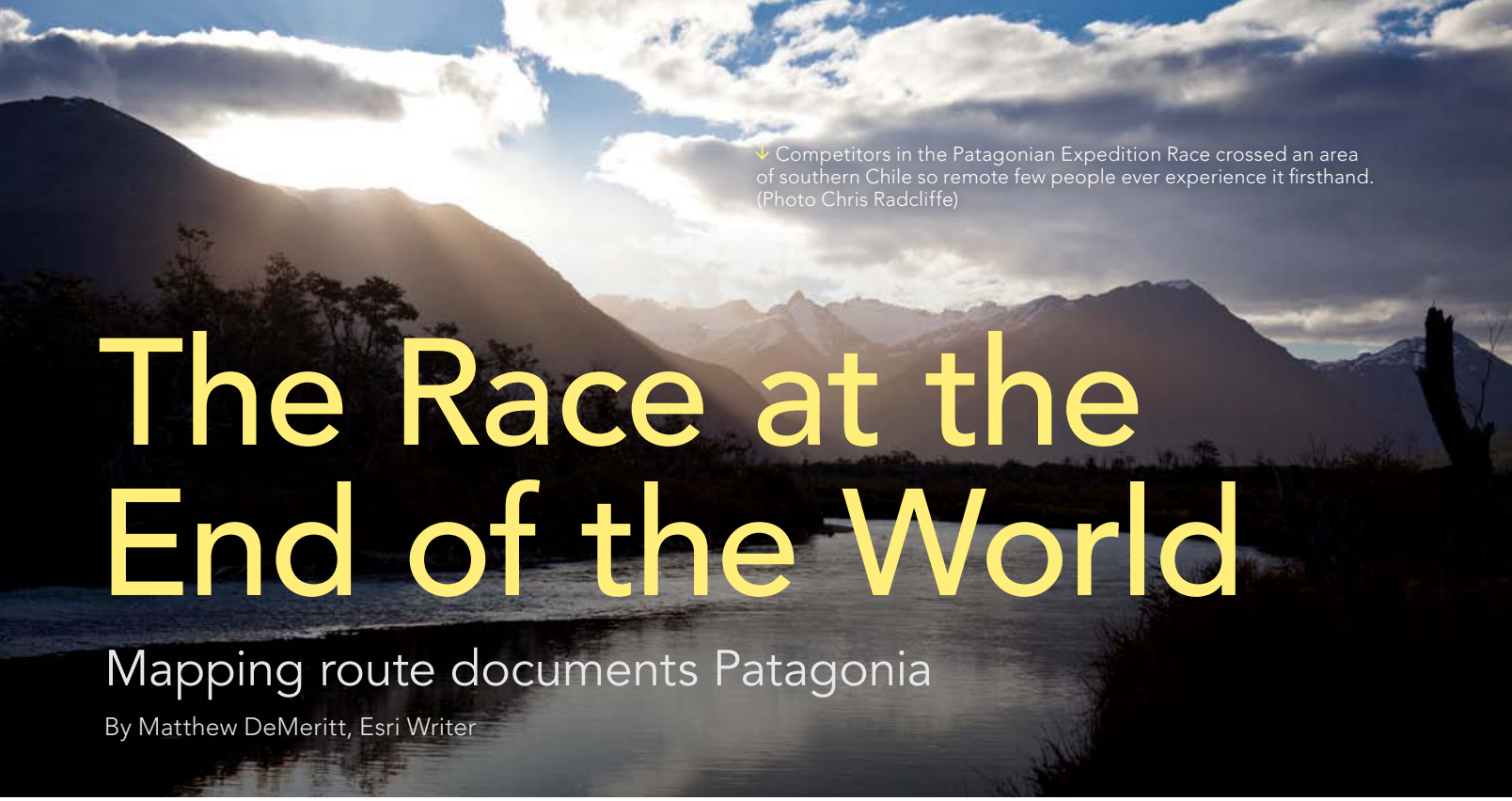


Competitors in the Patagonian Expedition Race crossed an area of southern Chile so remote few people ever experience it firsthand. (Photo Chris Radcliffe)

The Race at the End of the World

Mapping route documents Patagonia

By Matthew DeMeritt, Esri Writer

Maps, created using GIS, helped athletes competing in the Patagonian Expedition Race hike, bike, and kayak across often dangerous topography in a 10-day physical and mental contest held in February 2012.

Although Patagonia, a vast region of diverse wilderness located at the southern tip of South America, spans portions of Argentina and Chile, the 600-kilometer (373-mile) race takes place only in Chile. In previous years, each racing team only had a crude, small-scale overview of the country's topography to guide them. This year, race organizer Nómadas International Group wanted to give racers a more comprehensive view of the course to help them safely traverse Patagonia's glaciers, rivers, and mountainous terrain.

Staff cartographers Jason Blair and Katie Panek created maps of the route using Esri's ArcGIS technology. ArcGIS was used not only to make maps that gave racers a more detailed picture of the route but also provided a new topographic record of Patagonia that will benefit ecological research.

Better Maps for Informed Conservation

Celebrating its 10th anniversary, the Patagonian Expedition Race has a larger purpose than pure competition. "The race calls attention to the uniqueness of the region," said Jack Dangermond, president of Esri. "GIS technology used to create maps for the race will also inform the work of conservationists trying to understand complex relationships within Patagonia's ecosystem."

The race aims to raise $20,000 before the end of the next race to enable scientific tracking of the guemal population—a critically endangered deer species that is a symbol of Chile—and increase awareness of and implement a viable conservation plan for the area. Constructing a more thorough cartographic picture of Patagonia will be invaluable in reaching these goals.

Building the Maps

To successfully cross Patagonia's ever-changing terrain, race teams needed maps that included the latest available data on the region. Last year, several racers were blown off their bikes by a freak windstorm on a seemingly mild day. Potential obstacles, such as deep snow and glaciers, are constantly in flux due to Patagonia's dynamic and unpredictable climate.

To begin plotting this year's racecourse, founder and director of the Patagonia Expedition Race Stjepan Pavicic digitally plotted the route based on his extensive experience hiking the mountains of Patagonia. Blair and Panek loaded the file containing the route into ArcGIS for editing and modified the route based on the latest data on the region. They obtained that data using online sources such as digital elevation models from the National Aeronautics and Space Administration (NASA) and publicly available Landsat imagery.

Patagonia's remote backcountry has virtually no topographic record—not even old maps of the region were available. "ArcGIS software helped facilitate creative approaches to mapping data and solving geospatial problems in uncharted areas within the park," said Pavicic.

"We digitized features by hand, organized them within a geodatabase, and processed it in ArcGIS," said Blair. "We also conducted watershed analysis in ArcGIS to determine the location of major river networks and potential streams. The ability to view the surface water system is critical when planning the route to avoid hazardous situations. The landscape of the region required crossing large rivers throughout the route, which we were able to plan for in advance to allow a safe crossing for the racers and volunteers on the course."

Blair and Panek created an accurate vegetation layer for the 2012 race maps by combining information from different government sources and layers that they digitized from satellite imagery. Vegetation maps were particularly helpful in planning the official route for the race. Hillshade, annotation, and symbology were added to all the race maps.

Adventure Is the Prize

Twenty four-person teams, each with a designated navigator, competed in the Patagonian Expedition Race. Often referred to as the Last Wild Race, this event tested the athletes' mettle as they crossed choppy rivers, hiked slippery glaciers, and biked up and down treacherous mountain terrain. Team Adidas TERREX Prunesco, representing the United Kingdom, took first place in this year's competition.

Although winners receive no monetary prize, racers are motivated by the journey through wild southernmost Chile—a region so remote that most people only experience it through literature. "One of the things that struck me was that we were racing in the Magellan Straits, the Darwin range, and the Beagle Channel—the kinds of places you read about in books," said New Zealander Stuart Lynch, one of the members of Team Adidas. "It's quite a cool thing to come here and race at the end of the world."

Participants from 20 countries were guided through this wilderness only by their orienteering abilities and maps. This year's route took racers into the Cordillera Darwin, a mountain range in Tierra del Fuego covered with glaciers and peat bogs.

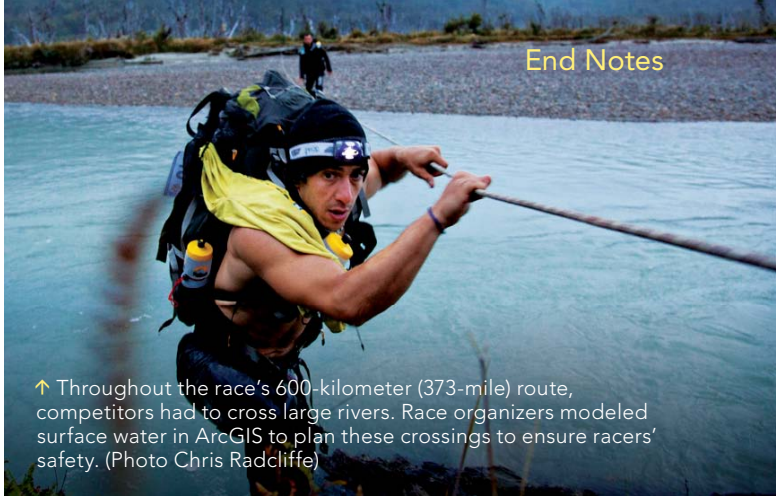
Distributing the Maps

Race officials distributed the map sets to participants and members of the media to plan and navigate the course through Tierra del Fuego. An overview map of the entire route included major streets for journalists and race organizers to follow to get them from the Punta Arenas to various locations along the course. The media used the overview map of the entire course to determine which locations to visit during the race.

The maps were not handed out until the day before the race, giving the teams only 24 hours after seeing the route to make final preparations and adjustments to their race strategies. "Each team's navigator received one set of maps," said Blair. "Navigators assumed responsibility for interpreting the maps and guiding the team through the course." Each map set consisted of 18 printed maps at differing scales for different needs. For example, the overview of the race course and surrounding region was provided at a 1:750,000 scale. More specific maps for navigating mountain bike trails and kayaking were scaled smaller.

"We wanted to keep the number of maps to a minimum to decrease weight and confusion, so we decided to use the smallest scale that would be practical for each segment of the race," said Blair. "The mountain biking routes were very straightforward, typically following dirt roads, and did not require any complicated navigation. Therefore, smaller-scale maps *[1:200,000]* were acceptable. However, the trekking sections did not follow any trails, and the course is simply a suggested route, so by providing a large-scale map *[1:50,000]*, the teams were able to determine the best route for travel and safely navigate the complicated terrain with a detailed map."

"ArcGIS software facilitated creative approaches to mapping data and solving geospatial problems in uncharted areas," said Pavicic. "Helping to improve the quality of maps available for Tierra del Fuego in Chilean Patagonia will result in long-term benefits for the people and environment."



↑ Throughout the race's 600-kilometer (373-mile) route, competitors had to cross large rivers. Race organizers modeled surface water in ArcGIS to plan these crossings to ensure racers' safety. (Photo Chris Radcliffe)

↑ Participants from 20 countries traversed the Patagonian wilderness using only their orienteering abilities and maps created with ArcGIS. (Photo Chris Radcliffe)

↑ Each team was given a set of 18 printed maps that included specific maps for navigating mountain bike trails and kayaking. (Photo Tony Hoare)

↑ The 2012 course took competitors across the Strait of Magellan, Karukinka, the Darwin Range, and a fjord in the Beagle Channel. (Photo Tony Hoare)