Most of the remaining wild pandas live in the remote Nature Reserves of the Minshan and Qinling mountains of western Sichuan, the latter a much smaller geographical area in Shaanxi Province to the north of the Minshan Mountain Range. Giant pandas enjoy the cool, moist climate of the mountains where perennielly dense (thick as clouds) mists are interrupted only by the occasional torrential rain in summer, while winters are mild but with snow. Unfortunately, the mountain ranges of the Sichuan Giant Panda Sanctuaries do not form a single, contiguous panda habitat. Instead it is broken up into small forested reserves, with
Most of the giant pandas in the wild live in the giant bamboo forests and lush vegetation where they live in large family groups.

human-related agriculture, towns, highways and dams constructed in between. Wildlife scientists as well as panda researchers refer to these problems as "habitat fragmentation". Their hope is to reconnect with mixed forest corridors to help isolated giant panda communities increase in gene pool diversity. I hoped to visit several of these sanctuaries and see a wild panda, but the probability was very low.

Southwest of Tanjiahe lies a series of Giant Panda Sanctuaries including the more popular Anzihe, Wolong, Fengtongzhai, Laba River, and Bifengxia Panda Reserves. I traveled 6 hours southwest to explore the mountains north of Ya’an and the Bifengxia Panda Reserve south of Baoxing where the Fengtongzhai Reserve is located. Spring was an amazing time to hike here as the surrounding mountains are covered with a beautiful forest of flowering cherry, dogwood, magnolia, walnut, and conifers. Steep mountain slopes ascended above a steep canyon filled with cascading waterfalls. Beautiful setting and my favorite in Sichuan. It had been raining all week until this morning, and thankfully blue skies. I walked the mountain trails listening to distant waterfalls, and thoroughly enjoyed the birdsong and serenity here. I also had the wonderful opportunity to spend hours observing a pair of young pandas in a Bifengxia reserve enclosure. The visitors were all enamored with pandas, from young to old, and I could see why.

Rt: Father Armond (Pierre) David 1870

The first western European to discover the giant panda was Father Armand (Père) David in 1869 who part of the Catholic Mission founded by St Vincent de Paul. He shared the gospel as a missionary in China based at Muping in Sichuan, and explored the mountains surrounding him and studied its natural history where he heard tales of a “white bear.” It was Père David’s second year in China, and Muping, at the base of
Fengtongzhai Nature Reserve. These remote mountains proved as dangerous as the friction between the forces of the Chinese Empire and the prince who ruled the region. He journeyed from Chengdu to the Catholic Church plant at Dengchigou in the Qionglai Mountains in Ya’an Sichuan. It took him weeks but commented in his journal the rich plant diversity with blooming cherry and primroses. He documented and collected 52 species of rhododendrons which he was the first to discover.

Below: Father Armond (Pierre) David 1869 and Dengchigou church he assisted with above Muping near Baoxing in todays Fengtongzhai Nature Reserve. He was an astute scholar and biologist.

It took him almost a week as he crossed a river by Wujin ferry, Youzha township in Quonglai and Dachuan town in Lushan, then climbed by trail the Dawengling Mountain to over 3000 m/9840 ft where he arrived in Dengchigou, the jurisdiction of the Muping Chieftain organization, todays Baoxing county. Here a church had been built in 1839 in a two-story Chinese courtyard on a mountain platform by the church of Chengdu Far Eastern Diocese in Paris. Today Dengchigou Church survived and restored located in Fengtongzhai, the setting is a picturesque scene with mountains rising straight up, and forested ravines and gullies that still support pandas. This Catholic Church, founded in 1839, is one of the earliest churches built in secret in Sichuan by those sent by French Far East Church.

Like many of the priests with a love for God’s creation, he collected animal and plant specimens throughout the steep mountain slopes and crossed many mountain ridges in fog. On one of his deeper explorations with a guide he had attempted to cross a steep ridge using stunted trees for ascending in the snow, got lost and became stuck as icy rain began to fall. They were rescued by mountain hunters who guided them down and offered their tree-bough beds in a hut for the night. On March 11 of that year, he saw, in the house of a man called Li, the pelt of a
panda who told him the black and white bear hid in the high mountains and dense forests in the surrounding area. He returned, and on March 23, his trackers captured a young live panda, but to bring it back, they killed it. Père David, who always felt a Franciscan awe at the works of creation, regretted killing animals to provide scientific specimens, but was obliged to follow the naturalists’ convention of preserving skins to send them to the Natural History Museum in Paris.

At the beginning of April 1869, hunters near Muping brought him a specimen of an adult panda. He noticed that the black markings were less dark than in the juvenile. On April 7 he was brought a live panda, which “does not look fierce, and behaves like a little bear”. Father David wrote a report to curator of the National Museum of Natural History in Paris describing the animal after studying the panda’s skeleton and fur naming it Airluropoda melanleuca. He chose this name to differentiate from the previously discovered lesser panda or red panda, which was discovered in 1821 in the foothills of the Himalayas. His report was published by the museums journal in 1870. More recently molecular and genetic studies have convinced taxonomists that the panda is a bear after all, if a strange one.

He sent specimens of 63 species of animal previously unknown, 65 new species of bird, and countless insects and plants. There were many new species of rhododendrons, primulas and mountain gentians all sent back to the Natural Museum of Paris. Père David’s great ambition had been to dedicate his life to bringing the Gospel to the people of China, and in photographs he is sometimes shown in a close-fitting round cap, pigtail and a Chinese version of moustache and beard classified as a Napoleon II Imperial. He was fluent in mandarin Chinese, and worked with national Chinese priests.

After the report in 1870, the giant panda specimens created a sensation at the Paris museum and sparked the curiosity of western explorers, primarily from Britain and Germany, competing to collect panda hides. Most famous were the two sons of former US President Teddy Roosevelt, Theodore and Kermit. By 1929 they became the first westerners to kill a panda at Qionglai Mountains and gave the skin to the Chicago Field Museums, then wrote a book of their
explore ‘Trailing the Giant Panda.’ A live young panda was acquired in 1936 which was brought back to New York City, and held by Theodore Roosevelt jr, who regretted every having killed a panda for its king. Roosevelt’s remorse had a significant impact on halting the hunt for giant pandas. From 1937 more than 10 giant pandas were sent from Sichuan to the US and Britain, a token of appreciation for their support in the war. By 1980 George Schaller with WWF explored Sichuan and documented the destruction of forest habitat, and with International

Experts in 5 years completed ‘The giant panda of Wolong’ monograph documenting the need to preserve forests to save the fate of this species. In 1990s the Chinese implemented a natural forest protection act and issued a logging ban on the upper Yangtze River, and established large natural reserves to protect habitat. But it wasn’t until recently that a successful breeding program coupled with reintroduction into the wild is reestablishing numbers lost by the huge bamboo die off in 1980. China has set aside since 1963 and increase number of panda reserves, which by now numbers 67 nature reserves in 2018.

I spent the day walking through the tranquil Bifengxia reserve and I became a celebrity with Chinese visitors wanting selfies with me. I managed to finally tour the enclosures, then spent the remainder of time at the enclosure with two immature juveniles about two years old. They were sitting together eating bamboo, with one stealing the bamboo from the other. Then the first climbed a tree to rest followed by the second that selected another tree. I walked across

Before conservationists and animal rights activists questioned the hunting of wild animals for sport, President Theodore Roosevelt’s sons embarked on an expedition to China sponsored by Chicago’s Field Museum of Natural History. Their most prized trophy is still on display in the museum’s Hall of Asian Mammals.
the trail and was amazed this panda had climbed a natural tree so quickly and effortlessly, then rested, offering amazing photographic opportunity with a variety of poses. It moved around, scratched its back, laid on a branch on its back with head hanging down, lifting legs above, comical, and I saw why they are endeared. The youngster got up mid observation of almost two hours, and pooped, sending a cascade of green logs to the forest floor.

I learned more about pandas Ailuropoda melanoleuca that are omnivorous bears but herbivores, compelled to eat half their own body weight in bamboo each day to meet their energy requirements and survive. Pandas derive most of their nutrition from the shoots. I also became aware of their population decline in past decades from both habitat loss and major bamboo area die offs. Development of highways, dams and population increase has isolated the mountainous reserves preventing migration. Bamboo colonies go through decades-long cycles, and form
giant colonies that can be connected within an entire watershed. Once they bloom, form flowers and then seeds (occurs every 60 years in one species), the entire colony dies. It then may take up to 10 years for a new colony to mature leaving pandas without a food source. The pandas are forced to migrate or starve, and must travel to another watershed or reserve to find a new vigorous bamboo colony as their food source. But if not connected with wild forested corridors, most pandas die unless there is another species of bamboo to help sustain them. Despite extensive protective measures, pandas are being forced into smaller and increasingly isolated and fragmented pockets of habitat where there is often insufficient bamboo or variety of bamboo species to support the declining populations.

Nine varieties of bamboo have been observed flowering in 14 counties in Sichuan since 2005, which account for 30 percent of bamboo eaten by the pandas according to research. The mountainous region witnessed extensive blossoming of the arrow bamboo, the pandas’ favorite, in 1984 and 1987, when the plants flowered, seeded and died. Hundreds of the endangered animals died of starvation. Near Baoxing 62 km north of Bifengxia, a bamboo die-off happened in the 1984 at Fengtongzhai National Nature Reserve where Father Armond David first was shown a panda skin in 1869. The massive bamboo die-off followed blooming and subsequently forced over a hundred starving pandas into local villages including Baoxing.
along the river. Many villagers attempted to help the starving giant pandas survive by adopting them and feeding them candied rice porridge. Within several decades the bamboo forests eventually recovered and the panda population has now increased to more than 140 giant pandas in the Fengtongzhai Nature Reserve, accounting for more than 10 percent of the national total.

Today Fengtongzhai is a somewhat isolated reserve of 39,000 hectares (116 sq. mi), that extends from the Sichuan Basin northwest to the Qinghai-Tibet Plateau transition zone. Along with many other reserves in the Minshan Mountains, it is known to have the highest temperate forest biodiversity in the world. To the north Wolong, where George Schaller did his research in 1963, also supports a diverse ecosystem and large number of pandas. But the densest population of giant pandas in the world is in adjacent Anzihe, a 39,550-hectare (116 sq. mi) reserve in the Longmen Mountains which links Wolong to Heishuihe.

Many conservationists argue that a stronger focus on restoring habitat would actually benefit the species more and that giant pandas are at their most vulnerable while traveling between reserves. Roads and mining have replaced poaching and timber harvesting as major threats, and previous generations of clear-cuts still impede bamboo growth. Tourism in parts of Sichuan province has grown too quickly for park staff to keep proper tabs on hikers and other traffic.

HABITAT AND ECOLOGY. Giant Pandas today are found in temperate montane forests of western and northwestern Sichuan between altitudes of 1,500–3,000 m/ 4920-9840 ft. They
are adaptive to a very wide range of forest structure, including broad-leaf, mixed conifer-broadleaf, and conifer forest. They feed on bamboo, and bamboo requires a cool, moist climate. Given the panda's design with a stocky build and thick fur, it thrives in Sichuan's temperate climate, but because of the food source does not in a hot, dry climate. Bamboo grows best as undergrowth in mixed, broadleaf and coniferous forests at an elevation of 1525 m/m- 3050m /4000-10000 ft, though the giant panda has been known to live on mountain slopes as high as 3960 m/ 12000 ft.

Pandas are uniquely placed in the family Ursidae bears within the order Carnivora, and anatomically designed with a simple stomach and short gastrointestinal tract. But they are herbivorous, feeding on a specialized diet of bamboo that is not very digestible, low in protein but high in fiber and lignin. The panda searches the forest for edible bamboo patches, and when found sits when eating, with its outstretched hind legs in front of it. They may spend from 12-16 hours daily eating and foraging, then sleep and in the process consume 12-15% of their body weight daily. If new bamboo shoots are available, the panda will typically concentrate on this food source and consumes about 13-15 kg/ 30-34 lbs. of parts of the bamboo that are seasonal. The plant fiber of bamboo is rich in cellulose and lignin, which requires specific microbes to break it down, a gut bacteria flora not typical of ruminants like deer or bovids for efficiently breaking down bamboo, utilizing only 17 per cent of the bamboo consumed. Their gut does not harbor plant-degrading bacteria such as Ruminococcaceae and Bacteroides that are typically found in herbivores like deer and takin with four-chambered stomachs. Instead their gut flora is dominated by a species of Clostridium species found in samples of panda excrement, which are less efficient in breaking down cellulose.

Bamboo as a low-calorie food source has a defining influence on behavior. In the past, primary forests had a greater bamboo diversity, with up to 25 different bamboo species available to the panda in any given original habitat. But since logging, many species have disappeared as humans have encroached on the bamboo's and panda's habitat. Today, only a handful of bamboo species remain. There are even fewer species in the altitude range that suits the panda and this has also contributed to the threatened status of the panda. The panda obtains most of its protein seasonally in the spring from bamboo shoots and in the summer monsoon bamboo leaves, but in the winter, they must concentrate on the less nutritious stems. However even in summer they consume the stems partly for the water they contain. The stem also contains protein, only in lesser amounts even if the high fiber content of the stems means that the panda must relieve itself up to 40 times a day. Despite the high-water content in the bamboo stem, it is not sufficient to fulfill the daily water requirements of the panda, so pandas must have access to rivers and streams, both of which, fortunately, there tend to be plenty of in the panda's habitat. The panda eats different parts of the bamboo plant depending on the season.
Pandas migrate in elevation seasonally with bamboo emergence, and synchronize their reproduction with the nutritional cycles of their bamboo species food source. During the year pandas switch between leaves and shoots from two most common bamboo species, a diet shift related to the concentrations of calcium, phosphorus and nitrogen. Both species of bamboo are critical for the pandas, because their yearly cycles, coupled with seasonal altitudinal migration, enables the pandas to adapt their life cycle on this low diversity and low-quality diet.

Pandas eat 20 or so bamboo species. A research center for endangered animals in the western province of Shaanxi has carried out tests aimed at helping pandas to broaden their eating
habits. The bamboos which form the main food for red pandas belong to the genera *Phyllostachys*, *Sinarundinaria*, *Thamnocalamus*, *Chimonobambusa*, and *Qiongzhuea*. Because of the synchronous flowering, death, and regeneration of all bamboo within a species, the giant panda must have at least two different species available in its range to avoid starvation. While primarily herbivorous, the giant panda still retains decidedly ursine teeth and will eat meat, fish, and eggs when available.

REPRODUCTION Their foraging is synchronized amazingly with their reproduction and migratory behavior where this large herbivorous carnivore can complete its life cycle on a narrow and seemingly low-quality bamboo diet. Pandas are solitary and must respond to long distance chemical cues to find mates usually in the spring in May. Competition for females can be intense and in one case in Wolong, a captive male released back into the wild was killed by a male during the mating season. Males have difficulty fertilizing available panda females, and since females do not conceive easily, and that only about half of infant pandas survive, there is a severe threat to the panda's reproduction and existence in the wild.

Fertilized female bears give within 5 months birth to unusually small, altricial young, a trait that has been associated with hibernation. However, pandas do not hibernate and yet they have the shortest gestation period (3–5 months) and give birth to offspring that are the smallest of any bear species; merely 0.1% of the mother's weight). As with other bears, pandas have an embryonic diapause, known as seasonal delayed implantation, in which the embryo remains suspended in the uterus in a state of arrested development until it attaches and resumes growth, sometimes months later. Delayed implantation may be designed with the ability to
adjust the timing of mating and the rearing of offspring to different seasonal environments. Mothers care for their young and when first born hold them to their chest and don’t feed for a week to keep them warm. Pandas are born with sterile intestines and require bacteria obtained from their mother's feces to digest vegetation.

Leopards, wolves and bears will prey on panda young. The infant panda is especially vulnerable when its mother is away foraging for bamboo several times daily for 2-3 hours at a time. However, for the first several days, the mother panda will forego both food and drink in order to be available to the infant panda. Its needs are to suckle almost all day long, for up to a half hour at a time, and with less than an hour between the end of one feeding session and the beginning of the next!

Young climb trees to escape predator. Besides the threats posed to the giant panda by human encroachment and loss of habitat, natural enemies include roaming packs of feral dogs, bears, and the snow leopard Panthera uncia which itself is an endangered species. It is critical for Chinese authorities to establish interconnecting corridors with mixed forests that harbor bamboo to secure its survival.

*Giant Panda immature 3 year old in tree. Captive natural Enclosure*
**Fengtongzhai Nature Reserve Wildlife**

*Orange bellied leafbird (D Koh), Black-faced laughing thrush, spotted forktail*

*Spotted laughing thrush, blue winged laughing thrush, black throated laughing thrush (G Potter)*

*Chines monal, Lady Amherst’s pheasant, blood pheasant (F Yap)*

*white eared pheasant, Temmincks pheasant, white browed rosefinch*

*Metallic blue Lycaenidae alpine area, Parnassius appollo Papilionidae. Alpine area*
Golden pheasant (B Josephs), black bear (D Jianxin), golden monkey

Golden monkey, Chinese goral (B Josephs), Tufted deer

Wild Giant Panda taken by villager Muping, red panda Below: takin Tanjiahe B josephs, captive panda Ya’an