

Water security for nature and people

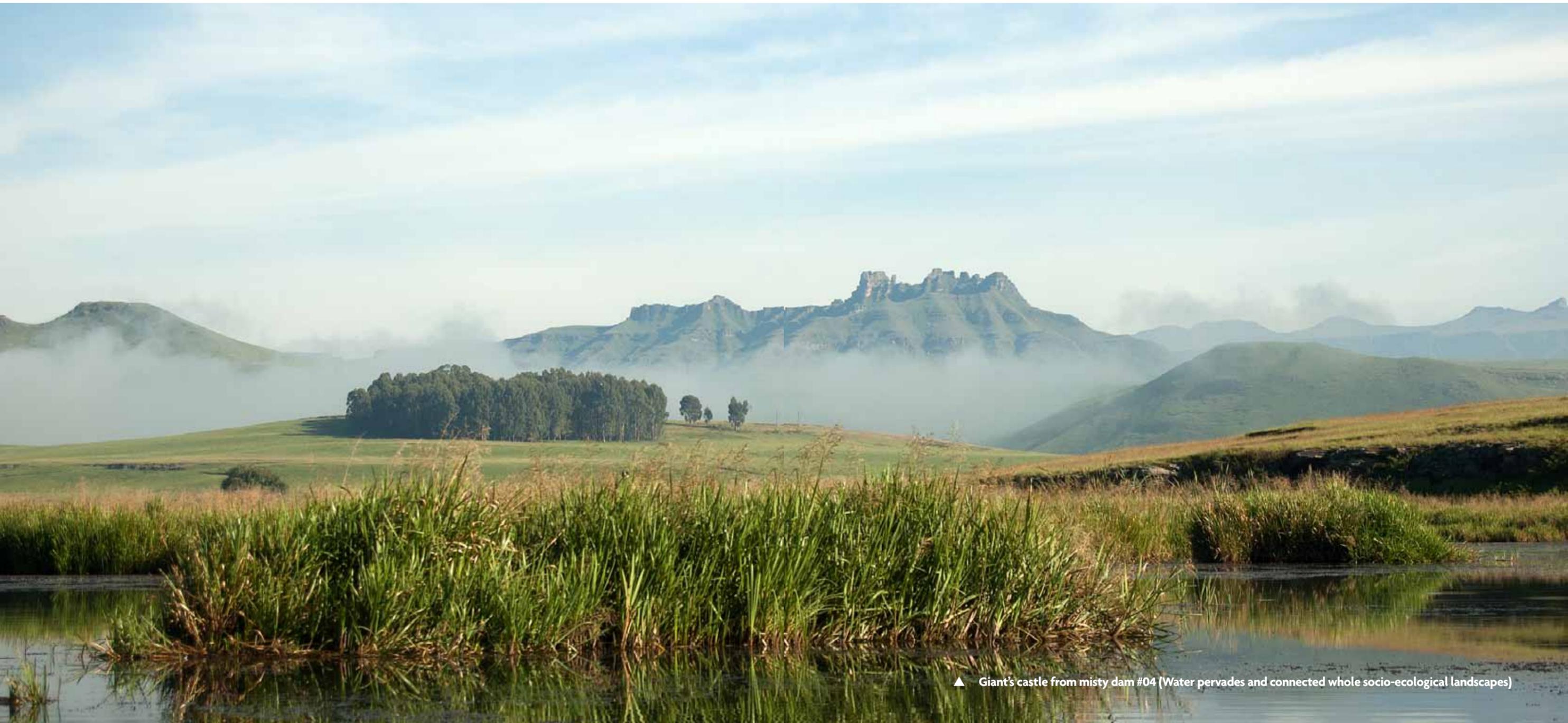
Mark Everard proposes that ‘natural infrastructure’ is essential for the long-term resilience of ecosystems, and that the multiple values provided by nature should be integrated into regulation, subsidy, planning and governance systems.

Water pervades the natural world, interacting with and transformed by its living and non-living elements. Talling and Lemoalle¹ observed that ecosystems and the human needs they support are driven by a cascade from physical processes (climate and topography), subsequently coloured by chemical processes (rocks, soil and their uses) and then biological processes. This same analysis applies to the character and functions of all ecosystems, shaped as they are by fluxes of water and the energy, chemical, sediment, biological and other loads it carries.

Consequently, all influences on the quantity, quality, timing, physical and chemical constituents, and residence time of water in habitats, at all scales, have

major implications for the habitats’ character and functioning, the human uses they can sustain, and adjacent ecosystems. This occurs from continental scale (orographic effect and run-off) to microscopic scale (localisation of nitrification and denitrification processes in adjacent aerobic and anaerobic layers of suspended particulate matter).

Water, then, plays a key connecting role in environmental resilience and production of ecosystem services. Historic emphasis on the discrete study of physical, chemical, ecological, biological, economic and social dimensions in education and research overlooks the fact that all elements are interconnected, as water flows permeate and link whole socio-ecological systems from the microscopic to the biospheric.





▲ Rietvlei wetland and dam near Pretoria SA. (© Mark Everard)

CONFLICT AND SOLUTION

The UN Millennium Ecosystem Assessment² and the UK National Ecosystem Assessment³ summarise at global and national scales respectively how multiple dimensions of human well-being depend upon the services of nature. Human security is indivisible from environmental security. If water becomes scarce or more episodic, environmental assets decline and resource conflicts become more probable due to the central importance of water for basic biophysical needs, cooling, transport and irrigation, recreation, aesthetics and diverse dimensions of quality of life.

The often-repeated prediction by former World Bank Vice President Ismail Serageldin that “wars of the 21st century will be over water unless we change the way we manage water”⁴ overlooks how competition for scarce water resources has sparked conflicts since the rise of hydraulic civilisations (societies managing water through technology rather than local access⁵). In 1967, the Six-Day War had competition for water and catchment lands at its heart. Deliberate flooding was the intent of the ‘Dam Busters’ missions of the Second World War, while draining the marshes of southern Iraq constituted a weapon of war for Saddam Hussein.

In southern England, post-medieval manorial court records catalogue rich case law relating to conflicts over water use for milling, water meadow, fishery

and navigation. However, co-management of water systems has conversely frequently served as a basis for co-operation, innovation and even peace-making between and within nations⁶⁻⁸.

Livelihood security is intimately related to water availability, including how it is shared and co-managed. This can be central in community-building, such as where co-operative water-sharing underpins centuries-old terraced paddy systems across the tropical world. Insightfully, Nelson Mandela perceived sharing of water and other environmental assets in the water-scarce nation of South Africa as fundamental to longer-term realisation of democracy, just as annexation of water was instrumental in entrenching privilege under apartheid.

ENVIRONMENTAL NEEDS VERSUS HUMAN NEEDS

Conceptual conflicts remain in allocating water to sustain the natural environment. In South Africa, there remains debate about balancing nature’s needs with those of people. Under the National Water Act 1998, an ‘Environmental Reserve’ set by the State reflects the portion of water reserved in catchments to maintain ecosystems, natural processes and strategic needs. Remaining water is then available for allocation to different human users through democratically constituted bodies. This has led to debate about whether nature should be favoured above human needs.

From the perspective of more environmentally educated countries, the need to reserve resources for sustaining nature may seem self-evident. However, perceptions of conservation are culturally subjective. The views of some sectors of South African society are clouded by a history of ‘environmental racism’ as, in common with the USA, the historic preferences of a ruling elite for establishing reserves for hunting or nature sanctuaries led to displacement and disenfranchisement of marginalised communities.

So the debate about balancing the needs of nature with those of people is often contested. Emerging ecosystems science proves useful in exposing the myopia of the underlying assumption, also commonly seen where business pressures work against conservation needs.

In reality, the needs of people and nature do not compete, as may appear from a utilitarian world view. Rather, the processes of nature support our ability to feed, clean and clothe ourselves; extract and dispose of economic resources; and weather extremes of flood, drought and temperature. If nature’s services are lost or degraded, so too is its capacity to enable people to live safe, wealthy, conflict-free and fulfilled lives.

Water security for the environment is then itself a myopic concept; the security of nature is indivisible from the security of people, including the economy. What people do has profound impacts on water flows and the natural environment, including its capacity to sustain human well-being. The core underpinning asset of nature, including water security, underwrites humanity’s options and future opportunities, even if legacy market forces, management paradigms and resource-flow assumptions driving much political and business decision-making do not yet reflect this reality.

WHAT LIES BENEATH?

Ecosystem services have gained accelerating acceptance into pedagogy and policy over recent years, particularly since publication of the Millennium Ecosystem Assessment². This has expanded understanding of the multiple values provided by water systems, biota and other elements of the natural world, over and above narrow utilitarian exploitation. Today, we see increasing emphasis on natural flood management, sustainable drainage and other urban green infrastructure, and emergence of economic tools such as payments for ecosystem services to bring formerly neglected services into decision-making.

Slower progress is occurring in recognising systemic context, and ascribing non-financial as well as financial values, to address all ecosystem services (provisioning, regulatory, cultural and supporting) defined by the Millennium Ecosystem Assessment². Of these categories, supporting services remain the least readily quantifiable and hence the most overlooked. Many purported ecosystem service studies focus on more readily monetised services,

either overlooking other services or assuming their values are internalised in quantified services; this focus on services already close to the market system that is the principal architect of ecosystem degradation undermines claims of systemic analysis.

Serious consideration of environmental security relates to system resilience, to which services that are hard to value (particularly supporting services such as soil formation, water cycling, habitat for wildlife and so forth) and regulatory services play a disproportionately significant role.

Climate instability and the demands of a growing global population highlight that it is not merely human-made water infrastructure that matters. ‘Natural infrastructure’, significantly including natural water storage and purification systems that add value to technological systems, represents a more fundamental resource securing human well-being⁹. Natural infrastructure is essential for the long-term integrity and resilience of the ecosystems that underpin continuing human well-being, and that society must therefore progressively internalise into statute, markets and corporate governance.

UNDERSTANDING THE SYSTEM

Control of water underpinned the founding of the first recorded global civilisation in Mesopotamia, allowing people to escape day-to-day subsistence, thus enabling settlement and societal differentiation. Innovations to increase security and productivity through water management, both technological and institutional, have underlain subsequent civilisations.

Mismanagement of water systems has also underlain the demise of many civilisations, such as the incremental effects of soil salinisation and nutrient depletion in Mesopotamia and progressive lead poisoning from plumbing systems in ancient Rome.

RECONNECTING SOCIAL AND ENVIRONMENTAL SECURITY

Developed world perspectives have tended to regard water security as a technical issue, managing supply through predominantly technocentric solutions. Dramatic successes have been achieved. For example, virtually all the water needs of the province of Gauteng, the economic and industrial heartland of South Africa encompassing Johannesburg and Pretoria, are provided by massive dam and transfer schemes from catchments outside Gauteng and even outside South Africa (such as the Lesotho Highlands Project).

However, water is more than a commodity, playing many wider roles in ecosystems, such as soil formation and fertilisation; supporting biodiversity, fisheries and ecotourism resources; regional aesthetic and spiritual value; crop production and grazing. This all contributes to overall resilience, livelihood support and diverse cultural value systems. Overlooking these wider services is inequitable and economically inefficient,

and also erodes the capacities of the environment to secure future human well-being.

Water also has an important social context. Centralisation of water management in post-independence India led people in arid rural Rajasthan to abandon village-scale water management and natural-resource stewardship practices, leading to progressive ecological degradation, human hardships and village abandonment. Since 1987, the Ghandian-based NGO Tarun Bharat Sangh¹⁰ has promoted reinstatement of village-scale governance, leading to re-establishment of community-based groundwater recharge techniques, increasing water availability and soil moisture between monsoons, uplifting food and economic security, freeing women from water-carrying, and bringing about repopulation of villages.

Only when ecosystems and human livelihood needs are integrated will serious progress be achieved towards sustainable management of the contiguous socio-ecological system. This entails integrating the multiple values provided by nature – monetary, cultural, inherent and other value systems held by people sharing the resource – into regulation, subsidy, planning and governance systems at all scales.

This integration is implicit in the Convention on Biological Diversity's Ecosystem Approach, to which the UK signed up in 1995. It is an ever more pressing need with rising human numbers and demands for food, water and energy, compounded by climate change and urbanisation.

Reintegration of nature into society is seen in SuDS (sustainable drainage systems) and 'green infrastructure' in urban settings, natural flood management and catchment-based water quality protection measures at landscape scale, and a shift back towards community-centred management. Further knowledge transfer is essential across all policy areas, recognising the central significance of water in securing environmental health and its capacities to support human well-being.

SECURING THE FUTURE

This brings us back to the importance of the security of water and other environmental resources for the human 'securitisation' agenda, connections not lost on the defence community. The Development Concepts and Doctrine Centre (DCDC) of the UK's Ministry of Defence takes a strong interest in resource security as a means to avert conflict and to secure enduring peace post-conflict, with natural resource stewardship and security featuring prominently and frequently throughout DCDC's *Global Strategic Trends – Out to 2040* review¹¹.

For the pacifist, the convergence of military thinking with an ecosystems ethos may seem bizarre, perhaps

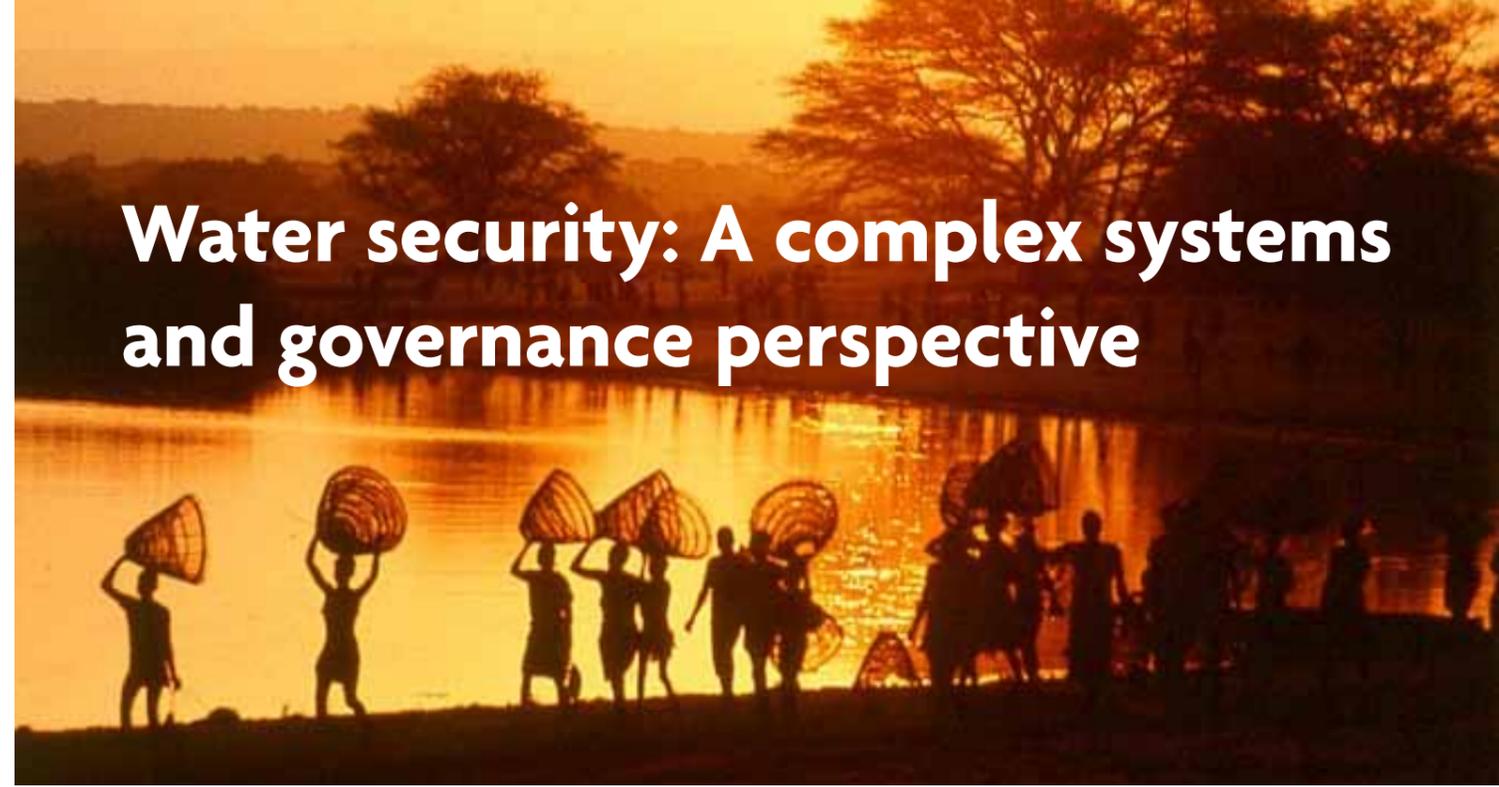
suspicious. However, it indicates an embedded understanding of human dependency on water systems and other natural infrastructure, and how collaborative stewardship can lead to positive-sum beneficial outcomes and improved security not only for the environment but for all who depend upon it now and into the future. **ES**

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Water security: A complex systems and governance perspective



▲ **Figure 1. Impounding the Pongola River has increased the vulnerability of traditional fisherfolk living downstream.** (Source: Kevin Rogers)

Charles Breen, Bimo Nkhata and **Duncan Hay** argue that improving water security will depend on developing appreciation for the complexity of social – ecological systems and our ability to sustain collective management.

“The Global Agenda Council on Water Security believes that only far-sighted and collective action can avert future water crises and ensure water security for communities, businesses and countries. This collective action, however, will be more successful if the diverse social and economic values that different groups attribute to water and its use are respected and reflected in their actions.” (World Economic forum¹)

The quote reminds us that water security is embedded in a complex system characterised by multiple, dynamic interdependencies among resource users, and with a resource that is itself complex. If we are to become far-sighted and act collectively we must find ways of living with complexity while acting in ways that respect the diverse social and economic values the different groups attribute to aquatic resources. How might we do this?

COMPLEXITY OF AQUATIC AND SOCIAL SYSTEMS

Aquatic systems, particularly rivers, lakes and wetlands, provide a variety of ecosystem services that change across the landscape, creating a template of opportunities for people to engage in and benefit from. As people exercise their choices of which benefits to access, and where and when to do so, a

complex pattern emerges among the beneficiaries. The social pattern mirrors the ecological template. It is just as heterogeneous and dynamic because not only must it adapt to the variability in the supply of ecosystem services, it is also being shaped by changing preferences and demand.

The ecological and social systems are coupled, each affecting the other, while at the same time being influenced by common factors such as climate change. In complex social-ecological systems of this nature there are so many pathways through which a disturbance may be propagated that the relationship between cause and effect can be difficult to discern, particularly when change may be suppressed in one pathway and multiplied in another, and take many years to become evident².