

1. Introduction

Brazil is one of the BRIC (Brazil, Russia, India, China) countries. The 21st century is heralded to be the century of the BRIC countries. Brazil is set to experience one of the fastest economic growth rates in the world. Together with this is the increase in its insatiable demand for energy which, if not coupled with increased energy efficiency efforts or discovery of new sources, would put immense pressure on the energy economy. Home to the Amazon rainforests and numerous other forest covers, wood has figured to be an integral energy source in Brazil since the olden times. Now, there is renewed interest in the Brazilian woodfuel production system and these papers highlight the importance of developing a standardization process of fuelwood and charcoal production to ensure renewability and long-term sustainability. They examine both urban and rural consumption trends, trace the production chain, and select certain industries to showcase the possible promise of fuelwood utilization and the peril of charcoal consumption. By briefly discussing two past certification processes of forest management and chain of custody, these practices are linked to the possible development of criteria and indicators for the woodfuel industry.

Guyana is a tropical country in South America and has a high forest cover of over 75%. Yet because it sits on a landscape with readily available fossil fuels, fuelwood only accounts for 7% of total energy usage which is atypical for a developing country. However, three decades ago, there was a large fuelwood industry in Guyana and today, despite its low share of total energy, fuelwood still figures to be a significant localized source of energy and income. On the other hand, charcoal production in Guyana is robust as it produces to fulfil both local and export demand. Charcoal is mostly from the secondary forests, and made using the adoption of the pit tumulus and portable kiln methods. Farmers, loggers and professional producers constitute the suppliers of charcoal, and outlining the supply sources and analysis of particular units in the production processes have resulted in several recommendations put forth by the researcher for the Guyana woodfuel industry.

Nepal is land-locked and despite being nestled between economic powerhouses India and China, is still one of the least developed countries in Asia. In an effort to improve Nepali standard of living, bettering access to clean and affordable energy is part and parcel of this quest. Traditional biomass fuels, including fuelwood and charcoal, comprise the bulk of national energy consumption and the slow national development means that this trend will persist in the near future. Nevertheless, energy policies and institutions have so far failed to provide due attention to such integral part of the national energy economy. This paper calls for a paradigm shift of national energy policy by instituting criteria and indicators of sustainable woodfuel production systems. It builds upon the momentum of the development of specific criteria and indicators for community forestry and forest management developed under the auspices of the ITTO. The C&I should incorporate the sustainable management of both the forest source and the woodfuel product in order to truly ensure long-term systemic sustainability. Probing the prevailing woodfuel production system in Nepal provides a clearer picture of the challenges and opportunities for policy makers to enact regulations in select areas which will be outlined later on.

Tanzania derives approximately 92% of its energy from fuelwood and charcoal, this group of woodfuels is an integral part of the national development agenda and the daily lives of citizens. More recent concerns on global warming have increased the scrutiny on the environmental sustainability of resource management practices. In

Tanzania, the rapid deforestation has been attributed to unsustainable fuelwood consumption particularly for agriculture and other small industries with charcoal production being charged for the degradation of woodlands. An analysis of the fuelwood production reveals the competitive and cooperative relationship of fuelwood with select industries. Furthermore, charcoal production has become one of the main rural economic activities due to the little expertise and capital required. Because of the presence of numerous small-scale producers, the large informal economy makes it hard to obtain official records on the producers and their volumes as evident in how 75% of the charcoal supply in Tanzania's largest city remains undocumented. The certification process that will be presented in the later section of the paper will incorporate such realities in the formulation of C & I for sustainable woodfuel production.

The Philippines being the second largest archipelago in the world that stretches over 7,107 islands, the Philippines is naturally endowed with a wealth of flora and fauna. Its lush forests provide various types of natural resources, among these are woodfuels. Nonetheless, woodfuels are also sourced from non-forest areas and areas that are "in-betweens." Woodfuels have figured to be one of the major sources of energy for Philippine households and industries, yet are also in the centre of debates regarding causes of deforestation and environmental degradation. Cognizant of the increasing importance of woodfuel as an energy source and the controversies surrounding them, this paper documents the various chains of the production system of woodfuels so as to develop a broader understanding of the issues and challenges in developing a system for sustainable management. Using anecdotal evidence from various parts of the archipelago and the case study of Cebu, the present woodfuel production system is mapped out with an analysis of pertinent issues that relate to production chain certification.

COUNTRY SUMMARIES

Brazil

In a world where the search for alternative fuels is the order of the day, Brazil is at the forefront of these discussions. Apart from being the second most forested country in the world, it also has huge potential in producing ethanol. Hence, this external and internal overemphasis on the development of alternative fuels has left energy policies for traditional sources wanting. Thirteen percent of the country's energy is derived from woodfuels, with the charcoal and fuelwood sectors employing over 235,000 people.

As such, the authors Noguiera, Coelho and Uhlig discuss the historical and contemporary narratives of charcoal and fuelwood production in Brazil in the hope of putting forth policy recommendations later on. Their discussions show that the concern for fuelwood production sustainability lies in the ability of select industries to implement good management practices. As households generally obtain their supplies from non-forest areas, they do not accelerate deforestation and desertification. Moreover, the pulp and paper industry may serve as a model of a fuelwood production and consumption sustainability program due to its present self-sufficiency and energy independence.

On the other hand, the major concern for charcoal is its concentrated production in dense pig-iron industrial areas which has accelerated the denudation of forests. To address this, the researchers sketch out several attempted solutions including

improved furnace technology and reforestation. In spite of the absence of a set of guidelines for sustainable forest management and in particular the non-existence of a set of Criteria and Indicators for sustainable woodfuels production, the government still played a significant role in affecting the market conditions of fuelwood due to the subsidization program and policies it instituted up until 2001. Hence, these papers provide the picture of the woodfuel sector including its political underpinnings in the hope of achieving a set of standards to ensure renewability and sustainability of the woodfuel system.

Guyana

There is a need for woodfuel baseline studies so that policy formulation particularly Criteria and Indicators for sustainable woodfuel production can be undertaken. According to the author, G. C. Clarke, the South American nation of Guyana is one of the few countries that exports charcoal to neighbouring areas. With its ready supply of fossil fuels, the country is neither a major supplier nor consumer of firewood. Nonetheless, this paper still asserts the importance of the production, transport, sale and use of firewood in Guyana as it contributes to the local energy and income. Moreover, the recent reports of increasing proportion of charcoal produced for exports may be a tell-tale sign of a new engine of growth. By documenting the firewood and charcoal production process, the researcher was able to show the relative small size of both industries judging from the licenses that were issued and the royalties that were collected. Despite firewood being officially recognized as a forest produce, the only regulations that persist are the required licenses and removal permits. As such, there is a growing concern of the sustainability of current woodfuel production system. In fact, the intensive exploitation of the *wallaba* forests for woodfuel extraction has been blamed for the severe degradation of this forest type. Hence, the researcher calls for more in-depth studies in quantifying the environmental repercussions of present practices and delve into the precise location of raw materials and obtain more information on socio-economic impacts.

Nepal

The set of Criteria and Indicators for sustainable woodfuel production in Nepal was culled from various documents particularly that of International Tropical Timber Organization (ITTO). The author, Tara N. Bhattarai, did a comprehensive review of the wood energy systems in Nepal in this case study. Accordingly, Nepal, being the youngest republic in the world, is the poorest, least developed country in South Asia. With it being in the early stages of development, the country still relies heavily on traditional sources of energy like woodfuels and biomass. Thus, woodfuels serve both as a revenue source and as an energy source. Nonetheless, despite statistics pointing to the Nepali economy being heavily reliant on traditional energy sources in the near future, present energy policies mainly focus on commercial energy sources. Hence, this paper stresses the need to establish a set of criteria and indicators for woodfuel production sustainability so as to address environmental and energy-security concerns. It charts and analyzes present wood energy systems and recognizes the inherent qualities of woodfuels derived from public and private lands. Because of the differences in land size, presence/absence of zoning regulations, and each type of forest ownership's long-term viability, two separate monitoring systems are needed.

The lack of information regarding the total volume and value of woodfuels from private lands traded in the market only allows the establishment of a framework based on product tracking and the transformation process, without really identifying the

source. On the other hand, since woodfuels produced by government lands are usually by-products and residues of the implementation of forest management plans, a multi-pronged approach of certifying the product as well as the source and process is possible, and highly recommended. In this way, economic, ecological and social concerns can be addressed. Nepal has had two previous forest certification systems with different goals and criteria; the new, suggested system aims to incorporate these two different goals of promoting international trade and ensuring environmental sustainability. The author recognizes that only with the concurrent certifications of the forests and forest products can there be a sustainable production of woodfuels – both economically and environmentally.

Philippines

By tracing the history and evolution of woodfuel production and consumption in the Philippines, the paper convinces readers of the importance of woodfuels (fuelwood and charcoal in particular) as an energy source for both households and select industries. Yet, as far as energy management and policy is concerned, it has often not been given due importance or in some instances even neglected. E. M. Remedio and T. G. Bensel's research shows that the Philippines have the sufficient amount of woodfuel resources to meet the immediate needs of the future. Claims regarding woodfuel demand outstripping supply thereby threatening our energy security are unfounded; instead, the challenge for the Philippines is to develop a framework to ensure a more sustainable harvesting of woodfuel resources in the country. With years of accomplished research coupled with her international organizational experience, the author is in a unique position to provide a critical analysis of the Philippine woodfuel production system. Her work provides an upbeat, optimistic view regarding the need to develop comprehensive legal, institutional and policy frameworks for a more sustainable woodfuel production system. Examining the criteria and indicators for sustainable forest management (SFM) adopted by the Department of Environment and Natural Resources based on the model created by International Tropical Timber Organization (ITTO), the paper outlines a number of recommendations for the development of a set of Criteria and Indicators specific to the Philippine Woodfuel Production. It calls for the synergizing of the various agencies that presently deal with woodfuels in order to create and formalize an institution whose main responsibility it is to oversee woodfuel production in the Philippines. At the end of the day, this research hopes to see the adoption of such recommendations so as to tackle this important challenge facing the Philippines today, and maybe even serve as a model for the development of sustainable woodfuel production systems in other developing countries.

Tanzania

The premise of this paper, as set forth by authors R. E. Malimbwi and E. Zahabu, is that the current woodfuel production practices are not sustainable and they are primarily responsible for tropical deforestation, hence there is a need to develop a certification procedure that emphasizes sustainability. Moreover, the importance of improving the current fuelwood production system in Tanzania stretches far beyond the ensuring of environmental sustainability. Understanding Tanzania's rural context where fuelwood gathering is done mainly by women and children, improving the system would mean freeing up the women for other employment opportunities and the children for schooling opportunities. The opportunity costs associated with fuelwood gathering are too huge to be ignored; hence, this research proposes a system of certification of forests and woodfuels that also keeps these issues in mind when formulating criteria and indicators

for sustainable woodfuel production. In the second half of the paper, limitations of an effective certification system in Tanzania are discussed and possible remedies are recommended.

CONCLUSIONS AND RECOMMENDATIONS

The five case studies showcase the fact that the status of forestry and woodfuels - be it fuelwood or charcoal – are all case specific and site specific. Some countries have drafted their Criteria and Indicators for sustainable woodfuels production; others are mid-way of doing so, while others, have not prioritized such task. Lack of political will, lack of disaggregated data, lack of technical expertise, social and cultural factors and even environmental implications have all coloured the case studies of the countries under study: Brazil, Guyana, Nepal, Tanzania, and the Philippines. Nonetheless, all agree that in order to sustain current production and consumption of woodfuels, policy is high on the list of must do. As such, the individual case studies are significant documentation efforts towards the promotion and implementation of sustainable woodfuel production in the years to come. FAO together with partners and collaborating agencies such as IEA need to strengthen and reinforce the commitment to pursue C and I work. Resources will have to be allotted and technical expertise need to be developed to ensure the success of such endeavour in the nearest future. Below are the case specific conclusion and recommendations for the five countries represented:

Brazil

Despite the lush forested areas in Brazil, the scarcity of wood still exists and there is no bioenergy policy that deals specifically with wood energy sources. As such, the paper outlines the regulatory, economic and fiscal recommendations for the sustainable production of Brazilian woodfuels.

There has to be long-term targets and timelines to increase the supply and lower the cost of the planted wood which are used directly as energy source or converted to other forms such as charcoal. To aid the collection of supply and demand statistics, there needs to be a national wood energy information system that gathers and publishes the relevant data. A breakdown into regional statistics can further enhance the predictability of long-term market conditions and places producers, consumers and policy-makers in better positions to respond.

Furthermore, the establishment of standards and practices on wood energy systems reinforces the direction of certification. Such principles should help increase the forested area in Brazil and develop forest management techniques in line with modern ecological strategies. An adoption of forest zoning with sustainable management in select areas can help the continuity of wood supply to charcoal producers as this protects some forested areas from being subsumed by agricultural expansion.

Another step that could be taken to move towards a more sustainable woodfuel production in Brazil is to promote the research and development of improved technology. Universities and other research institutions can delve into the respective situations of forests and woodlands in order to pinpoint the stressed areas.

To support such steps, strict enforcement of set regulations on the transport and use woodfuels is necessary. Broader surveillance against illegal deforestation and corruption can strengthen enforcement efforts. Better equipped personnel and a

stronger legal framework is required to underpin such stringent implementation, although the lack of local capacity building and adequate funds may be constraints.

To sum it up, this study highlights that residential woodfuel usage is not relevant and some industrial sectors are even energy self-sufficient. Nonetheless, the presence of select industries whose efforts seriously undermine the sustainability of woodfuel production calls for the proactive approach towards policy-making. A holistic energy policy needs to recognize the pervading importance of woodfuels in households and industries.

Guyana

The enduring importance of woodfuels in Guyana dictates the need to institute sustainable management practices of these resources. Although firewood only comprises 3.5% of the total timber produced in 2006, a closer examination of the socio-economic circumstances of the people in Guyana drives home its continuing importance to the country's economy. Moreover, charcoal production serves as a means of livelihood for a lot of local community members. Reports of increased Guyana charcoal shipped overseas highlight the sector's long-term potential for expansion, generating jobs and alleviating the pressure exerted by the energy demand of a burgeoning economy. Efforts to encourage this expansion are laudable, yet this should be kept in check with sustainability standards in mind.

Even though environmental repercussions are still difficult to quantify, there is a growing consensus among experts that the charcoal and firewood sub-sectors have contributed to the degradation of certain forest types. As these forests are relatively fragile and easily accessible, the actions of the industry produce quite significant environmental repercussions.

To tackle such environmental sustainability challenges, there needs to be more conscious efforts in pinpointing the exact location of woodfuel sources and quantifying the amount of trees cut for private, domestic purposes. Despite the fact that there were only nine firewood dealers in 2006, the fact that most cutting was done by smaller, independent cutting units made monitoring the dealers' actions not that effective. Moreover, reserve areas may be established within white sand forests in order to preserve the unique ecosystem and to safeguard water supply. The rehabilitation of forest cover and development of a forest fire protection plan are also recommended actions for forest management officials.

In developing a comprehensive woodfuel energy policy, the present size and attributes of wood resources should be coupled with the long-term vision of how the sector would look like. Such a policy framework can serve as groundwork for a national management plan for woodfuel production, which includes criteria and indicators for sustainable woodfuel production and protocols for proper monitoring and feedback.

Nepal

In conclusion, there needs to be a system put in place that certifies the overall management of the forest. This means that there has to be simultaneous certification of the source and the process to ensure the sustainable production of woodfuels. The set national standards can help ensure the long-term sustainable supply of important firewood and charcoal for trade. Since Nepal has woodfuels produced from public and private lands, the underlying differences in attributes between two sources necessitate two separate monitoring systems.

With regards to the certification of sustainable woodfuel production from public lands and their trade, it is possible to undertake it at the Forest Management Unit (FMU) levels. The principles, criteria and indicators identified for the certification of community forest management can serve as a guide for the development of similar principles, criteria and indicators for the certification of sustainable woodfuel production for trade. The pursuit of SFM is a long-process, yet the productive function of forests cannot be stopped indefinitely while SFM is being developed. Instead, an approach that could be taken is to first identify the standards that the country would adopt in the SFM certification and then establish C & I for its monitoring. Such C & I should include common elements of the C & I outlined by groups at the regional and global level. Furthermore, the huge amount of financial and technical resources used in its development would require outside assistance. The development of a certification system admittedly is a long process; hence a plausible short-term approach would be to ensure the sustainable production of certain forest products like fuelwood and charcoal harvested from public lands.

On the other hand, private forest management is more complex. The recommendations put forth by the present study is only directed to government-managed forests and based on the premise that forest certification is only a step towards initiating a SFM certification in Nepal. Moreover, they also do not apply to the certification of sustainable production of indirect woodfuels and those recovered from all sources, and charcoal. Such processes need a separate “chain of custody” monitoring system – one where the transformation and transportation of the products are tracked. In the process of developing the abovementioned standards, particular attention should be given to ensure illegally harvested products do not get mixed with the regulated ones. This product tracking system coupled with the principles, criteria and indicators for the sustainable production of direct woodfuel from government lands support the ongoing efforts of promoting SFM in Nepal.

On a macro-scale, it is possible to engage the services of an accredited international certifier for the initiation of forest certification albeit this is oftentimes expensive. As an alternative to this expensive approach, the country has established the Nepal Foresters’ Association (NFA), a national working group comprising important stakeholders to come up with a flexible set of national certification standards. Tasked to devise and test an economical and practical forest certification system that matches FSC standards, it tapped on the UNDP/GEF Small Grant Program to further this initiative. This development of a national authority of forest certification allows the organizing of national initiatives while making good of commitments made by Nepal to regional and international agencies. With a national certifying infrastructure in place, the NFA can then apply for accreditation from an international certifying agency.

This study recommends that the NFA consider the proposed principles, criteria and indicators both for the certification of government managed national forests and forest plantations and CF, and for the certification of private forests, TOF and indirect woodfuels outlined in this study.

Philippines

Woodfuels are still a very important energy source in the Philippines. A number of industries and majority of households rely on fuelwood and charcoal for both primary and secondary energy sources. Users are predominantly low-income households, where fuelwood and charcoal trading also serve as revenue streams for urban and rural households alike. In rural areas, about 70% of households gather fuelwood for

free from the surrounding, non-forest areas. Hence, it is because of fuelwood's free nature that efforts by the DENR to introduce more efficient cookstoves may be resisted by the locals.

Despite the fact that fuelwood and charcoal figure to be a major alternative to imported energy, the Philippine energy plans fail to factor in the integral role of woodfuels in the country's energy economy. Guidelines linking woodfuel requirements to the management and development of energy resources are also absent. Moreover, there is no specific institution that is directly responsible for overseeing and coordinating woodfuel related programs and research. This leads to the lack of information regarding both the aggregate and localized supply and demand of woodfuels. Such a scenario leads to some resource-rich provinces having underutilized fuelwood resources, while other Category I, II, III provinces may encounter shortages in the short-term. Aside from the absence of a central coordinating agency, the preference for fuelwood over other biomass resources can also result to over-exploitation of primary fuelwood resources. Consequently, many rural areas possess surplus and underutilized secondary biomass resources.

It is also important to note the limitations of the trade of woodfuel resources. Aggregate demand and supply may balance out, yet the spatial distribution of supply and demand and ensuing transportation costs may limit this aggregate model. As such, a spatial variation to woodfuel sector policies must be practiced to recognize such location-specific characteristics.

A closer look at biomass conversion technologies reveals that there are no constraints to their availability. However, the currently used technologies are inefficient as there is no institution spearheading the research efforts of such cost-sensitive technologies. Albeit there are a number of improved technologies for charcoal production, the majority of charcoal is still produced using old, inefficient methods in underground pits or above ground mounds. Such inefficient production and use of charcoal as a biomass fuel may compromise the resource sustainability of fuelwood, unless conversion technologies are further improved. This harks back to the need to re-evaluate present charcoal production policies and programs, and further underscores the need to establish a formal institution whose main responsibility is to oversee the woodfuel sector.

Presently, the Philippine Forestry Sector is working out guidelines and schemes to implement the C & I system for Forest Certification. Such a system applies to the forest and forest products, yet the majority of woodfuels are produced in non-forest, small farm management units. As such another set of C & I is needed to certify woodfuels from agricultural and non-forest lands.

Several indicators still continue to fall short of compliance with the present Philippine C & I system as they only apply to the national level but not at the forest management unit levels. Policies, laws and regulations pertaining to the governance of forest management exist and are implemented only on the national level. Moreover, institutions that oversee sustainable forest management are poorly structured and staffed at the FMU levels. At the local level, there is also no process of identifying and protecting endangered flora and fauna, which also means the absence of biological corridors and stepping stones that connect protected areas. The percentage of total forest area devoted for the protection of soil and water at the FMU levels continues to fall short of the compliance of the Philippine C & I System. Furthermore, the indicator pertaining to value of the national forestry sector to the GDP is still under consideration.

Tanzania

The need to develop a certification procedure for woodfuel production that emphasizes sustainability has never been stronger. Deforestation has largely been attributed to the unsustainable woodfuel production techniques currently adopted, so the paper puts forth several recommendations that address the current limitations of the system.

An important research area would be on the development of standards for woodfuel forest management as the dearth of management plans leads to the lack of reliable data and forest inventory. With more actionable data accompanying efforts to engage forest practitioners, these practitioners are in a better position to evaluate and monitor the management practices.

Important institutional capabilities need to be developed, and wherever present, strengthened. The cost of the certification process balloons due to the lack of local certifying agencies as the government has to tap on services of expatriates. Furthermore, the weak enforcement of land tenure and user rights lead to occasional disputes which hamper the certification of the land. Certification is admittedly still a new concept in Tanzania; the only national project that has certification as a prerequisite has not achieved its goal to date. The complexity of the certification process further reinforces the need to develop formal institutions to accelerate the process.

As a final step to ensure long-term sustainability, a market for certified woodfuels needs to be developed. The current practice of extracting woodfuels from unmanaged forests makes it possible to get them for free. As such, the more expensive certified wood and charcoal may not be a viable alternative from the users' point of view. Hence, research on more efficient woodfuel production and distribution techniques can help certified woodfuels become a more viable alternative.