Centering 30 × 30 conservation initiatives on freshwater ecosystems

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Regional, national, and international 30 × 30 conservation initiatives would be strengthened by including a specific focus on freshwater ecosystem conservation that supplements terrestrial conservation strategies. Globally, freshwater habitats support essential biodiversity and ecosystem services, yet are being lost at disproportionately high rates relative to terrestrial systems. Making freshwater ecosystems an explicit focus of 30 × 30 initiatives would assist in curtailing these losses while advancing 30 × 30's mission to address climate change, economic sustainability, food security, and equitable outdoor access across a variety of landscapes. Here, we explain how fresh water can serve as a key piece of 30 × 30 conservation efforts. We emphasize that to address the challenges of traditional area-based conservation programs, 30 × 30 should (1) focus on watershed-scale conservation planning and (2) evaluate conserved areas based on five freshwater priorities: connectivity, watershed disturbance, flow alteration, water quality, and biodiversity. We use examples from the US state of California to illustrate how addressing freshwater systems can help guide 30 × 30 conservation.

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The next decade will be critical for slowing biodiversity loss and addressing climate change. Current efforts to advance biodiversity conservation focus largely on area-based targets, which aim to set aside a specific proportion of land and sea to achieve conservation goals. Scientific evidence suggests that at least 30% of land and sea area must be conserved by 2030 to reverse substantial biodiversity loss and mitigate the effects of climate change (Dinerstein *et al.* 2019). This goal, often referred to simply as "30 × 30", has been adopted by more than 50 governments around the world (Campaign for Nature 2021), including the US federal government (US Executive Order No 14008 2021) and many US state governments (eg California [CA] Executive Order N-82-20). The mobilization of governments worldwide around the 30 × 30 concept creates an unprecedented opportunity to advance global conservation. However, policy makers still must determine how good intentions for biodiversity conservation and climate mitigation and adaptation can be converted into actionable plans.

In a nutshell:

- "30 × 30" is a collection of global initiatives that share a common goal of conserving 30% of land and sea area by 2030
- Well-conserved freshwater ecosystems can support 30 × 30 targets such as water quality, economic security, biodiversity, climate resilience, and outdoor access
- The 30 × 30 initiatives also present a valuable opportunity to better conserve freshwater ecosystems like rivers, lakes, and wetlands, and in so doing advance broader landscape-scale conservation
- Planning conservation at the watershed scale and evaluating conserved areas for a set of freshwater priorities will help 30 × 30 efforts leverage freshwater ecosystems to gain conservation benefits

We argue that centering freshwater ecosystems in 30 × 30 initiatives offers a unique opportunity to advance 30 × 30 objectives and to overcome persistent freshwater conservation challenges. Major goals of many 30 × 30 initiatives include supporting ecosystem services, biodiversity, and carbon storage. The conservation of freshwater systems can help meet each of these goals. For example, freshwater systems offer critical ecosystem services that enable agriculture, transportation, recreation, economic productivity, and drinking water systems. In addition, freshwater species compose 10% of global biodiversity (Strayer and Dudgeon 2010), and rivers and riparian habitat provide movement corridors for aquatic and terrestrial species to traverse landscapes (Hilty and Merenlender 2004; Krosby *et al.* 2018). Moreover, although covering a mere 5–8% of Earth's terrestrial surface area, freshwater wetlands store 20–30% of the world's soil carbon (Mitsch and Gosselink 2015; Nahlik and Fennessy 2016). However, despite the benefits of healthy freshwater systems, these environments are also acutely in need of additional conservation investment. Globally, freshwater systems endure impacts from development, fragmentation, pollution, biodiversity loss, invasive species, and climate change (Dudgeon 2019). In many situations, area-based conservation is inadequate for conserving freshwater systems. Area-based conservation often focuses solely on terrestrial areas, and many

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protected areas underrepresent freshwater habitats and are ill-positioned to protect large, interconnected waterways (eg Abell *et al.* 2017; Dudgeon 2019). As an effort that focuses on creating, improving, and connecting conservation areas, the 30 × 30 initiative provides an opportunity to refocus and reposition global conservation efforts to benefit freshwater systems and the habitats they support.

Here, we explore why and how freshwater ecosystems can be a central focus of 30 × 30 initiatives. Using the California 30 × 30 initiative as an example to explore 30 × 30 policy development and implementation related to freshwater ecosystems, we discuss how 30 × 30 objectives could benefit from focusing on freshwater systems and how 30 × 30 can address persistent challenges in freshwater conservation, as well as priority actions for including freshwater ecosystems in the 30 × 30 framework.

30 × 30 background

In the US, the 30 × 30 initiative will largely rely on area-based conservation, meaning the protection of 30% of land area and coastal zones (Rosa and Malcom 2021). Parts of the landscape that contribute to 30 × 30 will likely include traditional protected areas (such as national parks or national monuments), along with other types of areas where conservation practices will be adopted (such as agricultural and forested working lands) (Rosa and Malcom 2021). The combination of these approaches gives 30 × 30 flexibility to initiate and improve conservation efforts in a variety of landscapes and land-use types. But with this flexibility comes the challenge of deciding where conservation efforts should be prioritized.

Another challenge confronting 30 × 30 is specifying what will be considered "conserved". Conservation goals are likely to be broadly defined in 30 × 30 policy documents (eg CA Executive Order N-82-20) (Panel 1). Although broad goals may exist, in many cases the specifics of how to evaluate, achieve, and monitor 30 × 30 conservation goals are unclear, and policy makers at state and national levels must establish criteria for gauging whether conservation in a particular area meets standards for inclusion in 30 × 30.

Many 30 × 30 programs will likely employ a portfolio of management measures to address the primary challenges of prioritizing and defining conservation in a variety of land and sea ecosystems. As the portfolio of 30 × 30 conservation solutions is developed, we propose that freshwater ecosystems be used as focal ecosystems around which area-based conservation planning is centered (Panel 1; Figure 1). Importantly, both freshwater and terrestrial conservation planning are critical to the success of 30 × 30, and centering freshwater ecosystems in 30 × 30 need not replace sound terrestrial conservation strategies. However, protecting terrestrial habitats and species does not guarantee that freshwater systems are also protected, necessitating special consideration for freshwater systems (eg Abell *et al.* 2017; Leal *et al.* 2020).

How 30 × 30 can address persistent freshwater conservation challenges

Effective conservation of freshwater ecosystems requires unique strategies. Rivers, lakes, and wetlands exist in networks that span across terrestrial landscapes, and it is commonly assumed that freshwater ecosystems are implicitly protected through terrestrial conservation efforts (Thieme *et al.* 2016; Abell *et al.* 2017). As a result, area-based conservation plans rarely target freshwater particularities and needs specifically, instead treating freshwater systems as a subset of the terrestrial landscape. This approach is ineffective for protecting freshwater ecosystems, which depend on conservation of both a river network and its surrounding terrestrial drainage area (Leal *et al.* 2020). Indeed, recent studies demonstrate that land-based conservation initiatives that lack explicit freshwater priorities often deprioritize and contribute to the decline of freshwater habitats and species (Tickner *et al.* 2020). However, conservation efforts that focus on a freshwater network and the surrounding watershed have been shown to confer conservation benefits to both freshwater and terrestrial environments (Abell *et al.* 2010; Leal *et al.* 2020).

To effectively include freshwater systems in area-based land conservation programs, 30 × 30 initiatives should proactively address several specific challenges that typically plague freshwater conservation efforts. First, a 30 × 30 initiative that effectively conserves freshwater systems must focus on conservation at the watershed scale. Disturbances that occur in one part of a watershed can easily result in downstream impacts throughout the full river network, and watershed-scale impacts such as habitat fragmentation, flow alteration, pollution, and landscape disturbances can affect entire river systems and the billions of people who rely on them. Land-based conservation programs often fail to address watershed-scale impacts because protected areas rarely include entire watersheds, and disturbances that happen outside a protected area can still affect waters within protected areas (Nel *et al.* 2009; Hermoso *et al.* 2015).

Second, effective 30 × 30 programs must include stipulations for specifically evaluating and protecting freshwater ecosystems within conserved lands. Even within protected areas, freshwater systems and waterways are not always well protected because human activities (such as building of dams, culverts, bridges, and roads) can directly alter stream networks and riverine processes (eg Thieme *et al.* 2020). Such alterations often negatively impact river ecosystems through habitat fragmentation, modified flow regimes, reduced riparian vegetation, increased sediment runoff, disrupted nutrient cycling, and transport of pollutants into waterways (Nel *et al.* 2009).

Third, 30 × 30 efforts must include both terrestrial and freshwater biodiversity targets. As noted above, land-based protected areas often do not explicitly target freshwater biodiversity, and freshwater and terrestrial biodiversity hotspots do not always overlap (Nel *et al.* 2009; Abell *et al.* 2017). For instance, in California, areas with the highest freshwater biodiversity generally occur outside of existing protected areas

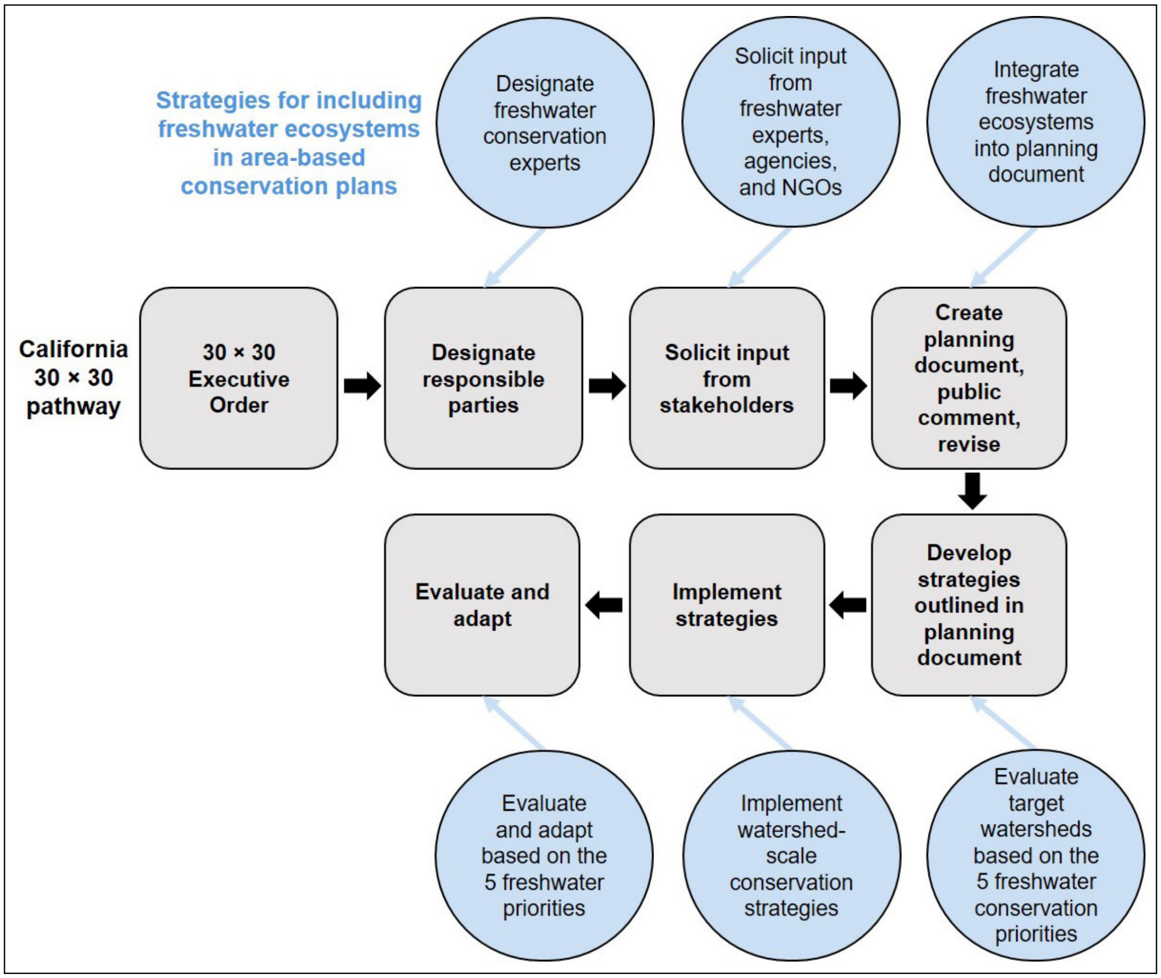

Figure 1. Stages of implementing a 30 × 30 conservation scheme using the California 30 × 30 initiative as an example (gray boxes). We emphasize ways to specifically include and address freshwater ecosystems in each step of the process (blue circles). The gray boxes and in particular the "Implement strategies" step of 30 × 30 involve a variety of conservation strategies that are described in greater detail in the California 30 × 30 Pathways document (www.californianature.ca.gov/pages/30x30).

(Howard *et al.* 2018). To accommodate the frequent lack of overlap between freshwater and terrestrial biodiversity, 30 × 30 plans must explicitly consider biodiversity targets across multiple taxa and ecosystem types.

Overall, 30 × 30 initiatives will not necessarily be effective for freshwater conservation simply because freshwater ecosystems happen to be included within conservation areas designed around and managed for terrestrial biodiversity. However, there are ways in which 30 × 30 can shift focus to center on freshwater ecosystems and address associated conservation challenges (Figure 1). In the next sections, we recommend ways to implement 30 × 30 that overcome traditional freshwater conservation challenges and meaningfully include the unique conservation needs of freshwater systems.

Incorporating freshwater conservation into 30 × 30

To incorporate freshwater conservation into 30 × 30 plans, we propose a two-step approach (Figure 2). First, we recommend that *areas for inclusion in 30 × 30 be identified and prioritized based on watershed boundaries*. Watershed-scale conservation protects stream networks as well as the surrounding terrestrial drainage area, and such areas can easily be mapped for inclusion at varying scales. Notably, a watershed-based conservation approach allows freshwater ecosystems to be protected in a manner consistent with a 30 × 30 area-based land conservation scheme.

Second, we suggest that *when targeting areas for conservation, practitioners should use five priorities to evaluate freshwater ecosystem status* (Table 1; Figure 3). We consider evaluating ecosystem status as a critical step in assessing both terrestrial and freshwater systems for inclusion in 30 × 30. The five priorities we outline below and in Table 1 will help practitioners assess whether current management strategies include, and are effective for protecting, freshwater systems and services (Table 1). If a particular area is included in 30 × 30 but does not reflect the five priorities for freshwater conservation, then 30 × 30 management plans should explicitly address how to improve freshwater conservation in that area.

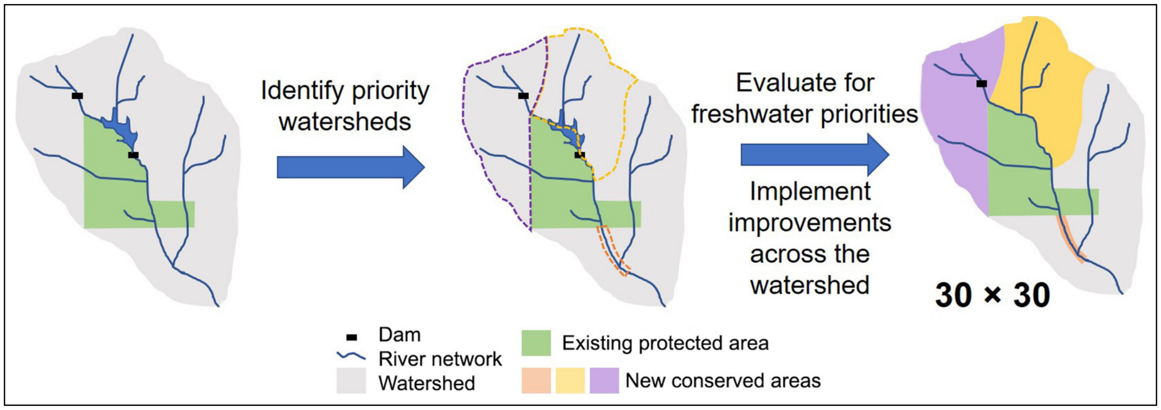

Figure 2. Two steps for incorporating fresh water into 30 × 30 conservation initiatives. First, area-based conservation planning should occur at the watershed scale. This includes identifying priority watersheds based on existing ecological integrity and/or restoration potential, and then implementing conservation strategies in those areas. Second, both newly conserved watersheds and existing protected areas should be evaluated for freshwater priorities (Table 1). This evaluation should be useful for identifying conservation improvements (such as dam removal, riparian corridor restoration, or other restoration activities) that should be implemented as part of inclusion in 30 × 30. These strategies will help guide 30 × 30 initiatives to focus on freshwater ecosystems.

Watershed-based conservation planning

Watersheds are natural area-based units around which 30 × 30 conservation planning can be structured (Figure 2). Watershed boundaries are naturally delineated areas that integrate across many ecological and social dimensions. Conservation at the watershed scale is critical because rivers occupy the lowest elevations on a landscape and are at the receiving end of both terrestrial and freshwater processes. Focusing on watersheds thereby broadens conservation initiatives to include both terrestrial environments as well as their downstream effects on freshwater systems. We strongly encourage 30 × 30 practitioners to use watersheds as convenient spatial units to structure conservation planning. Planning conservation efforts at a watershed scale can help identify how to connect existing protected areas, prioritize where to implement new conservation efforts, and involve stakeholders in the planning process (Howard *et al.* 2018; King *et al.* 2021).

Watersheds exist at many scales. Large watersheds can be broken down into smaller watersheds, which themselves can be further broken down into sub-watersheds. The scalable nature of watersheds is useful to 30 × 30 because it allows watershed-based conservation to occur at whatever scale is most relevant for a particular conservation effort. For example, 30 × 30 efforts in urban settings may include a small amount of land area, thereby focusing on small urban watersheds. On the other hand, 30 × 30 efforts involving conservation easements across large swaths of rural and agricultural land could focus on a larger watershed. In addition to protecting freshwater networks, protecting watersheds at different scales could be used to strategically support other conservation efforts. For instance, many terrestrial species use rivers and riparian areas as movement corridors (Hilty and Merenlender 2004), and conserving a small watershed could protect these corridors and enhance connectivity between

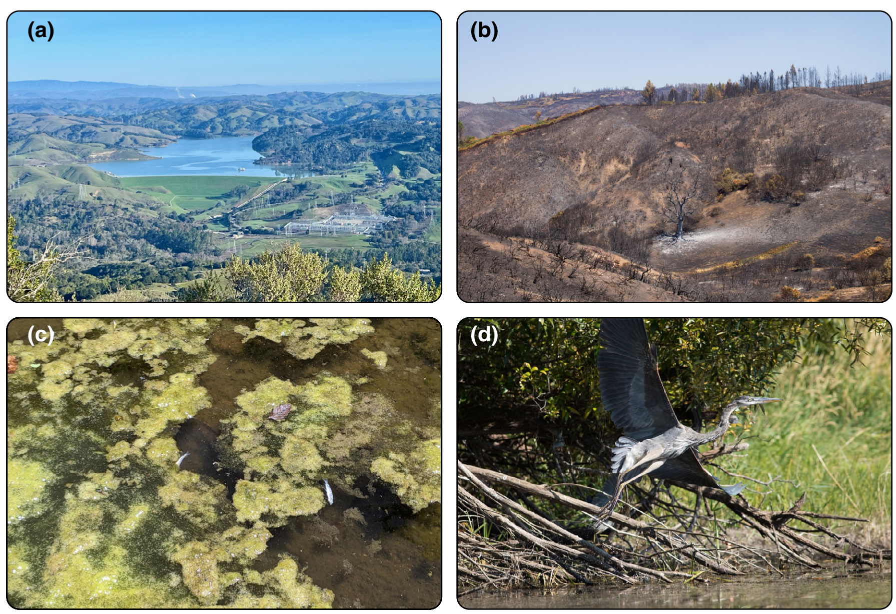

Figure 3. Freshwater ecosystem conservation under 30 × 30 should be based on five priorities, which should direct future conservation measures in both high-quality ecosystems and systems with high restoration potential. Priorities include connectivity, watershed disturbance, flow alteration, water quality, and biodiversity. For example, (a) Briones Dam reduces *connectivity* in Bear Creek, California (image credit: L Andrews); (b) wildfire in Hopland, California, creates widespread *watershed disturbance* (image credit: P Parker Shames); (c) poor *water quality* in Porter Creek, California, kills fish and reduces recreational opportunities (image credit: G Rossi); and (d) freshwater ecosystems support *biodiversity* in Klamath Lake, Oregon (image credit: J Shames).

Table 1. Five freshwater conservation priorities and specific connections to the objectives of California 30 × 30

Priority	Definition	Importance	Issues	Connection to CA 30 × 30 objectives
Connectivity	Physical and biological connections between freshwater systems exist in four dimensions [1]. Freshwater connectivity occurs in longitudinal (eg along a river channel), lateral (eg between channel and floodplain), vertical (eg between groundwater and channels), and temporal (eg presence of water through time) dimensions.	The free movement of materials (eg nutrients, sediments, water) and organisms through a river network supports critical physical, chemical, and biological processes. Natural patterns of connectivity over space and time are important for maintaining these processes and supporting freshwater species and habitats [2].	Dams and culverts that restrict movement of water, sediment, and organisms reduce longitudinal connectivity [2]. Wetland draining, floodplain development, and channel engineering reduce lateral connectivity [2]. Overdrawn aquifers reduce vertical connectivity [3]. Changes to a river channel, water abstractions, or changes in flow regime reduce temporal connectivity [4].	2,3,4
Watershed disturbance	Activities or processes within a drainage area that impact freshwater ecosystems throughout the watershed. Local disturbances include alterations to a riparian area or stream channel that impact part of a river [5].	River networks act as "endpoints" that integrate land and water processes throughout a watershed [6]. Protecting freshwater systems necessitates considering processes in the surrounding terrestrial environment.	Urban and agricultural development, mining, deforestation, and fire can alter flow, increase sediment and pollutant runoff, and impact groundwater. Loss of riparian vegetation can reduce shading and leaf litter, alter thermal and nutrient dynamics, and disrupt movement corridors [7].	1,2,3,4
Flow alteration	Changes in natural waterflow patterns, specifically changes in magnitude, frequency, duration, timing, and rate of change of streamflow [8].	River flow regimes are primary organizing forces in many freshwater systems. Flow regimes create physical habitat [9], govern life histories [10], and control invasive species [11].	Water diversions and dams that impede natural flow patterns alter the physical structure of rivers [9]. Changes to flow regimes disrupt biological patterns and life histories that are adapted to natural flow regimes [10].	2,3,4
Water quality	Quality as measured by physical (eg temperature, conductivity), chemical (eg pH, dissolved oxygen, nutrient concentration), and biological (eg bacteria, algae) factors [12].	Good water quality supports outdoor access and recreational activities; it is also a critical component of freshwater habitat and benefits native aquatic species [6].	Poor water quality can pose a risk for humans, degrade freshwater ecosystems, and endanger species that live in and depend on freshwater habitats [12].	1,2,5
Biodiversity	The number of species living in aquatic habitats, including algae, bacteria, fungi, plants, invertebrates, and vertebrates [6].	Freshwater systems contain 33% of vertebrate species and 10% of all species globally [13], and provide important habitat and movement corridors [14].	Freshwater habitats are vulnerable to invasive species, which can amplify the effects of disturbance, change native species behaviors, restructure food chains, and extirpate native species [12,15,16].	2,4

Notes: Numbers in the right-most column represent which of the five main objectives of the California 30 × 30 Executive Order (CA Executive Order N-82-20) are met by each freshwater conservation priority. See Panel 1 for more details on California 30 × 30 objectives. [1] Ward (1989); [2] Ward and Stanford (1995); [3] Brunke and Gonser (1997); [4] Poff *et al*. (2007); [5] Abell *et al*. (2017); [6] Dudgeon *et al*. (2006); [7] Allan (2004); [8] Poff and Zimmerman (2010); [9] Wohl (2017); [10] Lytle and Poff (2004); [11] Kiernan *et al*. (2012); [12] Reid *et al*. (2019); [13] Strayer and Dudgeon (2010); [14] Hilty and Merenlender (2004); [15] Strayer (2010); [16] Gallardo *et al*. (2016).

existing habitat patches. Alternatively, focusing on a larger-scale watershed could help restore river network connectivity and enable long-distance migrations for freshwater species.

To facilitate the use of watershed-scale conservation in 30 × 30, we recommend that conservation management practitioners at the local, regional, and national level identify priority watersheds. We view 30 × 30 as a mechanism to conserve high-value habitat and to support the restoration of degraded habitat. Therefore, the selection of priority watersheds should consider both existing ecological integrity (for example, pristine headwaters or areas within existing national parks) as well as restoration potential (for example, old hydropower dams that could be removed to restore connectivity). Apart from ecological integrity or restoration potential, watersheds might be prioritized because they contain diverse freshwater and terrestrial habitats or species, provide useful movement corridors for wide-ranging species, are of cultural importance, offer outdoor recreational opportunities, are vulnerable to climate change, and/or connect protected areas.

We envision that watersheds conserved under 30 × 30 could encompass a patchwork of conservation strategies that recognize local conditions, stakeholder values, and pre-existing conservation programs (eg Dudgeon *et al.* 2006). For example, parts of a conserved watershed might be included in a formal protected area, and other parts in working lands with conservation easements, tribally managed lands, urban areas with explicit freshwater and riparian management plans, or parts of a river that require dam removal or reoperation. In some areas, watersheds might already be well conserved, and these watersheds could also be incorporated into 30 × 30. A patchwork

Panel 1. Freshwater ecosystems advance 30 × 30 objectives: examples from California

The stated goals of the California 30 × 30 initiative demonstrate how explicitly centering freshwater ecosystems could support broad objectives of the 30 × 30 movement. The California 30 × 30 Executive Order was established in October 2020 (CA Executive Order N-82-20) and includes five primary objectives to be accomplished through new conservation programs and acquisitions: (1) to safeguard California's economic sustainability and food security; (2) to protect and restore biodiversity; (3) to enable conservation on a broad range of landscapes; (4) to build climate resilience; and (5) to expand equitable outdoor access and recreation. Many types of environments, including terrestrial, coastal, marine, and freshwater systems, must be included to achieve these goals, but because freshwater systems are highly vulnerable, here we specifically focus on the benefits of fresh water.

Economic sustainability and food security: Much of California's three-trillion-dollar economy depends on access to water, and intact freshwater ecosystems maintain water quality (Hanak *et al*. 2012). Freshwater ecosystems can retain water during drought and minimize flood events (Lund *et al*. 2018). Freshwater fish support food security and culturally important foods. For example, declining populations of coho salmon (*Oncorhynchus kisutch*) and Chinook salmon (*Oncorhynchus tshawytscha*) have resulted in negative socioeconomic, health, and cultural impacts for Indigenous peoples in northern California (eg Stercho 2006; Willette *et al*. 2016).

Biodiversity: Freshwater species diversity is a critical component of California's overall biodiversity, and freshwater systems are essential for meeting 30 × 30 biodiversity goals (Moyle 2002). Of California's 927 endemic freshwater species, 90% are vulnerable to extinction, and these species rely on habitat integrity such as flow regime and habitat complexity (Lytle and Poff 2004; Howard *et al*. 2015).

Broad range of landscapes: River systems tie landscapes together by flowing through multi-use lands (Abell *et al*. 2017; King *et al*. 2021). Watersheds define landscape boundaries in geologically and ecologically meaningful ways, and can be used to demonstrate how neighboring land users are linked by processes affecting water supply and quality (King *et al*. 2021).

Climate resilience: Inland freshwater wetlands store large amounts of carbon (Mitsch and Gosselink 2015; Nahlik and Fennessy 2016). Retaining soil moisture in waterways and groundwater systems can help buffer against catastrophic fire (Warter *et al*. 2021). Connected river networks provide large-scale movement corridors, which allow terrestrial and aquatic species to relocate as temperature regimes shift due to climate change (Krosby *et al*. 2018).

Outdoor access: Rivers support outdoor recreation activities like fishing, boating, wildlife viewing, and swimming. In urban areas, stream habitat enhancement can increase greenspace access for marginalized communities (Villamagna *et al*. 2014).

Panel 2. Opportunities for watershed-scale conservation: examples from California

Examples from California illustrate that multi-benefit freshwater conservation is achievable. For instance, the Yolo Bypass in northern California provides societal and ecological benefits on multiple scales. As an engineered floodplain in the Sacramento River watershed, the Bypass reduces flood risk and also creates agricultural land; serves as a wetland refuge for migrating waterfowl; provides habitat for native fish; and offers recreational opportunities for hunters, birders, and other community members. The Bypass is particularly valuable habitat for threatened splittail (*Pogonichthys macrolepidotus*) and Chinook salmon (*Oncorhynchus tshawytscha*), which often use associated flooded rice fields (Sommer *et al*. 2001). The Bypass exemplifies how large-scale watershed-based conservation strategies can help achieve 30 × 30 goals, as well as improve protections for freshwater habitats and species. Building and supporting programs that achieve multiple objectives could be a major strength of 30 × 30 initiatives around the world.

The Klamath River in northern California and southern Oregon provides an example of collaboration and conservation at a watershed scale that we envision could strengthen 30 × 30 initiatives. Dams along the Klamath River alter flow regimes, water temperatures, sediment movement, and salmonid disease prevalence, all of which have contributed to a 95% reduction in spring Chinook salmon populations from historical levels (Nehlsen *et al*. 1991). In response to declining river health, collaborative governance efforts that involve tribal, state, federal, and private interests have resulted in a plan to remove dams (KRRC 2020). Removing four dams on the Klamath River will restore river connectivity and functional flow regimes, benefit salmonid populations, improve water quality, and address environmental justice issues. The dam removal process on the Klamath River highlights the importance of leadership and collaboration between tribes, local conservation groups, agencies, and state and national policy makers (eg Diver *et al*. 2022). Such collaboration could be an example for watershed-scale conservation as part of 30 × 30 initiatives.

approach to watershed conservation will help negotiate trade-offs between protection and extractive uses of freshwater systems. Although freshwater conservation ultimately maintains the capacity of an ecosystem to provide services, trade-offs must be made between conservation and demands for water resources, and 30 × 30 must seek to balance resource extraction with the benefits of protecting ecosystems.

Freshwater priorities for evaluating existing and proposed protected areas

We recommend that practitioners use five freshwater priorities – connectivity, watershed disturbance, flow alteration, water quality, and biodiversity – to evaluate existing protected areas as well as areas that will be newly conserved under 30 × 30 (Table 1; Figure 3). These priorities should be evaluated in high-quality, intact ecosystems, as well as in systems with high restoration potential. Assessments of these freshwater priorities should occur alongside evaluations of conservation priorities for terrestrial and coastal ecosystems, and the combined results of these appraisals should guide 30 × 30 plans. In Table 1, we briefly define the five priorities, describe why each priority is important to freshwater conservation, discuss common conservation issues that fall under that priority, and connect each priority to specific goals from the California 30 × 30 initiative (Table 1). In addition, examples of how to measure and evaluate ecosystems for each priority are provided in WebTable 1.

Conclusion

The numerous 30 × 30 area-based efforts currently underway can achieve far-reaching results by leveraging and centering conservation actions on freshwater ecosystems. 30 × 30 is a broad set of initiatives that must take many conservation priorities into account, and freshwater ecosystems will certainly not be the only conservation focus of 30 × 30. However, we suggest that specific attention to freshwater ecosystems using a watershed-based approach will advance 30 × 30 goals and offer better protection of both terrestrial and freshwater systems (Figure 1). We present specific examples of the benefits of and opportunities for watershed-scale conservation using California as a case study (Panel 2), and we believe that comparable conservation programs that center on freshwater systems could reap similar benefits for the California 30 × 30 initiative. Conserved freshwater systems weave together multi-use landscapes, provide connectivity and habitat for aquatic and terrestrial species, integrate processes of upstream landscapes, and support a wide variety of ecosystem services including water quality, crop irrigation, biodiversity protection, climate resilience, and outdoor access. Therefore, the conservation of freshwater ecosystems should be an explicit focus of 30 × 30 initiatives.

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Data Availability Statement

No new data were collected for this study.

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