By Bobby Oerzen

TOTALLY TUBULAR

Bicycles made of bamboo are growing in popularity.

Bamboo has different meanings and uses throughout the world. In India, bamboo is a symbol of friendship. In China, it's used to treat infections. In the United States, it makes a great bicycle.

The Bamboo Bike Studio in Brooklyn, N.Y., holds a weekend course that teaches customers how to build their own custom-fitted bamboo bikes. "Bamboo is very user-friendly," says Marty Odlin, one of the studio's owners. "There's no way a nonexpert could build a steel bike from scratch in a weekend. But with bamboo, it's possible."

Odlin has a vision that extends beyond the United States. He and the other owners of the Bamboo Bike Studio are helping set up factories that will mass-produce inexpensive bamboo bikes in the western African country of Ghana. If the venture is successful, bamboo might acquire one more meaning. In Ghana, it might mean new jobs and inexpensive transportation.

RENEWABLE RESOURCE

Bamboo bikes are a natural fit in Ghana because bamboo grows abundantly throughout sub-Saharan Africa. It grows on every continent, in fact, except Europe and Antarctica. The Bamboo Bike Studio harvests bamboo from backyards in New Jersey.

Despite what you might think, bamboo is not a tree; it's a grass. It's also one of the fastest-growing plants in the world. It can grow up to 100 centimeters (39 inches) in a single day. That's why many New Jerseyites are more than happy to donate their bamboo.

Bamboo is also strong. Like all grasses, bamboo is made of *silicon dioxide* (SiO_2), or *silica*, a hard compound that is the most abundant building block of rocks on Earth. The high concentration of silica in bamboo gives it a very high *yield strength*. Yield strength is how much stress a material can withstand before permanently changing shape.

Bamboo's high yield strength helps it survive in the wild. "It's a plant that evolved in windy climates," says Odlin. "So it's suited to absorb a lot of stress and shock."

Bamboo's yield strength makes bike frames extremely durable. Traditional bike frames made from steel, aluminum, or carbon fiber sometimes bend or crack. Not bamboo. The yield strength of bamboo is slightly higher than that of steel. Of the 200 bamboo bikes that have left the Bamboo Bike Studio, none have come back. "These are bikes people can ride indefinitely," says Odlin.

SHOCK ABSORBER

Another important property when comparing bike frame materials is *stiffness*. A bike's ability to absorb shock depends on it, says Joel Fajans, a physicist at the University of California, Berkeley. The stiffness of a material is determined by its *elastic modulus*, or how much the material will bend when force is applied. It is a measure of how much weight a material can hold and still return to its original shape.

If a material is too stiff—has a high elastic modulus—a bike rider feels the shock of every bump. If the material is too soft, the bike bends easily, forcing the rider to pedal harder and use more energy. Many bike riders contend that bamboo's stiffness provides the smoothest, most comfortable ride.

Bamboo has another quality that absorbs shock. "Bamboo allows *vibration damping*," says Odlin. Vibration damping is a material's ability to straighten a wobble. When a bike hits a bump on the road, its frame may vibrate the same way a tuning fork does when it's struck. That kind of response is extremely uncomfortable. In a bamboo bike, the *vascular bundles* dampen vibrations. Vascular bundles are tubes that transport nutrients in a live bamboo stalk.

All in all, contends Odlin, the bamboo bike is "the perfect everyday bike." Its durability and comfortable ride are ideal for both leisure and business. In a poor country such as Ghana, bicycles are in high demand because very few people can afford cars. So bicycles are used to transport most of the country's food and material goods.

LOCAL INDUSTRY

As popular as bikes are in Ghana, the country cannot afford to construct factories to build traditional bikes. Even importing frames from outside the country and then assembling the bikes locally is beyond the country's means. But mass-producing bicycles from locally grown bamboo is a viable business option, says Odlin. He plans to show teams of Ghanaian workers how to quickly assemble bamboo bikes. He estimates each worker will be able to produce about four bikes a day.

Left: bamboo. Above: Bamboo Bike Studio co-owner Marty Odlin

In Brooklyn, Odlin has helped customers from ages 12 to 70 build bamboo bikes. He hopes he has also helped them develop a new respect for what they own. "It's hard work to build these bikes," Odlin says. "It causes people to appreciate the product.

"In America, we have too much stuff," Odlin adds. "So we don't appreciate what we have. In developing countries such as Ghana, people don't have enough stuff. We want people in America to have a better relationship with their goods, and people in Ghana to have access to more goods. We may work in Brooklyn, but this is a global effort." **CS**

Clockwise from top: Courtesy Bamboo Bike Studio (2); iStock; Christian Hansen/*The New York Times*/Redux; Courtesy Bamboo Bike Studio (3)

Left: Marty Odlin and one of his employees, Hannah Barnes, cut bamboo. Right: Another employee assembles parts of a bamboo frame and glues them together with epoxy.

Left: Installing a front wheel on a bamboo bike frame. Right: Justin Aguinaldo, a designer at the Bamboo Bike Studio, tests a new bicycle at the company's shop.

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