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WHEN SHOULD CONSERVATION DRAW THE LINE AND WHEN SHOULD  
IT TO PUSH FORWARD

By

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2013

Thesis

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When should conservation draw the line and when should it push forward

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### Abstract Content

Over the past ten years I have been in the field and on the ground on a variety of conservation projects. Throughout my undergraduate career I naively thought I would leave school with the ability to save every species. As long as I kept my passion and my determination I and other conservationists could save them. Fast forward to where I am at today. I learned how many issues exist within conservation ethical, legal, financial, lack of diversity, etc. and that regardless of how passionate we can be as conservationists it doesn't mean anything if you don't educate, engage and involve the public. In this series of stories, I explored an ethical on one hand and logical on the other, approach to saving species called conservation triage. I explored horseshoe crabs and their unique blue copper-based blood that saves millions of lives every day and the importance of ensuring these fossil-like species continue to exist. Lastly, I produced a photo essay on the importance of diversity and inclusion in wild places, conservation and the meaning of wilderness today. I spent many meetings along fellow biologists where diversity was and is a topic that often was ignored and shrugged off and instead of me writing a whole piece on the topic, I wanted to instead use the photos to tell the story as well as the subjects in the photos. I considered these difficult and important conversations when asking where conservation is drawing the line and when should it be pushing forward.

## **Conservation Triage-To Save or Not to Save**

As the effects of climate change become irreversible and the window to save species from extinction shrinks, conservationists are being pushed even harder to make tough choices between survival and extinction.

Everyday wildlife habitats, and the species living within them, are prioritized or ranked. One ranking tool is the International Union of Conservation of Nature Red List, a catalog of global species status, used to measure extinction risk. So far, there are 142,500 species on the Red List with an estimated 41,415 species threatened with extinction.

Even if a species is unlucky enough to make that list, not every species has enough research to say how the species is doing and makes it difficult for wildlife managers to come up with an appropriate management plan. Without knowing how to manage a species increases the chance that the species will not be able to avoid extinction.

“Triage in conservation is important because it is logical. All conservationists have to meet conservation goals with limited resources,” said Jeff Maynard, a project leader for SymbioSeas, a marine science applied research center. “This requires them to allocate resources and to think about how exactly they are going to do that.”

At hospitals, the concept of triage refers to a decision for a limited staff to focus first on patients who are most likely to have good outcomes at the expense of the sickest patients. It’s a way for medical professionals to apply limited resources for the greatest outcome. But it also means that many of the sickest patients will die without receiving high levels of care.

According to the National Library of Medicine, during the pandemic one solution was to triage all the patients and give priority to those would benefit more as well as setting prerequisites for allocating insufficient medical resources and allowing the public to trust those resources would be allocated appropriately.

Currently, there are no universal mandates or procedures that exist on how to rank or prioritize wildlife at risk of extinction. Hospitals triage as human disasters happen. Conservation triage is happening everyday with no transparency, and everyday another species is at risk of disappearing.

“In this long run of work in conservation and addressing the greatest threats, the threats and problems just aren’t going away,” Maynard said.

A group of species facing these threats is coral reefs. Coral reefs protect coastlines and provide jobs and food for more than a half a billion people. Within the next century, it is predicted there will be a 43 percent decrease in coral reef habitat due to a process called coral bleaching.

Similar to plants, an algae lives within coral that not only provides the rainbow-like colors but more importantly it acts as the corals main food source. As water quality and temperatures

change due to stressful environmental changes due to climate change, these algae begin to be pushed out of the coral, causing the coral to turn white.

Maynard primarily focuses his research on triaging coral reefs. As coral reef habitat continues to decrease, and with 33% of reef building corals on the IUCN Red List, scientists and conservationists are struggling to decide which habitat should be saved first.

Maynard noticed that some coral reefs in areas that lack human population are more adaptable to rising ocean temperatures. Maynard's work focuses on researching and protecting those areas, which he has found to have a greater chance of survival, or what he and his team call "resilience."

Maynard's team collects data used to develop and recommend reef management plans. The data include factors like coral bleaching resistance, coral diversity, and coral disease. Once these factors are lumped together and evaluated the team comes up with a resilience score. The higher the score, the more likely the coral is to survive.

"Frankly, I am not crazy about the term." said Leah Gerber, founding director of the Center for Biodiversity. Instead of interpreting the term for what it is, Gerber interprets the idea in the context of triage as clear and transparent decision making, bringing together different disciplines in solving the biodiversity crisis.

Gerber has worked to revive endangered species management and explains the work has been achieved with the same amount of money using cost-effective algorithms, or in other words, prioritization. "It is not exactly triage. My work focuses on achieving more outcomes by thinking more clearly on them."

In a 2016 *Proceedings of the National Academy of Sciences* study, Gerber estimated that only 25 percent of conservation or management actions are needed to recover a species. The study went on to explain how despite going through the effort of defining all of the things that would need to happen, in the end, there are simply not enough funds.

The study explains how 200 more species could be saved by focusing on the least expensive first, in other words, triage.

Maynard believes that the resilience theory doesn't get rid of hope, but instead brings more hope in the face of continued environmental and human stresses on coral reefs.

The theory can help "reef managers" in decision making processes by identifying and prioritizing coral reef habitat that can be saved.

According to Gerber, currently, the U.S. Fish and Wildlife Service uses prioritization tools, but they lack transparency. Due to the Endangered Species Act, the agency is technically not allowed to "let a species go." Without transparency, there is no public scrutiny.

But not everyone views the theory as is as Maynard's team. Others reject the idea of triage based on ethics.

"There are species that we deem *worthy* of saving or conserving," said Rebecca Chapman, doctoral student at Ohio State University. Chapman has been compiling data and research showing how cultural and historical significance and impact should be considered into management plans.

Chapman believes that since humans have driven a living species to near extinction, they "owe it to the species" to save them, no matter the cost. "You can't assign values based on the economics of their recovery, and then those deemed uneconomic to save are assigned fewer resources for their recovery."

"Essentially what you are doing is assessing a dollar value to something that shouldn't be assigned a value," Chapman said. "In Hawaiian cosmology, islands are like gods and ancestors, humans were born from coral...it is also important to conserve species based on their cultural impact."

"As you can imagine it's super contentious to let a species go," Gerber said. It makes her uncomfortable knowing that some species aren't going to make it. "I don't want to face that reality. We should do what we can for each species, but we are not currently in a position where we can fund everything."

In order to save more species Gerber says that there needs to be funding, better interagency cooperation and coordination, and a national strategy.

A 2021 *Conservation Biology* essay states, "The world's intellectual and economic resource are more than adequate to meet conservation needs, especially if one design disbursement mechanisms." The study suggests rapid-action small grants can be the most effective way to provide direct support for species.

"Let's be clear here, in the absence of appropriate funding, we need to triage or prioritize a species," Gerber said. "It may make people uncomfortable, but it really is no different than what we are doing now."

Last year, the world said goodbye to 23 species declared extinct by the U.S. Fish and Wildlife Service. "If we don't invest money into saving endangered species now, we will have to invest far more in the future," Gerber said.

## **Blue-Blooded Creatures Saving Lives & Why We should Return the Favor**

As the world begins to move past the pandemic, one organism and its copper-based blue blood is playing a major role helping to prevent contaminants in human health treatments.

Today, conservationists are uncertain of what the future holds for horseshoe crab populations as the animal responsible for saving so many lives may be in endangered by the very industry it has created.

What do horseshoe crabs have to do with human health? “Almost everything,” said John Tanacredi, director of the Center for Environmental Research and Coastal Oceans Monitoring, otherwise known as CERCOM.

Habitat loss, pollution and overfishing are all human-caused factors in the decline. Within the biomedical industry in the United States, it is estimated that 10% horseshoe crabs die of the half of a million collected in the blood extraction process every year.

Horseshoe crabs have been around for more than 450 million years, earning the nickname the “living fossil.” As COVID-19 vaccines have been produced, followed by boosters, it is important to acknowledge the animal responsible for keeping toxins out of the human body.

Horseshoe crabs are also essential for other species of wildlife. Scientists have observed that when the horseshoe crab population drops in the mid-Atlantic, there is a direct link to lower shorebird populations.

Each spring, with the full moon acting as its guide, hundreds of thousands of horseshoe crabs crawl onto beaches across the U.S. mid-Atlantic to lay its eggs.

Migratory birds such as the red knot, ruddy turnstone, sandpipers and other shorebird species rely on the horseshoe crab eggs, as a single female can lay as many as 90,000 eggs at a time. Using the eggs to gather nutrients for its long migration is the red knot who has one of the longest migration routes of any bird, from the arctic to the southern tip of South America.

The red knot is listed as threatened under the Endangered Species Act and researchers claim it could be due to a decline in horseshoe crab eggs.

The horseshoe crabs’ unique blue blood is extremely sensitive to toxins, limulus amoebocyte lysate, or LAL. Its blood acts as a “bacterial endotoxin detection system,” Tanacredi said. In simpler terms, it prevents bad bacteria from entering humans. Its blood is used to ensure vaccines, drugs, and medical devices are toxin free.

Horseshoe crabs have been playing this vital role in the biomedical industry for the past 40 years. According to Tanacredi with only four species of horseshoe crabs in existence, scientists have recorded a decline in all four species. The horseshoe crab is listed as vulnerable on the International Union for Conservation of Nature (IUCN) list, whereas its close relative, the Asian horseshoe crab, has been listed as endangered.

Tanacredi has studied a variety of invertebrate species over his career, in other words “basically anything without bones.” At CERCOM, the largest horseshoe crab breeding laboratory in the United States, his research has focused on horseshoe crabs for the past 43 years, and he is considered a world authority on the species by peers.

Horseshoe crabs are not the only species dedicating its lives to medicine. According to scientists, 75 percent of all medications are derived from plant or marine life.

“Life and understanding where we get our medicines, not just from someone in a lab making it up.” Tanacredi said.

Tanacredi’s inspiration and admiration for the horseshoe crab comes from a Franciscan priest, George Ruggieri, who wrote *The Healing Sea: A Voyage into the Alien World Offshore* in 1978. It discussed the medicines humans obtain from the environment.

The book tells the story of the Madagascar rosy periwinkle, a small purple flower plant harvested by scientists and studied in the 1950s. Fast forward 17 years, and now two chemicals provided by the periwinkle – vinblastine and vincristine – are today being used as cancer-fighting medicines against acute lymphoblastic leukemia, otherwise known as childhood leukemia.

The disease “would have been a death sentence before these chemicals,” Tanacredi said.

According to scientists, vincristine has helped increase the chance of surviving childhood leukemia from 10 percent to 90 percent, while vinblastine is used to treat Hodgkin’s disease. Vincristine decreases the number of immune cells that are found in the blood and in lymph tissue called lymphocytes and slows and stops the growth of cancer cells in the body.

“The lymphocytes of children with this disease dramatically increase. Children basically suffocate to death. It’s brutal,” Tanacredi said.

Observing the effects of childhood leukemia with his own child who was diagnosed at age , Tanacredi explained that his under underwent 10 years of treatment and is now considered cured, thanks to the rosy periwinkle.

“No one plans on these life experiences. This is why we preserve biodiversity,” Tanacredi said.

Tanacredi explains in the U.S. alone, there are 200,00 deaths every year from sepsis. Without horseshoe crabs he explained that number would double, if not triple.

However, Chris Chabot, a professor of biology at the University of New Hampshire, already has found ways to decrease the number of horseshoe crab casualties due to the bleeding process. Chabot found that the biomedical bleeding triggers a decrease in the oxygen carrying protein called hemocyanin. This decrease can result in fewer mating opportunities and even death.

“Thankfully horseshoe crabs don’t taste so good, otherwise the population would be doing a lot worse,” Chabot said.



In addition to the biomedical bleeding, the fishing industry captures and kills approximately 78,750 horseshoe crabs annually, according to the Atlantic Marine Fisheries Commission, and are used as bait to capture whelk, a type of mollusk used for recipes.

“Horseshoe crabs are this important resource for humans and animals, should they be used as much as they are for the fishing industry as well?” Chabot would like to see more restrictions and sustainable fishing regulations.

“The impact of horseshoe crabs is vital to our economy and health standard of living,” said David Wheeler, executive director at the Conserve Wildlife Foundation. “The biomedical industry is required to get horseshoe crabs back into the wild within 36 hours.”

The collection and bleeding process are supposed to be regulated by the Atlantic State Marine Fisheries Commission. Wheeler explains it can be hard to tell what the biomedical industry regulations are when harvesting horseshoe crabs, as other factors aren’t even regulated.

“If they take the crabs from 200 miles from their lab, they can release them in area more convenient for them. They aren’t required to release them where they harvested them,” Wheeler said. “There is no transparency.”

According to two studies done in 2016 and 2017 by Meghan Ownings at the Biological Bulletin, most biomedically bled horseshoe crabs suffer from disorientation, preventing horseshoe crabs from finding beaches to mate and lay its eggs.

Ownings’ studies also suggest that crabs take three to seven days to regain recover from the bleeding process. It can take up to four months for amoebocytes, a type of cell that helps increase eggs production, to return to normal levels.

The study states that the bleeding process alters a crab’s biological rhythm, which can also affect mating behaviors. Researchers worry that may be reducing the number of reproducing females and the number of eggs laid, which then lowers population levels and decreases the overall survival of the horseshoe crab.

To lower the number of horseshoe crabs being harmed or dying from the bleeding process, Chabot suggests how the effects need to be minimized by delaying the harvest by a few weeks to avoid breeding seasons, removing less blood and putting the horseshoe crabs back in the water within the same day. But those changes aren’t popular with industry.

“There was significant push back by some people associated with the biomedical industry,” Chabot said. “They thought we were trying to stop them, when in fact we were just proposing more efficient regulations that would help prevent horseshoe crab loss due to the process and to protect the species.”

According to Chabot, a synthetic or artificial alternative called recombinant Factor C or rFC has existed for the past 20 years. The alternative is produced by a Swiss biotech company called Lonza and “it seems to be looking really good.”

A number of studies are looking at what could be the next gold standard, and rFC has proven to be as effective as horseshoe crab blood. But in 2020 U.S. Pharmacopeia, an organization that decides on the guidelines for the pharmaceutical industry, rejected rFc.

“U.S. Pharmacopeia told its experts there was too little practical experience with drug products tested with rFC to put the synthetic tests on equal footing with horseshoe crab blood tests, which have been widely used for decades,” reports The Guardian article.

“It was a bit a disappointment. The industry tends to be very conservative, and they like to stay with what works.” Chabot said. “I am hopeful though, eventually it may be used, just not yet.”

Currently, there is a price tag on an irreplaceable. A quart of horseshoe crab blood can sell for \$15,000 and it remains a stronghold of a \$500 billion industry.

The COVID-19 pandemic has created an increase of research into vaccines and treatments, increasing demand for the unique blue-blooded creatures. Tanacredi continues to support the biomedical industry’s use of the crab’s blood for medicine, but he’s eager to see a synthetic alternative.

“That’s what I envision, it’s what I hope,” he said.

## Wild Places, Wild Faces

It was the beginning of my first season working as a biological science technician at Glacier National Park. I was attending my first division meeting and sat at the corner of the room. A majority of the meeting was spent reviewing the results of an employee survey taken the year before. But when the survey came to the topic of how national parks lacked diversity and inclusion, the discussion was over before it had even started. We had quickly moved onto the next topic.

I, the only Hispanic person in the room, just looked around and thought that out of all the public land agencies I have worked for, that was the closest I had ever got to a discussion on the topic.

According to statistics gathered by the U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service, an estimated 70 percent of people who visit the outdoor spaces on public lands are white.

It is important to recognize when I mention diversity, I am not just using it as a code for race. Diversity represents not only race, but it is also based on the experiences and barriers to resources and opportunities faced by individuals.

Although working in the conservation field is where my passion lies, I can't help but notice the work doesn't mean anything unless we have everyone included in the conversation. So, when I am out in the field, I take advantage when I can, and share the work I do, and any knowledge I have on the area I am working in.

Sections of Glacier National Park are considered "recommended designated wilderness areas". While working in the field I would talk to individuals about numerous fun facts about the park but when I mention this fact, they would look at me with some confusion and ask, "Isn't anywhere outside, wilderness? How is this area different than the area with trees over there?"

An old English word meaning "land inhabited only by wild animals" the first perspective or concept of wilderness emerged in Europe in the 1200's.

This concept of "wild animals" also included Indigenous Americans.

As they settled across North America, English settlers continued to use the term "wilderness" generously. Comparing the vast forests to wastelands and deserts.

In 1964, the Wilderness Act was created. It provides protections for more than 750 wilderness areas. These areas provide habitat for wildlife, filter the air we breathe, provide economic boosts, provide places to recreate, spiritual and cultural lands, among many other benefits.

The concept of wilderness appears to be constantly evolving. The primary perspective of wilderness depends on the individual. An individual's experience in the wilderness can have a special personal impact not found in non-wilderness areas.

“Diversifying wilderness areas and the conservation movement means more than simply recruiting people from diverse backgrounds to enter traditional conservation fields. It also means understanding better how all people relate to, engage with, and care about the environment,” stated the National Audubon Society.

I took advantage of my access to outdoor spaces and asked seven individuals to share what their perspectives were on the term wilderness and what does diversity and inclusion in wilderness mean to them.



Image: Miguel Angel is 64 years old and spent his first 15 years living in El Salvador before moving to the United States. Photo location: Cracker Lake, Glacier National Park. Over 90 percent of the park is proposed to be formally designated wilderness. Land designation: Blackfeet, Salish, Pend d'Oreille, and Kootenai tribes.

**What does wilderness mean to you?**

Wilderness means wild. In my mind there are no designated wilderness areas. You can find it anywhere you go. Whether it be a salt marsh, or a forest, wilderness exists everywhere. It's the middle of the woods, animal and plants undisturbed, no garbage, no noise. When a tree falls down don't clear it. Let the people walk around it or over it.

**What does diversity and inclusion in wilderness mean to you?**

Well you don't see many people as dark-skinned as me out here. There is a lack of access and knowledge. A lot of people just don't know where to go or what exists it can be uncomfortable when you stick out in the wild. You can be like an exotic species in an unexotic place.



Image: Robert Chinn, retired superintendent and local Montanan in the Summers. He has spent the past 30 years exploring Northwest Montana.

Photo location: Bighorn National Forest, MT.

Land designation: Salish, Pend d'Oreille, and Kootenai tribes.

**What does wilderness mean to you?**

Wilderness is just about any place that I have yet to fully explore and understand. It is a trail in Glacier National Park that I have hiked many times but somehow find that it reveals something new or unique that I haven't experienced before. It is observing the interaction of wildlife (including humans) as they go about their daily lives. Gazing above from the back porch on a dark evening opens a vast wilderness to contemplate. In its most expansive meaning wilderness is the space in my mind yet to be filled with the wonders of the universe.

**What does diversity and inclusion in wilderness mean to you?**

From one angle diversity and inclusion is part of the definition of wilderness - you can't have wilderness without the full diversity and inclusion of the plants and animals that exist within an environment. That is a prime purpose of setting aside specific wilderness areas - to preserve and protect the existence of intact natural environments with all the wonders that exist for our exploration and contemplation. A second angle is the examination of the diversity and inclusion of human interaction within areas considered to be wilderness. It seems that many people in our urban technology enhanced society live day to day without adequate interaction with the "natural" world - in a way they suffer from a "nature deprivation disorder". The many health benefits of communing with nature is well documented. It is imperative that we provide equitable opportunities for all people, regardless of their circumstances, to access and grow within our natural world. For those who have not yet enjoyed the experiences associated with time spent in "wilderness" areas, barriers to access should be removed and replaced with incentives to explore. Special attention should be devoted to our young children, whose very nature, and given the opportunity, are ravenous explorers.



Image: Tina Zenzola, super volunteer who is passionate about all things wild and local Montanan.  
Photo location: Upper Two Medicine, Glacier National Park. Over 90 percent of the park was proposed to be formally designated wilderness.

Land designation: Blackfeet, Salish, Pend d'Oreille, and Kootenai tribes.

**What does wilderness mean to you?**

Wilderness is large connected and diverse landscapes that are still pristine and unspoiled by the impactor presence of humans. It has diverse plant and animal life. Perhaps species that are hard to find in other places and still feels "wild." I very much need wilderness to be a place where I can go to be a student of nature, to feel nature's power and to feel the mystery and awe of its beauty and splendor.

**What does diversity and inclusion in wilderness mean to you?**

Wouldn't it be refreshing to see people with completely diverse ethnic and cultural background and different physical abilities in the wild? Wouldn't it be cool to see women wearing hijabs and people with prosthetics and people with brown and black hair? This would be diversity and inclusion.



Image: Kyle Van Atta, native Montanan and wildlife biologist.

Photo location: National Bison Range.

Land designation: the Confederated Salish and Kootenai tribes.

**What does wilderness mean to you?**

To me, wilderness is a window into the past. It is the conservation of the environment to retain a trace of a previous state in an ever-changing world.

**What does diversity and inclusion in wilderness mean to you?**

In this country wilderness is set aside for all to enjoy regardless of race, religion, or creed. Previous generations had the forethought to retain wilderness for future generations, and I think it is important for all to be able to enjoy it.



Image: Renata Harrison, native to Ohio and science communication specialist.

Photo location: Glacier National Park, MT.

Land designation: Blackfeet, Salish, Pend d'Oreille, and Kootenai tribes. Over 90 percent of the park was proposed to be formally designated wilderness.

**What does wilderness mean to you?**

It means different things to me. It wasn't until I started working for a land management agency that the meaning began to change. Before that, it would have meant a place with no infrastructure built by humans, not stores, not a lot of roads, no power lines. But when I started work for the National Park Service, I learned a lot about federal designated wilderness. The idea of a place "untrammelled" I really believed that for a while. But now I believe it is all bullshit. That's is where I am at right now.

**What does diversity and inclusion in wilderness mean to you?**

I understand this as encouraging and including people who been kind of put aside from the idea of wilderness by people who keep it and manage it for themselves. Wilderness is absolutely for every type of human regardless of race, background, or anything else. But we have to acknowledge that it is not as easy as we may think because we have made it really difficult for lots of people for a long time. We have to keep trying to make other people feel safe and welcome in wilderness.





Image: Terry Peterson, wildlife biologist and local Montanan.

Photo location: East Glacier, MT.

Land designation: Blackfoot tribes.

**What does wilderness mean to you?**

As an adult and an educated wildlife biologist, I believe wilderness is central to preservation of animal and plant species at all trophic levels to sustain intact ecosystems. Intimately, by the time I was five, an only child, living far away from other children, wilderness or the wild uninhabited places in my life were my best friends. They were constant, beautiful, and I had an intense ongoing relationship with those places. I would walk there, spend a couple of hours or all day, and actually talk to trees. Even though I was in the petrified forest part of the time, my love of the ‘woods’ at Glacier and around our family home in Whitefish was my true love. The forest sustained me both physically and spiritually. It continues today.

**What does diversity and inclusion in wilderness mean to you?**

Diversity and inclusion are inexorably connected. I think diversity is too generic a term because the many different groups of people, whether it be ethnicity, socio-economic status, proximity to wild areas, or having a family that visited wilderness, there are differences as to why inclusion has not happened. Historically and today, wilderness is a ‘white persons’ place. Diversity means that ALL people, regardless of ethnicity or education, should have access to wilderness. Whether Native American, black, Hispanic, Asian, poor, or urban, we all deserve the solace of nature. It should be safe, close-by, accessible, and nurturing.



Image: Kat Barres, native Georgian and Scientists in Park at Glacier National Park. First year leaving her home state and has

completed her first ever backpacking trips this summer.

Photo location: Mt. Brown, Glacier National Park. Over 90 percent of the park was proposed to be formally designated wilderness.

Land designation: Blackfeet, Salish, Pend d'Oreille, and Kootenai tribes.

**What does wilderness mean to you?**

Wilderness, to me, is the place where I can escape from the hustle and hurry of our culture. Wilderness is the place where I put away my phone, try my best to enjoy the small moments, and just sit watching the sunrise. Wilderness is the place where I restore my soul and regain hope in the human spirit by realizing the fragile and incredible beauty around me.

**What does diversity and inclusion in wilderness mean to you?**

I believe diversity and inclusion in wilderness is about providing equitable access, education, and training. Many Americans don't live in area where wilderness is accessible. As a result, they might feel unprepared or unable to spend time in wilderness. I believe education and training on accessing wilderness areas, leave no trace, and resource stewardship are ways to mitigate these access issues.