

**Editor's Note:** Almost ten years ago, a biologist and environmental scientist published "Asia's Turtle Crisis and Conservation: Environmental Education and Cultural Geography" in the fall 2011 issue (vol. 16, no. 2). The essay that follows is an update to their work with collaborators in a continuing effort to address this ongoing crisis. Readers are encouraged to first read the article from the fall 2011 issue at <https://tinyurl.com/89m38pum>.

## TURTLES ALL THE WAY DOWN

### An Update on the Asian Turtle Crisis with New Directions

By Thomas P. Wilson, Bradley R. Reynolds, Pelf-Nyok Chen, Rajeev Chauhan, Penni Jo Wilson, Tabitha M. Wilson, and Team Salamander

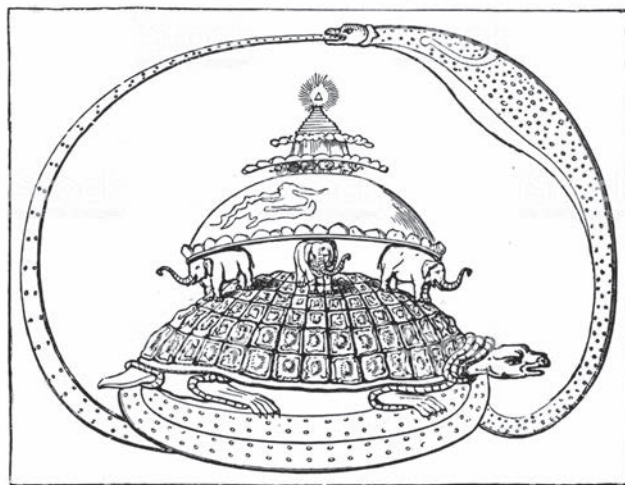


Figure 1: A Hindu representation of the Earth supported by a tortoise and the quarter-elephants, surrounded by a Naga (half-human, half-serpent being). Source: Wikipedia at <https://tinyurl.com/7k5ewt49>.

In Chinese mythology, the goddess Nuwa cuts the legs off the giant turtle Ao and uses them to prop up the sky. In Hindu mythology, Kurma the Tortoise King, one of the avatars of Vishnu, props up Mount Meru and assists in the churning of the Ocean of Milk, thereby allowing the gods to recover the Elixir of Immortality.<sup>1</sup> The concept of a World Turtle, supporting the very earth upon its back, is a mythical theme that appears in a variety of mythologies, including those of Asia. That turtles are revered in Asia and viewed as symbols of longevity and power is readily apparent. What is so confounding and seemingly contradictory is in the way turtles are also heavily exploited in Asia, even to the point of extinction. This essay is intended to provide interested readers with more current information about developments since 2011.<sup>2</sup> In addition to describing the current state of turtles in Asia, we discuss some basic natural history and provide insight on what educators can do to help minimize impacts to populations of Asian turtles. We also highlight two case studies that focus on turtle conservation efforts in Malaysia and India, respectively. Our intent is that this information be used as a teaching tool for the inspiration and preparation of future generations of conservationists, both in America and abroad.

In keeping with the aforementioned mythical theme, imagine a Giant Mother Tortoise supporting Four Elephants upon her back, which in turn support the world (Figure 1). Emmanuel de Veiga, a Jesuit priest familiar with Hindu mythology, recorded this depiction in 1599.<sup>3</sup> Now, imagine the Giant Mother Tortoise being forcibly ripped away from this scenario, prompting the collapse of all that depend upon her. When switching from mythology to natural history, consider the concept of a keystone species, and beyond that, consider what ecologists call an extinction cascade. A keystone species is a species upon which other species in a community or ecosystem depend, even though the keystone species may not be present in great numbers. If the keystone species is not present at all, then the communities or ecosystems associated with it would likely change in significant ways, and perhaps collapse altogether. Protecting keystone species is a high priority for conservation biologists because the loss of keystones "can create extinction cascades that result in a degraded ecosystem with much lower biodiversity at all trophic levels."<sup>4</sup> An extinction cascade is a "series of secondary extinctions that are triggered by the primary extinction of a key species in an ecosystem."<sup>5</sup> For that reason, conservationists must focus not only on keystones but also on highly connected communities by using umbrella species (Figure 2). They must focus on the complex interactions that characterize such communities and work to keep important ecosystems healthy, productive, and stable. When Asian turtles go extinct, this has far-reaching and unforeseen consequences for other forms of biodiversity, ecological communities, and habitats, and for human beings as well. Turtles and tortoises are extremely important, ecologically speaking. They contribute to both aquatic and terrestrial food webs, both as consumers and as energy-rich prey for other organisms. They can also serve as scavengers, keeping aquatic ecosystems healthy and clean.

Nearly ten years ago, it was reported that over half of Asia's turtle species were considered endangered or critically endangered. Sadly, the situation has not improved. Researchers drawing upon data from the International Union for the Conservation of Nature (IUCN) report that Asian turtles are more imperiled than ever, with three-fourths of Asian turtle species now endangered or critically endangered. This increase is driven by much higher levels of exploitation in Asia when compared to other parts of the world.<sup>6</sup>

Turtles, it must be conceded, have instrumental value in that they represent a resource, if used sustainably. Using turtles for food and for medicine sustainably,



Figure 2. Male Painted Terrapin (*Batagur borneoensis*) is a large umbrella species that lives in Southern Thailand, Malaysia, Borneo, and Sumatra, where their populations have been rapidly decreasing due to the harvesting of adults. Source: Photo by Penni Jo Wilson.

however, may prove tricky, if not impossible, due to the life history of turtles. Turtles are long-lived, and their ability to successfully reproduce over many years generally makes up for high juvenile mortality, but turtles typically reach sexual maturity later in life. In ecology, K-selected species typically show late maturity, a longer lifespan, and a larger body size, with small numbers of offspring produced at each reproductive event. The strategy with K-selection is to reproduce multiple times across many years over a long lifetime. In short, turtles are K-selected, and this contributes to their endangerment in the face of heavy exploitation and habitat loss. In essence, they are compromised or killed before they can successfully reproduce and replace themselves in the population. Given the great difficulty inherent in sustainably using turtles as a resource, it might be better to focus on other measures of value possessed by Asian turtles. They complete food webs. Asian turtles also serve as ecological indicators that facilitate important environmental monitoring. Conservationists should also focus on and promote the intrinsic value possessed by Asian turtles. The notion of intrinsic value is an important one. Intrinsic value has to do with worth, separate and distinct from anything an organism or species can do for human beings. Such ideas need to be promoted among the human populations that exploit turtles so that education can facilitate on-the-ground conservation efforts.

To educate large groups of people about turtles is not impossible, and it has been done successfully in both Malaysia and India. Freshwater turtles are threatened in Malaysia and India due to development and overexploitation, and because turtles accidentally get caught up in fishing nets and drown. They are also collected for the pet trade. Local governments and grassroots organizations launched local turtle conservation projects to better study and conserve native turtles. From there, major policies were passed, and the local governments started protecting turtles through the setup of biological reserves and through myriad conservation efforts. The locals, many of whom were former poachers or people that did not appreciate turtles, were now open-minded to protecting turtles, their nests, and their associated habitats. In what follows, we highlight some ongoing work by describing two case studies from Asia.

### Malaysia Case Study

One of the coauthors began her career researching turtles as a graduate student in 2004. She developed a research project that focused on feeding habits of southern river terrapins (*Batagur affinis*; Figure 3) that were being head-started as part of a larger conservation project. By 2008, she was awarded an opportunity to study abroad, where she worked on various freshwater turtle conservation projects throughout the USA and Canada. This experience inspired her to embark on a new journey with turtles by cofounding the Turtle Conservation Society of Malaysia (TCS) in 2011. The mission of this society is to restore depleted wild populations of freshwater turtles through research, conservation projects, educational programs, public awareness campaigns, and community empowerment initiatives. In 2018, as a result of her successful conservation efforts with Asian turtles, she was named the Commonwealth Point of Light for Malaysia by Her Majesty Queen Elizabeth II. In 2011, she initiated a community-based terrapin conservation project involving local villagers by securing, incubating, head-starting, and releasing river terrapins. Like many others, she strongly believes that for any conservation project to be sustainable, local communities must be involved and meaningful partnerships fostered. As a result of these partnerships, she has helped save more than 5,800 river terrapin eggs from human consumption and release more than 3,000 head-started terrapins.

She continued to pay it forward by establishing a River Terrapin Conservation Center in 2016. This center consists of an *ex situ* (off site outside of natural habitat) hatchery, a head-starting pond, and a mini turtle gallery—the first of its kind in Malaysia. The gallery houses the shells, skeletons, and wet specimens of nine freshwater turtle species and is open to visitors. This gallery allows the general public to learn about the Asian Turtle Crisis, and it dovetails with local educators as they work together to create and spread turtle conservation awareness to rural school students.



Figure 3: Two Malaysian researchers recording data from a southern river terrapin (*Batagur affinis*). Source: Photo by Vera Nieuwenhuis/Photographers Without Borders (PWB).

To educate large groups of people about turtles is not impossible, and it has been done successfully in both Malaysia and India.



Figure 4: Yellow-headed temple terrapin (*Heosemys annandalii*) at Khao Yai National Park, Thailand. Source: © Shutterstock. Photo by Weranut.





Figure 5. Researchers rescuing an Indian peacock softshell turtle (*Nilssonina hurum*). Source: Photo by Sanjeev Chauhan.

Turtle conservation education centers have been established every ten kilometers (6.2 miles) along the Chambal River.

In 1995, another coauthor began working with turtles and water quality as a research assistant in the National Chambal Sanctuary. Through this research, he learned that many turtles were being hunted for food, and this overexploitation placed these populations at risk of extinction. He found this unsustainable use alarming, so he reached out and took a grassroots approach to conservation by investing his time in the local community, educating others and himself. He learned from local shepherds that to save turtles, their habitat must be protected. In 1999, he formed the Society for Conservation of Nature (SCON) to help authorities stop the hunting of turtles and protect their associated habitats. In 2002, he learned of a project that was intended to convert native wetlands into agricultural lands, and he knew this would be a major setback to world turtle conservation, so he began a successful awareness campaign to protect wetlands and turtles by working tirelessly with the High Court and the World Bank. Because of this successful campaign, he was extended an opportunity in 2006 to study turtles in the USA, where he worked on various freshwater turtle conservation projects. These efforts culminated in being recognized by the International Union for the Conservation of Nature (IUCN), where he was awarded honorary membership in both the Tortoise and Freshwater Turtle Specialist Group (TFTSG) in 2006 and the Crocodile Specialist Group in 2013. Since then, he has continued to protect and legislate for turtle conservation and other aquatic species, and this has been recognized several times by state government, as well as by the Wildlife Institute of India, an autonomous institution of the Ministry of Environment, Forest, and Climate Change. He has continued to partner with local communities and nongovernmental organizations to establish the first *in situ* (within natural habitat) hatchery for two species of river turtles (*Batagur dhongoka* and *Batagur kachuga*) native to the Chambal River. In recent years, he has initiated a community-based river turtle conservation project that involves 134 local schools. Turtle conservation education centers have been established every ten kilometers (6.2 miles) along the Chambal River. It is in these informal settings that students and the public can come together to gain information on turtles and other aquatic denizens of these riverine systems. It is through these efforts that more than 100,000 people have directly benefited. It is now common for both rural and urban communities to stand up for wildlife and make every effort to minimize harmful impacts to avoid future crises by informing government and nongovernmental organizations. However, the work is far from done, because as humans encroach on habitats, wildlife-human

To date, they have conducted more than 120 “turtle camps” and benefited more than 15,000 students. These educational programs include a talk on Malaysian turtles, the threats they face, and the actions that individuals can take to prevent future extinctions (Figure 4). This echoes the spirit of turtle conservation in the USA and India, where people are informed of the critical role that turtles play in ecosystems and in human culture. Students learn to be more mindful of the choices they make regarding turtles as pets and what they can do to help minimize habitat loss. Many educators and students of the program become bloggers and write about the importance of turtles, and they share this passion for turtle conservation in newspapers, magazines, and on social media. Throughout it all, our dedicated Malaysian colleagues remain optimistic about the future of the Asian Turtle Crisis and want us to consider the following: In the past decade, we have had the pleasure of meeting numerous people who have been instrumental to our growth as researchers, project managers, and entrepreneurs. We have collaborated with like-minded researchers on a range of projects that may not have been immediately possible otherwise, and we believe that things are better now compared to when we first started nearly twenty years ago.

A similar project was documented in Cambodia. Cantor’s giant soft-shell turtle (*Pelochelys cantorii*), native to slow-flowing rivers in Southeast Asia, for example, was once thought extinct. But in 2007, nests were discovered along the Mekong River in northern Cambodia. Upon this discovery, Cambodia’s Department of Fisheries joined forces with Conservation International and with the World Wildlife Fund. This partnership ultimately led to the creation of the Mekong Turtle Conservation Center in Sambor, Cambodia, along with the formation of a community-led nest protection program. Former poachers are now paid to guard and protect turtle nests. Such efforts have facilitated the protection of almost 10,000 hatchlings associated with approximately 400 nests. The hatchlings are reared to young adulthood and eventually released. All the while, tourists visit the center in order to learn more about Cambodia’s turtles.<sup>7</sup>

#### India Case Study

interactions are on the rise, and as a result, poaching continues to this day. In the last twenty-five years, unsustainable use has become one of the biggest threats to turtle conservation. People need to do more by taking a more proactive stance that supports local conservation efforts and assist law enforcement to help curtail trafficking. For example, historically, the population numbers of the Indian peacock softshell turtle (*Nilssonia hurum*; Figure 5) were stable, but within the last decade, their numbers have declined so low that their long-term survival is now in question. No doubt, mass awareness helps educate people so that they are motivated to conserve turtles and their associated habitats. This makes it more likely that interested individuals will reach out and find ways to help. Helping can be as simple as providing intellectual, technical, or financial support to a local, regional, or global organization, society, or conservation project.

As with TCS and SCON, environmental protection, economic development, and community empowerment blend together to ensure that threatened turtles have a better chance at a brighter future, but these efforts need to continue and more needs to be done. Within the next two decades, it is estimated that roughly 100 species of freshwater turtles and tortoises may go extinct because of poaching and illegal trade. Roughly ten species are already extinct in the wild. Ten years ago, the Việt Nam leaf turtle (*Mauremys annamensis*) and the Yangtze giant soft-shell turtle (*Rafetus swinhoei*; Figure 6) were specifically highlighted as being vulnerable to extinction or were functionally extinct. According to the IUCN, both turtles are still considered critically endangered with either unspecified or decreasing population numbers. For the Việt Nam leaf turtle, there are probably no more than fifty mature individuals left in the wild.<sup>8</sup> As bleak as that sounds, for the Yangtze giant soft-shell, the situation is even direr. The last-known female Yangtze giant soft-shell on the planet recently died in a zoo in China, leaving behind only three known males. This in turn sent conservationists scrambling to find at least one more female in the wild.<sup>9</sup> That makes both of these species members of what biology's greatest living naturalist E. O. Wilson calls The One Hundred Heartbeat Club. This term describes critically endangered species that have 100 or fewer individuals left alive in the wild. The goal, of course, is for these two species to enjoy a comeback, like the way the Cantor's giant soft-shell turtle has. With so few individuals left, however, this may prove impossible.

The good news is that more people and more organizations than ever before are battling the Asian Turtle Crisis. One large organization, the Turtle Survival Alliance (TSA), seeks to prevent the extinction of turtles, but they also strive to bring species back from the brink of extinction through various *in situ* and *ex situ* recovery efforts. For the TSA, prevention and recovery are at the forefront of their mission. TSA and other organizations do meaningful field research as a part of their conservation efforts, and they develop, manage, and support captive breeding programs for critically endangered turtle species, both inside and outside of the many Asian countries considered turtle diversity "hotspots." A hotspot is a small geographic area with many endemic species, endemic meaning that those species are found in only one place in the world and nowhere else. Hotspots often face severe threats in the form of habitat destruction and overexploitation. Conservation organizations repeatedly stress the importance of captive breeding programs as a form of "assurance" against species going extinct in the wild. They likewise stress the importance of battling species extinctions in key countries such as Bangladesh, Cambodia, China, India, Myanmar, and Việt Nam, because it is in those countries that the war on turtles will be fought and won—or lost entirely. Finally, the TSA also owns and manages more than 2,000 turtles and tortoises at various facilities. They work to place these animals with private individuals, zoos, aquariums, universities, and veterinary schools.<sup>10</sup> For example, one of our coauthors is a TSA affiliate who is currently safeguarding several Asian species that are listed as endangered, and these include yellow-headed temple turtles (*Heosemys annandalii*; Figure 7) and Forsten's tortoises (*Indotestudo forstenii*; Figure 8) as part of an assurance colony.

In a terrifying turn of events, smugglers are now targeting turtles from the United States. These smugglers seek to move turtles collected in the United States across state lines and ultimately into Asia, where they are likely sold in Asian markets. *National Geographic* references Special Agent Ryan Bessey with the US Fish and Wildlife Service, who states that the demand for North American turtles in Asia has "skyrocketed" in the last decade or so. American turtles are especially in demand in China, with one trade route traced from Atlanta to Los Angeles and then to Guangzhou in the southern part of China. Harvested American



Figure 6: Yangtze giant soft-shell turtle (*Rafetus swinhoei*) Source: Asian Species Action Partnership (ASAP!) website at <https://tinyurl.com/3dxu6b9p>.

The last known female Yangtze giant soft-shell on the planet recently died in a zoo in China, leaving behind only three known males.



Figure 7. A young yellow-headed temple turtle (*Heosemys annandalii*). Source: Photo by Tabitha M. Wilson.



Figure 8. A young female Forsten's tortoise (*Indotestudo forstenii*) that is being head-started. Source: Photo by Thomas P. Wilson.





Figure 9. Diamondback terrapins (*Malaclemys terrapin*) are sought after in the illegal pet trade. Source: © Shutterstock. Photo by Miiko.

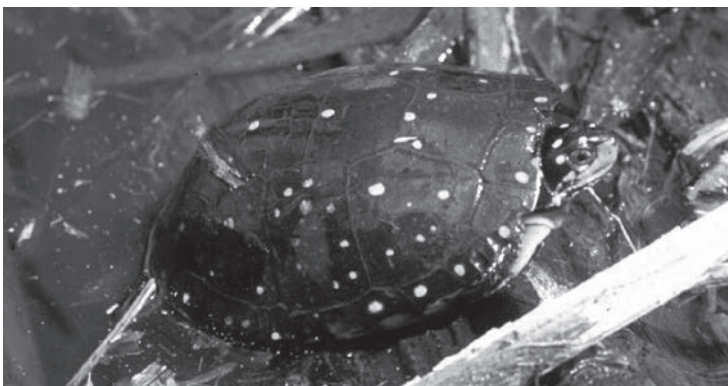


Figure 11. North American spotted turtles (*Clemmys guttata*) are highly sought after in the illegal pet trade. Source: Photo by Thomas P. Wilson

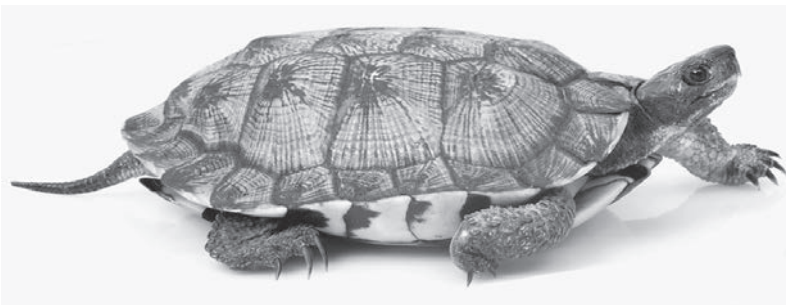


Figure 12. North American wood turtle (*Glyptemys insculpta*). Source: ©Shutterstock. Photo by fivespots.

“In the end, we will conserve only what we love. We will love only what we understand. We will understand only what we are taught.”



Figure 10. A North American native turtle, an eastern box turtle (*Terrapene carolina carolina*) being monitored at one of our long-term study sites. Unfortunately, eastern box turtles have found their way into Asia via the illegal pet trade. Source: Photo by Thomas P. Wilson.

turtles tend to wind up in China and in Hong Kong, along with other destinations in Asia, including Thailand, Malaysia, Japan, and Indonesia. Much of the demand for American turtles and for turtles from other countries and continents is due to the desire for exotic pets. Diamondback terrapins (*Malaclemys terrapin*; Figure 9), box turtles (of the genus *Terrapene*; Figure 10), spotted turtles (*Clemmys guttata*; Figure 11), and wood turtles (*Glyptemys insculpta*; Figure 12), all North American species, are especially popular in Asia for this purpose. Asia has decimated their own turtle populations, and now unscrupulous individuals are looking elsewhere as a means of helping meet the ever-present demand for turtles across Asia.<sup>11</sup> This is especially troubling, as North American turtles already face a wide array of threats. Like Asian turtles, American turtles are also subject to unsustainable use, environmentally unfriendly harvesting methods, habitat destruction, habitat degradation, and natural predation.

We know that, globally, nearly half of all freshwater turtles and tortoises are at risk of extinction. People are therefore encouraged not to keep turtles as pets but rather invest in local grassroots conservation efforts that are already working with turtles in the field. We know that turtles are long-lived, and many species take decades to attain sexual maturity and have low to variable juvenile survivorship. Now, imagine a female turtle emerges to lay thirty-five eggs during the nesting season, but before daybreak, all her eggs are taken by egg collectors. Do readers think the population can sustain this pressure for each day of the nesting season over a ten-year period? In short, this process is unsustainable, particularly when it is coupled with high levels of habitat loss, climate change impacts, and emerging diseases. We encourage people to use design process thinking and engage in capacity building by using adaptive conservation and management strategies to better protect the world's turtles. This echoes the pressing need for on-the-ground conservation action by becoming educated about turtles and their associated threats, protecting habitats, creating legislation, building consensus, funding enforcement, and investing in research and local communities. We know that conservation is never convenient, but we believe that if these concepts are integrated into adaptive management strategies, then turtles can be preserved around the world—and especially in Asia. In the future, we predict that properly trained Asian scholars with a passion for turtle conservation will pay it forward by influencing potentially hundreds or thousands of people in the years to come. To quote African ecologist Baba Dioum, “In the end, we will conserve only what we love. We will love only what we understand. We will understand only what we are taught.”<sup>12</sup>

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## NOTES

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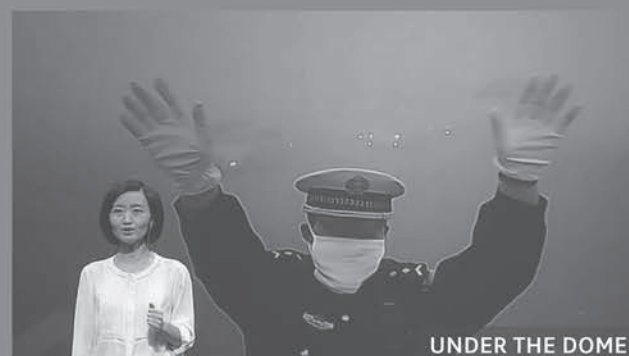
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