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**Technological Innovation for an Emerging
Ramie Eco-industrial Cluster in China**

SHI Han
 Department of Environmental Science & Engineering
 Tsinghua University, China
 Yale Center for Industrial Ecology, USA
han.shi@yale.edu


The research project in China is being conducted in full
 cooperation with Wuhan University of Science and Engineering.

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Country Profile - China

- ✓ Population: 1,319.98 million
- ✓ Area: 9,598,100 km²
- ✓ Jurisdiction: 31 provinces
- ✓ GDP per capita (PPP): \$5,370
- ✓ GDP growth rate: 11.4%
- ✓ GDP composition: Agriculture 11.7%, industry 49.2%, service 39.1%
- ✓ Labor force: agriculture 42.6%, industry 25.2%, services 32.2%



- ✓ Major Environmental Concerns:
 - Water: serious surface water pollution, COD discharges (13.81 million tons) decreased by 3.2% in 2007.
 - Soil erosion: 37.08% of territory subject to soil erosion
 - Energy: coal accounts for 69.4% of energy consumption in 2006
 - Air quality: serious air pollution in some cities; acid rain remains severe and SO₂ emissions (24.681 million tons) dropped by 4.7% in 2007.
 - Natural environment: forest coverage continued to recover in 2007, 15% of the national territory were designated as nature reserves.




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What is Ramie?

- ✓ Ramie is a flowering plant and one of the key bast fibers for the textile industry. Ramie is indigenous to China (commonly known as China grass) and significant in the world textile industry. The main export markets for China ramie products are Japan and Europe.
- ✓ China accounts for about 90 % of ramie cultivation and processing worldwide. It is estimated that ramie cultivation and processing generated RMB 5 billion yuan in 2003 in China, accounting for one-twelfth of economic revenues from all cash crops unique to China.

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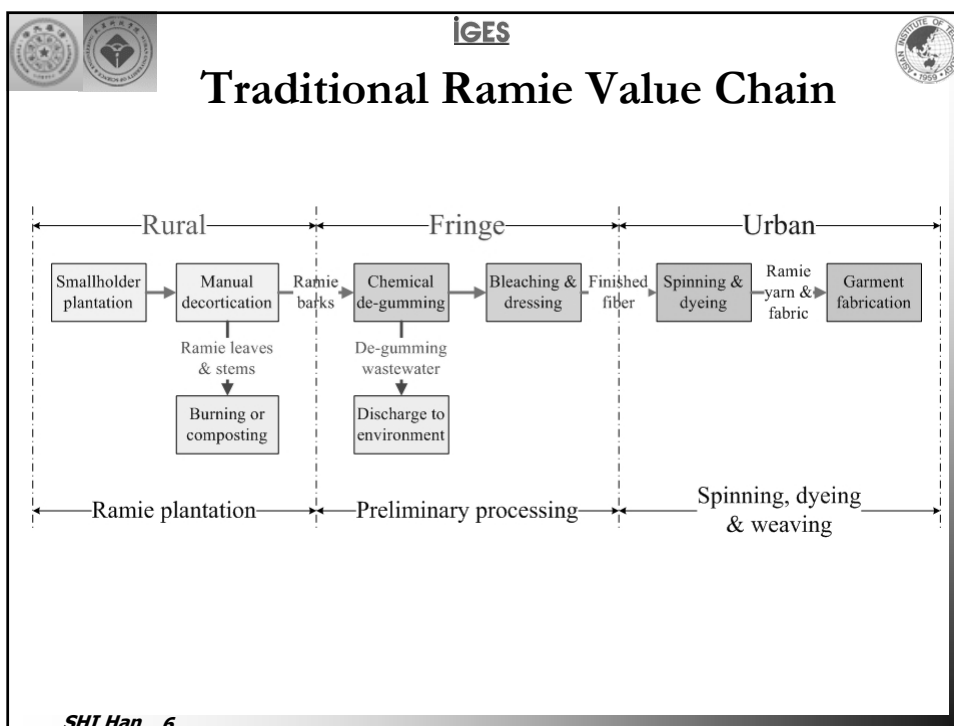
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World Average Production of Natural Fibers (1998-2000)

No.	Fiber	Production (Million tons)
1	Cotton	19.32
2	Jute	3.52
3	Wool	1.52
4	Flax	0.6
5	Sisal	0.386
6	Kapok	0.195
7	Ramie	0.17
8	Abaca	0.095
9	Silk	0.1135
10	Hemp	0.08
	Total natural fibers	26.0

Source: Franck, Robert R. (Editor). *Bast and Other Plant Fibres*. Cambridge, 2005

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Problem No 1:

Ramie Plantation & Harvesting

- ✓ Smallholder plantation
 - Small scale, low profitability, and difficulty in adopting new technologies and varieties
 - Varying genetic varieties result in inconsistent harvesting seasons and fiber features
 - Small quantities of ramie cores and leaves result in little byproduct reuse
- ✓ Manual de-cortication
 - High labor requirements
 - High labor costs
- ✓ Vendor purchase in small quantities
 - Inconsistent quality of raw ramie fibers



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Traditional Ramie Value Chain:

Harvesting & De-cortication



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**Traditional Ramie Value Chain:
Raw Ramie Fiber and Byproducts**





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**Problem No 2:
Preliminary Processing of Ramie Fiber**

- ✓ High energy consumption of ramie de-gumming
- ✓ High water consumption of ramie de-gumming
- ✓ Heavy pollution caused by de-gumming effluent
- ✓ High-temperature cooking by alkali downgrades the quality of ramie fiber



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Problem No 3:

Limited Use of Ramie Fiber & Residues

- ✓ Ramie fiber: Ramie fiber is principally used by the textile industry, and can be further developed for use as absorption materials, cigarette filters, etc.
- ✓ Ramie leaves: Ramie leaves contain rich protein nutrition and are good alternative animal feeds. Furthermore, ramie leaves can also be used to extract intermediaries for cosmetics, but are mostly returned to ramie plantation fields.
- ✓ Ramie cores: Ramie cores can be used as raw materials for paper-making and plywood as well as mushroom growth media. However, ramie cores are mostly discarded in the ramie fields except that a very few quantities have been used to produce match sticks.

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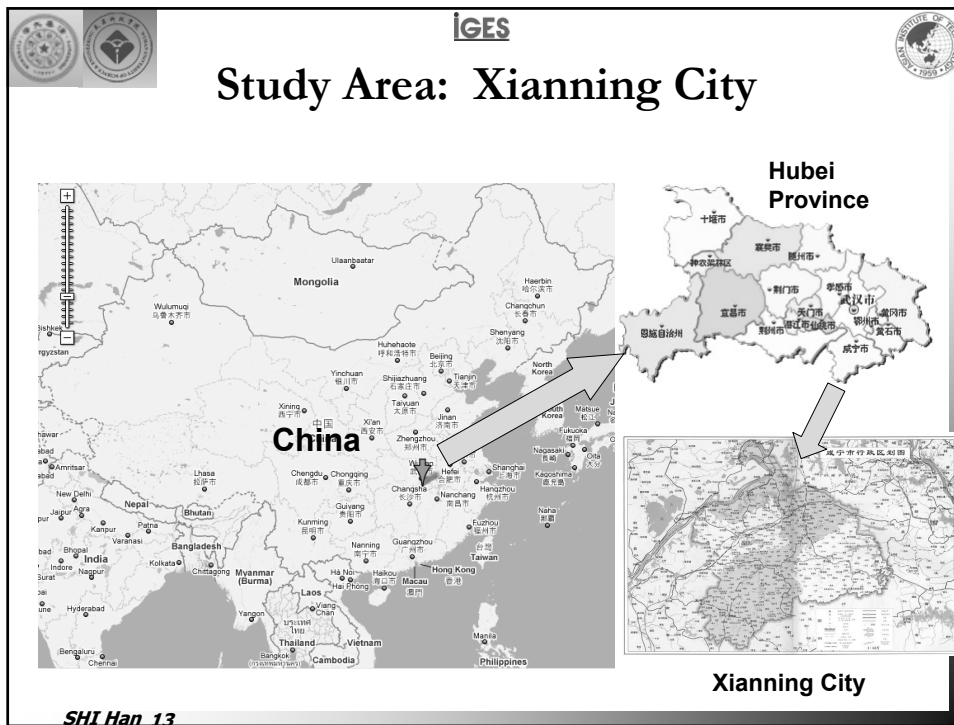
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Ramie residues



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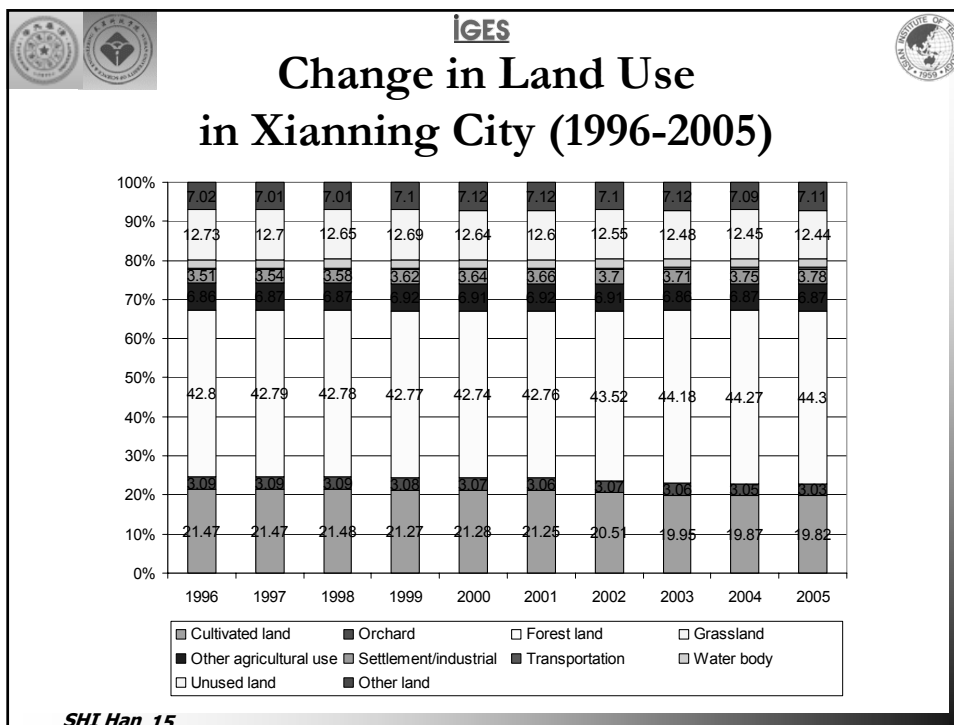


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Profiles of China, Wuhan & Xianning

	China	Hubei Province	Xianning City
Area (km ²)	9,598,100	185,900	9,861
Population (million)	1,321.29	60.70	2.86
% of Rural population	55.1%	56.2%	71.6%
GDP (billion Yuan)	24661.9	915	28.68
% of agriculture	11.7%	15.5%	23.9%
% of industry	49.2%	44.7%	41.8%
% of services	39.1%	39.7%	34.3%
Per capita GDP (PPP \$)	\$5,370	\$4,337	\$3,293
Labor force (million)	769.9	35.84	1.325
Rural labor force (%)	61.88%	63.11%	>65%

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Main Agricultural Products in Xianning City (2005-2007)

Year	2005	2006	2007
Crop	(t)	(t)	(t)
Grain	1,015,300	1,037,000	1,141,500
Edible oil	84,500	87,400	84,400
Cotton	1,656	1,863	2,500
Ramie fiber	23,400	27,957	27,800
Tea	16,400	17,000	17,300
Vegetable	1,878,700	1,914,900	1,993,300
Fruit	30,300	33,100	41,800

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