivers (Brierley et al., 2023), moves towards ecological civilization are already close to a lived reality in parts of China (Hansen et al., 2018; Pan, 2016; St'ahel, 2023; Wei et al., 2021). Ecological civilization has become a core national development strategy and a foundational pillar of China's 'New Era' of systemic change towards a green economy (Hansen et al., 2018; St'ahel, 2023; Wei et al., 2021; Xue et al., 2023; Zhang & Fu, 2023). It is now regarded as equally vital as economic, political, cultural and social development. Since 2018, ecological civilization has been embedded in the constitution as the ideological framework for the country's environmental policies, laws and education (Wei et al., 2021; Westman & Huang, 2022; Xue et al., 2023).

The initiation and development of ecological civilization in China build on philosophy, historical experience and modern science, incorporating traditional philosophical theories such as Taoism's advocacy of "the Tao way follows nature" and Confucianism's advocacy of "unity of man and nature" (Pan, 2016; Xia & Schönfeld, 2011). Working with the river accords directly with the Daoist concept *wu wei*, wherein passive relations of non-interference and natural conformity 'step back' and 'go with the flow', aligning with the natural order and avoiding excessive human intervention to achieve harmony and inner peace (Brierley et al., 2025b; Mathews, 2023). Such framings can inspire and guide the quest to achieve sustainable ways of being.

As envisaged by Clayton & Schwartz (2019, p6), global ecological civilization comprises a variety of regional and local ecological civilizations (i.e., individuals-in-community) in ways that meet collective needs – concerns for the common good and a dignified life for everyone (Marinelli, 2018; St'ahel, 2023). Significant institutional steps have already been taken to support moves towards ecological civilization across China. Prospectively, the nationwide network of river chiefs (760,000 village-scale representatives) presents opportunities to embed societal relations to rivers at the heart of ecological civilization (Wu et al., 2020).

Concluding comment

Although rivers are screaming, we are yet to listen to and learn effectively from them. Insights generated from recently developed systematic resource bases demonstrate that rivers are individualistic, unhappy and emergent. The key implication for river managers, planners and policy makers is to recognize rivers as living, indivisible and evolutionary entities, knowing and applying catchment-specific understandings using practices that work with the river. Respectful more-than-human practices relate healthy socio-cultural framings to the rights of the river, strategically and proactively addressing collective concerns now and into the future. The aspirational agenda outlined here conceives rivers at the heart of ecological civilization, founded on principles of equity in the quest

for a just sustainability. Living generatively with living rivers entails listening to and learning from each and every river. No-one wants to consciously harm a river, do they? It pays to dream …

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