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Deep roots in culture, shallow roots in nature: Identifying sustainable bamboo management challenges for China and the implications for multidisciplinary research

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1. Introduction

This is the age of standardisation, be it Millennium Development Goals (MDGs) or certification schemes. Although standardisation seeks to prioritise goals and monitor progress, it can restrict culturally diverse approaches. For example, poverty becomes an entity (Escobar 1995) defined through MDGs as a construct of international development organisations. The implications such categorisations bring to diverse social and economic contexts is yet unknown (Green 2006).

The Chinese government is moving towards market mechanisms to promote environmental sustainability. The Forest Stewardship Council (FSC) is a globally recognised label gaining ground within Non Timber Forest Product markets (NTFP) (Mallet and Karmann 2001). The FSC has been described as a 'boundary object', creating new governance networks outside existing authority of government, creating or adapting verification practices to 'join together heterogeneous resources' (Eden 2009).

Bamboo FSC certification has been adopted as an NTFP in China, Columbia and India however there have been efficacy issues with the normative label. China has recently developed bamboo certification standards in response to biodiversity loss and soil degradation through intensive bamboo management practices. This paper aims to identify a need for a bio-cultural understanding of *blue print* environmental market mechanisms through sketching the current issues within Chinese bamboo forests. This article will contribute by identifying areas for agricultural economists to expand their toolkit through a multidisciplinary approach to natural resource management.

1.1. Bamboo the 'orphan' crop

Bamboo is an interesting plant because of its 'orphan' crop status (Vajpayee 2004); transcending category boundaries. In the Northern hemisphere bamboo is considered a *grass* (World-Book 2002), whilst in China it is not. The most commercially viable bamboo in China, *Phyllostachys pubescens* (*Moso* or *Mao*) is considered a *valuable hardwood* (Fu 2001). In FSC terminology bamboo is considered a NTFP. In South America a motion was passed to re-categorise bamboo as 'bamboo and rattan' under FSC (FSC 2005). Unlike other NTFPs, bamboo can constitute both the majority of the forest or be an extractive resource. Research has also been undertaken to consider bamboo under carbon trading schemes such as the Clean Development Mechanism (CDM) (Widenoja 2007), in which bamboo is considered a *tree* (INBARa).

Bamboo has been coined 'the grass of hope' (PIA 2008); it is a miracle plant with over 1500 recorded uses (Ranjan 2001). It is a potential replacement resource for two essential natural resources: timber and fabric, whilst new research is continually expanding the scope of uses for bamboo (Scurlock et al. 2000; Ghavami 2005; Wang et al. 2006; Platts 2008; Transmere 2008).

1.2. Blueprints and Boundary objects

Standardization and replicability have become essential in order to make the local manageable. Legislation and ''blueprinting'' have become the established practice rather than seeking alternatives drawn up by local stakeholders (Blaikie 2006). Much international development and environmental terminology has become 'boundary objects' facilitating communication across

disciplinary borders by creating shared vocabulary (Star and Griesemer 1989). However with blueprints and the transcending of boundaries there is a risk of simplification.

Bamboo with its multifaceted uses is deeply embedded within Chinese culture, is growing within the economy and is facing environmental challenges. These issues are entwined and inseparable; Licht et al (2007) found that culture affects governance more than economic factors. This has implications for blue prints which advocate 'good governance' based on a predominantly Northern value base, therefore there is a need to acknowledge these multidimensional characteristics when applying blue print or generic approaches to forestry and agro-forestry.

This paper is divided into three sections. The second section introduces bamboos bio-cultural roots, the third section briefly covers generic sustainable management strategies before the final section touches on practices within Chinese governance.

2. Bamboos bio-cultural roots

2.1. Deep roots in culture

竹亦得风，天然而笑; *as the wind whistles through bamboo, it naturally brings a smile.*

Bamboo is rooted in Chinese culture, having a 7000-year history of cultivation and utilisation (Wang et al. 2008). In language radicals are the basis of Chinese characters. The bamboo radical indicates the root of a tree lying above ground 竹 (zhu), root or source (Pound 2008). It is present

in items historically, or currently made of bamboo, however a number of characters derive their significance from bamboo; 笑 (xiao) to smile; to laugh, is linked to bamboo through the emotional effect of the sound of the wind through bamboo. By the 17th Century, 960 characters had the bamboo radical.

Bamboo is one of four most admired plants in China, along with the plum, orchid and chrysanthemum, known as the "four gentlemen" or the 'four men of honour' (四君子). The characteristics of the plants are highly admired; traditionally people aspired to have the same qualities as the plants. The merits of bamboo were summarized by renowned Tang poet Bai Juyi (772-846): its deep root denotes resoluteness, its tall, straight culm represents honour, its hollow interior modesty and its clean and spartan exterior exemplifies chastity. He concluded that bamboo warrants the title "gentleman" (Baidu 2008a).

2.2. Growing roots in the economy

The bamboo sector is one of the fastest growing forest land uses in China (Mertens 2008), worth an estimated US$ 5.4 billion (Marsh 2007). Global tropical deforestation has led to growing timber shortages and calls for the utilisation of alternative resources (Liese 2002). China boasts over 500 species (Lei 2001) and the second richest bamboo resource in the world (FAO 2008) with approximately 7.2 million hectares of bamboo forest, constituting 4.5% of China's 159 million hectares of forest area.

Moso bamboo covers approximately 60% of the total bamboo area in China, representing 80% of China's GDP in the bamboo sector (Lou 2007). Bamboo forestry has increased in response to logging bans, both in terms of surface area (32%) and density of culms within the forest (41%). This combined expansion has resulted in a large increase in bamboo culms and shoots (590% and 1050% respectively), contrasting sharply to the decreasing output of timber (Ruiz-Perez 2004).

2.3. Shallow roots in nature

Bamboo is reportedly the fastest growing plant on earth; Moso bamboo can grow up to 119cm in 24 hours (Fu 2001). Bamboos roots are made of rhizomes, underground organs forming the structural foundations of the plant. *Phyllostachys* have leptomorph rhizomes which grow horizontally underground, whilst the culms above ground are dispersed (monopodial). Monopodial bamboos require annual rainfall exceeding 800mm; moisture being the primary consideration for growing conditions (Jiang 2007).

As a grass, 44% of root biomass occupies the top 10cm of soil and 75% within the top 30cm, unlike temperate and tropical trees, whereby 26% of root biomass constitutes the top 10cm and 78% the top 50cm, although roots can extend much deeper. The depth roots penetrate affects the supply of water for transpiration. Plants with roots only within the upper 20cm of soil have 47.8mm of water available for transpiration. In contrast, plants with roots extending 1m have 239mm of available water (Bonan 2002). Moso rhizomes extend to 20cm or 30cm deep (Jiang

2007). As monocultures bamboo plantations lack deep root systems for transpiration. The physiology of root systems highlights the need for diverse ecosystems to support transpiration.

Sustainable bamboo management offers many benefits to the environment through promoting carbon sequestration, hydrological cycle stability and oxygen production (Daglis 2002). Traditionally bamboo forests in China were unmanaged; Moso forests with mixed vegetation and abundant undergrowth dominated (Fu 2002). Since the 1960s, high yielding cultivation techniques involving removing trees and undergrowth have been practiced. Currently, 2 million hectares of previously biodiversity rich bamboo forest systems are suffering from biodiversity loss in China (Lou 2007). The current challenges facing sustainable bamboo management are monocultures, intensive harvesting, soil loosening, tending, insecticide, pesticide and chemical residues (Fu and Lou 2002), erosion and depletion of soil nutrients (Saxena, Rao et al. 2002; Zhou et al. 2006; Xu et al. 2008). In Zhejiang China, bamboo is dying due to a lack of biodiversity and deep root systems in monoculture stands.[1]

3. Sustainable management strategies

3.1. Soil and Biodiversity Conservation

In order to provide incentives for sustainable management of resources, valuation of ecosystem services has become a growing field of enquiry (Chee 2004; Kroeger and Casey 2007; Swinton et al. 2007). Costanza et al. (1997) estimated the annual value of ecosystem services at an

[1] Observations and discussions with bamboo farmers by the author in 2008

average of US$33 trillion, 1.8 times the current global GNP. Kroeger and Casey (2007), however, identified three key reasons for the absence of ecosystem service markets. Firstly there is a lack of a widely available and easily applicable, low-cost approaches to quantifying ecosystem service flows. Secondly it is difficult to attach economic value to flows; and finally many of these service flows constitute public goods.

Total Factor Productivity (TFP) is conventionally used by economists to assess sustainability by exploring the balance between land-saving technical change (positive TFP) and land degradation (Negative TFP). TFP however does not take into account market inputs and outputs, especially long term resource degradation such as soil loss or environmental externalities. Total Social Factor Productivity (TSFP), was designed to include both market and non marketed inputs and outputs at long term economic prices (Herdt and Lynam 1992). Although many soil models have been created, (notable ones include Tropical Soil Productivity Calculator (TSPC) developed by Aune and Lal (1995) and Erosion Productivity Impact Calculator (EPIC) developed by Williams et al (1987); amongst others) the non-point nature of soil erosion coupled with the high costs associated with monitoring make Northern designed policies difficult to implement. Only when farmers have sufficient economic incentive to adopt soil conserving practices on profitability grounds can policies be implemented; the best policy is not provision of subsidies, rather removal of constraints (Shiferaw and Holden 2000).

3.2. Forest Certification

A standardized model that is receiving increasing uptake in the South is forest certification. Forest certification is a non-state market driven (NSMD) governance mechanism seeking to

ameliorate global environmental and social problems in the absence of effective regulations through direct governance in the market place (Bernstein 2007). The market for product certification is increasingly becoming mainstreamed (Renard 2005) advancing towards a retailer imposed discipline whereby certification is required for market access (Klooster 2005). The harvest of NTFPs has come under increasing scrutiny because of their key role within global sustainable community agriculture (Mallet and Karmann 2001).

An FSC scheme was created in Columbia for bamboo however the sustainability of the programme has come into question due to the farmers themselves not understanding the motives behind the scheme. A local initiative is being developed in Ecuador and Columbia to try and create a more bottom-up mechanism for bamboo certification. In India plans for bamboo certification started in the late 1990s. Local experts claim that the forests themselves adhered to the FSC standards, however some of the community aspects were not adhered to, therefore the certificate was not granted. Efforts are underway to revitalize the project. Currently in 2009 there are 4 bamboo FSC schemes within China.

The assumption behind forest certification is that the consumer appreciates the inherent virtues of a certified product over uncertified products (Higman 2005). Certification is a market-based instrument that relies on a number of factors for success, namely demand, willingness to pay for the product and developed markets (Upton 1995). The costs of forest certification are borne by the *producer*, comprising of direct and indirect costs of preparation, auditing, compliance and maintenance of the certificate (Fischer et al. 2005). The initial aim of FSC was that price premiums would act as a lever to guarantee the marketplace (Cashore 2007). In Europe, however, certification has not produced the price premiums initially expected (Bass 2001; Rametsteiner and Simula 2003; Fischer 2005; Cashore 2007).

Large organisations benefit from economies of scale; Small Forest Enterprises (SFE) particularly in the South often find the expense of certification too high (Nussbaum 2002). The 'Goodwoods' project was a catalyst for change, directly influencing improved access to FSC certification for small producers with the development of the Small and Low Intensity Forests (SLIMF) standard. 'Goodwoods' discovered that conservation as a project goal is meaningless until project outputs are expressed in terms that are meaningful to the local communities' livelihoods (Le Quense et al. 2006).

Many positive aspects of forest certification are recognized, including increased market transparency, employment, wages and investment, forest planning, inventorying and a greater awareness of the multifunctional functions of the forest (Cashore et al. 2007). Although certification's ability to conserve biodiversity has been contested (Rametsteiner and Simula, 2003), many commentators support the assumption that certification benefits biodiversity (Gullison 2003; Cashore 2007).

Mutersbaugh et al. (2005) noted that certification may be evolving into another form of North–South inequality; less powerful producers in the South are pressurized into increasing production costs and reorganising their cooperatives, without guarantees of increased income or greater market access. The impacts of bamboo forest certification need to be considered regarding market barriers, capacity issues, potential advantages, disadvantages and the *true* level of empowerment granted to local communities.

4. Governance

Although certification is a non state market driven mechanism, it too works within the cultural context of the state. In China there are two striking examples of divergence from Northern ideologies: clientelism and environmental politics.

4.1. Clientelism

China (not uniquely) operates under complex forms of 'guanxi' (关系) or clientelism. Hu (2007) notes that 'guanxi' has two elements; firstly as a moral and social base for stable social order and secondly as a resource to seize economic opportunities through exchange. The later therefore translates more readily into Northern understanding of clientelism. Clientelism refers to a chain of personal bonds founded on mutual material advantage (Goldsmith 2003). Most actors do not act independently, but form links within a network, engaging in exchanges between local and national levels (Kettering 1988). According to Kaufman (1974), clientelism manifests itself in three ways. Firstly, actors are of unequal power and status, secondly, reciprocity is the basis of the relationship. Finally, the relationship is particularistic and private, anchored only loosely in public law or community norms (Goldsmith 2003).

So what role does clientelism play in sustainable management strategies? Often some of the most disadvantaged, poor, isolated or under represented populations work within agriculture. In many countries bamboo is considered 'poor man's timber' (Belcher 1996). Over 90% of China's bamboo forests are located in upland or hilly areas, often inhabited by ethnic minorities, in

generally underdeveloped and poor areas (Lei 2001). Bamboo offers livelihoods to over 10 million farmers in China directly involved with bamboo production work, whilst millions are involved in processing bamboo products (Lei 2001). While clientelism can bring benefits to some living in poverty, it breeds inequity, excluding individuals without assets with which to negotiate (Goldsmith 2003).

Goldsmith (2003) raised a key issue of actor influence when implementing projects in an international development setting. To what extent are agricultural loans or implemented projects provided according to pull or influence, as opposed to being offered to people based on objective criteria of eligibility? Informal institutions, such as 'guanxi' that are created through market transactions give rise to considerable differences in the allocation of capital and distribution of resources according to how people form networks within markets (Hara 1996).

Governance reforms have frequently involved changing the scale at which institutions operate (Batterbury and Fernando 2006), however the commitment to cultural sensitivity within the governance agenda is often only extended to those ''compatible with capitalism and modern state structures'' (Abrahamsen, 2000). This returns to the value laden concept of 'good governance'. A distinction should be made between 'corruption' and local clientelism exchange and efforts should be made to identify and limit marginalization.

4.2. Environmental Politics

Over the next 20 years, China is anticipated to have the greatest impact on the world, become the largest importer of natural resources and the biggest polluter. China, India, and Russia are pursuing an alternative model of development to Western countries through *state capitalism* whereby the state plays a prominent role in economic management (NIC 2008). The sustainable development of bamboo as alternative resource has a key role to play in the changing landscape of climate change uncertainty and resource scarcity. In Chinese terms, '*socialism with Chinese characteristics'* is moving towards land reforms whereby individual ownership of land will be the norm, with a pledge by the government to promote local level democracy under state control (Xinhua 2008).

When analysing environmental governance, China is a 'moving target' compared to other more established and less transitionary OECD environment institutions (Mol and Carter 2006). Environmental interests are being introduced in China in three ways: Firstly subsidies on natural resource prices are increasingly being abandoned. As of 2007, China adjusted export rebate policy on 2,831 commodities (37%) of items subject to customs tax. The aim was to ease friction between China's trade partners, and optimize the structure of export commodities (Smith 2007). A reduction in China's new export tariff rebate rate for flooring (including bamboo) by 8% is estimated to cause a 20% rise in costs to China's flooring industry. Experts suggest that some enterprises only make 10-20% profit, and others profit solely from the export tariff rebate (INBAR 2007b).

Secondly, there have been attempts to increase environmental fees and tax reductions, to initiate the 'polluter pays' principle. Finally, environmental and health dimensions of products are being taken into account with the ascension into the World Trade Organisation (WTO) which has led to embracing ISO and eco-labelling as common practice for export markets (Mol and Carter 2006) and quality standards for domestic products. Some businesses can hope to gain through premiums where income has been lost through subsidies removal. In particular bamboo flooring factories can hope to add value through certification and environmental standards.

China has a diverse historical conceptualisation and philosophy towards the environment with 'the unity of nature and man' (天人合议), Mao's mantra of 'man must conquer nature' (人定胜天) and contemporary 'ecological modernisation' (生态文明). As with the industrial revolution in the Northern hemisphere, the Mao years demonstrated the environmental costs of the belief of an oppositional relationship between humans and nature, contributing directly to deforestation, desertification and ill conceived engineering projects affecting waterways (Shapiro 2001). Historically since the 'opening up' of China in 1979, China has focused on 'the four modernizations' of economy, society, politics and culture (in which nature is absent). In 2007 *The China Modernization Report 2007: Study on Ecological Modernization* was published. Whilst no 'optimal' model for ecological modernization was presented, distinctions were made between the 'idealist European model', the 'pragmatic North American model', and a 'realistic model' (for newly industrialized countries). NGOs are less relevant in ecological modernisation processes compared to Western societies (civil society has only a recent history of NGOs with the sector being predominantly GONGOs (Government Organised Non Government

Organisations)). Modernisiation is primarily limited to the technological and economic dimensions of sustainable development, with limited reference to equity, equality, and empowerment (Zhang et al. 2007).

5. Discussion

No solution to the world's environmental problems is possible without China (Shapiro 2001). By considering the cultural, economic and natural roots of bamboo, this paper focuses on the social, economic and environmental foundations of sustainable development. Two key areas of enquiry arise from the sketch of bamboo management and the operative framework in China: firstly, the predominance of neoliberal market norms and secondly the need for a cross-cultural pluralistic approach to conservation involving considering the implications of categorisation. The predominance of Northern based agendas and mechanisms need to be considered whilst analysing the agency of conservation actors, regarding their perceived or implicit power.

5.1. Neoliberal market paradigm

There is growing momentum to valuate ecosystems and biodiversity through the market using certification and trading systems. In environmental sustainability, financial discount rates are shifting towards social discount rates which engage in ethical aspects (European-Communities 2008). New approaches to create trading schemes are arising such as 'Reducing Emissions from Deforestation and Degradation' (REDD). Trading mechanisms are complex, but the onus would be on companies rather than individual consumers to bear costs. The 'credit crunch' will invariably have an impact on the willingness of consumers to opt into corporate social

responsibility driven, price premium markets such as FSC, therefore trading certificates may become a preferred solution. The aim of trading mechanisms is to make the resource worth more in the natural environment than as a converted product. It is unclear at this stage which economic model would be preferred by bamboo farmers, since neither bamboo as a carbon trading resource nor as a certified product are established. Discounting, however, gives rise to "the optimist's paradox". The assumption of growth (measured by GDP) justifies using more resources and polluting more (Martinez-Alier 2008).

Although globalisation already affects many bamboo farmers in China, the coupling of nature into mainstream markets through certification or carbon trading could have resonance. China, along with the globe, is currently trying to decouple the carbon-economy relationship (Zhang 2000). Agricultural economists should consider the multidisciplinary relevance of 'blueprint' approaches, critically assess the coupling of *nature* and the *economy* within the current climate and consider the different 'capitalist' models emerging and the implications for valuing systems.

5.2. A Cross-cultural pluralistic approach to conservation

Callion and Degeorges (2007) noted that however good the intentions of those who promote biodiversity blue prints, issues are invariably simplified, leading communities to be "judged" according to criteria which reduces their life to an estimation of its environmental benefits. Local populations can go as far as "reformatting" (Michon 2002) their political claims and practices in order to benefit from funding organizations (Caillon and Degeorges2007).

Culture, history and politics are fundamental to the design of approaches (Berkes 2007). Although principles and criteria of FSC are guidelines, local interpretation is limited. Regardless of the scheme, local understanding is vital. This has been shown to be lacking in the previous FSC bamboo certification schemes. China has a state led environmental politics, which although having environmental modernization at the core, primarily focuses on economics and technology. The three economic modes of dealing with environmental politics in China present a pragmatic conformist view of environmental management, not entirely different from Western modes of practice. Nationalism in the Chinese state vocabulary is on the rise however promoted by both the Communist state and intellectuals (Zhao 2003), as China develops a stronger voice in global politics, China may carve out an alternative development ideology, not demonstrated thus far with their pragmatic realist approach (Alagappa 2003). Conservation actors, their role and their relative influence in clientelist networks need further research and understanding, beyond potentially inaccurate 'corruption' branding.

6. Conclusion

The bamboo sector is one of the fastest growing forest land uses in China. Intensification of management has led to biodiversity loss, erosion and depletion of soil nutrients. Bamboo is rooted deeply in Chinese culture, through the language, culture, civilisation, science and daily life. Bamboo is a grass with shallow root systems, physiologically relying on mixed forestry on sloping land to access water resources and maintain the soil. This research shows the move towards certification for bamboo globally, but highlights the lack of culturally embedded enabling environments for the protection of bamboo, a potential key substitute for timber, cotton,

construction material and edible product. In a world of finite resources, mechanisms for the conservation of biodiversity and soil resources for small scale agro-forestry need to be created as the search for substitute resources expands. Two key areas of enquiry arise out of this paper: the predominance of neoliberal market norms and the need for a cross-cultural pluralistic approach to conservation which does not rely primarily on Northern based agendas and mechanisms. The importance of conservation actors, in terms of their perceived or implicit power and the adaptability of 'blue print' approaches within the cultural framework in which they are framed are key areas for further research.

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