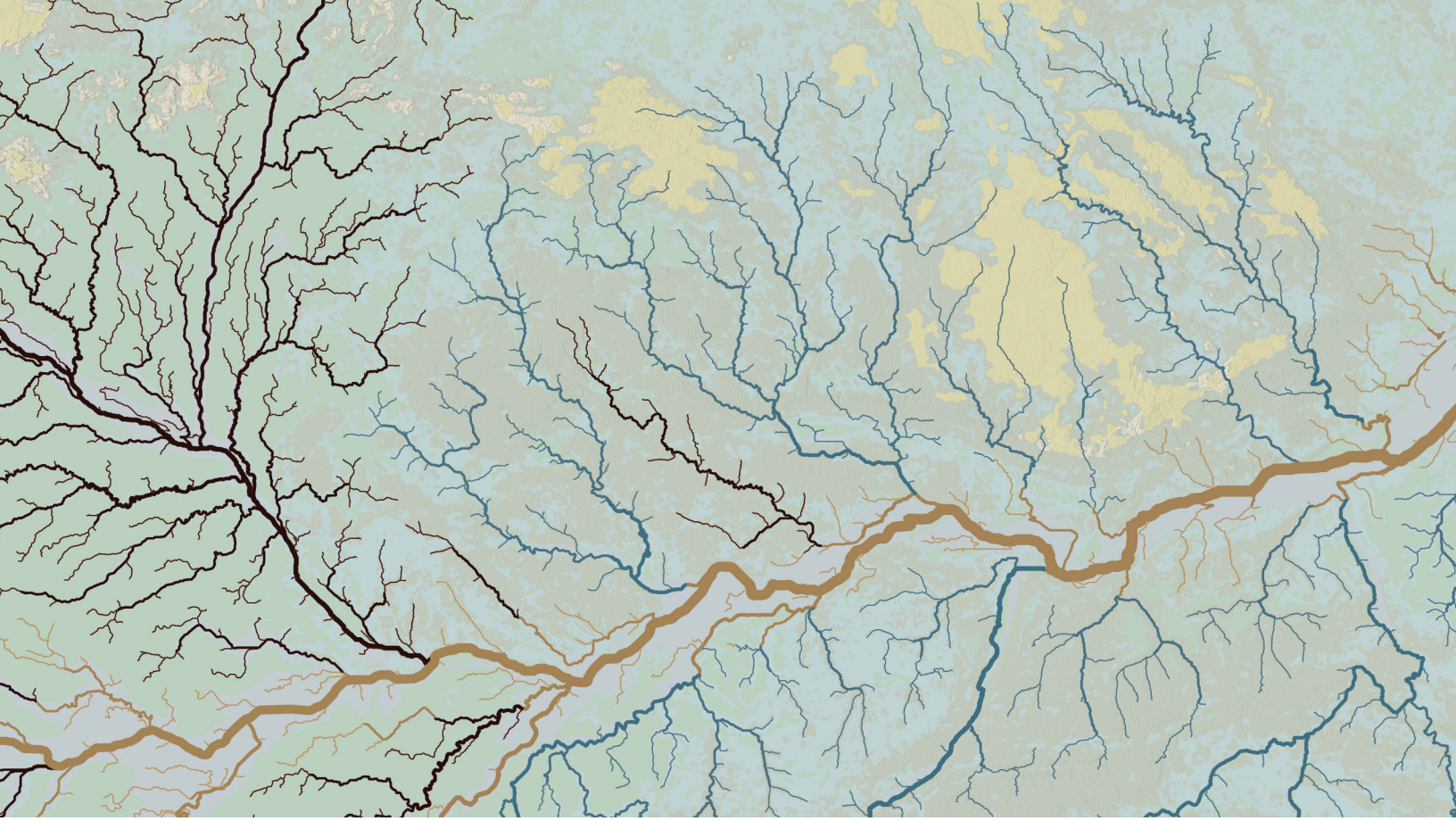
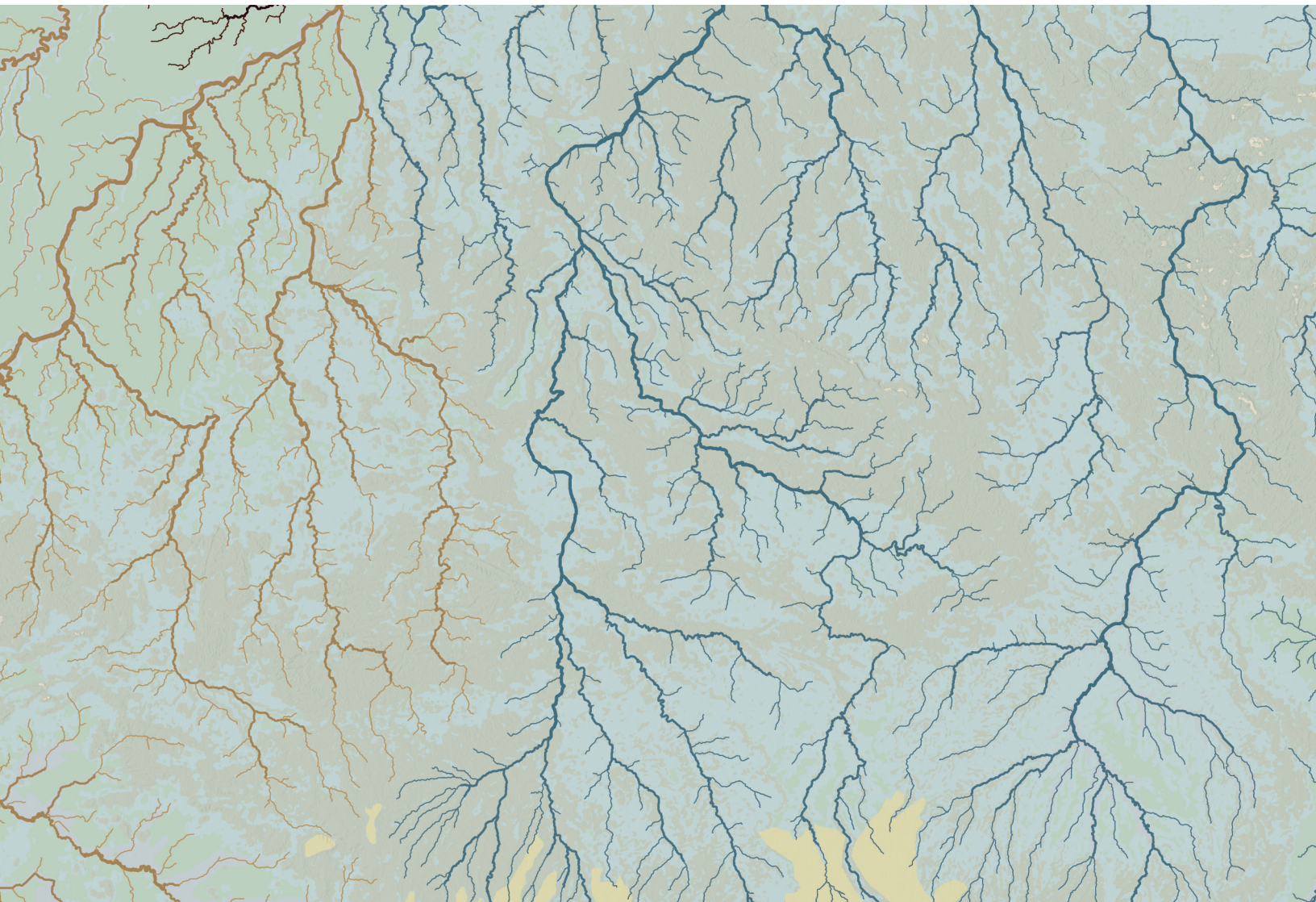


GEOSPATIAL CONSERVATION AT THE NATURE CONSERVANCY | *2022 Annual Report & Map Book*



Contents

About the Cover

With more than 1.45 million kilometers of rivers and streams, the Amazon basin is the world's largest river system network. The Amazon has a long and complex geologic history and is composed of several distinct landscapes and geologies where rivers are formed and traverse, giving it its signature three water types. "White" water rivers are muddy, with high loads of fine suspended sediments. They drain the Andes mountains from the western and southwestern portions of the basin and are characterized by rich nutrient concentrations and lower temperatures with a neutral pH. "Clear" water rivers are highly transparent with low suspended sediment. They drain the ancient rocky shields on the northern and southern edge of the basin, are characterized by low nutrients, and have a pH of around 5.5 with moderate temperatures. "Black" water rivers are a dark tinted color resembling tea, have little to no suspended sediment, and drain the western portion of the Guiana Shield and the sandy regions in the central and northwestern parts of the basin. They have high concentrations of humic and fulvic organic acids, are very poor in nutrients, and have high temperatures and high acidity with a pH of around 4.0. This diverse and varied group of river types sets the environmental stage for the expression of the richest freshwater biodiversity on the planet.

COVER DATA SOURCES: Global River Classification (GloRiC), Venticinque et al. 2016, USGS, Esri.

RIVER TYPES

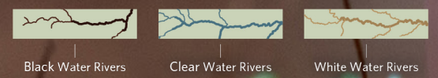


PHOTO: Ecuadorian poison frog in the Yasuní National Park and Biosphere Reserve. © Juan Manuel González Villa/TNC Photo Contest

Jonathan Higgins

INSPIRATION FROM A BELOVED FRESHWATER ECOLOGIST

Nicole Silk
Global Director of Freshwater Outcomes

This year's Geospatial Annual Report is dedicated to freshwater and the influence of one extraordinary and determined thought leader at The Nature Conservancy (TNC), Jonathan Higgins. Jonathan was an avid angler, a talented musician, a caring friend and a thoughtful mentor and teacher for the watery part of TNC. He was strident in his advocacy for all matters freshwater, impatient to advance solutions that moved us toward durable conservation outcomes and fiercely determined to make a difference within (and beyond) the organization.

One of his final contributions was the advancement of Project Refresh, an effort involving over 100 staff to reflect, recognize, celebrate and calibrate TNC's considerable freshwater achievements. His unyielding determination led us to sharpen our focus on investments that would have the greatest organizational impacts. Along with his coauthors, he published a highly influential article on durable freshwater conservation that provided internal guidance on best practices for measuring the conservation of rivers, lakes and wetlands in pursuit of TNC's bold 2030 Freshwater Goals. In his legacy, he leaves a solid foundation for our road ahead, including an internal Freshwater Council and a clear learning agenda for a Freshwater Community of Practice.

Jonathan reminded those around him to "think like a fish." His unconventional leadership challenged us to consider various perspectives when looking for solutions. For example, fish move. They don't just hang out in the main channel. They might hide in cool waters behind a rock during warm summer days and move downstream, into floodplains during high waters, to access food and reduce their energy consumption. Then during the breeding season, they swim upstream to remote gravel bars to lay their eggs. The constant movement of fish could teach us as practitioners the importance of adjusting our tactics whenever complex ecological issues arise. Jonathan was relentless in his pursuit of knowledge about whether we knew enough about these fish behaviors to map them or if we knew the range of key ecological attributes (KEAs—connectivity, hydrological regime, water quality, habitat and biotic composition) that was ideal for each species, and perhaps most importantly, were we doing enough to protect these KEAs across the whole system? He wanted to see it, to map it, to experience impact. And he knew this wasn't just about fish.

"Free-flowing rivers and other naturally functioning freshwater ecosystems sustain biodiversity, the food supply chain, drinking water, economies and cultures for billions of people worldwide. Therefore, their protection is critical to sustain these values."

I couldn't agree more with Jonathan. To up our game, we needed to be bolder, reach further and tell better stories. Today, we're doing just that through our audacious 2030 Freshwater Goals and, in part, through the spatial analysis and decision support mapping systems included in this year's Geospatial Annual Report. The world's waters and those living within them are calling. Guided by Jonathan's words of wisdom, *it's time to do more.*

2022 GEOSPATIAL ANNUAL REPORT & MAP BOOK

"Free-flowing rivers and other naturally functioning freshwater ecosystems sustain biodiversity, the food supply chain, drinking water, economies and cultures for billions of people worldwide. Therefore, their protection is critical to sustain these values."

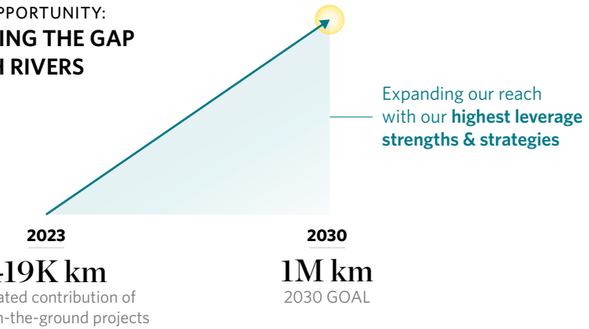
JONATHAN HIGGINS

TNC's 2030 Freshwater Conservation Goals

Since 1970, populations of freshwater species globally have declined by an average of 83%. We've lost 64% of the world's wetlands since 1900 and only 37% of the world's longest rivers remain unimpeded and free-flowing. These systems are vulnerable to the impacts of climate change as precipitation patterns become more unpredictable and regionally drier and wetter. Unfortunately, shifting weather patterns are likely to exacerbate preexisting patterns of water abundance and insecurity, increasing the need for climate resilient solutions.

Despite these challenges, we will not fail freshwater. TNC's mission is to conserve the lands and waters upon which all life depends. Our rivers, lakes, wetlands and floodplains are essential to all life—ours, and the various fish, plants, mammals, amphibians and invertebrates that call these places home. In response, we have deepened and expanded our commitment to freshwater conservation and are proud to report our current portfolio has over 450 freshwater conservation projects underway or completed across 36 countries.

THE OPPORTUNITY:
CLOSING THE GAP WITH RIVERS

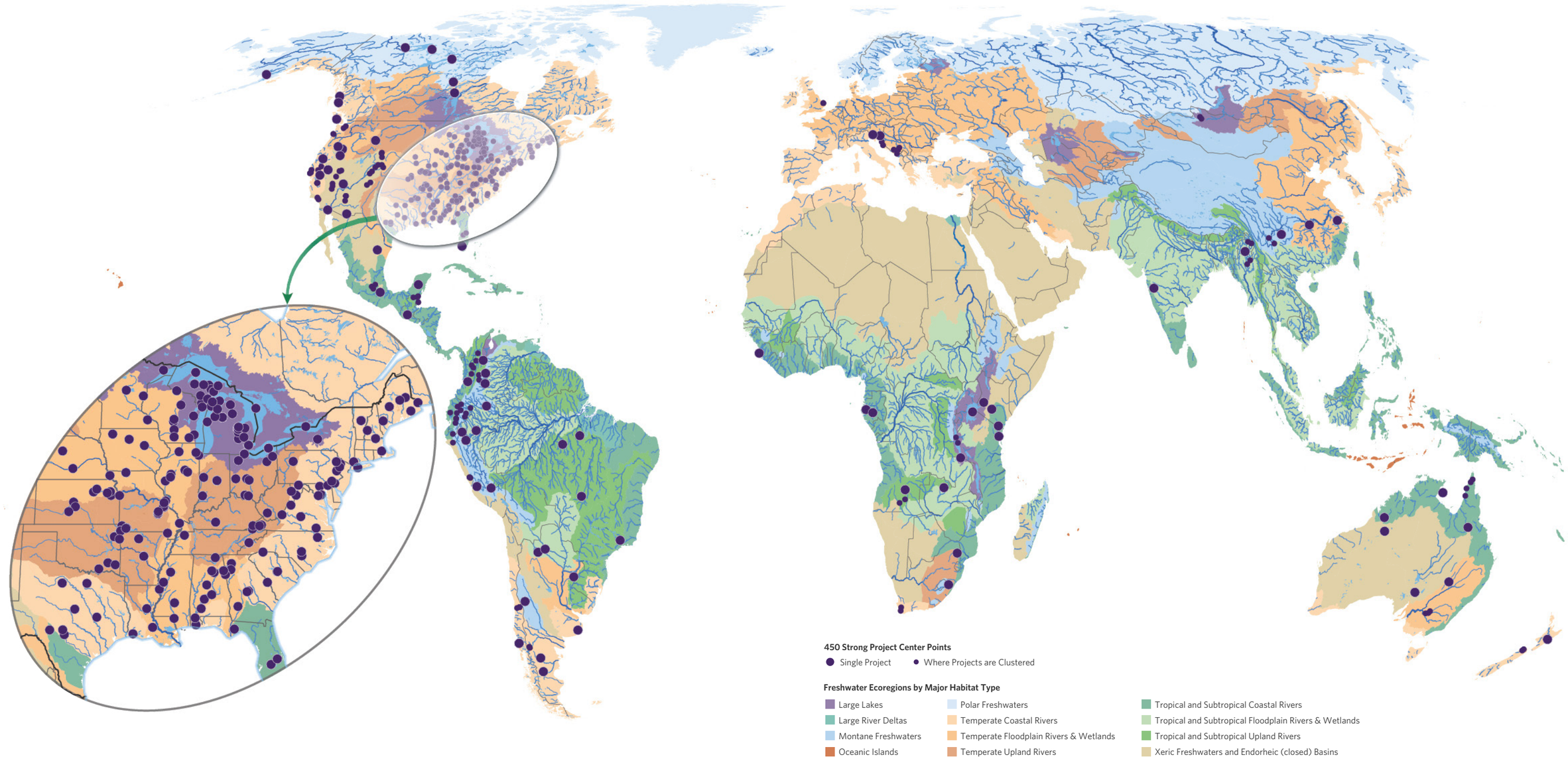


These conservation efforts exist in geographies where water is both abundant and scarce. The challenges facing communities with impaired waterways are unique, and our team tackles them head-on. The importance of maintaining productive working relationships with a variety of partners in every situation cannot be overstated. For example, we work with farmers and ranchers to improve water quality and with engineers and agencies to influence infrastructure decisions. We collaborate with water authorities on dam/barrier removal projects and work with private and public actors to advance novel financial and governance solutions.

To respond to today's dual crises of biodiversity loss and climate change, we set forth audacious 2030 goals—to conserve 1 million kilometers of rivers and 30 million hectares of lakes and wetlands, delivering benefits to 45 million people. However, our current portfolio of projects is likely to carry us approximately halfway toward these goals. Therefore, during the next seven years, we will double the impact of our investments by advancing both traditional and novel strategies that deliver freshwater outcomes, and direct this work towards places that offer the greatest opportunity for conservation at scale with lasting impacts.

PHOTO: Fishermen cast their nets on the Llanito swamp using a traditional fishing technique known as the "corral", whereby several fishing canoes corral the fish, Magdalena River, Colombia. © Paul Smith

2022 GEOSPATIAL ANNUAL REPORT & MAP BOOK



Our Freshwater Portfolio

450 STRONG & GROWING

The plight of freshwater systems is becoming visible, and solutions are in play. As a result of strong advocacy from key countries and support from a broad consortium of conservation organizations, including TNC, inland waters have been included in the Kunming-Montreal Global Biodiversity Framework's 30% protection and restoration targets, which were drafted at the 15th Conference of the Parties (COP15) to the Convention On Biological Diversity in Montreal, Canada in December 2022. These aspirational goals will require a huge lift by governments, corporations, nonprofits and local communities.

At TNC, we are putting our collective "back" into this lift by aligning them with our 2030 freshwater conservation goals. We are leveraging our freshwater expertise in science and practice, working across political and institutional boundaries and investing in high-value conservation opportunities. Our current freshwater projects span six continents, 36 countries, 90 freshwater ecoregions and ten major habitat types. Projects include dam removals that restore fish passage, watershed investment programs that keep water clean and flowing for communities, inland fisheries management and policy, and legislation and regulation collaborations that promote durable freshwater protection. Our mission of protecting the global supply of freshwater is woven throughout our commitment to meet the Conservancy's ambitious goals for oceans, lands, people and climate change.

FRESHWATER PROJECTS: Point locations of our freshwater projects around the world. Many of these points represent larger areas such as watersheds or river basins. Most of the world's major freshwater habitat types are represented in this work. Our portfolio of projects with freshwater outcomes continues to grow. Future versions of this map will reflect recent expansion of our freshwater work into new regions, as well as freshwater benefits of terrestrial and climate change projects.

Annual Geospatial Survey

GEOSPATIAL TRENDS

The Nature Conservancy conducted a fourth annual survey in May-June 2022 to assess the status and needs of our geospatial community across Geographic Information Systems (GIS), Earth Observation and data science disciplines. We asked respondents about their use of the cloud platforms, storage and compute needs, training, software usage and specific geospatial areas of expertise and technology support. With this information, we have begun to track trends since 2019 to build an effective enterprise geospatial system that supports practitioners and elevates our geospatial work to a higher level of excellence.

Note: Like all surveys, results are only as accurate as the response rate. Therefore, results do not necessarily reflect the status of the entire TNC geospatial community

1,660
STAFF INVITED TO PARTICIPATE IN THE SURVEY

381
RESPONDENTS [90% COMPLETED THE ENTIRE SURVEY]

Defining TNC's Geospatial Community

1,767 GEOSPATIAL COMMUNITY MEMBERS

1,597 TNC STAFF USING GEOSPATIAL COMMUNITY MICROSOFT TEAMS

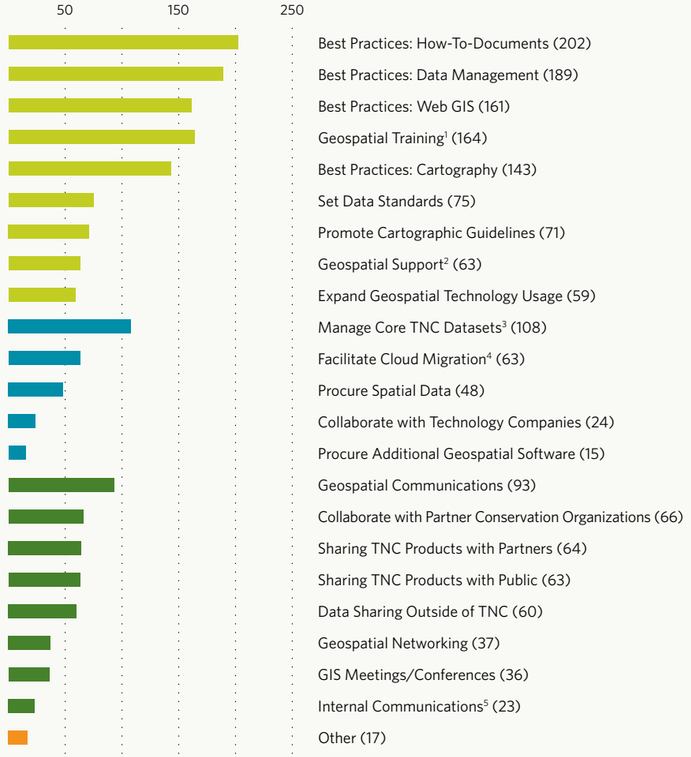
1,588 ACTIVE MEMBERS ON ARCGIS ONLINE

526 USERS ON CONSERVATION GEOCLOUD (AWS)

48 EXTERNAL PARTNER ORGANIZATIONS SUPPORTED (BY EXTENSION) ESRI AUTHORIZED ENTITIES

Priorities of Geospatial Community

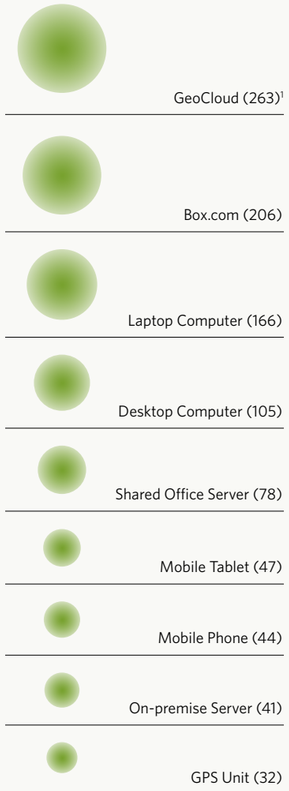
We asked respondents to identify the top priorities that the Geospatial Systems IT team should focus on to impact the community's work significantly.



1 Esri courses, other vendors, etc.
2 Help Desk
3 Organize, manage and centralize
4 Azure, Amazon Web Services, etc.
5 TNC Intranet

Storing Spatial Data

Most respondents now use TNC's Conservation GeoCloud to store their spatial data. Box.com, laptop and desktop computers are also widely used to store spatial data. The use of shared and on-premise office servers continued to decline in 2022.

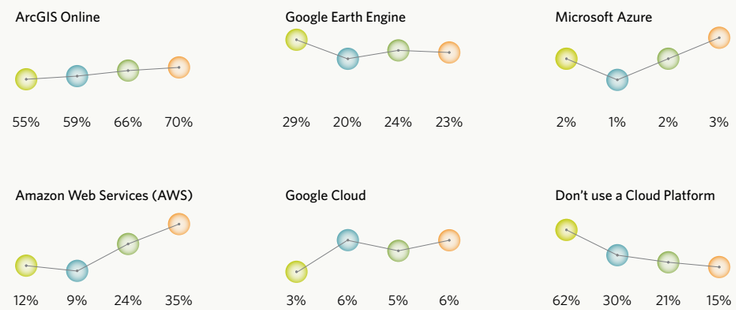


1 Primarily AWS and ArcGIS Online

Cloud Platform Usage

In the past four surveys, we have seen increased reported usages of cloud platforms, principally ArcGIS Online and Amazon Web Services (AWS). Our Geospatial Operations team has also migrated spatial data from outdated on-premise servers to the GeoCloud. Usage of Google Cloud and Microsoft Azure has remained consistent with data science projects.

2019 2020 2021 2022



Protecting Freshwater Ecosystems in the Amazon

THIS EXTENSIVE, HEALTHY AND CONNECTED FREE-FLOWING RIVER NETWORK REPRESENTS OPPORTUNITIES AND CHALLENGES FOR CONSERVATION

With an area of 6.9 million square kilometers, the Amazon River Basin is the largest in the world and has a profound impact on global and local biodiversity, climate and people. The Amazon is the most biodiverse region on earth for freshwater fauna, it is globally recognized for its diversity, richness and abundance of freshwater species and habitats and boasts high rates of endemism. There are more than 2,700 fish species and 36 aquatic megafauna species, more than anywhere else on earth. For the Amazon's freshwater biodiversity to thrive, it must be sustained by an extensive network of healthy, free-flowing rivers connected with floodplains and wetlands.

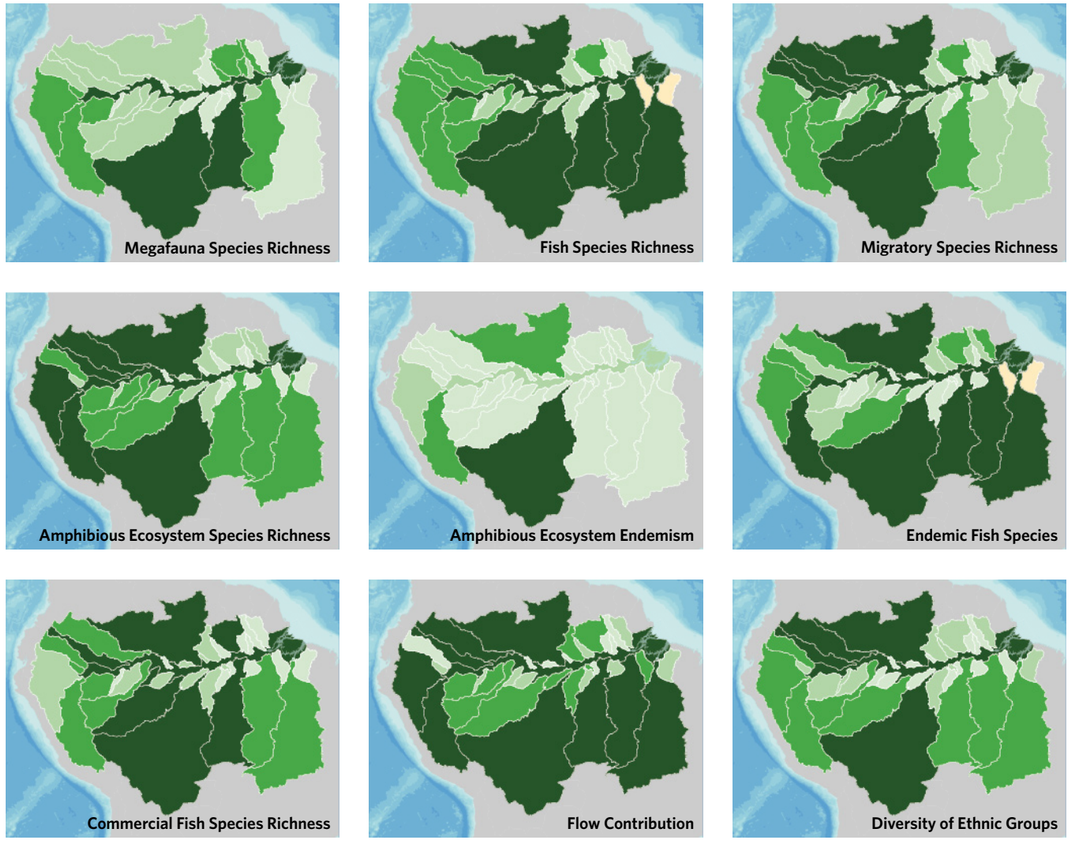
The Amazon River originates in the Andean cordillera 6,600 meters above sea level, gathering water from eight countries before discharging to the Atlantic Ocean. In its entirety, the Amazon discharges more freshwater than any other river on the planet. This extensive, healthy and connected free-flowing river network represents opportunities and challenges for conservation. However, to maintain its health and biodiversity, quick action is required as these unique aquatic ecosystems are being altered due to hydroelectric dams, mining, oil extraction, deforestation, conversion to agriculture and other pressures facing the integrity of the Amazon River. These threats are projected to grow in number and intensity in the near future.

In addition to its amazing biodiversity, the Amazon River is a lifeline for more than 47 million people living on its riverbanks and throughout its basin. Notably, the Amazon Basin is home to nearly 2.7 million Indigenous People from more than 400 diverse ethnic groups. The relationship between these Indigenous groups and the freshwater ecosystems woven throughout the region is evident by their deep social, cultural and economic connections to the land and water. All people of the Amazon rely on rivers, floodplains and wetlands for food, transportation and water supply as well as cultural and religious practices.

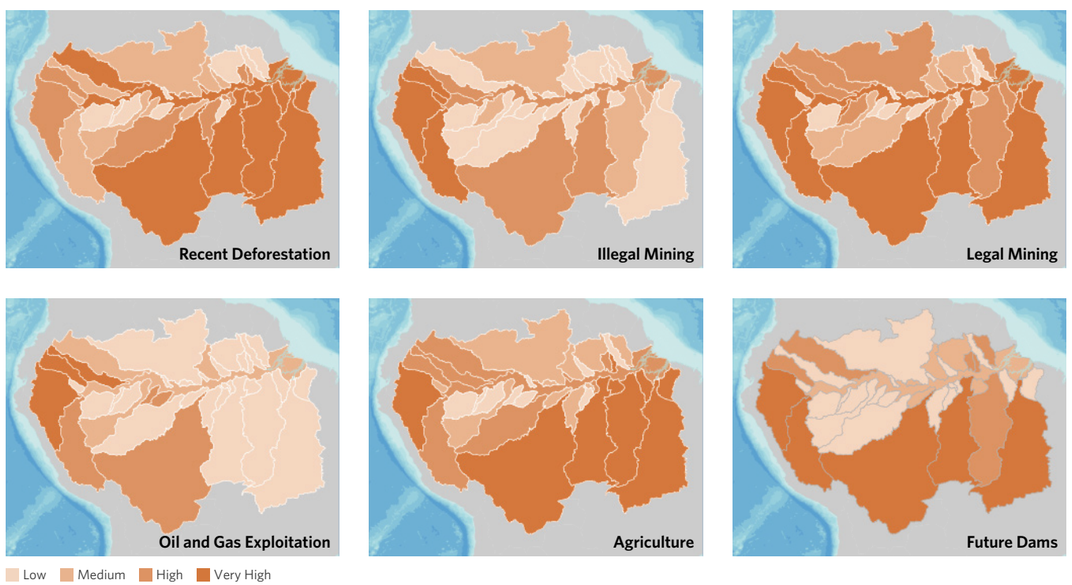
Considering the global importance of the Amazon River Basin for freshwater biodiversity conservation and the people that rely on it, TNC has placed this area at the forefront of our conservation vision for 2030. TNC developed a conservation strategy for the Amazon Basin freshwater systems by leveraging the organization's Conservation by Design planning principles and working within a landscape planning context. Our work aims to maintain a connected and resilient basin for biodiversity and freshwater ecosystems by helping societies to prosper, supporting Indigenous Peoples and local communities in sustaining their livelihoods and cultures and contributing to global climate regulation.

PHOTO: Tekakro Xikrin fishing on Rio Bacaja near the village of Pot-Kro, in the Brazilian Amazon. Tekakro uses many techinques such as coconut larve to catch minnows and then uses minnows to catch piranhas. Parts of the piranhas are used for bait to catch fish for food. © Kevin Arnold

BIODIVERSITY & CULTURAL



THREATS



MAPPING THE BASIN

The geographic scope of this work encompasses the entire Amazon Basin. Hydrologically, the basin comprises thirty-five tributary catchments or sub-watersheds, plus the central mainstem corridor.

As part of the planning process, we developed a prioritization plan across the sub-watersheds. Nine of them plus the main stem are considered white water dominated, 11 are black water dominated and 16 are clear water dominated (see About the Cover section for definitions of these water systems). To guarantee adequate representation, we further prioritized seven sub-watersheds within white water, four within clear water and three within black water. This was to ensure that each selection maintained a representation of the origin of the waters (Amazonian lowlands, Andes, Brazilian Shield and Guianan Shield).

The spatial analysis for prioritization included eight biodiversity and one cultural dataset and six threat-based data layers. We identified priority areas in places where high biodiversity and high threat values coincided. We also accounted for low connectivity due to existing dams. The resulting prioritization included 14 sub-watersheds, guaranteeing representation of water types and water origins for a total of almost 5.4 million km², constituting nearly 78% of the entire Amazon Basin.

MAPS

OPPOSITE: Sub-watersheds were ranked for nine biodiversity and cultural values and six threat values.

THIS PAGE: Sub-watersheds of the Amazon. Priority sub-watersheds are based on analyzed rankings of biodiversity and cultural values and threats.

DATA SOURCES

TNC, Venticinque et al. 2016, Global River Classification (GloRiC), Natural Earth, Esri.

MAPPING CONSERVATION GOALS

Based on the conservation planning principles of sustaining viable ecosystem structure and function to support Amazon biodiversity, we set high-level, long term conservation goals. This spatial analysis of sub-watershed priorities provides us with the right blueprint to track and meet these ambitious goals. The most critical component of this plan is the maintenance of connected corridors in free-flowing rivers and headwaters that remain connected to the main stems. The functionality of wetland and floodplain ecosystems, and the flood pulses that feed them are additional goals we can track with this analysis. To maintain diversity, our goals for the Amazon Basin include:

80%
of main-river connected corridors remain functional/healthy (free-flowing)

80%
of wetland areas and flood pulses remain functional/healthy

30%
of headwaters are connected to main stems

All of these include the preservation of livelihood values for communities and Indigenous Peoples.

As TNC moves toward implementation, we are developing explicit conservation strategies to carry out in Colombia, Ecuador, Peru and Brazil where we, and a variety of partners, are promoting a system-based approach. These strategies will both help us achieve our conservation goals in the Amazon Basin by 2030 and realize our long term vision beyond 2030 of protecting 23,180 kilometers of free-flowing large and very large rivers, 535,454 kilometers of free-flowing and connected small and medium-sized rivers and over 66 million hectares of wetlands.

1. Maintaining connectivity corridors

The Amazon presents a significant opportunity for durable freshwater protection of areas, including Indigenous territories, that encompass 55% of the Amazon Basin. With the initiation of the recent Kunming-Montreal Global Biodiversity Framework, countries in the Amazon Basin have committed to protecting 30% of ecosystems inclusive of inland waters. Many current protected areas fail to address key ecological factors necessary to maintain freshwater biodiversity, often lacking specific management interventions for critical issues such as pollution and connectivity loss. TNC is working to increase freshwater protection and strengthen the territorial and resource use rights of Indigenous and local communities ensuring the durability of species movement within the Amazon River network.

2. Provide sustainable food and water

Contributing to water and food security through the implementation of nature-based solutions and community-based fisheries management is of significant focus for TNC in the Amazon. Building on more than 20 years of successful experience in promoting long-term mechanisms for water source protection in the region (i.e., several mature water funds protect water sources in the Amazon Basin), TNC is conducting spatial mapping of water security assets to guide nature-based investments with donors and investors, supporting the creation and management of new water reserves in Ecuador to guarantee water provision to local populations and leveraging policies to improve these solutions.

3. Maintain healthy and connected river networks

In areas with high flows, hydropower is one of the fastest-growing sectors due to soaring energy needs and a shift from carbon-based energies. There are already plans for many more hydropower dams in the future, which would cause significant ecological impacts, threatening the connectivity of free-flowing rivers. The nuances around hydropower as a viable alternative to carbon-based energy illustrates why a shared strategic framework is needed across stakeholder groups. As a science-based organization, TNC is leading a case study in the Marañon watershed in Peru to strengthen decision-making around dam construction to reduce impacts on people and nature in energy planning. TNC is committed to supporting countries as they transition to low-carbon economies, avoiding projects that can have negative impacts on the environmental and socio-economic landscape.

Advancing these conservation strategies will amount to 15 million hectares of wetlands and 200,000 kilometers of rivers under protection, thereby providing meaningful progress toward our 2030 conservation goals.

THE FUTURE OF THE BASIN

If the Amazon River Basin is to maintain its position as the most important basin for freshwater biodiversity, TNC and partners must act now. Our commitment to conservation in the Amazon Basin and the people depending on it is evident through our conservation prioritization planning process, and our roadmap and vision for 2030.

Our work relies on geospatial data and tools across a variety of scales in the Amazon River Basin. Our commitment to increase and improve our understanding of biophysical and cultural aspects of this globally-significant freshwater ecosystem will continue into the future. Geospatial conservation science guides our priorities and provides decision support in achieving our vision, as we use it to track and measure progress towards our goals.

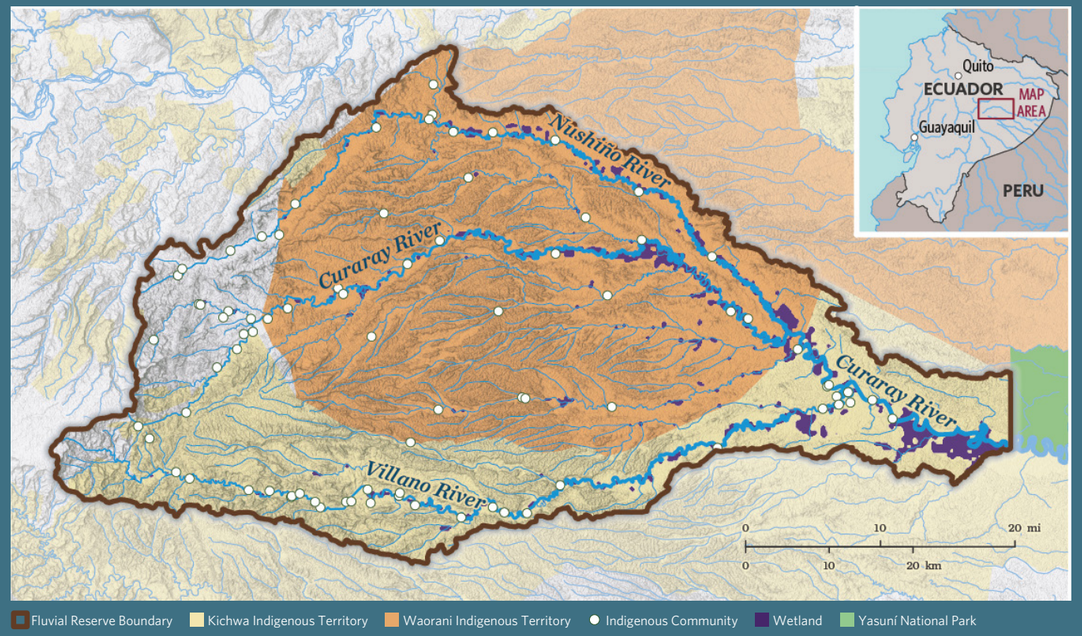
PHOTO: Members of the Waorani nationality from Gomataon community. © Silvia Benitez/TNC

MAP: The Nushiño-Curaray-Villano Fluvial Reserve in the Ecuadorian headwaters of the Amazon is home to many Indigenous communities and an extraordinary array of freshwater biodiversity.

DATA SOURCES: TNC, Shuttle Radar Topography Mission (SRTM), Center for International Forestry Research (CIFOR), Red Amazonica de Informacion Socioambiental Georreferenciada (RAISG), Natural Earth.

Nushiño-Curaray- Villano Fluvial Reserve in the Ecuadorian Amazon

The Nushiño-Curaray- Villano Fluvial Reserve in the Ecuadorian Amazon is a first-of-its-kind, Indigenous-managed reserve that covers 371,000 hectares, 1,860 river kilometers of free-flowing rivers, 26,000 hectares of wetlands and includes 80 communities from Waorani and Kichwas Indigenous nationalities. This reserve was constituted as a conservation and sustainable communal use area (ACUS, a status officially recognized by the national environmental legislation in Ecuador). The creation was signed by Mr. Gilberto Nenquimo, President of the Waorani Indigenous nationality and Antonio Vargas, President of the Kichwa Indigenous nationality of Pastaza. With approximately 200 fish species that underpin the subsistence fisheries of 4,300 Indigenous People and local communities, the Fluvial Reserve is of particular importance for freshwater biodiversity. TNC's Durable Freshwater Protection (DFP) framework was used to support and guarantee the long-term provision of water, food (e.g., fisheries), transportation and other tangible and intangible contributions for the well-being of local communities. DFP provides freshwater conservation practitioners a framework to stimulate more effective protection and strategy development. They define durable as having a high probability of providing dedicated, secure and enforceable protection into the future—at least 25 years. With this framework, our efforts will leverage geospatial technology for delineating the reserve boundaries, improve understanding of the distribution of conservation values and aid in the development of the reserve management plan.



River Ecosystems in Crisis

Freshwater systems are facing an urgent biodiversity crisis. Since 1970, monitored populations of freshwater species have declined globally by 83%, much faster than terrestrial or marine species (WWF, 2022). Wetlands are disappearing three times more quickly than forests (Gardner and Finlayson 2018) and the hydrologic cycles that sustain river systems are threatened by climate change. Decisions around water and land use often assign low priority to freshwater ecosystem health, with consequences for biodiversity and the ecosystems' multiple benefits to local and downstream communities. To address this challenge, TNC and partners are developing science, policy and financing solutions to conserve and protect freshwater ecosystems.

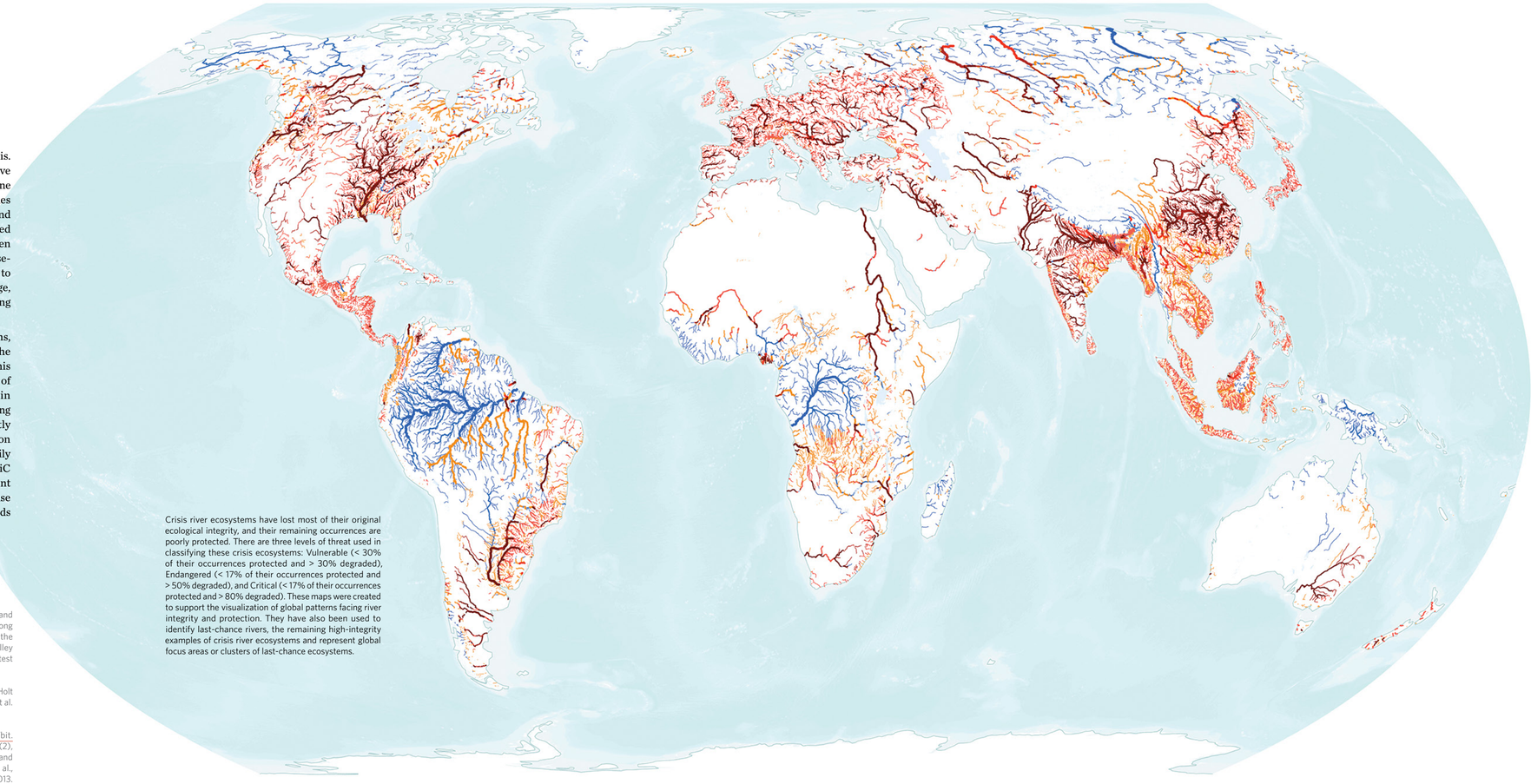
To visualize these trends and guide conservation actions, TNC conducted a spatially explicit global assessment of the ecological condition and protection of river ecosystems. This assessment was made possible by the recent development of publicly available global river databases. Using advances in hydrologic sciences, satellite remote sensing and data processing capabilities, these data development efforts have significantly advanced water resource management and global conservation efforts. These global databases include the HydroSHEDS family of seamless hydrographic data (Lehner et al. 2008), GloRiC (Ouellet Dallaire et al., 2019), the free-flowing rivers assessment and database (Grill et al. 2019) and the HydroATLAS database of hydro-environmental information for rivers and watersheds of the world (Linke et al. 2019).

PHOTOS: Setting traps to assess fish population diversity and health in wetland restoration projects in the marsh of Cedar Point National Wildlife Refuge, along southern shore of Lake Erie, near Toledo, Ohio. © Ariana Lindquist; Jaguar in the Pantanal, Brazil. © Elize Labuschagne/TNC Photo Contest 2019; Long Valley Wetland in Sheung Shui, Hong Kong, China. © Wing Ho Poon/TNC Photo Contest 2019

DATA SOURCES: FEOWs (Abell et al. 2008), World Zoogeographic Regions (Holt et al. 2013), GloRiC (Ouellet Dallaire et al. 2019), Free-Flowing Rivers (Grill et al. 2019), HydroATLAS (Linke et al. 2019).

REFERENCES: Abell et al., 2008. BioScience, 58(5), 403-414. https://bit.ly/3HccuQz; Ouellet Dallaire et al., 2019. Environmental Research Letters, 14(2), 024003. https://bit.ly/3n5I2BO; Gardner and Finlayson, 2018. Global wetland outlook. In Ramsar Convention Secretariat. https://bit.ly/3mW1PTj; Grill et al., 2019. Nature, 569(7755), pp.215-221. https://bit.ly/3V4XObC; Holt et al., 2013. Science 339:74-78. https://bit.ly/3V6BRsD; Lehner et al., 2008. Eos, Transactions, American Geophysical Union, 89(10): 93–94. https://bit.ly/41AC7m5; Linke et al., 2019. Scientific data, 6(1), p.283. https://bit.ly/3ArVL83; WWF, 2022. Living Planet Report 2022. https://bit.ly/44250t1

Crisis river ecosystems have lost most of their original ecological integrity, and their remaining occurrences are poorly protected. There are three levels of threat used in classifying these crisis ecosystems: Vulnerable (< 30% of their occurrences protected and > 30% degraded), Endangered (< 17% of their occurrences protected and > 50% degraded), and Critical (< 17% of their occurrences protected and > 80% degraded). These maps were created to support the visualization of global patterns facing river integrity and protection. They have also been used to identify last-chance rivers, the remaining high-integrity examples of crisis river ecosystems and represent global focus areas or clusters of last-chance ecosystems.

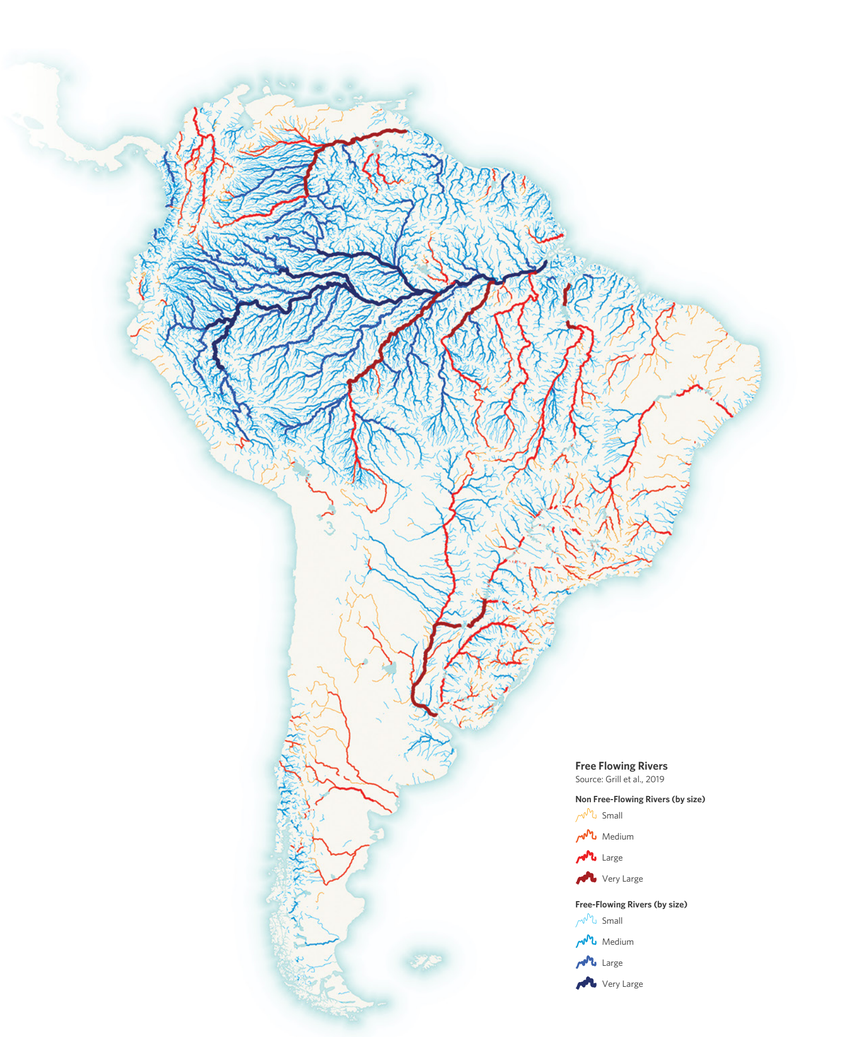


Converted Land Use

Cropping or Grazing on Historic Forest (%)

- 51–101
- 1–50
- 0

To assess river ecosystems in crisis, river ecosystem types were first defined according to climate, hydrology and physical habitat, then analyzed for ecological condition—loss of integrity—and protection status. The ecological condition was assessed according to upstream impacts from converted land use and loss of free-flowing connectivity due to dams, reservoirs and other infrastructure. Protection status is the fraction of the upstream watershed in protected areas, or other areas managed for conservation. This methodology was developed and refined for South America and then applied globally. The result, shown in the global map on the front page, identifies river ecosystems in crisis due to both high ecological impacts and little or no protection across their global extent.



Free Flowing Rivers

Source: Grill et al., 2019

Non Free-Flowing Rivers (by size)

- Small
- Medium
- Large
- Very Large

Free-Flowing Rivers (by size)

- Small
- Medium
- Large
- Very Large

Protected Status

Source: Linke et al., 2019

Upstream Area Protected (%)

- 91–100
- 41–90
- 1–40
- 0

Map Spotlight

LAKE TANGANYIKA BASIN

Vincent Abere
Cartographer
TNC Africa Program

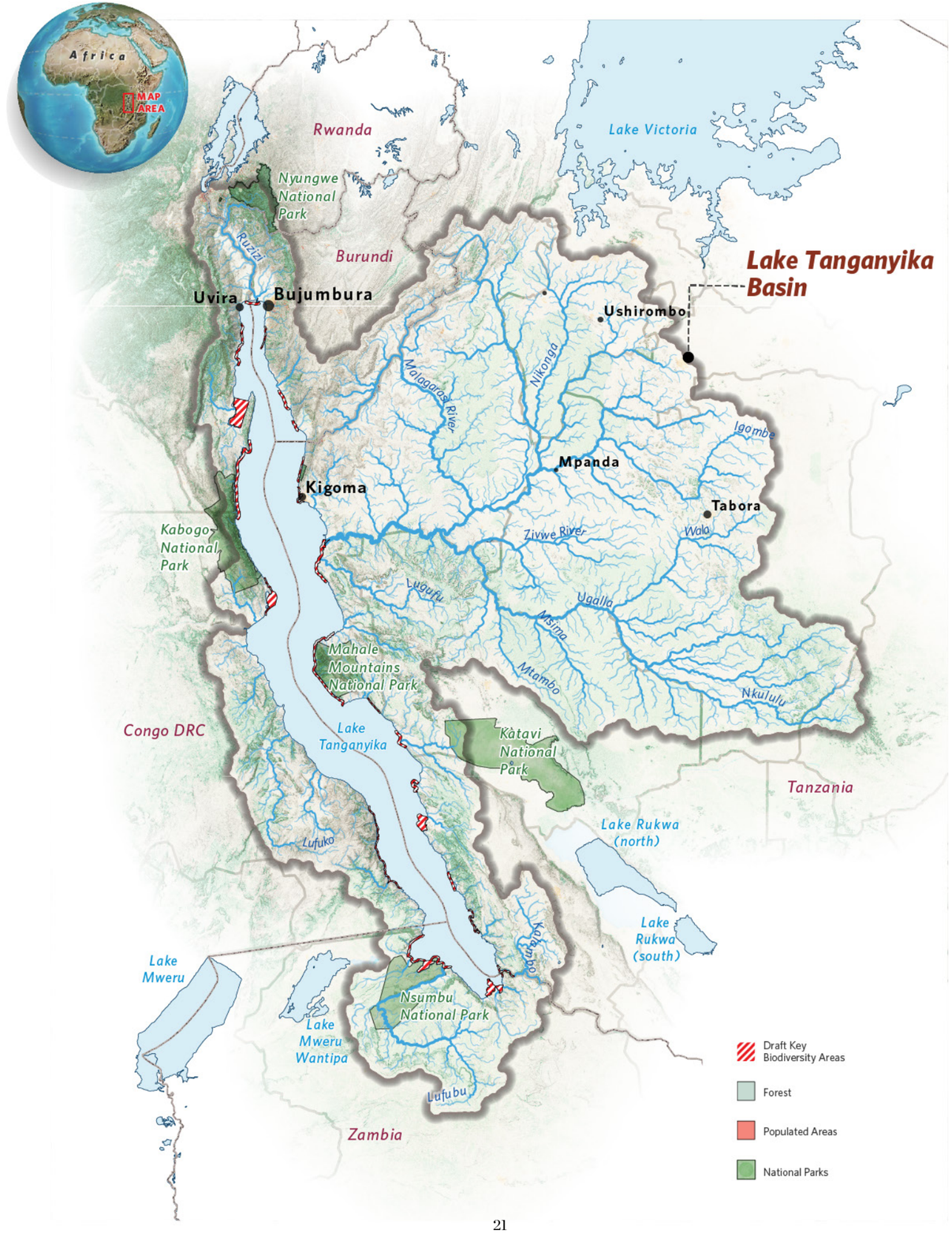
A beacon of biodiversity, Lake Tanganyika is the most intact large lake in the world, holding 17% of the world's surface freshwater and more than 200 species of cichlids. Bordered by four nations—Tanzania, the Democratic Republic of the Congo (DRC), Burundi and Zambia—the lake's fisheries provide food and jobs for millions of people who live in remote villages along its shores. Despite its staggering size, the lake remains vulnerable to growing threats. Most of its aquatic life hugs a narrow shelf just offshore, beyond which the water depth drops precipitously to nearly a mile deep.

Building on progress made over the past seven years through the Tuungane project on the Tanzanian shore, TNC is now expanding our work across the entire lake. In partnership with communities, local governments and other stakeholders, we are looking to rapidly scale community-based fisheries co-management and other proven strategies. Thus far, TNC has mapped 22 freshwater Key Biodiversity Areas (KBAs) that will guide our effort to strengthen and expand protection from the current <1% of the lake's area to at least 30% of the KBAs to help avert hydropower dams on key tributaries and avoid caged aquaculture development in sensitive habitats.

MAP: Species-level data derived from the research of scientist Ad Konings, a leading expert in cichlids of Lake Tanganyika, and the IUCN Red List were used to calculate freshwater species richness within the Lake Tanganyika basin based on hydro basin dataset boundaries. Through this process, Key Biodiversity Areas (KBAs) were identified which have the potential for application of local and regional management and conservation strategies.

Vincent Abere joins TNC as the Cartographer for the Africa Program. He contributes to the Africa conservation program by working with the cartography and design teams and the strategy and program leads to establish and implement a portfolio of cartographic products. Vincent has a BSc in Geospatial Engineering from the University of Nairobi and has worked on various GIS roles in conservation and research. Vincent is based In Nairobi, Kenya.

PHOTO: Women spreading dagaa out to dry after purchasing it directly off the boats, Mgambo, Tanzania. © Ami Vitale



Looking Ahead: 2023

IMPROVING CONSERVATION PROJECT ACCOUNTING WITH GEOSPATIAL SYSTEMS TO ACCURATELY REPORT ON OUR 2030 GOALS

The Nature Conservancy has come a long way regarding our freshwater ambitions, projects and the influence of our strategies and innovations. For the first time, we have tangible, organization-wide, numeric freshwater goals that are driving our collective impact. The organization's conservation project accounting database, Conservation Hub[1] is improving our ability to track progress toward these goals while building a culture of accountability. The impacts of our geospatial work are conveyed through visually compelling maps that help our audience see where we are today, what is possible and how to think like a fish, a nod to the systems-based thinking that is woven throughout the legacy of Jonathan Higgins. As we partner on global commitments and agreements, the importance of conveying conservation stories and progress through maps becomes essential, not only for our own leadership, but for our current and future supporters worldwide, including public and private partners.

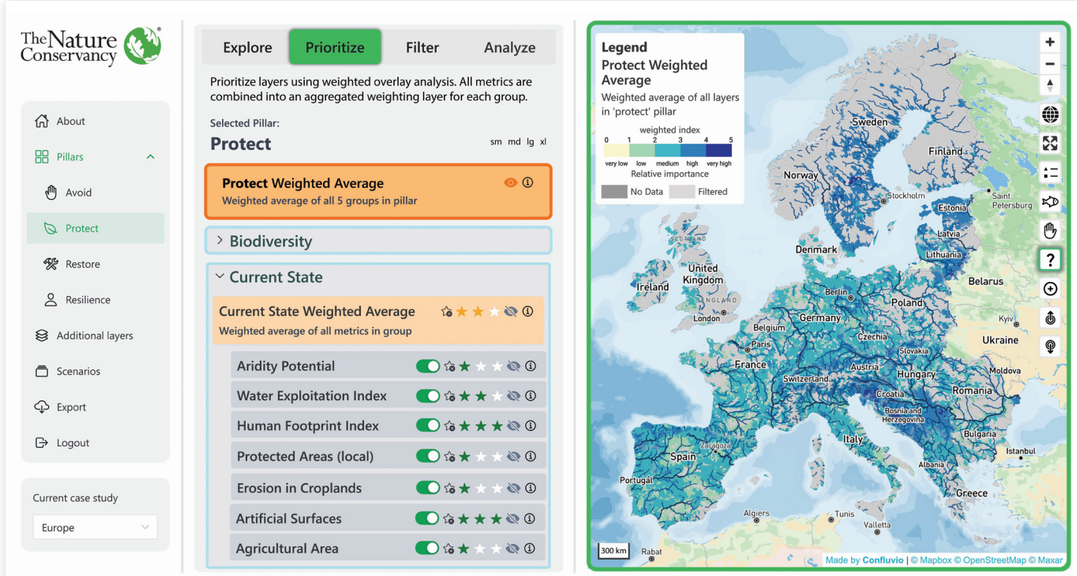
As we imagine what is next, we should pause to appreciate the power of geospatial data to unlock new views and creative solutions to the challenges facing our planet's rivers, lakes and wetlands. Compelling geospatial analyses provide momentum for projects promoting new linkages between cities, farms and floodplains relevant to the climate challenges ahead. Ultimately, how we manage our freshwater ecosystems is a societal decision. Yet, improvements in accurate conservation accounting powered in part by current geospatial data and tools can refine our short-term decisions, leading to a healthier planet in the long-term. Our work conserves, restores and contributes to a thriving planet for people and nature. Geospatial systems have a significant role to play in supporting these goals as we assess our conservation milestones and progress, both now and with an eye toward 2030.

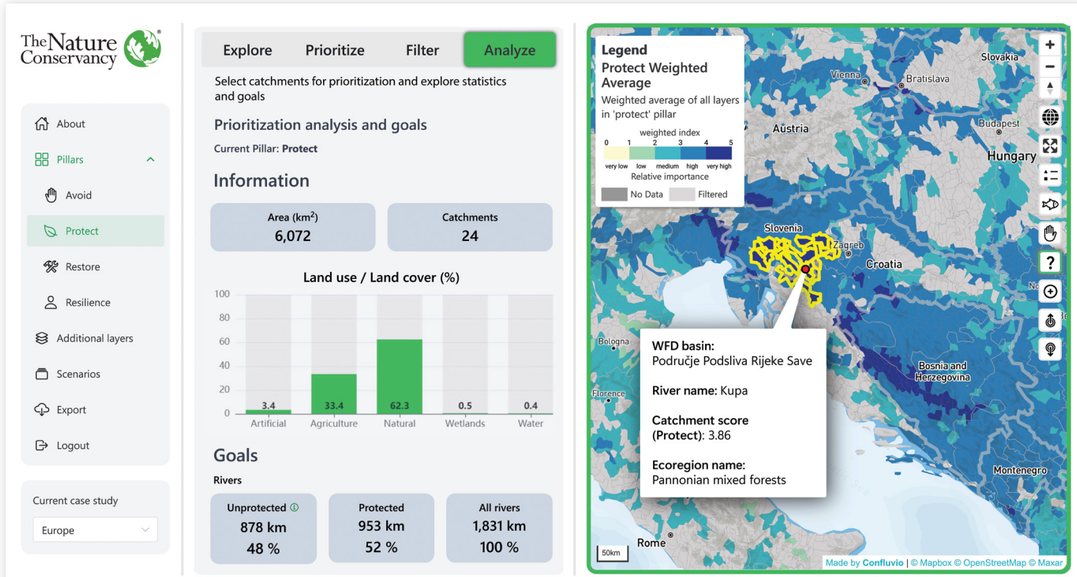
1 As reported in last year's Geospatial Conservation Annual Report, TNC's Conservation Hub is an organization-wide, internal conservation accounting system that allows leaders and teams to make informed decisions to maximize the organization's achievements towards our 2030 goals. The Hub is designed to track our conservation progress and assess the financial health of our work. The organization can access the Hub to explore specific components of each strategy and project and get a comprehensive perspective on our conservation portfolio.

PHOTO: A riverboat tour makes its way downstream on the Mississippi River in Memphis, Tennessee. © Rory Doyle

Regional Focus

NEW PRIORITIZATION TOOL TO GUIDE FRESHWATER CONSERVATION IN EUROPE





Still in development, this web map will guide TNC's growing freshwater work in Europe. Our Europe freshwater team, in collaboration with Confluvio is building a fully customizable tool to help assess the highest priorities for protecting or restoring freshwater biodiversity, key habitats and ecosystem services. The wealth of information in the decision support tool will assist TNC and our partners in meeting 2030 goals for freshwater.

Acknowledgements

This fourth edition Geospatial Conservation Annual Report & Map Book has been a collective effort between TNC staff in IT, Marketing as well as our Freshwater and Conservation Science departments. A big thanks goes to Jan Slaats, Jay Sullivan and Rachel Schultz for conducting our annual survey, printing the report and developing a digital companion to this report. Danielle DeGarmo (contractor) did the incredible layout and design work, and a special thanks goes to Megan Dettenmaier for her editing review. Additional support came from Mrinal Joshi and Grace McMurry in our Marketing department. Content and review for the feature story in the Amazon Basin was provided by Silvia Benitez, Paulo Petry, Leonardo Sotomayor, Ana Guzmán, Rocío Sánchez Maldonado and Gabriela Celi Checa. Without them we would not have such an incredible story to tell about one of TNC's most significant conservation priorities. Spatial analysis and review for River Ecosystems in Crisis was provided by Jonathan Higgins, Paulo Petry and Mike Heiner. Gratitude also goes to other freshwater scientists and planners: Robin Abell, Shiteng Kang, Mary Khoury, Nick Miller, Tara Moberg, Amy Newsock and Jim Oakleaf. Thanks also goes to Vincent Abere in our Africa region for being this year's Cartographer featured in our Map Spotlight, and to Misty Herrin, Tracy Baker, Julie Damon and Colin Apse for editing the text in that section. Max Ricker and Günther Grill contributed the graphics and information about the Europe freshwater tool shown on the facing page. In the spirit of One Conservancy, we say thank you to all these folks for their essential contributions. We also extend appreciation to TNC's global leadership in IT and Conservation Science, most notably Theresa Shaw, Mitch Head and Nicole Silk for championing the work of TNC's geospatial conservation community. Finally, we are most appreciative of our long-standing partnerships with Esri, Amazon Web Services and Microsoft in continuing to support this incredible conservation work. We are most grateful for your support!

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