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Forests, women and health: opportunities and challenges for conservation

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SUMMARY

Health issues of forest women in developing countries merit more serious attention. This paper reviews existing literature on the interface of women, health and forests to highlight conservation opportunities and challenges. Most women in forests are collectors and users of forest species. However, existing conservation efforts, deforestation, poor health services and household responsibilities can intensify health and safety concerns for forest dependent women. Women are likely to bear the strenuous burden of carrying fuelwood (and other forest products) long distances and inhaling smoke while cooking. The burden of unintended childbearing, diseases and cultural issues can compound their health problems. To improve local livelihoods and environments, some organisations have initiated activities that integrate conservation and human health objectives, including family planning. This article provides project examples, where the involvement of women has been identified as a key component in effectively meeting both conservation and development goals.

Keywords: women, human health, forest conservation, fuelwood, integrated projects

Forêts, femmes et santé: défis et opportunités pour la conservation

M. WAN, C.J.P. COLFER et B. POWELL

Les questions de santé des femmes vivant dans la forêt dans les pays en voie de développement méritent une attention sérieuse. Cet article examine la littérature existante sur les questions liées des femmes, de la santé et de la forêt, pour souligner les opportunités et les défis qu'elles lancent à la conservation. La plupart des femmes vivant dans les forêts récoltent et utilisent les espèces forestières. Cependant, les efforts existants de la conservation, la déforestation, les services de santé faibles et les responsabilités de ménage peuvent intensifier les soucis quant à la sécurité et à la santé des femmes dépendantes de la forêt. Il est probable que ce soient les femmes qui doivent soutenir le fardeau écrasant du transport du bois de combustion et d'autres produits forestiers sur leur dos sur de longues distances, ainsi que l'inhalation des fumées durant la combustion et la cuisine. Le fardeau des grossesses non prévues, des maladies et des questions culturelles peut aggraver leurs problèmes de santé. Pour améliorer l'existence et l'environnement, certaines organisations ont créé des activités intégrant les objectifs de conservation et de santé, en incluant le planning familial. Cet article fournit des exemples de projets où la participation des femmes a été identifiée comme étant un élément clé pour parvenir à atteindre efficacement les buts de conservation et de développement.

Bosque, mujer y salud: oportunidades y retos para la conservación

M. WAN, C.J.P. COLFER y B. POWELL

El tema de la salud de la mujer que trabaja en el bosque en países en vías de desarrollo merece ser considerado más seriamente. Este artículo es una revisión de la literatura existente sobre la interacción de la mujer, la salud y el bosque con la que poner de relieve oportunidades para la conservación y los retos existentes. La mayoría de mujeres que trabajan en el bosque son recolectoras o utilizan las especies forestales. Sin embargo, los esfuerzos de conservación actuales, la deforestación, los servicios de salud deficientes y las responsabilidades del hogar pueden aumentar la preocupación existente sobre la salud e higiene de las mujeres que dependen del bosque. Las mujeres sufren habitualmente la carga agotadora del acarreo de leña (y otros productos forestales) a largas distancias y el respirar humos al cocinar. Sus problemas de salud pueden agravarse con la responsabilidad de hijos no planeados, las enfermedades o por razones culturales. A fin de mejorar los medios de subsistencia y el medio ambiente local, algunas organizaciones ya han iniciado esfuerzos que integran los objetivos de conservación con los de la salud humana, incluyendo la planificación familiar. Este artículo proporciona ejemplos de proyectos en los que se ha identificado la participación de la mujer como un componente clave para alcanzar de manera efectiva tanto los objetivos de conservación como los de desarrollo.

INTRODUCTION

Although a number of gender-related issues have garnered the attention of policy makers and researchers, health issues of forest-reliant women in developing countries merit more serious attention. Within forestry particularly, the multiple forest functions that intersect with women's lives have been comparatively ignored. The literature discussed here comes from divergent fields and represents the tip of a substantial knowledge 'iceberg' fairly inaccessible to foresters.

Here we introduce existing literature on the interface of women,¹ health and forests to highlight conservation opportunities and challenges. Resources important to most forest women include fuelwood, fodder and foods. In many regions, women are the ones responsible for collecting these for their families' subsistence needs and/or cash income. They are likely to bear the arduous burden of carrying firewood long distances,² as well as inhaling smoke from cooking. Due to the minimal availability of health services and the burdens of household responsibilities, forest dependence can also intensify specific health and safety concerns for women. Unintended childbearing and expanding family sizes can compound health problems. Women's customary use of fuelwood, forest medicines, fibers, fruits, vegetables and bushmeat makes them repositories of considerable ecological knowledge (see e.g., Boer and Lamxay 2009, Eyzaguirre 2006, Johnson and Grivetti 2002). Relevant traditional knowledge and strong forest-reliance can together provide a compelling rationale for forest conservation; and external acknowledgement of these facts can contribute to better collaborative management of such resources. In an effort to improve local livelihoods and environments, some organisations have begun to integrate conservation and human health objectives, including family planning (e.g., Africa Biodiversity Collaborative Group, Population Action International, WWF; examples in Boxes 2–5).

Women, as half of the human global population, represent a huge potential human resource. Tropical forest women³ tend to have access to virtually no labour-saving devices and lack the possibility of limiting their reproductive roles. This has meant that huge amounts of female creativity, energy and knowledge have not been accessible to those trying to manage forests more sustainably or protect forest areas more effectively. Additionally, because women tend also to be responsible for the care of sick family members, they have a special interest in improving the health of their communities. Our experience suggests that efforts to provide birth control and to improve local health represent powerful incentives for local women to become involved in conservation efforts.

Here, we first introduce the global relevance of the issue. The second section outlines some examples of issues that affect the health of women in forests (some directly forest-related, some not, but important for those working in forest conservation to be aware of), and the final section explores the links of these realities to conservation, using specific examples.

GLOBAL RELEVANCE

We highlight two related global concerns: the first is the eight Millennium Development Goals (MDGs) identified in September 2000 (see Box 1). Global actors were encouraged to make them a reality by 2015.

Four of the eight goals are directly related to human health (MDG 1, 4, 5 and 6); and two are specifically related to women (MDG 3 and 5). Ten years have passed, yet adult female mortality rates in developing countries are still far higher than in developed countries (Table 1).

BOX 1 *Millennium Development Goals*

- MDG 1: Eradicate extreme poverty and hunger
- MDG 2: Achieve universal primary education
- MDG 3: Promote gender equality and empower women
- MDG 4: Reduce child mortality
- MDG 5: Improve maternal health
- MDG 6: Combat HIV/AIDS, malaria and other diseases
- MDG 7: Ensure environmental sustainability
- MDG 8: Develop a global partnership for development

TABLE 1 *Female mortality rate per 1,000 females age 15–60 years*

	Mean	Median	Std. Deviation
Developing countries			
1990	213	187	102
2000	216	178	124
2007	209	164	134
Developed countries			
1990	80	75	24
2000	67	62	20
2007	59	54	21

Calculated from: WHO Data 2010

¹ The category 'women' encompasses a huge range of behaviour, knowledge, and interests (see e.g., Leach 2007). Yet there remain sufficient patterns and tendencies among women, vis-à-vis men that some level of generalisation is justified (a level we try not to exceed).

² Such a burden varies substantially by forest type and human settlement patterns – greater in dry forests (e.g., East and North Africa, parts of India, eastern Indonesia) and in resettlement areas that cluster people too densely (e.g., parts of Indonesia, Laos).

³ By 'forest women' we refer to women living in/around forests, whose lives are directly dependent on it and/or have significant impacts on it.

The second global issue of relevance derives from our observations of change in the world's climate. Our emphasis on change has meant that concepts like *dynamism*, *resilience*, *uncertainty* and *future trends* have become increasingly common. These are concepts that apply at the global and landscape levels, but also pertain to women's lives. As we examined the literature and our own substantial experience of

rural forest women and their lives, we were struck by the repetition of patterns; the specifics, the locations and times may change, but similar patterns frequently recurred elsewhere, later. Although ten year old research might no longer represent the studied reality, its findings were often relevant for women in other areas and at different times. Older studies remained useful in highlighting forest women's problems and

BOX 2 *"A Bagagem das Mulheres da Floresta" of the Secretary of Women Extractivists*

The rubber tappers movement in Brazil helped to catalyse a profound shift in perceiving environmental and human rights goals as inherently intertwined.

Realising the growing importance of women in the social movement, in 1995, the National Council of Rubber Tappers (CNS) created the Secretary of Women Extractivists specifically to treat questions relating to forest-reliant women. Strategically, the Secretariat chose health as its entryway to women's issues, as health issues are generally not perceived as threatening to men. In addition, an extreme lack of basic education and health care in remote areas of Amazonia had left women isolated, ignorant and fearful about basic health issues. Given the strong prior tendency for community meetings to be male-dominated, the mere chance for rural women to meet and discuss health concerns was a huge conquest.

Today, one of the foremost projects of the Secretariat, "Bagagem das Mulheres" (the Baggage of Women) is signifying all the knowledge which women hold as well as the tools in the forms of books, videos and workshops that the project brings to them. Workshops focus on health care, prevention of sexually transmitted diseases, family planning, environment, raising income through forest products and community organisation. From 1995 until 2011, the project has conducted 430 workshops reaching each of the over 80 conservation units in remote regions of Amazonia.

In 2009 the project received the Chico Mendes Award for Health and Environment in Acre, as well as the Award for the Defense of the Human Rights of Women in the United Kingdom. The project has also worked closely with the Ministry of Health in a massive effort in which they successfully amended public health policy and nomenclature to include, "forest populations". Since its founding, female leadership within extractive reserves has grown; seven women are currently Presidents of Conservation Units. And after years of deliberation, the name of the National Council of Rubber Tappers has recently been changed to the National Council of Extractivist Populations, to include not only collectors of all types of forest products, but also – women.

[Courtesy of Fatima Cristina da Silva, CNS]

BOX 3 *Linking Conservation and Human Health in West Kalimantan, Indonesia*

The forests of Gunung Palung National Park in western Borneo, Indonesia, are some of the most biodiverse – and threatened – in the world. Just as tenuous is the health of people living among them. Women, in particular, are vulnerable to lung disease from cooking with wood, and that problem can worsen when human-induced forest fires blanket large areas in smoke. Remote villages and bad roads make it costly and difficult to access health care, whether for routine visits or for emergencies like complicated childbirth. And those emergencies can ruin an extended family's finances. To make money, some people turn to illegal logging. Others burn the rainforest to clear new land for pesticide-laden crops and plantations. But in damaging the forest, people hurt themselves; clean watersheds become contaminated and floods damage fields and roads and accentuate disease. Thus, environmental destruction, poverty, poor access to and high cost of quality health care, lack of knowledge, and transportation problems are all linked in a vicious cycle.

Enter Alam Sehat Lestari (ASRI), an Indonesian NGO whose name means "healthy nature everlasting." Based beside the national park in the town of Sukadana, ASRI seeks to interrupt that cycle and return Gunung Palung's forest and communities to a healthier coexistence. A survey, conducted early on, showed the villagers spending some \$145 yearly on food – lower than what they spent on cigarettes (\$297) or healthcare (\$209). One of the reasons for the high health care costs was the lack of nearby access. Building on the villagers' requests, ASRI first began running a high-quality health clinic and mobile clinic; it offers free birth control and inexpensive diagnostics and medications, as well as ambulance service. Second, it offers people incentives to stop illegally logging, in the form of discounts on health care as well as training in organic farming. Third, ASRI offers eco-friendly and conservation-promoting work opportunities. Patients and their families may pay with non-cash means, such as manure for the clinic's garden or seeds for its reforestation site. Widows are eligible to receive goats, which provide them with manure, and a measure of economic independence.

Environmental destruction and human disease are exceedingly complicated problems, but they are linked. ASRI believes that spotting and protecting those links between people and nature is the key to securing good health for both.

[Prepared by Jenny Blair, ASRI]

opportunities pertaining to health, in providing insights for foresters who struggle to incorporate gender and health into forestry research/management strategies.

Writing this article has demonstrated the degree to which useful materials were spread among diverse literatures, using hugely divergent vocabularies and methods, with vastly different goals. We found, for instance, the health literature to be biased toward urban settings; the forestry literature to be biased toward men's behaviour and knowledge; and many gender studies (like the health research in fact) neglect to indicate the habitat of the study population.

With these concerns and constraints in mind, we selected four topics that are important in the lives of women living in tropical forests. We provide a smattering, a potpourri, of interesting topics, with important real-life implications for human well being and forest management.

Our selection has built on our observations of women's lives, over a combined 45 years of field experience in the forests of Africa, Latin America and Asia. We have not chosen to emphasise *poverty* per se (despite the acknowledged

shortage of financial resources among these populations), because of our sense of the disempowering effect of such an emphasis (Escobar 1995), in global discourse. It stresses the weaknesses rather than the strengths in populations under study; and unlike more specific observations, as identified here, an emphasis on poverty provides few insights or hints for constructive action.

We have defined 'forests' broadly, focusing on the forests of the developing world. We include the emblematic tropical rainforests of the Amazon and Congo Basins, of Borneo and New Guinea. But we also address women's lives in the dry forests of eastern and southern Africa, the Sahel, parts of India and eastern Indonesia. From a human perspective, we have looked at the lives of hunter gatherers, swiddeners, frontier dwellers, resettled populations, inhabitants of parks, refugees – any women whose lives depend on and/or affect forests. We have used such a broad brush partly to introduce foresters to the breadth of disciplines with 'something to say'; but also because of the paucity of materials; the issues identified beg for further study and attention.

BOX 4 *Linking Women and Forest Benefits through Improved Stoves*

Improved household energy practice (i.e. using improved stoves) have been linked with the MDGs, including the goals related to betterment of women and forests:

MDG 3: Promote gender equality and empower women

- Alleviating the drudgery of fuel collection and reducing cooking time will free women's time for productive endeavours, education and child care.
- Reducing the time and distance that women and girls need to travel to collect fuel will reduce the risk of assault and injury, particularly in conflict situations.
- Women's involvement in decisions about household energy promotes gender equality.

MDG 5: Improve maternal health

- Reducing indoor air pollution will alleviate chronic respiratory problems among women.
- A less polluted home can improve the health of new mothers who spend time close to the fire after having given birth.
- More accessible fuel sources can reduce women's labour burdens and associated health risks, such as prolapse due to carrying heavy loads.

MDG 7: Ensure environmental sustainability

- Where biomass is scarce, easing the reliance on fuelwood through more efficient cooking practices will lessen pressures on forests.
- Using cleaner, more efficient and convenient fuels (such as natural gas and electricity); and improved stoves can increase energy efficiency and decrease greenhouse gas emissions (Rehfuess 2006).

In Nepal, a Population, Health and Environmental project introducing the use of improved cook stoves reduced consumption of firewood by 4,804 metric tons per year (or about 12,000 trees), and dramatically reduced the number of cases of acute child respiratory infections (D'Agnes 2009).

When women of Bonfi in coastal Guinea use the Chorkor oven, which requires less fuelwood than traditional stoves, to smoke their fish, the women found they had extra time to attend literacy classes, because they spent far less time stoking the fires (Anoko 2008). This oven not only reduces fuelwood and labour requirements, but produces better quality smoked fish that can be stored for a longer time, and thus can also be sold when prices are higher (Kleter 2004, UNDP 2001).

Roy (2008) reported that women around Chunati Wildlife Sanctuary (Bangladesh) who used improved stoves which created less indoor air pollution and increased energy efficiency collected forest fuelwood less often and in smaller amounts, compared to those who used traditional stoves.

A SAMPLING OF ISSUES LINKING WOMEN, HEALTH AND FORESTS

Although many of the problems discussed here also affect women beyond forests, remoteness and shortages of household resources tend to increase the severity of any particular problem *in* forests. National health programs prioritise areas where their ‘health dollars’ will go furthest, making serving sparsely-populated forest areas difficult (e.g., Cunningham *et al.* 2008 for Africa; Ali 2008, Persoon 2008 for Asia; Goicolea 2001, Oliveira 2005 for Latin America). Forest women typically have fewer economic resources, and less control over shared resources, than their husbands, and therefore even less access to any available formal medical care (Allotey *et al.* 2008). Forestry institutions, though in recent years recognising some responsibility for the well being of people living in forests,⁴ have traditionally ignored health and food security issues.

We have selected four disparate categories designed to reflect the range of issues that affect women’s health in forests. These are forest resources, reproductive matters, diseases and culture.

Forest Resources

This section focuses primarily on the collection and use of fuelwood⁵, however the issues are similar for collection of fodder and wild plant food resources. These topics demonstrate how living and working in/near forested areas and the loss of forest resources can adversely affect women. They serve as an entree into a broader range of issues linked to forests and their use – specifically nutritional adequacy, health dangers related to the collection of non timber forest products (NTFPs) for subsistence and sale, and occupation-related health hazards (some parallel to or related to those described below).

Forest resource collection

Most women who live in and around forests in developing countries collect the majority of fuelwood, fodder and wild vegetables used by their households (cf. Agarwal 2009a, Biran *et al.* 2004, Nakro and Kikhi 2006, Nilsson 2006, Robinson and Kajembe 2009, Roy 2008, Tabuti *et al.* 2003). Fuelwood is used for cooking, smoking meat or fish, making charcoal, lighting, mosquito repellent, sometimes heating

BOX 5 *Hand in Hand: Bringing together Health and Environment Sectors in Madagascar*

In Fianarantsoa province in eastern Madagascar, a stunning sliver of biodiverse forest remains, yet those who live on its periphery are unable to access basic health services and markets.

Champion Commune sought to improve access to health services while simultaneously helping rural communities better manage their natural resources and improve their livelihoods. Champion Commune built upon prior multi-sectoral work, and challenged communities to set and achieve health, environment, economic growth and good governance goals.

One community adjacent to Ranomafana National Park surpassed its goals, and found a multi-sectoral approach fit their development needs, saying:

- Even if people use family planning to have healthier children, unless they are able to grow nutritionally good food, their family’s health will not improve;
- Improved agricultural techniques that do not rely on herbicides and pesticides are better for the environment and for families;
- Protecting the surrounding area adjacent to water sources helps the environment and provides cleaner water for human consumption;
- One cannot separate the two: healthy people and a healthy environment go hand in hand!

The health sector gained access to underserved populations in areas of high biodiversity, and the project found that people were more receptive to environmental initiatives due to greater community trust (a result of also addressing stated community health needs). In addition, there was an increase in male participation in health initiatives, and a rise in female participation in natural resources management activities.

Like families in developed nations, Malagasy households in isolated villages want to choose when and how many children to have. Children’s and mother’s lives – as well as forest health and economic growth – are tied to ensuring better access to family planning and health services in remote, biodiverse regions. By working hand in hand, integrated initiatives such as Champion Commune help do just that.

[Courtesy of Kristen P. Patterson, the USAID-funded Kaominina Mendrika (Champion Commune) project]

⁴ But compare sets of criteria and indicators for sustainable forest management. Many include concerns about access to resources, community health and worker safety.

⁵ Interest in fuelwood as a topic of scientific study has varied over the years, as has scientific interest in women’s relations to it. According to Bassam and Maegaard (2004) fuelwood scarcity affects around 60% of rural women in Africa, 80% in Asia and 40% in Latin America.

houses and water for bathing or for earning cash income. Its collection is among the most time-consuming chores undertaken by rural women (Carr and Hartl 2010). Such use of their time reduces their opportunities to pursue education⁶ or to participate in other capacity building or income generating activities (Anoko 2008, Population Action International 2000).

Not surprisingly, women often develop useful knowledge about the forest products they regularly use. For example, women may know which firewood burns better (Edmond 2008, Gbadegesin 1996, Godfrey *et al.* 2010), is most suitable for cooking certain type of foods, has longer burning duration, requires less attention, and produces less smoke and ash (Brouwer *et al.* 1996). Women similarly have detailed knowledge of and are sensitive to changing availability of wild plant foods in their local environments (Daniggelis 2003, Johnson and Grivetti 2002).

With forest degradation in developing countries women face increasing difficulty in collecting firewood, fodder and wild vegetables (cf. Adedayo *et al.* 2008, Ayanwuyi *et al.* 2007, Gupta 2008, Kidanu *et al.* 2009, Nakro and Kikhi 2006, Nilsson 2006). Collection and use require the expenditure of more time and energy (Agarwal 2001, Brouwer *et al.* 1996, Gbetnkom 2007). Kitts and Roberts' (1996) 1990 Indian findings of APDC found that before deforestation, women and children had sought fuelwood within a 1–2 km walk. Seven to eight years later, they had to walk 8–10 km every day to get enough fuelwood to cook the evening meal. Such long journeys

“...[induce] neglect of children at home, meals are skipped, the sick ones are not adequately taken care of and the school is not regularly attended as older children either accompany their mothers in search for firewood or are assigned to take care of the young ones and other domestic chores.” (Godfrey *et al.* 2010, p. 847)

Elsewhere Gbetnkom (2007) noted that more time in collection reduces time spent for cooking and income generation. Social and cultural expectations, as well as child care and other time-consuming daily tasks, often means that resource depletion near the home affects women before it affects men, who can venture further to obtain the same resources (Bizzarri 2010, Powell *et al.* 2010). A study by Cooke (1998) in Nepal examines the implications of changing levels of resource availability over a 14 year period, on women and girls in Nepal, finding adverse effects of resource degradation on girls' educational achievement.

Forest closure or forest protection for conservation or prevention of deforestation can also cause hardships for women, especially for poor, landless women (Agarwal 2009b). For example, in Nigeria, some women had to walk more than 4 km to collect firewood in an open access area because of their restricted access to the trees on communal

and family land (Adedayo *et al.* 2010). In many cases, women and girls have had no choice, but to collect these forest products illegally from protected areas, their neighbours' forests or tree plantations. Some have been beaten, had their fuelwood confiscated, and been subjected to demands for bribes, verbal (Sarin 2000, Sarin *et al.* 1997) or sexual abuse, rape, even death by forest guards or other forest owners (Gain 2010, Haile 1991). Restricted forest access may also reduce women's access to wild forest foods, many of which provide important micronutrients often scarce in foods from other sources (Powell *et al.* 2011, Vinceti *et al.* 2008).

In facing a scarcity of fuelwood, some women have substituted it with other less efficient fuels such as twigs, leaves, dung, crop residue for fuelwood (Agarwal 2001), even plastic (Lemenih and Kassa 2007). These inferior fuels require more time to light and more effort to keep them burning, thus making cooking more time-consuming and preventing women from simultaneously attending to other work (Agarwal 2007, Brouwer *et al.* 1996, Gbadegesin 1996). Even though cooking with twigs can be faster for a brief time (perhaps 10 minutes), about 2.5 kg more of fuel are required to cook the same meal (Brouwer *et al.* 1996). These inferior fuels also produce more harmful smoke (Brouwer *et al.* 1996, Subba 1999).

Besides the direct problems for women, relating to fuelwood and wild plant food acquisition, fuelwood scarcity can also have indirect adverse effects including changes dietary composition, either by omitting foods and meals (Bizzarri 2010, Cooke *et al.* 2008, Gardner-Outlaw and Engelman 1999) or substituting certain dishes (e.g., for beans, an important source of protein and micronutrients in many rural diets) with less nutritionally beneficial ones (Brouwer *et al.* 1996, 1997). Reductions in cooking time (Cecelski 1995, Ishaya *et al.* 2009) can decrease the nutritional quality of the diet as well as increase the risk of food-borne disease. Some women in refugee camps have been reported to have sold or traded their food rations (dried beans, grain, flour) for fuelwood, since they did not have enough fuel to cook the food (Bizzarri 2010, Patrick 2010). Given the well-established cyclical links between nutrition and infection, the impact of women's decreased access to fuelwood and forest foods can cause health problems for the whole family.

Fuelwood smoke

Combustion of biomass, including fuelwood, releases significant quantities of health-damaging pollutants, including several carcinogenic compounds (Naeher *et al.* 2007). For example, biomass fuels can release 1500–2000 µg/m³ of respirable particle indoor pollution, while kerosene and gas produce 76 µg/m³ and 101 µg/m³, respectively (Rehfuess 2006). Globally, women spend from 3–7 hours per day near stoves, preparing food (WHO 2005a). Compared to men, they are more consistently exposed to the negative health effects of

⁶ A UN study (UN 2010) found that “Women who receive an education are less likely to die in childbirth and more likely to have healthy children. The under five mortality rate falls by about half for mothers with primary education and the benefits increase with each additional year at school.” (p. 4)

smoke from the firewood and other solid fuels they use for cooking. Poor ventilation of kitchens is common and worsens the situation. Indoor smoke exposure has been found to be responsible for 39% annual deaths due to chronic pulmonary diseases in women, while only 12% in men (Rehfuess 2006).

WHO (2005a) found that “[i]n high-mortality developing countries, indoor smoke is responsible for an estimated 3.7% of the overall disease burden, making it the most lethal killer after malnutrition, unsafe sex and lack of safe water and sanitation,” with “59% of all indoor air pollution-attributable deaths thus fall[ing] on females”.

Meta analysis by Smith *et al.* (2004) showed strong evidence that smoke from solid fuel usage in households in developing countries was linked to pulmonary diseases in the women. “Women exposed to indoor smoke are three times more likely to suffer from chronic obstructive pulmonary disease (COPD), such as chronic bronchitis or emphysema, than women who cooked with electricity gas or other cleaner fuels.” (Rehfuess 2006, p. 10). Similar respiratory effects were noted for their young children since women care for children while cooking (Table 2). Rehfuess (2006) also noted that in Africa and South East Asia annually there were over 600,000 deaths of children under five years caused by pneumonia and other acute respiratory infections due to indoor air pollution.

Cataracts represent another health problem that can be caused by exposure to smoke, including smoke from biomass. Pokhrel *et al.*'s (2005) study in Nepal and India confirmed the causal relationship found in three earlier studies: that the risk of cataracts is increased by indoor exposure to smoke from solid cooking fuel. Smith and Mehta (2003) also noted links between solid fuel use and blindness.

Women's Reproductive Health

Reduction of maternal mortality is one of the core objectives of the 5th MDG, yet in 2008 there were an estimated 358,000 maternal deaths (deaths associated with pregnancy and childbirth) globally, with less than 1% of these deaths occurring in

TABLE 2 *Health effects of solid fuel usage in developing country households*

Disease	Population affected	Strength of evidence
Chronic obstructive pulmonary disease	Females >15 years	Strong
	Males >15 years	Intermediate
Lung cancer (coal smoke only)	Females >15 years	Strong
	Males >15 years	Intermediate
Blindness (cataracts)	Females >15 years	Intermediate
Tuberculosis	Females > 15 years	Intermediate
Acute lower respiratory infections	Children < 5 years	Strong

Source: Smith *et al.* 2004 in Smith 2008 (p. 102)

developed countries (WHO *et al.* 2010). Because, malnutrition during childhood can lead to a small birth canal and obstructed labour (a main cause of maternal mortality), one important step towards reducing maternal mortality is to break the intergenerational cycle of chronic under-nutrition (UN-SCN 2004). Achievement of this MDG will require efforts which cut across disciplines and government divisions, including nutrition, food security, agriculture and forestry.

This section focuses on two recurrent female health problems: uterine prolapse and stillbirth – both of which tend to be overlooked within the field of forestry despite the fact that forest use, management and governance decisions and policies can have an impact on factors associated with their development. Forest women have an elevated risk for these problems due to limited access to medical care and forest-related activities (such as heavy manual labour and malnutrition common in many forest communities).

The International Labour Organization (ILO) specifies:

“No woman should be assigned to manual transport of loads during a pregnancy which has been medically determined or during the ten weeks following [birth] if in the opinion of a qualified physician such work is likely to impair her health or that of her child.” (CIS 2007)

The ILO recommendation for maximum weight for manual carrying is 55 kg for men and should be “substantially less” for women (CIS 2007). The ILO further urges care regarding “arduous work involving the manual lifting, carrying, pushing or pulling of loads” for pregnant women (CIS 2007). In many countries the maximum recommended limit for lifting and carrying by women is only about 20 kg (ILO 1988 in Poschen 1993), however many (if not most) women who live in or near tropical forests carry burdens of fuelwood and water far exceeding this amount daily.

Carrying heavy loads for long distance can lead to several health problems such as, musculoskeletal disorders, miscarriage, stillbirth, or uterine prolapse (Messing and Östlin 2006). Haile (1991) found more than 6,000 women working as fuelwood carriers in Addis Ababa, Ethiopia, walking an average of 30 km (an increase from a previous study showing 24 km) up and down rugged hills, round trip, with some carrying up to 77 kg of fuelwood on their backs. The women spent about 7 hours a day doing this work. Women in the village of Chembe, Malawi walked between 0.5 and 4.9 km to their fuelwood source in Lake Malawi National Park (Biran *et al.* 2004). They also had to climb steep hills and descend the hills again, carrying around 29 kg of fuelwood (more than half of their body weight); some also carried their young children (an additional 9 kg on average). Kibera women around Ngong Forest in Kenya similarly earned their income from carrying up to 70 kg of fuelwood (Paula 2009).

Uterine prolapse

Uterine prolapse involves the uterus falling or sliding from its normal position in the pelvic cavity, in extreme cases, out of the vaginal canal (Pradhan 2007). It is one of five types of pelvic organ prolapse.

Unlike in developed countries where this extremely unpleasant condition occurs among postmenopausal women and is unrelated to childbirth, in Nepal it was found in a younger group with a mean age of 28 years (Subedi 2010). For many, prolapse occurs after giving birth to their first child (often at a young age) and is a permanent condition which they live with for life (Bodner-Adler *et al.* 2007, Pradhan 2007, The Advocacy Project n.d.). Ravindran *et al.* (2000) reported 87% of a small sample (N=37) of agricultural labourers from rural India were found to be suffering from uterine prolapse. Data on prevalence and age of onset for uterine prolapsed (and other types of pelvic organ prolapsed) are extremely limited for developing countries, but it seems likely that this condition is widespread, although greatly underreported (Scherf *et al.* 2002, Sherrie Palm pers. comm.). Risk of uterine prolapse is heightened by an arduous work load and carrying heavy loads (such as fuelwood, water, fodder, other NTFPs) during and soon after childbirth, low availability of skilled birth attendants (particularly with difficult births),⁷ lack of nutritious food, early or closely-spaced pregnancies (Bodner-Adler *et al.* 2007, Kumari 2009, Pradhan 2007). Bonetti *et al.* (2004) noted that women carrying heavy load daily on their backs or heads could increase pressure on their pelvic organs.

This problem is common in Nepal, where the majority of the rural population⁸ depend on forests as part of their subsistence agriculture practices (Gautam 2009). Women reported having to continue collecting wood from the forest and doing other strenuous field and domestic work, despite their pain (Subedi 2010, The Advocacy Project n.d.). A 2006 demographic and health survey showed that the problem has already affected more than 600,000 Nepalese women, and 200,000 are in need of immediate corrective surgery (Kumari 2009).

This maternal health condition, besides causing great physical pain, also disrupts marital and sexual relations. Women suffering from uterine prolapse often receive physical and verbal abuse from their husband and mother-in-law because of the condition, with some husbands leaving or threatening to leave their wives (Bonetti *et al.* 2004, Kumari 2009); others incorrectly consider it indicative of venereal disease (Allotey and Gyapong 2005). Shy and afraid of the consequences, many women who suffer from this disease hide their problem from others for decades (Farkouh 2009).

Stillbirths

Lawn *et al.* (2010) estimated that there are 3.2 million stillbirths globally per year and Fretts (2010) suggests that 98%

of these occur in developing countries, indicative of a significant problem. Moreover, maternal mortality and stillbirths are highly correlated, particularly in the developing world. Similar to uterine prolapse, the risk factors for stillbirths include: access to medical care, number of pregnancies, maternal age, multiple births (e.g., twins), untreated maternal infection (such as malaria and syphilis), exposure to pollutants, complications during pregnancy (pre-eclampsia, diabetes, anemia, obstructed labour) and poor foetal growth (IUGR – Intra-Uterine Growth Restriction) (Allotey *et al.* 2008, Fretts 2010). Complications during pregnancy and IUGR are both strongly linked to nutrition, another obstacle faced by forest women. The shortage of resources and reduced availability of formal medical care in remote forested areas suggests that higher rates are likely to be found in such regions.

Although the issue is definitely under-researched, systematic review of four studies⁹ on the effect of indoor air pollution from biomass cooking smoke on pregnancy showed a 51% increase in risk of stillbirth for pregnant women exposed to the pollutants (Pope *et al.* 2010, Yakoob *et al.* 2009). One study in India showed that women cooking with biomass fuels (wood, animal dung or crop residues) were twice as likely to have experienced two or more stillbirths as those using cleaner fuels, like electricity, liquid petroleum gas, biogas or kerosene (Mishra *et al.* 2005). Haile's (1991) Ethiopian study reported the incidence of miscarriage among fuelwood carriers – a task performed routinely by rural forest women – as 16% on average, and 44% among those aged 35–44.

Disease

Numerous illnesses that plague forest dwellers have been widely reported (see e.g., Colfer *et al.* 2006).¹⁰ Although most of these diseases are not uniquely found in forested ecosystems, they play a major role in the health and well-being of forest people, and have important implications for forest management and conservation. For example, several authors have linked HIV/AIDS exposure and prevalence in forested parts of Africa to residence near roads (Orubuloye *et al.* 1993), migrant labour (Hunt 1993), and other timber-related infrastructure (e.g., brothels).¹¹ While some parasites and infectious diseases are more prevalent in men (Zuk and McKean 1996), others (such as malaria) affect women, and particularly pregnant or lactating women, more seriously than men. Additionally, in most developing countries infection and food and nutrition security have a cyclical relationship: poor nutrition impairs immune function and increases risk of infection,

⁷ Cunningham *et al.* (2008, p. 36) report mid-1990's data on Swaziland (with a doctor-patient ratio of 1:6,600), Ghana (1:16,100), and Tanzania (1:24,390). Ratios in forested areas are typically lower than such national averages; and we found no evidence to suggest that such ratios have improved significantly in Africa.

⁸ In 2009, only 17.7% of Nepal's population lived in urban areas (Asian Development Bank 2011) and women are the primary users of forests (Giri and Darnhofer 2010).

⁹ All of which have adjustments for confounding factors.

¹⁰ See Dry and Leach (2010) for a fascinating collection of papers on diseases, many of which are relevant for tropical forest contexts.

¹¹ The account of women's roles in providing sexual services in large scale plantation agriculture by Enloe (1989) nicely parallels the situation in many timber concessions, each of which may have an associated brothel.

and infection impairs absorption of and increases requirements for many nutrients (Semba and Bloem 2008). In forest communities gender differences in infection rates are likely exacerbated by gender differences in food security and nutrition.

There are a variety of patterned, disease-related advantages that accrue to men (in forests and out) *vis-à-vis* women, including better access to medical facilities (partly through their greater general mobility), higher likelihood of accurate diagnosis and treatment¹², more consistent follow-up, and more extant medical knowledge about men's health than women's (Allotey and Gyapong 2005).

Malaria

Malaria is one of the most common parasitic diseases in tropical forest areas (Allotey *et al.* 2008) and one of the top three killers among infectious diseases (Sachs and Malaney 2002). People become infected through the bites of mosquitoes infected with the plasmodium parasite. Ernst *et al.* (2006) mentioned that incidence of malaria increases as distance to forest decreases. Other studies have demonstrated the links between deforestation and increases in malaria risk (Olson *et al.* 2010, Pattanayak *et al.* 2006, Patz *et al.* 2008, Vittor *et al.* 2006).

WHO (2003) found that “[p]regnant women are particularly vulnerable to malaria as pregnancy reduces a woman's immunity to malaria, making her more susceptible to malaria infection and increasing the risk of illness, severe anaemia and death.” Pregnancy and breastfeeding (and menstruation) also increase the body's requirements for many nutrients, increasing the likelihood of deficiency and resulting impaired immunity. Indeed, pregnant women suffer “. . . a two- to three-fold higher risk of severe malarial illness than non-pregnant women” (WHO 2003).

The disease causes more female than male deaths (aged 15 or older) (Allotey *et al.* 2008) and pregnant women are twice as likely as non-pregnant women to contract malaria (Espinosa *et al.* 2000). Pregnant women represent a high risk group, in which malaria can lead to miscarriage, low birth weight, stillbirth (Murphy and Breman 2001, WHO 2005b), premature delivery and neonatal death (WHO 2005b), cerebral malaria, pulmonary oedema (fluid in the lungs), hypoglycaemia (low blood sugar), or renal failure in the mother (summarised in Okoko *et al.* 2003; see also Reuben 1993). The disease kills about 10,000 pregnant women per

year in Africa (WHO 2009). Prevalence of infection and parasite density are highest during the first half of a pregnancy and decline gradually during the second half (Okoko *et al.* 2003). The combination of a high pregnancy rate and living in a malaria-endemic area, such as many tropical forests, creates a potent risk of maternal mortality. According to Reuben (1993), cerebral malaria causes 40% mortality in pregnant women: double that of non-pregnant women. Malaria is associated with increased iron requirements and anemia, already a major problem in women of child bearing age (and a major risk factor for maternal mortality) (Semba and Bloem 2008).

Many of the world's forest women live in malaria endemic areas and often have lower access to dietary sources of iron (such as meat) and less access to treatment compared to men (Bentley *et al.* 1999, Gittelsohn *et al.* 1997, Gittelsohn and Vastine 2003, Messer 1997).

‘Culture’,¹³ Food Systems and Health

The links between people's health, food security and their cultures have been extensively examined by anthropologists,¹⁴ and differently, by medical practitioners. The former have typically seen the positive aspects of cultural systems; the latter, beliefs and practices deemed harmful.

Several important features of human food and health systems, including those in forests, should be borne in mind:

- Extreme variability from place to place;
- Integration of health within broader, holistic, and changing cultural systems;
- Mutability of individuals' beliefs, goals and behaviour, as well as of more patterned behaviour;
- Pluralistic ways in which individuals may view health, often combining the ‘traditional’ with the ‘cosmopolitan’ in their own health care.

The place of women within such systems varies enormously. Some examples of the unique roles women play related to forests and health include: the central (and culturally mediated) role of women in the maintenance or expansion of human population (Colfer *et al.* 2008); women's greater roles in bringing up children with or without environmental concerns, with or without forest-related knowledge; women's differential forest knowledge, often focused more

¹² Allotey *et al.* (2008) describe a survey conducted by Simonsen *et al.* (1995) in Tanzania, which found that a physical examination for Filariasis for males included the genitals, arms and legs, whereas examination for females omitted the genital examination.

¹³ By culture, we refer to the (somewhat patterned) values, beliefs, behaviour of human beings that are transmitted in some (changeable) form from one generation to the next. These behaviours include the whole spectrum of human behaviour (e.g., politics, kinship, religion, ethics, economics, subsistence, etc.) – *not* simply specific individual beliefs or exotic religious practices. Although the study of ‘culture’ has become a bit passé in anthropology, due to greater recognition of the mutability and internal diversity among human groups, we still see patterns in human behavior, thus find the concept useful. Here we risk alienating some anthropologists by simplifying some of the human complexity, in recognition of length limitations and the different disciplinary backgrounds of most readers of this journal.

¹⁴ Useful compendia include: Conrad and Gallagher 1993, Landy 1977, McClain 1989, McElroy and Townsend 2004, and Whitaker 2006. Examples of useful overviews include classic texts by Foster and Anderson (1978) and Helman (1984).

on NTFPs (Pérez *et al.* 2002, Porro and Stone 2005, Powell *et al.* 2010), sometimes medicinal plants (Leaman 1996), less on timber (Bolaños and Schmink 2005, Sithole 2005); the roles of select women as healers (Jordan and Davis-Floyd 1993, McClain 1989, Tsing 1993); among others.

One of the most critically important women-forest-health interstices with cultural implications relates to food security and nutrition. Women almost always play major roles in the provision of adequate food to their families – whether cooking, marketing, production and/or gathering – functions key to the ongoing, day-to-day maintenance of forested populations. In or near forests, such foods typically include forest products (e.g., Colfer 2009, Ibarra *et al.* 2011, Laird *et al.* 2011, Ogle *et al.* 2001, Powell *et al.* 2011, Vinceti *et al.* 2008).

A study from the Western Ghats in India found that women hold significant amounts of knowledge about wild plant foods and that spending time with their mothers during collection and processing of wild foods is the primary means by which children learn about such foods (Cruz Garcia 2006). Cultural proscriptions are learnt simultaneously when mothers pass on their knowledge of identification and use of forest products and can have positive or negative health implications. Chotiboriboon *et al.* (2009), for instance, found that among the Karen of northern Thailand, consumption of various nutritious foods, including banana, ripe mango, papaya, pineapple, pomelo, wild pig and wild chicken, was forbidden when ill with fever or malaria. In the East Usambara Mountains, Tanzania, some local people believe that a woman should not consume traditional bitter vegetables (which are mostly wild) after giving birth (Powell *et al.* 2010). Forest women's access to wild plant food species (when and where they are permitted to harvest different species) is also bound by gendered cultural norms (Price 1997).

The reproductive sphere is one arena in which women are uniquely affected, with sometimes very specific cultural injunctions. Traditional beliefs or taboos may restrict women from eating certain food during pregnancy and lactation, reducing their nutritional intake (Creed-Kanashiro *et al.* 2009). Bentley *et al.* (1999), who studied the Lese women of the Democratic Republic of Congo (DRC), found women compensating for their loss of bush meat and other taboo food items, by increasing their consumption of cassava, which they linked to an increase in goitrogenic health problems. Some Karen women (in the Thungyai Naresuan National Wildlife Sanctuary, Thailand) see wild animal meat, including that of reptiles, insects and aquatic animals, as harmful for infants and pregnant and lactating women; after childbirth these women consume only warm water with salted rice for one to two weeks (Chotiboriboon *et al.* 2009) (a time when their requirements for micronutrients found in animal source foods, such as iron, is high); see also Boer and Lamxay (2009), on similar beliefs among the Brou, Saek and Kry of Laos.

On the other extreme, Dounias describes the enviable position of first time (primiparous) mothers among the Ntomba, also of the DRC (Dounias with Colfer 2008):

“During this long period of seclusion [two to four years], over-feeding and intensive care have beneficial consequences for the health status of both the mother and her firstborn. . . [T]he primiparous mother incarnates the ‘true mother’ and radiates a symbolic image of purity and good health that is a source of pride and psycho-cultural wellbeing for the whole community.” (p. 282)

More importantly, from an anthropological and human perspective, is the integration of such beliefs in a broader cultural system that in many cases depends crucially on the forested environment for its continuation. The interest in maintaining such cultures is not to maintain or create human museums, but rather as a kind of global insurance for the human species. At community and landscape scales, a threshold level of cultural stability is important for the maintenance of human life; and at an individual level, a woman's (and man's) sense of *meaning* in her/his life depends on (varying) threshold levels of cultural continuity. The lives of women who have depended on the forest for food security, subsistence and incomes and who lose such access – through gazettement as a park, the intrusions of a logging, mining or plantation company, or resettlement to a different context – suffer cultural and psychological losses, often even more devastating than the material losses sustained. Better forest management will acknowledge these aspects of health (both physical and mental).

WIN-WIN OPTIONS FOR WOMEN AND FOREST CONSERVATION

Two issues are addressed in this section: the advantages of linking women and conservation efforts, from the perspective of the environment; and the advantages of such links accruing to women.

Linking Women's Health and Forest Conservation – an Environmental View

There are both ethical and pragmatic reasons for addressing health and population issues in efforts to conserve forests. Issues of justice suggest that women, as forest users, should have a say in forest management (see, for instance, Agarwal 2000). The sometimes dire state of women's health in and around forested areas (as seen in much of the information provided so far) – provides ethical rationale. Food and food security, in addition to health, have been designated as a human right (Article 25, The Universal Declaration of Human Rights, the United Nations). Numerous authors have noted the primacy with which communities, and particularly women, tend to view their own food and health needs (cf. Ali 2008, Cronkleton 2005, Rao 2008), particularly in forested areas where formal health care systems are limited. The pragmatic implication of this for conservationists is that people are already motivated to improve their health; the ‘health card’ can serve as a potent entrée into a community and increase people's willingness to work with conservation

projects.¹⁵ Box 3 provides an example of this practice in West Kalimantan, Indonesia.

Another issue of relevance for conservationists is the generally adverse effects of human population (and particularly population growth) on forests and protected areas. A growing population can create serious pressures on the environment and on local resources. Yet in recent years the topic of human population has been effectively taboo in conservation circles. We concur with Chaudhary (2000), Kidanu *et al.* (2009), Smail (2002), WWF (2002), and others, who believe that the burden of a growing global population can no longer be ignored.¹⁶

Climate change has strengthened researchers' interests in holistic analyses (cf. the *Millenium Ecosystems Assessments*) – a trend that affords greater likelihood that women, health and forest issues will be effectively addressed. Engelman, who has written extensively on the importance of linking population and environment issues (Engelman 1998, Engelman *et al.* 2006), has recently emphasised the linkage among population, carbon emissions and women's lives (Engelman 2010). The disease-related issue of deforestation has important links to climate change (to wit, the extensive and growing literature on REDD and REDD+, see www.cifor.org). Kidanu *et al.* (2009), in a recent Ethiopian study of the links between climate change and population, argued that increases in population were the major cause of deforestation in their forests, leading in turn to climate change. Women are the logical parties to involve in efforts to address these interlinked issues.¹⁷ Box 4 provides examples of projects that eased both women's health and deforestation problems.

Our extensive experience at the forest management unit level has shown how increases in population – whether due to natural increase or to in-migration – complicate the lives of forest managers (whether formal or 'traditional') and often spell dangers for human health and forest sustainability. Some problematic actions include, for instance,

- Local or in-migrating people need more land for food crops and as their children age,
- Local or in-migrating people yield to temptations to log or perhaps over-harvest NTFPs to fund their children's education or their own health care, and

- Communities increasingly violently resist the actions of external parties that limit their own access to local resources.

A number of environmental and development organisations have begun to include a human health aspect in their conservation projects (e.g., TNC, WWF, CI, USAID). A primary motivation for these organisations has been the recognition that projects without local involvement are less likely to succeed.¹⁸ In the next section, we turn to the implications at the level of the individual woman.

Linking Women's Health and Forest Conservation – some Women's Views

Many daily activities and ailments forest women endure – such as carrying heavy loads, exposure to indoor smoke pollution and forest diseases, and reproduction-related health problems – are often interrelated and exacerbate women's experience of disease. There is a strong need for attention to women's health for their own good, regardless of conservation outcomes. The priority that forest women themselves attribute to health has already been mentioned (see also Freudenberger 2010). Like environmental issues, many of these health problems are further exacerbated by the birth and care of large numbers of children.

Forests usually have low population densities. While this is partly responsible for the health profession's tendency to overlook people in remote areas, the low population densities can be due to low birth rates, but are often due to high mortality rates – related to infectious diseases, decreasing food availability and/or lack of health care services. Both high mortality rates and high rates of out-migration can disguise high birth rates, a topic which the environmental community must overcome the aversions to discussing.

One can imagine that women might consider pregnancy and giving birth to be a unique privilege of women; no [human] male can experience this. Yet this privilege remains one of the leading causes of death among women in developing countries. As noted above, more than 350,000 women die annually from complications of pregnancy and childbirth, almost all of them in developing countries (WHO *et al.* 2010). High fertility rates, combined with under-nutrition and poor

¹⁵ We are viewing people's involvement in conservation efforts (appropriately designed to take local human rights into account) as beneficial both ecologically and for local people's own lives. Such involvement can also build local skills (negotiation, self-analysis, conflict resolution, leadership, etc.), which can be more broadly useful to them (see Box 2).

¹⁶ Others disagree. In an excellent, international study, Geist and Lambin (2002) examined 152 cases of tropical deforestation, finding population of lesser importance compared to economic, institutional, technological and cultural factors. Rudel's (2005) more nuanced study used 'qualitative comparative analysis' to untangle the factors involved in deforestation and reforestation in 115 cases around the world, demonstrating, among other things, the varying roles of population growth from region to region. The growth of population undeniably has different relevance in different forests, with no simple, linear, positive relationship between population growth and forest loss.

¹⁷ Although controversial, a substantial literature argues for women's greater natural ecological awareness *vis-à-vis* men (see Shiva 1989, Diamond and Orenstein 1990). The latter, for instance, see the devaluation of natural processes as a product of masculine consciousness that "...denigrated and manipulated everything defined as 'other' whether nature, women, or Third World cultures" (pp. ix–x). Leach (2007) provides a convincing critique of these views.

¹⁸ Interestingly, a study by Shandra *et al.* (2008) concluded that "high levels of women's and environmental international NGOs per capita are correlated with less deforestation."

health care services in remote areas, also increase women's general morbidity and mortality. An empirical model for rural South Africa showed a positive and significant correlation between wood scarcity (based on longer time taken to access wood resources) and women's fertility (Aggarwal *et al.* 2001).

Colfer *et al.* (2008) use causal loop diagramming to show common interconnections among women's pregnancies, caretaking responsibilities (for children, the elderly and the infirm), income generating and educational opportunities, as well as time and energy to become involved in community action, politics and... conservation. These factors carry different value among different groups, intimately affected by cultural propensities and individual difference, but they are likely to be significant for all women. Besides the adverse, global implications of population growth, high fertility rates have adverse health impacts on individual women and their families. Frequent pregnancies and near-continuous childcare can reduce women's and girls' involvement in forest conservation efforts as well as their opportunities for any self-actualisation unrelated to reproduction.¹⁹ Further, repeated childbearing jeopardises women's health. Usually, a lack of time and energy are among the reasons women give when asked why they are not involved in community forest based activities (Agarwal 2000, Bolaños and Schmink 2005, Jewitt 2000). Agarwal (2000), for instance, suggests that "...[i]n the face of acute shortage, ...the very values of nurture and caring for others, especially children, might lead women not toward conservation but its opposite" (p. 298).

Women in forested areas often ask for reproductive health services (Engelman 1998, 2007, Population Action International 2004; see Box 5). Howard *et al.* (2008) describe the positive attitudes of Senegalese refugees toward family planning in their camp in Guinea. Bremner *et al.* (2009), Carr *et al.* (2006) and Goicolea (2001), separately, document the unfulfilled interest of forest women in determining the number of their children in Ecuador. In developing countries, around 215 million women who want to avoid a pregnancy are still not using an effective method of contraception (Singh *et al.* 2009). Knowledge of modern family planning methods may not mean having access to them (particularly in remote forested areas); and it is not uncommon for women in rural areas also not to have the needed knowledge.

Not only women suffer from excessive childbearing (cf. Mavanza and Grossman's (2007) on a dismayed Tanzanian father of 23 children who learned about family planning too late). Bonetti *et al.* (2004) note Nepali men's concerns about the women in their community, who had to return to heavy labour immediately following childbirth. The men recounted

a story about a community woman who had recently gone to the forest to have her baby alone – a situation they found very concerning. Similarly Katang men (Laos) expressed their concern about the many women who died in childbirth in their community. Many mothers in this community also gave birth in the forest near the village (Chitthalath and Earth 2001); reported also by Boer and Lamxay (2009), among the Brou, Saek and Kry of Laos.

CONCLUSIONS

Attempts to link the food security and health of women and their forest environments are fairly new, at least in an explicit, purposeful manner. Awareness of the potential for building on such links to produce 'win-win' situations in forests and forest communities has grown over time (see Boxes 2–5). In many forest communities, gender divisions of labour mean that women bear a heavy responsibility of providing and cooking their families daily meals. Women's central role in food acquisition and preparation may mean that, compared to men, they have stronger impetus than men to ensure local food resources are used sustainably. Women's greater global roles in nursing ill family members give women unusually strong motivation to address the health issues of all family and community members, not just their own, effectively. Women's greater focus on food and health is likely a key driver of differences in conservation priorities between men and women.

In moving forward, we agree with the account by Blay *et al.* (2004) of their experience in Tanzania, who attributed their successes to "...awareness-raising, community participation and empowerment ..." (p. 51). We recognise how difficult these approaches are.²⁰ But there are several pragmatic reasons that we continue to see them as the most likely to succeed. There is growing awareness of:

- Ecological and cultural diversity globally
- The degree to which 'tribal' and 'cultural' group members differ internally
- The ubiquity of change and the resulting need for continual adaptation
- The inadequacy with which many governments respond to crises and/or provide routine basic services, strengthening the need to empower local communities to deal with these needs themselves and gain a stronger voice in determining their own futures.
- A growing global demand for greater democracy, attention to human rights, and self-determination.

¹⁹ There are tremendous differences from place to place in women's valuation of childbearing. However, in the Indonesian, US, Iranian (Qashqa'I) and Omani villages where Colfer has conducted long term ethnographic research, there have always been women concerned to both limit childbearing and carve out time for non-reproductive activities. Colfer has also discussed this issue with women in Africa and Latin America, on shorter term visits, who have expressed fatigue at so many children, and the desire to limit childbearing and expand their horizons – within their own cultural frames.

²⁰ See for instance, Cooke and Kothari (2002) on the 'tyranny' of participation; Manor (2005) on the ineffectiveness of user groups; Mutimukuru-Maravanyika (2010) on political naiveté; Wollenberg (2001) on the need to attend to power politics; and more.

All of these factors make the pre-planned, 'command and control,' unilineal, logframe style of 'development' increasingly anachronistic and improbable of success.

Besides the bullets listed above, another series of constraints applies more dramatically to women: shortages of time and finances, illiteracy, lack of knowledge of the national language, responsibility to care for children and the elderly or ill. Women are particularly affected by the cycle of malnutrition and infection; each of the factors listed here, has the potential to exacerbate this cycle. These factors have functioned in effect to further mute women's voices.

We do not under-estimate the difficulty of addressing women's concerns and approaching health and forest management from holistic, culturally and ecologically sensitive, adaptive/learning perspectives. But we believe that such a paradigmatic shift is needed; and, in fact, is the only approach that will eventually bring a 'development' that forest women might appreciate and that might maintain forests.

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REFERENCES

- ADEDAYO, A.G., OYUN, M.B. and KADEBA, O. 2010. Access of rural women to forest resources and its impact on rural household welfare in North Central Nigeria. *Forest Policy and Economics* **12**: 439–450.
- ADEDAYO, A.G., SALE, F.A. and KEKEH, O. 2008. Rural household wood energy utilization pattern and its impact on deforestation in Akoko South West LGA, Ondo State, Nigeria. In: ONYEKWELU, J.C., ADEKUNLE, V.A.J. and OKE, D.O. (eds.) *Research for Development in Forestry, Forest Products and Natural Resources Management*. Proceedings of the First National Conference of the Forests and Forest Products society, 16th–18th April, 2008. Federal University of Technology, Akure, Nigeria. 159–164.
- AGARWAL, B. 2000. Conceptualising environmental collective action: why gender matters. *Cambridge Journal of Economic* **24**: 283–310.
- AGARWAL, B. 2001. The hidden side of group behaviour: a gender analysis of community forestry groups. Queen Elizabeth House Working Paper No. 76. 28 p.
- AGARWAL, B. 2007. Gender inequality, cooperation and environmental sustainability. In: BALLAND, J.-M., BARDHAN, P. and BOWLES, S. (eds.) *Inequality, cooperation and environmental sustainability*. Princeton University Press, Princeton, New Jersey. 274–313.
- AGARWAL, B. 2009a. Gender and forest conservation: The impact of women's participation in community forest governance. *Ecological Economics* **68**: 2785–2799.
- AGARWAL, B. 2009b. Rule making in community forestry institutions: The difference women make. *Ecological Economics* **68**: 2296–2308.
- AGGARWAL, R., NETANYAHU, S. and ROMANO, C. 2001. Access to natural resources and the fertility decision of women: the case of South Africa. *Environment and Development Economics* **6**: 209–236.
- ALI, R. 2008. Approaching conservation through health. In: COLFER, C.J.P. (ed.) *Human health and forests: A global overview of issues, practice and policy*. Earthscan, London. 317–332.
- ALLOTEY, P. and GYAPONG, M. 2005. The gender agenda in the control of tropical diseases: A review of current evidence. Special Programme for Research and Training in Tropical Diseases. World Health Organization, Geneva, Switzerland.
- ALLOTEY, P., GYAPONG, M. and COLFER, C.J.P. 2008. The gender agenda and tropical forest diseases. In: COLFER, C.J.P. (ed.) *Human health and forests: A global overview of issues, practice and policy*. Earthscan, London. 135–160.
- ANOKO, J.N. 2008. Gender and equity in the protected areas of West Africa. FIBA and UICN PAPACO. 84 p.
- ASIAN DEVELOPMENT BANK. 2011. Asian Development Bank & Nepal: Fact Sheet.
- AYANWUYI, E., OLADOSU, O., OGULADE, I. and KUPONIYI, F.A. 2007. Rural women perception of effects of deforestation on their economic activities in Ogbomoso area of Oyo State, Nigeria. *Pakistan Journal of Social Sciences* **4**: 474–479.
- BASSAM, N.E. and MAEGAARD, P. 2004. *Integrated renewable energy for rural communities: Planning guidelines, technologies, and applications*. Elsevier, Amsterdam, The Netherlands. 315 p.
- BENTLEY, G.R., AUNGER, R., HARRIGAN, A.M., JENIKE, M., BAILEY, R.C. and ELLISON, P.T. 1999. Women's strategies to alleviate nutritional stress in a rural African society. *Social Science & Medicine* **48**: 149–162.
- BIRAN, A., ABBOT, J. and MACE, R. 2004. Families and firewood: A comparative analysis of the costs and benefits of children in firewood collection and use in two rural communities in sub-Saharan Africa. *Human Ecology* **32**: 1–24.

- BIZZARRI, M. 2010. Safe access to firewood and alternative energy in Kenya: An Appraisal Report. WFP and Women's Refugee Commission. 52 p.
- BLAY, D., BONKOUNGOU, E., CHAMSHAMA, S.A.O. and CHIKAMAI, B. 2004. *Ngitili*: A traditional method of land rehabilitation in Shinyanga region, Tanzania. In: WOOD, P. and YAPI, A.M. (eds.) *Rehabilitation of degraded lands in sub-Saharan Africa: Lessons learned from selected case studies*. 48–51. http://www.fornis.net/system/files/synthesis_all.pdf.
- BODNER-ADLER, B., SHRIVASTAVA, C. and BODNER, K. 2007. Risk factors for uterine prolapse in Nepal. *International Urogynecology Journal* **18**: 1343–1346.
- BOER, H. de and LAMXAY, V. 2009. Plants used during pregnancy, childbirth and postpartum healthcare in Lao PDR: A comparative study of the Brou, Saek and Kry ethnic groups. *Journal of Ethnobiology and Ethnomedicine* **5**: 25.
- BOLAÑOS, O. and SCHMINK, M. 2005. Women's place is not in the forest: gender issues in a timber management project in Bolivia. In: COLFER, C.J.P. (ed.) *The equitable forest: Diversity, community and resource management*. Resources for the Future, Washington, DC. 274–295.
- BONETTI, T.R., ERPELDING, A. and PATHAK, L.R. 2004. Listening to "felt needs": Investigating genital prolapse in Western Nepal. *Reproductive Health Matters* **12**: 166–175.
- BREMNER, J., BILSBORROW, R., FELDACKER, C. and HOLT, F.L. 2009. Fertility beyond the frontier: indigenous women, fertility, and reproductive practices in the Ecuadorian Amazon. *Population and Environment* **30**: 93–113.
- BROUWER, I.D., HARTOG, A.P.D., KAMWENDO, M.O.K. and HELDENS, M.W.O. 1996. Wood quality and wood preferences in relation to food preparation and diet composition in Central Malawi. *Ecology of Food and Nutrition* **35**: 1–13.
- BROUWER, I.D., HOORWEG, J.C. and VAN LIERE, M.J. 1997. When households run out of fuel: Responses of rural households to decreasing fuelwood availability, Ntcheu District, Malawi. *World Development* **25**: 255–266.
- CARR, D., PAN, W. and BILSBORROW, R. 2006. Declining fertility on the frontier: the Ecuadorian Amazon. *Population and Environment* **28**: 17–39.
- CARR, M. and HARTL, M. 2010. Lightening the load: Labour-saving technologies and practices for rural women. United Kingdom. 76 p.
- CECELSKI, E.W. 1995. From Rio to Beijing. *Energy Policy* **23**: 561–575.
- CHAUDHARY, R.P. 2000. Forest conservation and environmental management in Nepal: A review. *Biodiversity and Conservation* **9**: 1235–1260.
- CHITHALATH, S.-A. and EARTH, B. 2001. From the forest to the clinic: Changing birth practice among the Katang, Lao. *Reproductive Health Matters* **9**: 99–104.
- CHOTIBORIBOON, S., TAMACHOTIPONG, S., SIRISAI, S., DHANAMITTA, S., SMITASIRI, S., SAPPASUWAN, C., TANTIVATANASATHIEN, P. and EG-KANTRONG, P. 2009. Thailand: food system and nutritional status of indigenous children in a Karen community. In: KUHNLEIN, H.V., ERASMUS, B. and SPIGELSKI, D. (eds.) *Indigenous peoples' food systems: the many dimensions of culture, diversity and environment for nutrition and health*. Food and Agriculture Organization of the United Nations and Centre for Indigenous Peoples' Nutrition and Environment, Rome. 159–183.
- CIS (International Occupational Safety and Health Information Centre). 2007. SafeWork Bookshelf. International Labour Organization. http://www.ilo.org/safework_bookshelf/english/.
- COLFER, C.J.P. 2009. *Longhouse of the tarsier: Changing landscapes, gender and well being in Borneo*, Borneo Research Council/ CIFOR/ UNESCO, Philippines, Maine. 433 p.
- COLFER, C.J.P., DUDLEY, R.G. and GARDNER, R. 2008. Forest women, health and childbearing. In: COLFER, C.J.P. (ed.) *Human health and forests: A global overview of issues, practice and policy*. Earthscan, London. 113–134.
- COLFER, C.J.P., SHEIL, D. and KISHI, M. 2006. Forests and human health: Assessing the evidence. *CIFOR Occasional Paper* 45. 111 p.
- CONRAD, P. and GALLAGHER, E.B. (eds.) 1993. *Health and health care in developing countries: Sociological perspectives*. Temple University Press, Philadelphia, PA.
- COOKE, B. and KOTHARI, U. (eds.) 2002. *Participation: the New Tyranny?* Zed Books, London.
- COOKE, P.A. 1998. The long-term effect of environmental degradation on women in the hills of Nepal* (PRELIMINARY DRAFT). International Food Policy Research Institute, Washington, DC.
- COOKE, P., KOHLIN, G. and HYDE, W.F. 2008. Fuelwood, forests and community management – evidence from household studies. *Environment and Development Economics* **13**: 103–135.
- CREED-KANASHIRO, H., ROCHE, M., CERRON, I.T. and KUHNLEIN, H.V. 2009. Traditional food system of an Awajun community in Peru. In: KUHNLEIN, H.V., ERASMUS, B. and SPIGELSKI, D. (eds.) *Indigenous peoples' food systems: the many dimensions of culture, diversity and environment for nutrition and health*. Food and Agriculture Organization of the United Nations and Centre for Indigenous Peoples' Nutrition and Environment, Rome. 59–81.
- CRONKLETON, P. 2005. Gender, participation and the strengthening of indigenous forest management in Bolivia. In: COLFER, C.J.P. (ed.) *The equitable forest: Diversity, community and resource management*. Resources for the Future, Washington, DC. 256–273.
- CRUZ GARCIA, G. 2006. The mother – child nexus. Knowledge and valuation of wild food plants in Wayanad, Western Ghats, India. *Journal of Ethnobiology and Ethnomedicine* **2**: 39.

- CUNNINGHAM, A.B., SHANLEY, P. and LAIRD, S. 2008. Health, habitats and medicinal plant use. In: COLFER, C.J.P. (ed.) *Human health and forests: A global overview of issues, practice and policy*. Earthscan, London. 35–62.
- D'AGNES, L. 2009. The population, health and environment (PHE) pathway to livelihoods improvement: Lessons and best practices from Nepal. USAID, Nepal. 27 p.
- DANIGGELIS, E. 2003. Women and 'wild' foods: Nutrition and household security among Rai and Sherpa forager-farmers in eastern Nepal. In: HOWARD, P.L. (ed.) *Women and Plants: Gender relations in Biodiversity Management and Conservation*. Zed Books, London. 83–97.
- DIAMOND, I. and ORENSTEIN, G. (eds.) 1990. *Reweaving the world: the emergence of ecofeminism.*: Sierra Club Books, San Francisco.
- DOUNIAS, E.W. with COLFER, C.J.P. 2008. Sociocultural dimensions of diet and health in forest-dwellers' systems. In: COLFER, C.J.P. (ed.) *Human health and forests: A global overview of issues, practice and policy*. Earthscan, London. 275–292.
- DRY, S. and LEACH, M. (eds.) 2010. *Epidemics: Science, Governance and Social Justice*. Earthscan, London. 299 p.
- EDMOND, J. 2008. Incorporating gender into PHE strategies: Experiences from Conservation International. Conservation International and USAID. 25 p.
- ENGELMAN, R. 1998. *Plan & conserve: A source book on linking population and environmental services in communities*. Population Action International, Washington, DC.
- ENGELMAN, R. 2007. Sustainability from the ground up – Working on reproductive health and the environment in communities. http://www.populationaction.org/Issues/Population_and_Environment/Sustainability_from_the_Ground_Up/Summary.shtml.
- ENGELMAN, R. 2010. Population, climate change, and women's lives. Worldwatch Report, Washington, DC. 43 p.
- ENGELMAN, R., BREMNER, J., DESOUZA, R.-M. and MOGELGAARD, K. 2006. Indigenous population, fertility, and reproductive intention in the lowland neotropics: Response to McSweeney. *Conservation Biology* **20**: 1315–1317.
- ENLOE, C. 1989. *Bananas, beaches and bases: Making feminist sense of international politics*. University of California Press, Berkeley, CA.
- ERNST, K.C., ADOKA, S.O., KOWUOR, D.O., WILSON, M.L. and JOHN, C.C. 2006. Malaria hotspot areas in a highland Kenya site are consistent in epidemic and non-epidemic years and are associated with ecological factors. *Malaria Journal* **5**.
- ESCOBAR, A. 1995. *Encountering development: The making and unmaking of the third world, Princeton studies in culture/power/history*. Princeton University Press, Princeton, N.J. 290 p.
- ESPINOSA, F.M., ALECRIM, W.D. and DANIEL-RIBEIRO, C.T. 2000. Attraction of mosquitoes to pregnant women. *Lancet* **356**: 685.
- EYZAGUIRRE, P.B. 2006. Agricultural biodiversity and how human culture is shaping it. In: CERNEA, M.M. and KASSAM, A.H. (eds.) *Researching the culture in agriculture: Social research for international development*. CABI, Oxford. 264–284.
- FARKOUH, N. 2009. Reframing maternal health in Nepal. *Policy Matters Journal* Spring: 33–38.
- FOSTER, G.M. and ANDERSON, B.G. 1978. *Medical anthropology*. John Wiley and Sons, New York.
- FRETTS, R. 2010. Stillbirth epidemiology, risk factors, and opportunities for stillbirth prevention. *Clinical Obstetrics Gynecology* **53**: 588–596.
- FREUDENBERGER, K. 2010. Paradise lost? Lessons from 25 years of USAID Environment Programs in Madagascar. International Resources Group, Washington D.C.
- GAIN, P. 2010. The Garo women in Bangladesh: Life of a forest people without forest. *WRM Bulletin* **152**: 23–25.
- GARDNER-OUTLAW, T. and ENGELMAN, R. 1999. Forest futures – Population, consumption, and wood resources. Population Action International, Washington DC. 68 p.
- GAUTAM, A.P. 2009. Equity and livelihoods in Nepal's community forestry. *International Journal of Social Forestry* **2**: 101–122.
- GBADEGESIN, A. 1996. Management of forest resources by women: a case study from the Olokemeji Forest Reserve area, southwestern Nigeria. *Environmental Conservation* **23**: 115–119.
- GBETNKOM, D. 2007. Forest management, gender: and food security of the rural poor in Africa. UNU- World Institute for Development Economics Research (UNU-WIDER), Helsinki, Finland. 20 p.
- GEIST, H.J. and LAMBIN, E.F. 2002. Proximate causes and underlying driving forces of tropical deforestation. *BioScience* **52**: 143.
- GITTELSON, J. and VASTINE, A.E. 2003. Sociocultural and household factors impacting on the selection, allocation and consumption of animal source foods: Current knowledge and application. *Journal of Nutrition* **133**: 4036S-4041S.
- GITTELSON, J., THAPA, M. and LANDMAN, L.T. 1997. Cultural factors, caloric intake and micronutrient sufficiency in rural Nepali households. *Social Science & Medicine* **44**: 1739–49.
- GIRI, K. and DARNHOFER, I. 2010. Nepali women using community forestry as a platform for social change. *Society and Natural Resources* **23**: 1216–1229.
- GODFREY, A.J., DENIS, K., DANIEL, W. and AKAIS, O.C. 2010. Household firewood consumption and its dynamics in Kalisizo Sub-County, Central Uganda. *Ethnobotanical Leaflets* **14**: 841–855.
- GOICOLEA, I. 2001. Exploring women's needs in an Amazon region of Ecuador. *Reproductive Health Matters* **9**: 193–202.
- GUPTA, P.H. 2008. From *Chipko* to climate change: Remote rural communities grapple with global environmental agendas. *Mountain Research and Development* **28**: 4–7.

- HAILE, F. 1991. *Women fuelwood carriers in Addis Ababa and the peri-urban forest*. International Labour Office, Geneva.
- HELMAN, C. 1984. *Culture, health and illness*. John Wright and Sons, Bristol, England.
- HOWARD, N., KOLLIE, S., SOUARE, Y., ROENNE, A.V., BLANKHART, D., NEWAY, C., CHEN, M.I. and BORCHERT, M. 2008. Reproductive health services for refugees by refugees in Guinea: family planning. *Conflict and Health* **2**: 12.
- HUNT, C.W. 1993. The social epidemiology of AIDS in Africa: Migrant labor and sexually transmitted disease. In: CONRAD, P. and GALLAGHER, E.B. (eds.) *Health and health care in developing countries: Sociological perspectives*. Temple University Press, Philadelphia. 1–37.
- IBARRA, J.T., BARREAU, A., DEL CAMPO, C., CAMACHO, C.I., MARTIN, G.J. and MCCANDLESS, S.R. 2011. Community conservation, payments for environmental services and food sovereignty in an indigenous community of the Chinantla, Oaxaca, Mexico. *International Forestry Review*, this issue.
- ISHAYA, S., MAISAMARI, G.J. and MOHAMMED, A.M. 2009. Fuelwood scarcity: women's perception, experience and adaptation strategies in Gwagwalada Area Council, Nigeria. *The Free Library* [http://www.thefreelibrary.com/Fuelwood scarcity: women's perception, experience and adaptation. . .-a0235407194](http://www.thefreelibrary.com/Fuelwood+scarcity:+women's+perception,+experience+and+adaptation.+.+a0235407194) [accessed May 25 2011].
- JEWITT, S. 2000. Mothering earth? Gender and environmental protection in the Jharkhand, India. *Journal of Peasant Studies* **27**: 94–131.
- JOHNSON, N. and GRIVETTI, L. 2002. Environmental Change in Northern Thailand: Impact on Wild Edible Plant Availability. *Ecology of Food and Nutrition* **41**: 373–399.
- JORDAN, B. and DAVIS-FLOYD, R. 1993. *Birth in four cultures: A cross-cultural investigation of childbirth in Yucatan, Holland, Sweden, and the United States*. Waveland Press, Prospect Heights, Illinois.
- KIDANU, A., ROVIN, K. and HARDEE, K. 2009. Linking population, fertility and family planning with adaptation to climate change: views from Ethiopia. Population Action International, Washington, D.C. 36 p.
- KITTS, J. and ROBERTS, J.H. 1996. *The health gap: Beyond pregnancy and reproduction*. International Development Research Centre (IDRC), Ottawa.
- KLETER, G.A. 2004. Control and prevention of contamination and spoilage in the traditional production of smoked fish in Ghana. RIKILT – Institute of Food Safety, Wageningen, The Netherlands. 23 p.
- KUMARI, B. 2009. Fallen wombs, broken lives: Responding to uterine prolapse in Nepal. United Nations Family Planning Association. <http://www.unfpa.org/public/News/pid/3282>.
- LAIRD, S.A., AWUNG, G.L., LYSINGE, R.J. and NDIVE, L.E. 2011. The Interweave of People and Place: Biological and cultural diversity in the lives of indigenous Bakweri and migrants to the Mount Cameroon region. *International forestry Review*, this issue.
- LANDY, D. (ed.) 1977. *Culture, disease, and healing: Studies in medical anthropology*. Macmillan Publishing Co., New York. 559 p.
- LAWN, J.E., GRAVETT, M.G., NUNES, T.M., RUBENS, C.E., STANTON, C. and the GAPPS REVIEW GROUP. 2010. Global report on preterm birth and stillbirth (1 of 7): definitions, description of the burden and opportunities to improve data. *BioMed Central Pregnancy and Childbirth* **10** (Supplement 1): 1–22.
- LEACH, M. 2007. Earth mother myths and other ecofeminist fables: How a strategic notion rose and fell. *Development & Change* **38**: 67–85.
- LEAMAN, D.J. 1996. *The medicinal ethnobotany of the Kenyah of East Kalimantan (Indonesian Borneo)*. Doctoral, University of Ottawa, Canada.
- LEMENIH, M. and KASSA, H. 2007. Summary report of the workshop proceedings on bridging the gap between the forestry and health sectors in Ethiopia. CIFOR, Addis Ababa, Ethiopia.
- MANOR, J. 2005. User Committees: A potentially damaging second wave of decentralisation? In: RIBOT, J.C. and LARSON, A.M. (eds.) *Democratic Decentralisation through a Natural Resource Lens*. Routledge, London. 192–213.
- MAVANZA, M. and GROSSMAN, A.A. 2007. Conservation and family planning in Tanzania: the TACARE experience. *Population and Environment* **28**: 267–273.
- MCCLAIN, C.S. (ed.) 1989. *Women as healers: Cross cultural perspectives*. Rutgers University Press, Rutgers, NJ. 274 p.
- MCELROY, A. and TOWNSEND, P.K. (eds.) 2004. *Medical anthropology in ecological perspective*. Westview Press, Boulder, CO. 466 p.
- MESSER, E. 1997. Intra-household allocation of food and health care: Current findings and understandings – Introduction. *Social Science & Medicine* **44**: 1675–84.
- MESSING, K. and ÖSTLIN, P. 2006. Gender equality, work and health: A review of the evidence. World Health Organization, Geneva. 46 p.
- MISHRA, V., RETHERFORD, R.D. and SMITH, K.R. 2005. Cooking smoke and tobacco smoke as risk factors for stillbirth. *International Journal of Environmental Health Research* **15**: 397–410.
- MURPHY, S.C. and BREMAN, J.G. 2001. Gaps in the childhood malaria burden in Africa: cerebral malaria, neurological sequelae, anemia, respiratory distress, hypoglycemia, and complications of pregnancy. *The American Journal of Tropical Medicine and Hygiene* **64**: 57–67.
- MUTIMUKURU-MARAVANYIKA, T. 2010. Can we learn our way to sustainable management? Adaptive Collaborative Management in Mafungautsi State Forest, Zimbabwe, CERES Research School for Resource Studies for Development, Wageningen University, Wageningen, The Netherlands.
- NAEHER, L.P., BRAUER, M., LIPSETT, M., ZELIKOFF, J.T., SIMPSON, C.D., KOENING, J.Q. and SMITH, K.R. 2007. Woodsmoke health effects: a review. *Inhalation Toxicology* **19**: 67–106.

- NAKRO, V. and KIKHI, C. 2006. Strengthening market linkages for women vegetable vendors – experiences from Kohima, Nagaland, India. In: VERNOOY, R. (ed) *Social and gender analysis in natural resource management – learning studies and lessons from Asia*. Sage, India. 65–98.
- NILSSON, A.K. 2006. Gender work in Lao PDR: Women and the fuelwood collection.
- OGLE, B., DUNG, N.N.X., DO, T.T. and HAMBRAEUS, R. 2001. The contribution of wild vegetables to micronutrient intakes among women: An example from the Mekong delta, Vietnam. *Ecology of Food and Nutrition* **40**: 159–184.
- OKOKO, B.J., ENWERE, G. and OTA, M.O.C. 2003. The epidemiology and consequences of maternal malaria: a review of immunological basis. *Acta Tropica* **87**: 193–205.
- OLIVEIRA, M. 2005. Women of the Amazon forest and citizenship. *Health Care for Women International* **26**: 484–489.
- OLSON, S.H., GANGNON, R., SILVEIRA, G.A. and PATZ, J.A. 2010. Deforestation and malaria in Mâncio Lima county, Brazil. *Emerging Infectious Diseases* **16**: 1108–1115.
- ORUBULOYE, I.O., CALDWELL, P. and CALDWELL, J.C. 1993. The role of high-risk occupation in the spread of AIDS: Truck drivers and itinerant market women in Nigeria. *International Family Planning Perspectives* **19**: 43–48+71.
- PATRICK, E. 2010. Voices from Dadaab: the daily struggle to cook a meal. <http://www.womenscommission.org/blog/1069-from-dadaab-refugee-camp> [Accessed 28 July 2011].
- PATTANAYAK, S., DICKINSON, K., COREY, C., MURRAY, B., SILLS, E. and KRAMER, R. 2006. Deforestation, malaria, and poverty: a call for transdisciplinary research to support the design of cross-sectoral policies. *Sustainability: Science, Practice, and Policy* **2**: 45–56.
- PATZ, J.A., OLSON, S.H., UEJIO, C.K. and GIBBS, H.K. 2008. Disease emergence from global climate and land use change. *Medical Clinics of North America* **92**: 1473–1491.
- PAULA. 2009. Ngong Forest: Slum women start energy project in Ngong Road Forest. Wildlife Direct. Available: <http://ngongforest.wildlifedirect.org/tag/fuel-wood/> [Accessed 8 July 2010].
- PÉREZ, M., NDOYE, O., EYEBE, A. and NGONO, D. 2002. A gender analysis of forest product markets in Cameroon. *Africa Today* **49**: 97–126.
- PERSOON, G.A. 2008. Hidden suffering on the Island of Siberut, West Sumatra. In: COLFER, C.J.P. (ed.) *Human health and forests: A global overview of issues, practice and policy*. Earthscan, London. 333–345.
- POKHREL, A.K., SMITH, K.R., KHALAKDINA, A., DEUJA, A. and BATES, M.N. 2005. Case-control study of indoor cooking smoke exposure and cataract in Nepal and India. *International Journal of Epidemiology* **34**: 702–708.
- POPE, D.P., MISHRA, V., THOMPSON, L., SIDDIQUI, A.R., REHFUESS, E.A., WEBER, M. and BRUCE, N.G. 2010. Risk of low birth weight and stillbirth associated with indoor air pollution from solid fuel use in developing countries. *Epidemiologic Reviews* **32**: 70–81.
- POPULATION ACTION INTERNATIONAL. 2000. Why population growth matters to the future of forests. *Fact Sheet*. Available at http://www.populationaction.org/Publications/Fact_Sheets/FS10/Summary.shtml [Accessed 20 January 2011].
- POPULATION ACTION INTERNATIONAL. 2004. Finding balance: Forests and Family Planning in Madagascar. http://www.populationaction.org/Publications/Documentaries/Finding_Balance_-_Forests_and_Family_Planning_in_Madagascar.shtml [Accessed 4 August 2011].
- PORRO, N.M. and STONE, S. 2005. Diversity in living gender: Two cases from the Brazilian Amazon. In: COLFER, C.J.P. (ed.) *The equitable forest: Diversity, community and resource management*. Resources for the Future, Washington, DC. 242–255.
- POSCHEN, P. 1993. Forestry, a safe and healthy profession? *Unasylva* **44**. <http://www.fao.org/docrep/u8520e/u8520e03.htm#forestry,%20a%20safe%20and%20healthy%20profession>.
- POWELL, B., HALL, J. and JOHNS, T. 2011. Forest cover, use and dietary intake in the East Usambara Mountains, Tanzania. *International Forestry Review*, this issue.
- POWELL, B., WATTS, J.D., ASAHA, S., BOUCARD, A., FEINTRENIE, L., LYIMO, E., SUNDERLAND-GROVES, J. and URECH, Z.L. 2010. The role of wild species in the governance of tropical forested landscapes. In: COLFER, C.J.P. and PFUND, J.-L. (eds.) *Collaborative governance of tropical landscapes*. Earthscan, London. 157–182.
- PRADHAN, S. 2007. Unheeded agonies – A study on uterine prolapse prevalence and its causes in Siraha and Saptari districts. Women's Reproductive Rights Program (WRRP), Centre for Agro-Ecology and Development (CAED), Kathmandu, Nepal. 90 p.
- PRICE, L.L. 1997. Wild plant food in agricultural environments: A study of occurrence, management, and gathering rights in northeast Thailand. *Human Organization* **56**: 209–221.
- RAO, V.S. 2008. Health and conservation in the cardamoms in Cambodia: Lessons learned from the CI-CARE partnership. Conservation International, Phnom Penh, Cambodia.
- RAVINDRAN, T.K.S., SAVITRI, R. and BHAVANI, A. 2000. Women's experiences of utero-vaginal prolapse: a qualitative study from Tamil Nadu, India. In: BERER, M. and RAVINDRAN, T.K.S. (eds.) *Safe motherhood initiatives: Critical issues*. Reproductive Health Matters, London. 166–72.
- REHFUESS, E. 2006. Fuel for life: household energy and health. Geneva: World Health Organization. 42 p.
- REUBEN, R. 1993. Women and malaria--special risks and appropriate control strategy. *Social Science & Medicine* **37**: 473–480.

- ROBINSON, E.J.Z. and KAJEMBE, G.C. 2009. Changing access to forest resources in Tanzania. *EfD. Discussion Paper* 09–10.
- ROY, B.C.S. 2008. Fuelwood, alternative energy and forest user groups in Chunati Wildlife Sanctuary. In: FOX, J., BUSHLEY, B.R., MILES, W.B. and QUAZI, S.A. (eds.) *Connecting communities and conservation: collaborative management of protected areas in Bangladesh*. East-West Center, Honolulu. 209–226.
- RUDEL, T.K. 2005. *Tropical forests: Regional paths of destruction and regeneration in the late twentieth century*. Columbia University Press, New York. 231 p.
- SACHS, J. and MALANEY, P. 2002. The economic and social burden of malaria. *Nature* **415**: 680–685.
- SARIN, M. 2000. 'Should I use my hands as fuel?'. In: KABEER, N. and SUBRAHMANIAN, R. (eds.) *Institutions, relations and outcomes: A framework and case studies for gender-aware planning*. Zed Books, London. 231–265.
- SARIN, M., RAY, L., MANJU, S., CHATTERJEE, M., BANERJEE, N. and HIREMATH, S. 1997. Gender and equity concerns in joint forest management In: RAO, N. and RURUP, L. (eds.) *A just right: Women's ownership of natural resources and livelihood security*. Friedrich Ebert Stiftung, New Delhi. 267–336.
- SCHERF, C., MORISONB, L., FIANDERA, A., EKPOC, G. and WALRAVEN, G. 2002. Epidemiology of pelvic organ prolapse in rural Gambia, West Africa. *International Journal of Obstetrics and Gynaecology* **109**: 431–436.
- SEMBA, R.D. and BLOEM, M.W. (eds). 2008. *Nutrition and Health in Developing Countries*, 2nd ed. Humana Press, New York.
- SHANDRA, J.M., SHANDRA, C.L. And LONDON, B. 2008. Women, non-governmental organizations, and deforestation: a cross-national study. *Population and Environment* **30**: 48–72.
- SHIVA, V. 1989. *Staying alive: Women, ecology and development*. Zed Books, London. 224 p.
- SIMONSEN, P.E., MEYROWITSCH, D.W., MAKUNDE, W.H. and MAGNUSSEN, P. 1995. Bancroftian filariasis – the pattern of microfilaraemia and clinical manifestation in three endemic communities of northeastern Tanzania. *Acta Tropica* **60**: 179–187.
- SINGH, S., DARROCH, J.E., ASHFORD, L.S. and VLASSOFF, M. 2009. Adding it up: The costs and benefits of investing in family planning and maternal and newborn health. Guttmacher Institute, New York. 40 p.
- SITHOLE, B. 2005. Becoming men in our dresses! Women's involvement in a joint forestry management project in Mafungautsi, Zimbabwe. In: COLFER, C.J.P. (ed.) *The equitable forest: Diversity, community and resource management*. Resources for the Future, Washington, DC. 171–185.
- SMAIL, J.K. 2002. Remembering Malthus: A preliminary argument for a significant reduction in global human numbers. *American Journal of Physical Anthropology* **118**: 292–297.
- SMITH, K.R. 2008. Wood: The fuel that warms you thrice. In: COLFER, C.J.P. (ed.) *Human health and forests: A global overview of issues, practice and policy*. Earthscan, London. 97–112.
- SMITH, K.R. and MEHTA, S. 2003. The burden of disease from indoor air pollution in developing countries: comparison of estimates. *International Journal of Hygiene and Environmental Health* **206**: 279–289.
- SMITH, K.R., MEHTA, S. and FEUZ, M. 2004. Indoor air pollution from household use of solid fuels. In: EZZATI, M., LOPEZ, A.D., RODGERS, A. and MURRAY, C.J.L. (eds.) *Comparative quantification of health risks: Global and regional burden of disease attributable to selected major risk factors*. World Health Organization, Geneva. 1435–1493.
- SUBBA, S. 1999. Women, woodfuel, and health in Adamtar village, Nepal. *Gender Technology and Development* **3**: 361–377.
- SUBEDI, M. 2010. Uterine prolapse, mobile camp approach and body politics in Nepal. *Dhaulagiri Journal of Sociology and Anthropology* **4**: 21–10.
- TABUTI, J.R.S., DHILLION, S.S. and LYE, K.A. 2003. Firewood use in Bulamogi County, Uganda: species selection, harvesting and consumption patterns. *Biomass and Bioenergy* **25**: 581–596.
- THE ADVOCACY PROJECT. n.d. Uterine prolapse in Nepal: Profile. <http://www.advocacynet.org/page/upaprofiles>. [Accessed: 25 July 2011].
- TSING, A.L. 1993. *In the realm of the diamond queen*. Princeton University Press, Princeton, New Jersey. 350 p.
- UN (UNITED NATIONS). 2010. UN chief kicks off drive to save more than 16 million women and children worldwide. *UN Daily News*. Available at <http://www.un.org/news/dh/pdf/english/2010/22092010.pdf>.
- UNDP (UNITED NATIONS DEVELOPMENT PROGRAMME). 2001. Improved fish smoking: Ghana. In: *Examples of successful initiatives in agriculture and rural development in the south, sharing innovative experiences*. Special Unit for Technical Cooperation among Developing Countries, United Nations Development Programme, New York. 240–254.
- UN-SCN. 2004. *Fifth report on the world nutrition situation*. Geneva, Switzerland: United Nations, Standing Committee on Nutrition and International Food Policy Research Institute.
- VINCETI, B., EYZAGUIRRE, P.B. and JOHNS, T. 2008. The nutritional role of forest plant foods for rural communities. In: COLFER, C.J.P. (ed.) *Human health and forests: A global overview of issues, practice and policy*. Earthscan, London. 63–96.
- VITTOR, A.Y., GILMAN, R.H., TIELSCH, J., GLASS, G., SHIELDS, T., LOZANO, W.S., PINEDO-CANCINO, V. and PATZ, J.A. 2006. The effect of deforestation on the human-biting rate of *Anopheles darlingi*, the primary vector of falciparum malaria in the Peruvian Amazon. *The American Society of Tropical Medicine and Hygiene* **74**: 3–11.

- WHITAKER, E.D. (ed.) 2006. *Health and healing in comparative perspective*. Pearson/Prentice-Hall, Upper Saddle River, NJ. 589 p.
- WHO Data. 2010. Adult mortality rate (probability of dying between 15 and 60 years per 1000 population). http://data.un.org/Data.aspx?q=adult+mortality+rate&d=WHO&f=MEASURE_CODE%3aWHOSIS_000004 [Accessed 7 September 2011].
- WHO (WORLD HEALTH ORGANIZATION). 2003. Lives at risk: malaria in pregnancy. Available: <http://www.who.int/features/2003/04b/en/> [Accessed 20 January 2011].
- WHO (WORLD HEALTH ORGANIZATION). 2005a. Indoor air pollution and health. *Fact sheets*, 292. Available at <http://www.who.int/mediacentre/factsheets/fs292/en/> [Accessed 20 January 2011].
- WHO (WORLD HEALTH ORGANIZATION). 2005b. The world health report 2005: Make every mother and child count. World Health Organization, Geneva. 219 p.
- WHO (WORLD HEALTH ORGANIZATION). 2009. 10 facts of malaria. Available: <http://www.who.int/features/factfiles/malaria/en/> [Accessed 18 January 2011].
- WHO, UNICEF, UNFPA and THE WORLD BANK. 2010. Trends in maternal mortality: 1990 to 2008. Estimates developed by WHO, UNICEF, UNFPA and The World Bank. World Health Organization, Geneva. 45 p.
- WOLLENBERG, E., ANDERSON, J. and EDMUNDS, D. 2001. Pluralism and the less powerful: Accommodating multiple interests in local forest management. *International Journal of Agricultural Resources, Governance and Ecology* **1**: 199–222.
- WWF (WORLDWIDE FUND FOR NATURE). 2002. Conservation on a crowded planet: A population sourcebook for conservation practitioners. Conservation Strategies Unit, WWF, Washington, DC.
- YAKOUB, M.Y., MENEZES, E.V., SOOMRO, T., HAWS, R.A. DARMSTADT, G.L. and BHUTTA, Z.A. 2009. Reducing stillbirths: behavioural and nutritional interventions before and during pregnancy. *BioMed Central Pregnancy and Childbirth* **9**(Suppl 1): S3.
- ZUK, M. and MCKEAN, K.A. 1996. Sex differences in parasite infections: Patterns and processes. *International Journal for Parasitology* **26**: 1009–1024.