THE CENTRAL IMPORTANCE OF WATER IN SETTING A TRANSACTIONAL GLOBAL CONSERVATION AGENDA

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ABSTRACT

Global politics has entered a more transactional era. Although ecosystem services provide valid economic arguments for conserving biodiversity, these arguments do not resonate with politicians focused on tangible, short-term benefits for their electorate. We need more cogent arguments for conserving large areas of land that provide transactional benefits to voters. Climate change falls short; it is a secondary threat to biodiversity and has limited political support, except when inclement weather directly impacts humans through floods, hurricanes or droughts.

All these disasters are fundamentally linked to water Paradoxically, the global water supply is becoming increasingly tenuous and variable, yet it remains intimately connected to the presence of forests and large montane areas. Developing an International Convention on Water would indirectly create an agenda that leads to the protection of a significant proportion of the Earth's terrestrial areas. The majority of protected areas lie above 1,000 metres. They need to be managed in ways that conserve biodiversity while ensuring they supply a continuous supply of clean freshwater for the planet's human populations and domestic livestock. Water could then flow from these areas into those with more intensive agriculture, industry, and the low-lying cities where most of the Earth's human population lives.

Keywords: freshwater, ecosystem services, agriculture, river, pollution

INTRODUCTION

Establishing a viable global network of national parks has been one of the major success stories of conservation biology and environmental policy over the last 50 years. But biodiversity is still declining. Some of what we have done as conservation biologists has slowed this decline, but not enough. We need to complement current biodiversity conservation efforts with innovative initiatives that resonate with the business and agricultural communities that support transactional politicians and with the electorate. We are now entering a period when transactional politics will dominate decisions that threaten the viability and integrity of national parks, wilderness areas, and their non-voting denizens. The viability of the parks that conserve Earth's vital stores of biological diversity has never been more threatened.

The situation is further complicated by considerable confusion within the global environmental movement regarding the distinction between climate change and biodiversity loss. Climate change is not the principal driver of biodiversity decline. There are two fundamental scientific facts we cannot ignore: (1) Habitat loss and overexploitation are the current primary drivers of biodiversity loss (Caro et al., 2022; Dobson et al., 2021) and (2) The best way to protect biodiversity is to reverse land use change through restoration and reinforce the protection of protected areas, while monetising their value. Concomitantly, this may slow and potentially reverse climate change. The global conservation community needs to present a more unified agenda that reflects these scientific facts.

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An uncomfortable asymmetry

Climate change can be slowed by reducing carbon inputs into the atmosphere, but it can only be reversed if we find ways to remove carbon dioxide and other greenhouse gases from the atmosphere. We can take significant steps in this direction and potentially reduce global warming by at least 25 per cent if we conserve and expand forests and savannas (Anderegg et al., 2020; Dobson et al., 2022). Forests and savannas have provided this service for at least the last two hundred million years, long before humans evolved to disrupt the system. There are no human-made technologies available that will scale up to remove carbon and other greenhouse gases from the atmosphere within the next 25 years (Santos, Ferreira, & Pedersen, 2022). And then, it will likely be too late.

Carbon storage and water provisioning as ecosystem services

Plant photosynthetic processes, as well as their roots and soil microorganisms, help clean water and facilitate nutrient uptake. The chemistry of photosynthesis and the physiology of plants determine the efficacy with which they scrub CO2 from the atmosphere, while cleansing large amounts of freshwater and returning it to the surrounding atmosphere (Reid & Lovejoy, 2022). Plants must transpire to supply their leaves with the water necessary for photosynthesis (Thomas, 2014). Chlorophyll converts carbon dioxide and water into oxygen, which is released into the local atmosphere, and amino acids, which are the building blocks that allow the plant to store carbon as structural tissue or as resources in its roots for next year's growth. Only a small amount of water absorbed by the roots and transpired by the leaves is used in photosynthesis; all of it is cleansed by passing through the plant. The large amounts of water absorbed by plant roots and released by their leaves maintain turgor pressure and flow. The water released can rise to form clouds, or precipitate out on surrounding surfaces, finding ways to flow back into the soil or streams and rivers. A strong hint of the efficacy of this process comes from the Keeling curve that quantifies levels of CO2 in the atmosphere (Keeling et al., 1976); while the general trend is continuously upward, due to excessive CO2 emissions, the annual cycle within the rising curve reflects leaf out in the northern forests and algal growth in oceans (Keeling, Chin, & Whorf, 1996). Both processes pull CO2 out of the atmosphere. These annual cycles serve as a yearly reminder of the power of higher plants and oceanic algae to mitigate climate change. It's the only time we see a decline in atmospheric CO2; it happens every year, and plants drive it.

Forests and savannas are major carbon sinks

The amount of carbon stored and volume of water cleansed vary between different plant groups: deciduous trees are denser than coniferous ones and mainly grow in warmer climates at lower altitudes and latitudes (Phillips et al., 2019; Thomas, 2014) In contrast, conifers have lower wood density but cover vast areas of the sub-Arctic and other arid regions (Mo et al., 2024). Their long afterlife partly compensates for their low wood density; they take nearly twice as long to break down when they die and can thus store carbon for a prolonged afterlife (Pielou, 1988). When rainfall falls below 800–1,000 mm/year, woodlands are replaced by grasslands (Sankaran et al., 2005; Staver, Archibald, & Levin, 2011), which predominantly store carbon in their extensive root systems. Grasslands do an excellent job of absorbing water from the soil whenever annual rains appear. Marine algae also remove vast amounts of carbon from the atmosphere and are rarely limited by water (Chung et al., 2011; Krause-Jensen & Duarte, 2016); the only constraint on their growth is light when they grow sufficiently densely. Marine algae have significant potential to supply future food for humans and livestock and to act as nurseries for increasingly embattled, polluted and overexploited fisheries.

The world's savannas and their extensive biodiversity are under the largest threat from agricultural expansion (Beale et al., 2013; Ogutu et al., 2014). The world's most important crops are grasses (corn, wheat, rice, sorghum, etc.), and these grow best in the same savanna habitats as their wild ancestors (Harris, 2014). Grass is also the preferred forage for the planet's vast herds of cattle, sheep and goats. Grazing could be much better managed as a way of promoting carbon storage and water recycling (Ritchie, 2020). Longer cycles of grazing within the annual rain cycle could allow grass more time to regrow at the maximum rates created by occasional grazing, particularly if it is fertilised gratis with one of the two most noxious by-products of cattle farming – poop! Creative management of grazing allows grass roots to build up as a carbon stock in the soil and minimises the rate at which ruminating cattle emit methane (the other noxious by-product that is an important greenhouse gas). Structured grazing reduces the need for burning at the end of the year, a practice that adds carbon and other pollutants into the atmosphere.

Economically, the above discussion places carbon storage and water supply on a different plane from other ecosystem services, which have largely fallen short as a mechanism for protecting biodiversity. Most ecosystem service arguments do not resonate with politicians and the majority of voters. Ecologically, ecosystem service arguments are often flawed, especially when they overlook the fact that all biological communities are characterised by a log-normal distribution of abundance, with many rare species and a few ubiquitous ones (Winfree et al., 2015). This means that more than 90 per cent of ecosystem services are supplied by 10 per cent of common species. These underlying patterns of species abundance mean that rare species contribute little to ecosystem services.

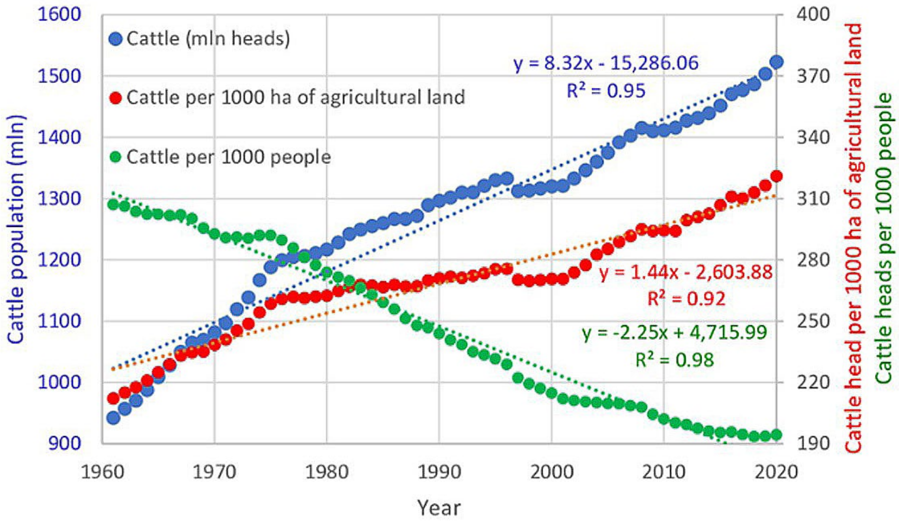


Figure 1. Global cattle population, density per 1,000 ha, and number per 1,000 people (Kozicka, Žukovskis, & Wójcik-Gront, 2023).

While considerable progress has been made in recent decades on evaluating ecosystem services, these arguments have only limited leverage in a political climate focused on short-term profits, fossil fuels, pseudo-currencies and military might. To conserve protected areas and their biodiversity, we must focus on the simplest, most tangible commodity they produce. In an ideal economic world, we need an ecosystem product whose value increases as rapidly as human population growth, one that is inelastic and cannot be replaced by an alternative product, and one that is fundamental to the lives of even the most marginalised members of humanity.

WATER!

Water is the one commodity that fulfils all three of these criteria. There is a finite amount of water on the planet: a cube whose base is around 50 per cent larger than Spain; 98 per cent of this cube is seawater (Pielou, 1998). A lot, but increasingly less, of the two-metre-deep pool of freshwater is stored in glaciers and the polar ice caps. The remaining freshwater is shared and recycled between the planet's 9 to 10 billion people, their business activities, and their agricultural needs. Livestock, humans and their business activities are all increasing. The available volume of freshwater is not. All humans require approximately 3 l of water per day (2.7 l for women and 3.7 l for men[1]). Industry, as well as computer data storage and increasingly AI, require vast amounts of cooling freshwater. Seawater is too corrosive for industrial cooling needs. Each of the 1.6 billion members of the global cattle herd requires 75 to 120 l of water per day, and nearly 50 per cent more at tropical temperatures (Figure 1). There are also 2.3 billion sheep and goats, and 0.75 billion pigs, which require 4 to 7.8 l/day and 8 to 12 l/day, respectively. Basic economics tells us the value of freshwater is rising faster than the number of people who need to use it. There is indeed water, water, everywhere, but increasing demand leaves fewer drops to drink.

All of this makes freshwater an increasingly valuable commodity. Most of the water we drink, or use to irrigate our crops, has been recycled. If we are lucky, this has occurred naturally through the evaporation of water falling as rainfall, which then passes through the roots and leaves of plants. If we are less fortunate, it has been industrially recycled, accumulating trace elements of chemicals that are detrimental to our physical and mental health. Many of the world's poorest people have minimal access to either source of recycled water. They bathe in weakly diluted sewage water and boil it to drink using firewood and charcoal, which concomitantly depletes forests and adds carbon to the atmosphere.

How could a focus on water help us achieve vital environmental goals, such as the protection of 30 per cent of the world's land and ocean areas by 2030? Let us initially acknowledge, whispering it quietly, that the Convention on Biological Diversity (CBD) is not well-suited for this purpose in the current and emerging political climate[2]. The CBD acknowledges many vital aspects of biodiversity and has drawn global attention to

1 Dietary reference intakes for electrolytes and water. US National Academies of Sciences, Engineering, and Medicine. https://www.nationalacademies.org/our-work/dietary-reference-intakes-for-electrolytes-and-water. Accessed Oct. 2, 2020.

2 The Convention on Biological Diversity is too complex, multifaceted and confusing for politicians and decision-makers. International treaties work best when focused on a single issue. For example, the Montreal Protocol works well and was quickly adopted as it focused on a unitary issue, the impact of refrigerants on the integrity of the ozone layer. Even the Paris Accord, which deals with climate, has too many variables for an overtaxed political mind. An international treaty on water has underlying simplicity, and while meeting fundamental human requirements, also has the potential for nefarious profits, all of which creates appeal across a broad political spectrum.

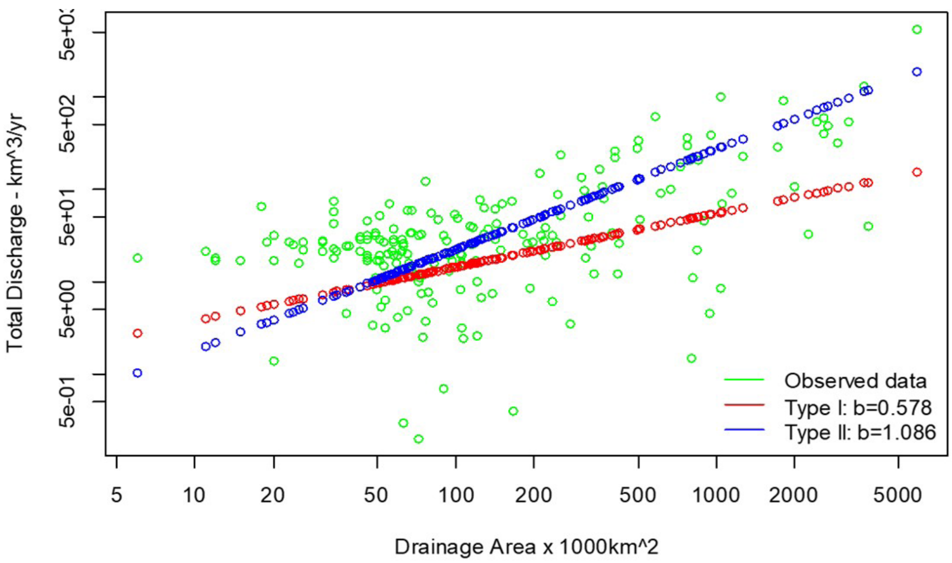
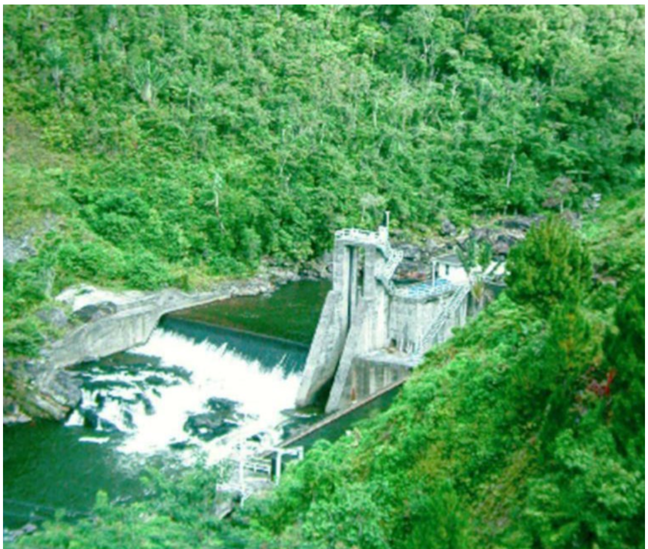


Figure 2. Total discharge from the world's 200 largest rivers by drainage area. Two regression lines are fitted to the log-transformed data. The red line illustrates the traditional least squares regression which assumes drainage area can be measured accurately. This curve begins to saturate. The blue line illustrates the major axis regression which assumes error in both drainage area and discharge (which is always highly variable). The second correct regression gives a slope of unity.



Hydroelectric dam in Ranomafana NP, Madagascar. The dam supplies all the electricity to power Madagascar's second largest city, Fianarantsoa. The park contains 13 lemur species; it was originally set up to protect the forest that supplies water to the river powering the hydroelectric scheme. © Andy Dobson

the problems associated with the loss of biological diversity. This has leveraged some popular support for conservation efforts that many nations have agreed to support. However, it fell short when confronted with woefully ignorant politicians in increasingly autocratic countries. Their focus is on short-term, popular projects that facilitate their re-election while maintaining the wealth of the oligarchies and industries that support their election campaigns.

Setting aside large areas of the planet's land mass to conserve biodiversity requires preserved land to produce tangible benefits that politicians recognise as vital to those who elect them, or to the economy of the military-industrial complex that allows them to retain power (Vidal, 2002). Thanks to water, most protected areas already make significant and fundamental contributions to key aspects of all nations' budgets. The health of their human populations, productivity of crops and domestic livestock, and industrial productivity are all dependent on the silent contribution of water.

Water, water everywhere

Most water arrives in all nature reserves, farms and other domesticated habitats as rainfall, some flows in from upstream rivers. Significant amounts of this evaporate from leaves and other surfaces, but this condenses at night or returns as rain (Pielou, 1998). Rain is generated by and collected by watersheds – often in montane areas. Rivers and streams carry water downstream where changes in altitude allow water to power hydro systems and then supply water to agriculture, industry and direct human use (Picture 1. Ranomafana). Water enters oceans in estuarine areas surrounded by salt marshes and mangrove forests that protect against storm damage and often act as primary nurseries for many fisheries.

River discharge scales with drainage area (Figure 2). (Earlier studies assumed a saturating relationship, but this stemmed from a fundamental flaw in their statistical analysis.) This linear relationship means that the larger the area of watersheds we protect, the more water will be available for downstream consumption. The water available to humans is essentially entirely dependent on

Forest of Parque Nacional Soberania, near Gamboa, Panama. Water from the park is essential for maintaining water levels in the Panama Canal. © Andy Dobson

the montane and lower altitude forested watersheds that feed streams and rivers. Most rivers originate in montane regions and flow through forests, then pass through savannas and agricultural land before forming estuaries and entering oceans; all are areas of high biodiversity. River water leaves forests and nature reserves in predictably located streams, rivers and underground aqueducts. Protected areas must find a way to leverage the outflow of this vital and most tangible ecosystem service. As many subsistence farmers cannot afford to pay for water, local and national governments, as well as private landowners, need to find ways to efficiently and ethically price and tax water in their national, regional and personal budgets (Salzman, 2017). This may require adding a 'water benefits' subsidy to admission fees for protected areas. The science is simple, but politicians and lawmakers need to develop policies that reflect this and more accurately value freshwater and the land that captures and cleans it (Garrick et al., 2017; Gleick, 2003; Postel, Daily, & Ehrlich, 1996).

Let us consider a tangible example provided by a protected area: Parque Nacional Soberania surrounds the Panama Canal, which provides the water that enables shipping to move between the Pacific and the Caribbean. The canal provides access to European markets for marine traffic from Southeast Asia and the West Coast of the United States, as well as to European and West African markets, and vice versa. The canal is primarily formed by Lake Gatun, whose river outlet was blocked by a dam after locks were constructed to raise shipping to the lake's level (McCullough, 2001). The recent construction of new locks that permit the passage of the world's largest container ships now allows around 20 per cent of world trade to pass through the canal (Wang, 2017). The water in Lake Gatun is entirely dependent upon water supplied by the forests of Parque Nacional Soberania (Condit et al., 2001) (Picture 2: Parque Nacional Soberania). The edge of this forest is continually eroded by small-scale agriculture, which leads to a reduction in water level in the canal, particularly during El Nino droughts (Condit et al., 2001).

One of the biggest business deals of 2025 was the purchase of the ports at either end of the canal, providing the American multinational investment company, BlackRock, with control over access to the Panama Canal. Curiously, there was no recognition in the purchase agreement of the canal's significant dependence on water supplied by Parque Nacional Soberania. This is arguably one of the world's single largest ecosystem services. The whole investment is dependent upon the integrity of the forest of Parque Soberania. It would seem wise for the Panama Canal Authority and BlackRock to levy an additional charge on every vessel passing through the canal, and use this revenue to preserve and expand the forests that feed the canal and keep water levels stable.

Land for water will conserve biodiversity

Several independent groups have suggested that between 25 per cent and 50 per cent of global land should be set aside for nature, biodiversity and all non-human species (Noss et al., 2012; Wilson, 2016). The goal of protecting a significant proportion of global terrestrial biodiversity might gain broader appeal among politicians and their electorate by the designation of 50 per cent of global land area above 500 m as wilderness to protect the water supply for humans and agriculture. The focus on rivers and lakes would also protect significant amounts of freshwater biodiversity (Leal et al., 2020; Piczak et al., 2023). Moreover, land used to supply freshwater would also function as a significant carbon sink, helping to mitigate global climate heating.

I make the case that the best way to set aside 50 per cent of land for biodiversity is to roughly split the global terrestrial environment into four quarters, each of which supports different but overlapping sets of biological diversity and each of which supports other components of the human economy. The key psychological and economic step here is to acknowledge that some areas are better suited for agriculture, some are better suited for biodiversity, and others are more suitable for human habitation. In an ideal world, we would divide these into non-overlapping areas. Logistically and politically, this is impossible. However, altitude already divides land areas along these lines, with most biodiversity conserved on

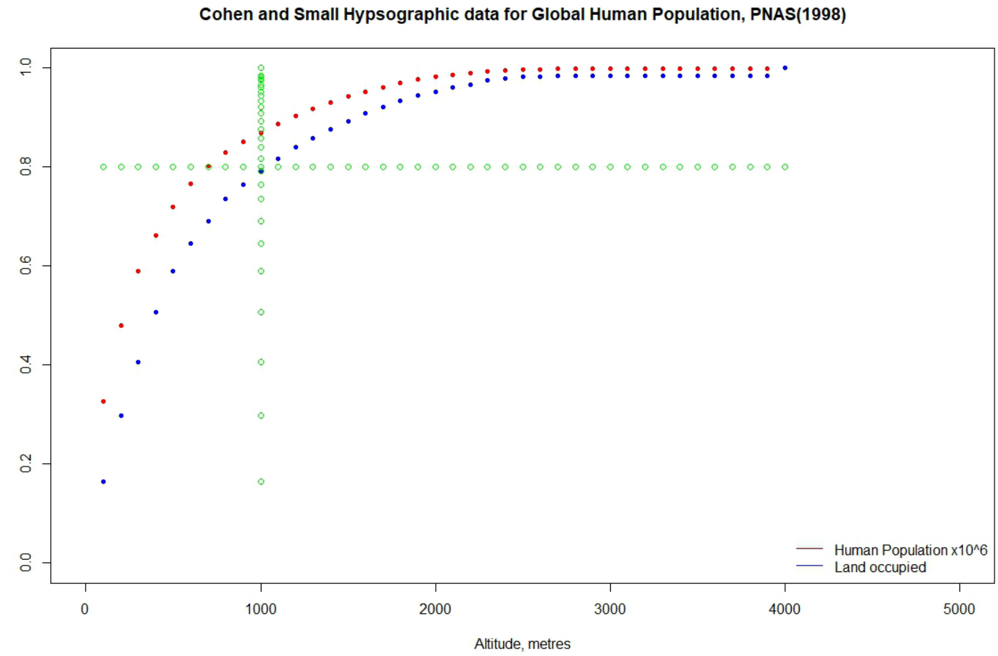


Figure 3. Hypsographic demography: the relationship between altitude and human population (red) and land occupied (blue). The red curve illustrates cumulative human population ranked by altitude in which people live. The blue curve illustrates total area of land occupied ranked by altitude. The green lines indicates that 80% of occupied land is at less than 1,000 m and that 80% of people live at less than 500 m (after Cohen & Small, 1998).

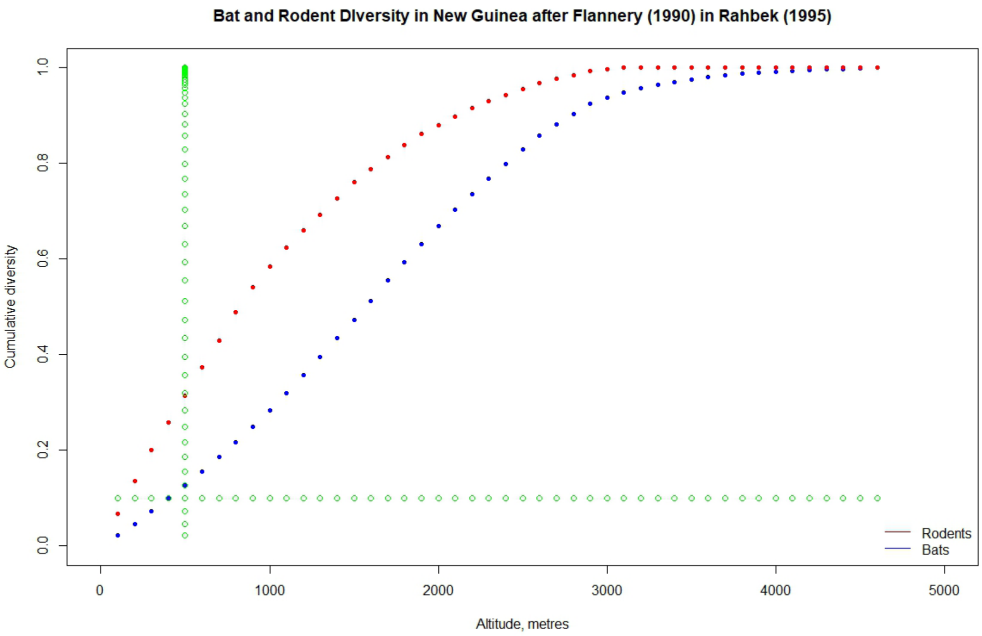


Figure 4. Species richness at different elevations from Rahbek review in *Ecography* (1995). Figure A plots data for rodent and bat diversity in New Guinea. In all cases, species diversity peaks at just over 1,000 m and more than 80% of diversity is present at greater than 500 m.

land at intermediate to higher altitudes (Fjeldså & Rahbek, 1997; Rahbek, 1995), while most agriculture and areas of high human population density tend to occur near sea level (Cohen & Small, 1998).

Three sets of information suggest that what I propose has already been partially implemented, more by luck than by design. Classical hypsographic studies of human demography and altitude have shown that the majority of the human population lives at altitudes lower than 500 m (Figure 3), and is typically located in coastal areas (Cohen & Small, 1998; Small, Gornitz, & Cohen, 2000). Unfortunately, these people will be significantly impacted by the sea-level rise that will occur as the polar ice caps recede and the ocean level rises due to climate heating. Their upslope movement will encroach on land at mid-altitudes and will likely lead to further agricultural expansion. As rising oceans are a consequence of climate change, it is doubly important to focus on conserving and restoring forests and savannas in ways that can help slow climate change and concomitant sea-level rise.

The second piece of evidence comes from ecologists' long-term fascination with altitudinal patterns of

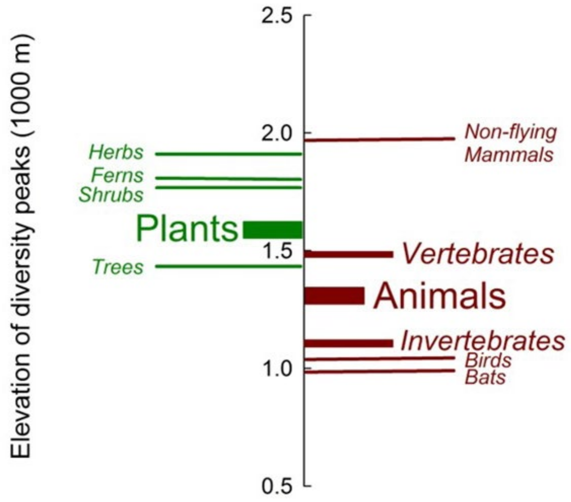


Figure 4B. Global variation in elevational diversity patterns (after Guo et al., 2013). The altitude at which elevational diversity peaks is illustrated for plants (on the left) and animals (on the right).

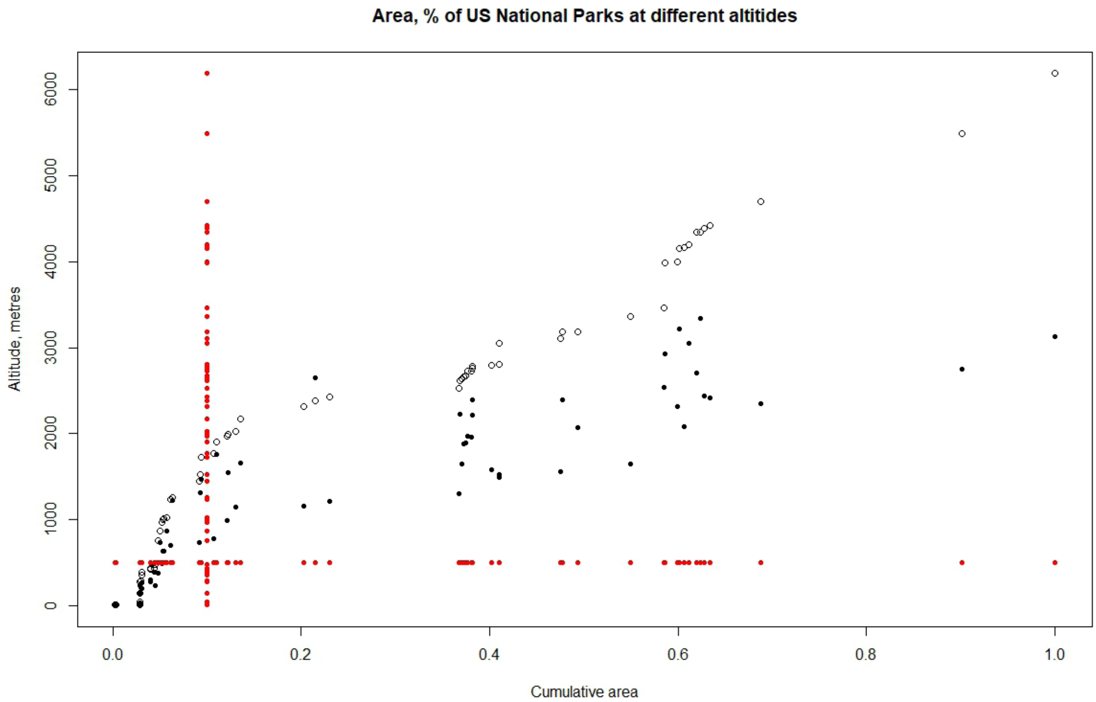


Figure 5. Relationship between altitude and area of land in national parks. The mean altitude for each of the 63 US National Parks is given by the solid circles, the highest elevation by the open circles. Ninety per cent of area (vertical red line) in National Parks lies in land above 500 m in altitude (horizontal red line). Data available from https://en.wikipedia.org/wiki/List_of_national_parks_of_the_United_States and https://en.wikipedia.org/wiki/List_of_national_parks_of_the_United_States_by_elevation.

diversity, which date at least to Humboldt's time in the 18th century (Wulf, 2015). The work of Rahbek illustrates that levels of biodiversity tend to peak at mid-altitudes (Fjeldså & Rahbek, 1997; Rahbek, 1995) (Figure 4). Crucially, more recent studies of a variety of animal and plant groups have confirmed that biodiversity tends to peak at altitudes higher than those where most humans and livestock reside (Guo et al., 2013) (Figure 4B). This means that most of the biodiversity tends to occur at altitudes higher than where most humans are living and growing crops.

The final piece of evidence concerns the altitudinal distribution of current national parks and wilderness areas. Although many parks in the US were initially set up to conserve their geological features, they also do an excellent job of protecting biological diversity. Data on altitudinal distribution of national parks in the United States show that only 3 per cent of their total area occurs in low-lying areas (<50 m), mainly in the Florida Everglades and Keys (Figure 5). Around 10 per cent lies below 100 m; the rest of the land occupied by US national parks lies at higher altitudes; more than 90 per cent lies above 500 m. I suspect that these altitudinal patterns of relative abundance are true for most continents.

Yellowstone National Park in winter accumulates water as snow which melts to supply water the following summer © Andy Dobson

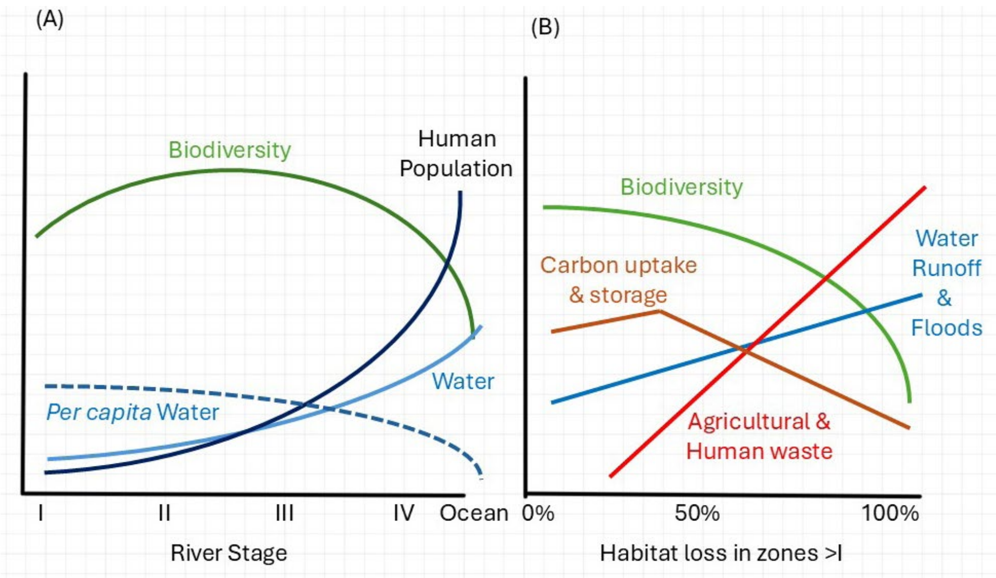


Figure 6. (A) Hypothetical relationships between rivers stage, biodiversity, human population density, water volume and per capita water available at different river stages from montane (IV) to the ocean. (B) Relationships between proportional habitat loss in upstream zones (II–III) of a river system and the amount of human and agricultural waste in the river, the rate of water run-off and resultant downstream floods, the amount of carbon stored or taken up by remaining vegetation, and its associated biodiversity. All of the rates in these figures can be parameterised and converted into a more detailed analytical

There is thus limited overlap in the United States between areas where the majority of humans live and areas high in biodiversity, where most protected areas are situated (Picture 3 Yellowstone in winter). Crucially, these areas supply significant amounts of freshwater to the agricultural lands and people living at lower altitudes, many of whom may never visit the parks that make their lives possible. As cities, industry and agriculture are totally dependent upon large supplies of freshwater, there is a huge incentive for conserving the lands that supply this water. This will indirectly protect biodiversity as a side benefit. If ways can be found to amortise the supply of water, this will provide funds and an incentive to protect both biodiversity and water supplies.

It is a relatively straightforward exercise to make simple 'toy models' of this form of land use and water supply. One can then build economic decision-making into these models (Figure 6, Dobson et al., in review). The model assumes that complex landscapes can be divided into altitudinal zones that reflect the different classical stages of river flow (river continuum concept; Doretto, Piano, & Larson, 2020; Vannote et al., 1980). At the lowest altitude (<200 m), rivers are turning into estuaries and flowing into the ocean. The majority of land in this zone

IV will have been converted into cities, manufacturing facilities, intensive agriculture, shopping malls and golf courses. Around 50 per cent of the human population lives here (Cohen & Small, 1998; Small & Cohen, 2004). Agriculture is more productive and tends to be focused in these lower-lying areas. However, both water and pollutants flow into this region from the areas between 200 and 500 m that surround it (zone III). At these slightly higher altitude lands, human population is lower, and both extensive and intensive agriculture are present. It is possible that significant biodiversity can be maintained in the areas between intensive agriculture, but this will decline as agriculture expands (Phalan et al., 2011).

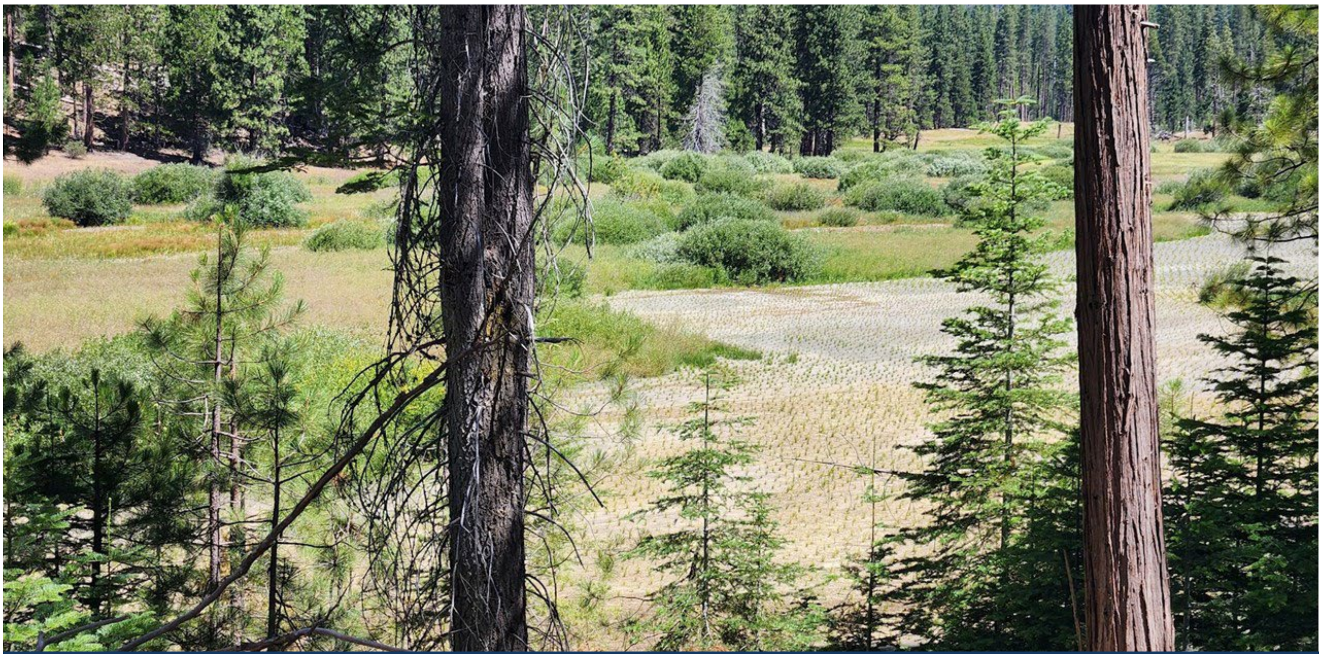
Many, but not all, nature reserves and protected areas are situated at higher altitudes on land that is largely unsuitable for agriculture. Zone II lies between 500 and 1,000 m, where agriculture is less intensive and a considerable area can be set aside for biodiversity. The classic example would be the Trento region of Italy, which produces high-end fruit, wine and dairy products, while also containing significant forests and montane areas that support Europe's largest wolf and brown bear populations. The Sierra Nevada of California has similar potential, but falls short for complex political reasons, not least the demand for water for agriculture in California's Central Valley (Thornton & Weiland, 2016). Water flows into zone III from the more mountainous regions that rise to the highest slopes. The highest areas in zone I are too steep for agriculture, often forested, and covered in winter snow, which serves as a major store of water into early summer. This highest area supports the lowest density human population, frequently supplemented by significant seasonal tourism in summer and winter, attracted by recreational activities which may occasionally include biodiversity. Water is stored here in snow fields and glaciers. It may also be stored in zones II and III as reservoirs used to drive hydroelectric schemes or to supply clean piped water to lower-lying coastal cities. The flow of water connects all four regions, and it is much cheaper to let water run downhill for free than to spend lots of energy moving it uphill. A significant amount of biodiversity can be conserved in the two highest regions, a relatively benign, pragmatic and economic way for nature to receive half.

A key hidden assumption underlying these models is that pollutants always accumulate in rivers and streams as they run downstream. The rate at which pollutants from agriculture (faecal pollution and chemical fertilisers) can be cleaned up is highly dependent on areas of habitat that are left with natural vegetation to absorb and utilise these 'accidental' plant nutrients. This creates a direct economic trade-off between biodiversity and water quality, and between the volume and type of food produced by agriculture. The best way to supply cheap, clean freshwater and healthy food to people living in low-lying cities is to optimise the amount of forest and savanna conserved around upstream watersheds. Several studies of children's health in different river systems confirm the importance of this effect (Herrera et al., 2017).

CONCLUSION

Freshwater is one of the most valuable resources on the planet (Brown, 1997; Chichilnisky & Heal, 1998; Postel et al., 1996; Pretty, 2003) and its value is increasing as per capita supplies of freshwater decline. Forests and savannas consistently produce large flows of clean freshwater. Humans, agriculture and industry have a fundamental dependence on access to the planet's finite supply of freshwater (Gleick, 2003; Salzman, 2017). All of which suggests that focusing new national and international conservation agendas around the theme of providing safe sources of clean freshwater for human populations is a win-win situation. Initiatives such as the Freshwater Challenge can play a major role here (https://www.freshwaterchallenge.org/). A conservation agenda that explicitly acknowledges the role that protected areas play in maintaining the supply of freshwater should find ways to charge for it (Garrick et al., 2017). This could provide funds to conserve and restore the land from which water flows (Figure 4. Restoration at Ackerson Meadows, Yosemite). All of which provides a powerful transactional economic mechanism for conserving large amounts of land and the species that provide the ultimate ecosystem service of cleansing and regulating freshwater flows.

There is, of course, no easy way to reorganise the global conservation agenda along the lines I have suggested. I would like to strongly emphasise that what I propose is complementary to current conservation efforts, not a replacement for them. However, complementing pleas to conserve biodiversity with transactional arguments to conserve freshwater and its biodiversity is an approach that will resonate across a broader political spectrum. Although there are considerable local, regional and international conflicts over freshwater and its distribution, the Dublin Statement on Water and Sustainable Development provides further impetus to develop local, national and international policy over water use (Giordano & Wolf, 2003; ICWE Secretariat, 1992). I do not doubt that the strongest motivation to drive this agenda will be the rapidly approaching shortage of viable, stable and long-term water supplies that are central to human health and agricultural production.



Restoration of flood meadows at Ackerson Meadows on the edge of Yosemite NP, California. American Rivers have restored the meadows by restructuring the soil and planting with native seeds. In the last two years, it has raised the water table by 15 feet and provided habitat for restored native vegetation and three endangered species: Western Pond Turtle, American Fisher, and the Willow Flycatcher © Andy Dobson

Focusing on land to provide water will inadvertently provide land that protects biodiversity.

Freshwater is central to human health and well-being. The global supply of freshwater is the ultimate constraint on economic growth. Concomitantly, freshwater is often the most pressing need for those living in poverty. The areas of land set aside as reserves to protect the water supply for humans and agriculture could potentially protect a major proportion of global terrestrial and freshwater biodiversity. A UN Convention on Water could be more effective than the UN Convention on Biodiversity in protecting biodiversity. Politically, conserving land for water is a much easier sell in a world where droughts and wildfires will increasingly plague humans and their equally thirsty domestic livestock populations and industries.

ABOUT THE AUTHOR

Andy Dobson has worked on the ecology of wildlife disease and conservation biology for most of his career. His research has focused on Serengeti NP, Yellowstone NP, coastal California, and on backyard birds across the United States. He is currently writing a series of books that describe how natural history interacts with quantitative biology to help us understand the natural dynamics of the ecological communities in national parks.

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RESUMEN

La política mundial ha entrado en una era más transaccional. Aunque los servicios ecosistémicos proporcionan argumentos económicos válidos para conservar la biodiversidad, estos argumentos no resuenan entre los políticos centrados en beneficios tangibles y a corto plazo para su electorado. Necesitamos argumentos más convincentes para conservar grandes extensiones de tierra que proporcionen beneficios transaccionales a los votantes. El cambio climático no es suficiente; es una amenaza secundaria para la biodiversidad y cuenta con un apoyo político limitado, excepto cuando las inclemencias del tiempo afectan directamente a los seres humanos a través de inundaciones, huracanes o sequías.

Todos estos desastres están fundamentalmente relacionados con el agua. Paradójicamente, el suministro mundial de agua es cada vez más escaso y variable, pero sigue estando íntimamente relacionado con la presencia de bosques y grandes zonas montañosas. La elaboración de una convención internacional sobre el agua crearía indirectamente una agenda que conduciría a la protección de una parte significativa de las zonas terrestres del planeta. La mayoría de las áreas protegidas se encuentran por encima de los 1000 metros. Deben gestionarse de manera que se conserve la biodiversidad y se garantice un suministro continuo de agua dulce limpia para las poblaciones humanas y el ganado doméstico del planeta. El agua podría entonces fluir desde estas áreas hacia aquellas con una agricultura y una industria más intensivas, y hacia las ciudades de baja altitud donde vive la mayor parte de la población humana de la Tierra.

RÉSUMÉ

La politique mondiale est entrée dans une ère plus transactionnelle. Bien que les services écosystémiques fournissent des arguments économiques valables en faveur de la conservation de la biodiversité, ces arguments ne trouvent pas d'écho auprès des politiciens qui se concentrent sur les avantages tangibles et à court terme pour leur électorat. Nous avons besoin d'arguments plus convaincants pour conserver de vastes zones terrestres qui offrent des avantages transactionnels aux électeurs. Le changement climatique n'est pas suffisant ; il s'agit d'une menace secondaire pour la biodiversité et il bénéficie d'un soutien politique limité, sauf lorsque les conditions météorologiques défavorables ont un impact direct sur les humains sous forme d'inondations, d'ouragans ou de sécheresses.

Toutes ces catastrophes sont fondamentalement liées à l'eau. Paradoxalement, l'approvisionnement mondial en eau devient de plus en plus précaire et variable, mais il reste intimement lié à la présence de forêts et de vastes zones montagneuses. L'élaboration d'une convention internationale sur l'eau permettrait de créer indirectement un programme menant à la protection d'une partie importante des zones terrestres de la planète. La majorité des zones protégées se trouvent à plus de 1 000 mètres d'altitude. Elles doivent être gérées de manière à préserver la biodiversité tout en garantissant un approvisionnement continu en eau douce propre pour les populations humaines et le bétail domestique de la planète. L'eau pourrait alors s'écouler de ces zones vers celles où l'agriculture et l'industrie sont plus intensives, ainsi que vers les villes de basse altitude où vit la majeure partie de la population humaine de la Terre.