

Bamboo - A Fiber Resource with Great Potential

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To date, over 1200 bamboo species have been identified globally of which only about 35 are used as raw material for the pulp and paper industry. Both tropical and temperate species exist, and bamboo comes in many sizes from small diameter "fishing poles" to large diameter bamboo which grows 100 feet (30 meters) tall in 3 to 4 years.

As shown in the following table, a more interesting feature of bamboo is that its fiber characteristics offer a wide range depending on the species with some bamboo having fibers similar to hardwoods and others having fibers similar to softwoods, as well as many species falling in between hardwoods and softwoods.

There are many features offered by bamboo which give bamboo great potential as a fiber resource for the pulp and paper industry such as:

- bamboo can be chipped in a similar manner to wood, and bamboo chips handle, pulp and bleach like wood chips
- bamboo chips could be blended with wood chips and co-cooked and bleached at existing wood-based chemical pulp mills - the clear advantage is that there is virtually no capital investment required to co-cook a blend of say 20% bamboo and 80% wood chips other than a possible chip blending station
- technology exists to clone bamboo which means that specific species could be cloned to meet specific pulp requirements
- cloning technology can be used to develop bamboo farms designed to produce fiber suited for specific wood-based pulp mills
- bamboo farming offers the potential to develop a fast growing fiber resource for the pulp and paper industry
- bamboo farms offer the potential for other industrial development such as the production of particleboard, MDF and hardwood flooring substitutes
- depending on the species, farms may also produce bamboo shoots for food
- from an **environmental perspective**, the use of bamboo chips must be restricted to using bamboo only from **certified bamboo farms** to prevent usage of natural stands
- bamboo cloning technology could be used to redevelop depleted natural stands

This last feature of using bamboo cloning technology to redevelop depleted natural stands offers great potential for enhancing the natural habitat of the **Giant Panda** and helping to ensure its continued survival. Pandas will eat a variety of plants, including irises, crocuses, horsetails, vines, certain grasses, and fir bark, and they will also eat meat but are not adept at catching prey. But the most important panda food by far is bamboo. Pandas eat more than fifteen species of bamboo, eating different parts of the plants at different seasons.

Every 40 to 120 years, all plants of a particular bamboo species in a region produce flowers and seeds after which they all die at about the same time. Then it takes about 3 years to for the bamboo forest to re-establish itself. When this happens, pandas normally feed on a different species of bamboo. But what if a region has only one or two species? In the mid-1970s and again in 1983, arrow and umbrella bamboo (two panda favorites) died out in northern Sichuan Province in China. For the first time in recent history, the pandas had nowhere to go because

people had built farms and villages down below which divided the panda habitat into mountaintop “islands”. And each mountaintop had but a single bamboo species. These were tragic events for pandas, many of which starved.

Using cloning technology, governments, NGO's and industry could work together to redevelop panda habitats with multiple bamboo species which are suited to their diet and which have sufficient differences that all of the species would not flower at the same time.

Bamboo farming offers great potential for multiple industrial uses but careful consideration must be given to the sustainable use of this potential resource both with respect to certified bamboo farming as well as the preservation of natural habitats and bamboo forests.

HurterConsult's position on the utilization of bamboo for industrial purposes is based on the development of certified bamboo farms.

Average Fiber Dimensions for Selected Bamboo Species

Species	Local Name / Comments	Length (mm)	Width (microns)	L/D Ratio	Lumen (microns)	Cell Wall Thickness (microns)
<i>Bambusa arundinaria</i>	India bamboo	1.73	22	79:1	6	8.0
<i>Bambusa arundinaria</i>	Daba	2.70				
<i>Bambusa beecheyana</i>		1.93	17.20	112:1	3.58	
<i>Bambusa blummeana</i>	Kauayan tinik	2.02	18	112:1	4	7.0
<i>Bambusa dissimulator</i>		2.32	15.19	151:1	3.38	
<i>Bambusa malingensis</i>		2.07	14.79	140:1	3.45	
<i>Bambusa multiplex</i>	Kauayan-china	1.36	18	76:1	2	8.0
<i>Bambusa nutans</i>		2.29	16.97	135:1	2.77	
<i>Bambusa oldhami</i>		1.92	16.97	113	3.17	
<i>Bambusa polymorpha</i>	Gamabetua	3.20				
<i>Bambusa stenostachya</i>		2.23	15.49	144:1	2.90	
<i>Bambusa textilis</i>		2.04	16.78	122:1	3.02	
<i>Bambusa tulda</i>		2.15	17.33	124:1	2.34	
<i>Bambusa tulda</i>	Mitenga	3.00				
<i>Bambusa tulda</i>	Spineless India Bamboo	1.45	20	73:1	5	7.5
<i>Bambusa tuldoides</i>		1.89	18.21	104:1	3.83	
<i>Bambusa ventricosa</i>		1.90	14.38	132:1	3.31	
<i>Bambusa vulgaris</i>		3.43	15.41	223:1	3.73	
<i>Bambusa vulgaris</i> Var. <i>Vittata</i>		2.98	16.21	184:1	3.43	
<i>Bambusa vulgaris</i>	Yellow Bamboo	1.60	20	80:1	4	8.0
<i>Bambusa vulgaris</i>	Kauayan-killing	2.33	17	137:1	4	7.0
<i>Bambusa vulgaris</i>	Kauayan-killing / top	2.22	8.7	255:1		
	Kauayan-killing / middle	2.23	9.6	232:1		
	Kauayan-killing / base	2.21	9.0	246:1		
<i>Dendrocalamus asper</i>		2.43	17.89	136:1	3.97	
<i>Dendrocalamus giganteus</i>		3.08	19.10	161:1	5.66	
<i>Dendrocalamus hamiltoni</i>	Kokwa	3.40				
<i>Dendrocalamus latiflorus</i>		2.44	17.06	143:1	3.44	
<i>Dendrocalamus longispathus</i>	Ora	3.50				

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<i>Dendrocalamus membranaceus</i>		4.31				
<i>Dendrocalamus merrillianus</i>	Bayog	2.16	14	172:1	6	4.0
<i>Dendrocalamus strictus</i>		2.22	18.17	122:1	4.33	
<i>Dendrocalamus strictus</i>	Salia	3.10				
	Salia / freshly flowered	3.00				
	Salia / flowered 4 years	3.50				
	Salia / mature	3.10				
<i>Gigantochloa aspera</i>	Giant bamboo	3.78	19	199:1	7	6.0
<i>Gigantochloa levis</i>	Bolo	1.80	22	82:1	6	8.0
<i>Gigantochloa scortechini</i>		3.29	12.90	255:1		
<i>Guadua amplexifolia</i>		1.69	14.47	117:1	3.28	
<i>Guadua angustifolia</i>		1.93	16.04	120:1	2.12	
<i>Guadua spinosa</i>		1.65	14.57	113:1	5.74	
<i>Guadua superba</i>		1.94	14.22	136:1	2.14	
<i>Melocanna bambusoides</i>	Muli	2.70				
<i>Neohouzeaua dullooa (Teinostachyum)</i>	Dolu	3.60				
<i>Ochlandra travancorica</i>		9.01				
<i>Ochlandra travancorica</i>	Eta	4.00				
<i>Oxytenanthera nigrociliata</i>	Kaliseri	3.61				
<i>Phyllostachys bambusoides</i>	Giant timber / top	0.92	8.9	103:1		
	Giant timber / middle	1.64	9.5	173:1		
	Giant timber / bottom	1.46	11.7	125:1		
	Giant timber / nodes	0.64	21.0	30:1		
<i>Phyllostachys nigra</i>	Pole-vault bamboo	1.86	19	98:1	6	6.5
<i>Phyllostachys viridis (Sulphurea viridis)</i>	top	1.09	8.9	123:1		
	middle	1.86	12.2	152:1		
	bottom	1.90	12.3	154:1		

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<i>Phyllostachys vivas</i>	top	0.99	8.7	114:1		
	middle	1.35	9.8	138:1		
	bottom	1.59	11.2	142:1		
<i>Schizostachyum diffusum</i>	Bikai	2.00	21	95:1	7	7.0
<i>Schizostachyum lima</i>	Anos	1.67	22	76:1	4	9.0
<i>Schizostachyum lumampao</i>	Boho	2.42	14	173:1	6	4.0