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The Major Importance of 'Minor' Resources: Women and Plant Biodiversity

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EXECUTIVE SUMMARY

Understanding women's influence on plant biodiversity is essential to our ability to conserve plant genetic resources, especially those plants that are useful to humans. Contrary to previous thinking, it is becoming clear that women know most about these plants because, throughout history, women's daily work has required more of this knowledge.

This paper describes how women predominate in plant biodiversity management in their roles as housewives, plant gatherers, homegardeners, herbalists, seed custodians and informal plant breeders. But because most plant use, management and conservation occurs within the domestic realm, and because the principal values of plant genetic resources are localised and non-monetary, they are largely invisible to outsiders and are easily undervalued. Gender bias has prevailed in scientific research about people-plant relationships, and conservation policies and programmes are still largely blind to the importance of the domestic sphere, of women and of gender relations for biodiversity conservation, and to the importance of plant biodiversity for women's status and welfare. Traditional knowledge and indigenous rights to plants are everywhere sex-differentiated, and gender inequalities are also implicated in processes leading to biological erosion.

Achieving the goals of the Convention on Biological Diversity, particularly those related to sustainable use and to benefit sharing, will require much greater attention to women's knowledge, management and rights, and to the domestic sphere. Examples of positive steps needed include: prioritising the conservation of plants that are important to women curators and reversing dynamics that lead to their erosion; recognising, valuing and promoting the inter-generational transmission of women's traditional knowledge and practices; recognising indigenous rights systems and, within these, women's rights to plants and land resources that sustain these plants; ensuring women's full participation in decisions and policies that affect their plant rights and the status and welfare that they derive from plant resources; and promoting and disseminating research that enhances our knowledge of the above.

THE MAJOR IMPORTANCE OF 'MINOR' RESOURCES: WOMEN AND PLANT BIODIVERSITY

Patricia Howard

INTRODUCTION

Across the globe, and particularly in tropical regions rich in biodiversity, in villages, on farms, in homesteads, forests, common pastures, fields and borders, it is women who manage most of the plant resources that are used by humans. This means that they have the greatest local plant knowledge and are mainly responsible for the *in situ* conservation and management of useful plants, whether domesticated or wild. The simple explanation for this is that, throughout history, women's daily work has required more of this knowledge. Globally speaking, it is women who predominate as wild plant gatherers, homegardeners, plant domesticators, herbalists and seed custodians. In several world regions and among many cultural groups, they also predominate as informal plant breeders and farmers. In many cultural and economic contexts, local wild and cultivated plant varieties are considered to be 'minor' resources, secondary to major staple crops and forest products; women are also seen as 'minor' actors, secondary to men who are presumed to be the knowledge holders, managers and preservers of most plant resources that are thought to be 'valuable', particularly to outsiders. However, because most plant biodiversity use, management and conservation occurs within the domestic realm and because the principal values of plant genetic resources are localised and non-monetary (use values and cultural values), they are largely invisible to outsiders and are easily undervalued.

Because of these gender and resource biases, biodiversity conservation policies, programmes and guidelines frequently omit reference to women, to gender relations, and to the domestic sphere. Most plant biodiversity research is also not gender sensitive, which can lead to incomplete or erroneous scientific results with

respect to the diversity, characteristics and uses of plants, the nature of people-plant relationships in culturally-specific contexts, and to the causes of, and potential responses to, genetic erosion. In many regions, biological resources constitute the greatest part of women's wealth, providing them with food, medicine, clothing, shelter, utensils and income. Continued access to these resources is vital to women's status and welfare, and therefore women's motivations represent *a principal driving force* to counter processes of biological erosion.

This paper¹ is about how gender bias affects scientific knowledge of the plant world and how this in turn affects our ability to shape that world in ways that we desire. The repercussions go far beyond simply creating biased scientific knowledge: they extend into related practices, policies and interventions that are intended to change the interactions between people, and between people and their environments, and they can distort the outcomes in ways that are unanticipated and not always desirable. Only by giving serious attention to women's knowledge, use, rights and needs with respect to local plant biodiversity can two of the major goals of the Convention on Biological Diversity be met: the sustainable use of its components, and fair and equitable sharing of the benefits from its use.

WOMAN THE HOUSEWIFE

Ethnobotanical case studies from across the world indicate that the majority of plant species and varieties used by humans are cultivated or gathered for their domestic (medicinal, culinary, nutritional and aesthetic) values (e.g. Posey, 1999). However, only rarely is it explicitly acknowledged that women, in their performance of domestic tasks, sustain an intimate relationship with plants. Domestic tasks include gardening, plant gathering, post-harvest preservation, storage, and processing of food, medicinal, fuel and fibre plants, and they are most often assigned to women and girls. In fact, the kitchen and pantry are quite possibly the most undervalued sites of plant biodiversity conservation. In spite of its reputation as the site of human 'reproduction', the domestic sphere is tremendously productive. It involves a highly demanding and holistic level of traditional technical knowledge and skills that require, in many instances, at least a third of a lifetime to accrue. It also requires frequent innovation to respond to external and internal change.

1. This briefing paper is based principally on a recently published book (Howard, 2003) that presents initial results of a review of scientific literature being conducted at Wageningen University into people-plant relationships. More information about this review and the results are available through the author.

Culinary traditions are a highly important aspect of cultural identity. Foods are consumed for their nutritional content and also for their emotional, ritualistic, spiritual and medicinal values. Food is a fundamental constituent of exchange and hospitality, which are in turn basic organising principles of many traditional societies. While the idea of what constitutes an adequate meal or dish may be influenced by men, women are generally considered as the 'gatekeepers' of food flows in and out of the home. Culinary traditions are perpetuated by the careful transmission of knowledge and skills from mother to daughter. Culinary preferences, as well as the post-harvest processes that are required in order to provide edible and culturally acceptable food, are probably the single most important reason for people's knowledge, selection, use and conservation of plant biodiversity. What is highly significant and yet mainly overlooked in conservation efforts is the fact that, as culinary traditions are lost, the principal reason that people maintain a large amount of plant biodiversity is also lost. This is particularly and intimately related to change in women's position and status (Box 1).

Box 1. The kitchen and plant biodiversity

In the Andes, the cradle of the world's potato diversity, research shows that agronomic conditions alone explain only a small percentage of the variation in crop diversity (Zimmerer, 1991). Rather, the maintenance of different potato and maize species groups corresponds to different *culinary requirements*, e.g. freeze-drying, soup making and boiling. In Tuscany, Italy, women use more than 50 wild plant species to make traditional soups (Pieroni, 1999). As young Italian women enter the labour force and spend less time in the kitchen, the knowledge that women hold about these wild plant resources may be completely lost. In Swaziland, Southern Africa, the pressure on women's time as they become dependent upon wage labour is a main factor contributing to the abandonment of traditional coarse grain staples and indigenous vegetables in favour of refined wheat products and exotic vegetable varieties (Malaza, 2003). On the other hand, in urbanised Quintana Roo, Mexico, immigrant Mayan women struggle to preserve their culture and biodiversity by transplanting a large number of varieties that are native to their homes in the Yucatan into their urban homegardens, mainly in order to maintain their Mayan culinary traditions. In this way, they maintain elements of their ethnic identity as well as conserve and diffuse plant genetic diversity (Greenberg, 2003).

The knowledge and skills required in the post-harvest food chain are complex and dynamic, and several studies show that traditional women's knowledge in food processing and storage often correlates with scientific knowledge. For example, women ferment plants using traditional techniques that reduce spoilage and increase nutritional value, and they use precise methods to store and preserve plants that reduce the incidence of pests and diseases (Howard, forthcoming). When harvested and stored in quantity, native plant foods can be dependable, all season staples (Norton, 1985; Madge, 1994). Food storage and preservation skills that depend

upon ethnobotanical knowledge are thus vital to ensuring household food security and to ensuring that plants are useful to people and are therefore managed and conserved. Nevertheless, it is not often that people-plant research or conservation policies and programmes consider the significance of women's domestic processing, storage and food preparation practices, knowledge or needs (Howard, forthcoming).

WOMAN THE GATHERER

It is not only foraging societies (those dependent mainly on hunting, fishing, and gathering) that depend on wild plants; they are also essential to human livelihoods throughout rural areas of the developing world. In most of these systems, women predominate as plant gatherers. According to one statistical analysis of 135 different societies with various subsistence bases (e.g., agriculture, animal production, hunting, fishing, and gathering), women provide 79% of total vegetal food collected (Barry and Schlegel, 1982).

Wild plants provide food, fodder, mulch, medicine, fuel and a multitude of materials for crafts and construction. They provide essential foodstuffs in times of food scarcity or famine. Men and women have different needs and responsibilities for gathered plants, and different knowledge and preferences. For example, research in Uttar Pradesh, India (Flickenger, 1997) shows that women have greater knowledge of the usefulness of wild plants than men and perceive their usefulness differently. Men primarily use gathered plants for agriculture (fodder and mulch) while women's uses are more related to the household—medicines, tonics, cleansers, fibre, food and tools. Much research also shows that men often collect plants from 'men's spaces' and women collect from 'women's spaces'. For example, men may be allowed to enter sacred groves or highland forests, whereas women's spaces often include disturbed environments close to home, such as field margins, irrigation canals, roadsides and fallows. But in many societies, women venture far from home to gather plants in relatively 'wild' places such as forests and savannah, and some research demonstrates that men are not permitted to gather in these women's wild spaces. Conservation programmes can easily and unwittingly change access to spaces (e.g., 'nature reserves') without recognising how these changes may advantage and disadvantage women and men differently.

The idea held by many conservationists that plants growing in natural environments are 'wild', is also often mistaken: many are not strictly either 'gathered' or 'wild' but are selectively managed and harvested (Box 2).

Box 2. Women as wild plant managers

Among one group of Californian Native Americans, basket making was historically based on the collection of white root (*Carex* spp.), where 250-750 plants were needed to make a single basket. While harvesting, women left sufficient rhizomes in place to keep the patch viable for future use. They also removed weeds, thus cultivating the bed and enhancing the habitat for the production of new plants. Women also cultivated the roots with digging sticks, encouraging the growth of long straight rhizomes. This system was sustainable for hundreds of years. Nowadays, the available gathering sites have largely disappeared, so modern basket weavers are growing their own materials in homegardens (Stevens, 1999; Dick-Bissonnette, 2003). Another example is provided by wild rice in the Great Lakes region of the US and Canada. As these territories were taken over by whites, and American wild rice became a world commodity, the benefits of wild rice management were wrenched away from indigenous women (Vennum, 1988; Applied History Research Group, 2000). But women's ethnobotanical knowledge of wild plant management was essential for the survival of these tribes for at least several centuries, and essential to the relatively high status that women enjoyed in these societies.

Across the globe today, foraging resources are declining rapidly. Population growth, market expansion and environmental degradation are increasing the time and labour invested in foraging activities, particularly by women, and women's gathering rights are being usurped. The reduction of foraged foods in the diet is leading to poorer nutrition and is reducing emergency food supplies, thus increasing reliance on food purchases and decreasing management, knowledge and use of local plant biodiversity.

WOMAN THE GARDENER

Homegardens are the oldest and most widely used cultivation systems on the planet. Most definitions of homegardens refer to their location near the home, their function as a secondary source of food and income for households, the predominance of family labour, and their multi-functionality as aesthetic, social and recreational spaces, as well as for providing medicines, herbs and spices, fodder, building materials and fuel. In most instances, they have far greater species diversity than cultivated fields, and hence should be recognised as the single most important repository of cultivar diversity. Tropical gardens are the most renowned form of homegardens and are the most complex agroforestry systems known. For example, in West Java where some of the world's richest homegardens are located, 240 plant species were found in gardens in just two sub-districts (Soemarwoto *et al.*, 1976).

The importance of homegardens for biodiversity conservation is only now being tentatively recognised (Watson and Eyzaguirre, 2001). Gardens “...represent a ‘genetic backstop’, preserving species and varieties which are not economical in field

production and are planted small-scale..." (Niñez, 1987). In swidden cultivation systems, useful varieties that would be lost due to clearing and burning are transplanted to homegardens where they may thrive (Okigbo, 1985). One of the most important reasons to conserve plants *in situ* rather than in gene banks is to permit their continued evolution, and it is in homegardens where much of this evolution takes place. Many authors have also noted that farmers first experiment with new crop varieties in homegardens before they are planted in fields. The migration of the potato from South America to other parts of the globe occurred through homegardens, and the diffusion of maize began when Incan women settled newly conquered territories and brought maize seed with them to plant in their new homes (Niñez, 1987). Homegardens are also essential to the transmission of knowledge across generations. For example, among the Maya in highland Guatemala, "*Women educate children through the chores of the garden. They teach how to use farm tools, what plants need to thrive, and how to manage crops, especially through weeding and harvesting*" (Keys, 1999).

While the gender division of labour in homegardening varies across regions and cultures, the close link between gardens and the domestic sphere everywhere ensures that women tend gardens and hold the majority of knowledge, skills and responsibilities for homegardening. Like much of women's work, homegardening is relatively invisible and is often disparaged as 'minor' or 'supplemental' to agricultural production. This perception perpetuates the invisibility and devaluation of women's contributions to plant biodiversity conservation. Yet homegardens are a vital resource, particularly for poor women, since they permit them to provide additional food and income for their families. It is clear that homegardens and their women managers have been relatively neglected in terms of development planning and food security, and this neglect must also be corrected in biodiversity conservation efforts.

WOMAN THE HERBALIST

The World Health Organisation estimates that 80% of the world's population uses plant medicines for their primary health care needs. Between 25 and 40% of all modern pharmaceuticals are derived from plants (Farnsworth *et al.*, 1985). Research on folk medicine and medicinal plants is booming, but this has tended to focus on the knowledge of folk medicinal specialists: shamans, midwives and herbalists (McClain, 1989). Shamans and 'medicine men' are usually men who have great magical power and status in their tribes, although female priestesses are prevalent particularly in Africa and Asia. Herbalists, on the other hand, are special-

ists in treating illnesses through the use of plants and are frequently women; midwives are also herbal specialists and usually women. Women's ethnobotanical knowledge and medicinal roles are often unexplored by ethnobotanists, who tend to make a beeline for the shaman or medicine man. But awareness is growing that the 'common' knowledge of lay women actually *predominates* in traditional health care systems (McClain, 1989; Good, 1987). Among the Quichua in the Ecuadorean Andes, for example, women can detail the effectiveness of individual herb-illness combinations, where a total of 350 plants are used (Kothari, 2003). Advice is sought outside the home only when these herbal medicines do not help. Knowledge of herbal remedies is often passed along the female line; for example girls learn to observe and treat minor illnesses while caring for siblings (Howard-Borjas, 2002).

Men and women not only have different knowledge of medicinal plants: their knowledge is also structured in a different way, which is related not only to the division of labour, but also to social power. But ethnobotanical research has structurally neglected female healers and the realm of domestic curing and herbalism (Kothari, 2003). It is not surprising, then, that this bias is being largely reproduced by those concerned with biodiversity conservation.

WOMAN THE PLANT BREEDER AND SEED CUSTODIAN

There would be no agriculture without seeds and not nearly as much seed variability without seed custodians and plant breeders. Increasingly, it is large multinational corporations and international institutions that manage gene banks, and increasingly the world's agriculture is dependent upon them and on the purchase of seed. Traditionally, however, plant breeders and seed custodians are small farmers, and often, if not predominantly, women. Women in sub-Saharan Africa as well as in indigenous societies in Latin America and the Pacific are usually directly responsible for food crop production. As crop producers, they consider all of those selection factors that are critical to farmers who produce in marginal environments and manage many varieties for many purposes. For example, in Rwanda, women produce more than 600 varieties of beans (Sperling and Berkowitz, 1994); while in Peru, in one small village alone, Aguaruna women plant more than 60 varieties of manioc (Boster, 1985). While both men and women are involved in crop selection and have highly specific knowledge and use a variety of criteria, these differ substantially between them, and women's criteria and knowledge are more often overlooked by formal plant breeders and conservationists. Women often have a broader set of varietal selection criteria than men, since they use plant materials

in more diverse ways: for example, rice not only provides food, but also straw for thatching, mat-making and fodder, husks for fuel, and leaves for relishes (Jiggins, 1986). Women's responsibility for post-harvest processing and family food supplies means that they try to ensure that varieties are in line with culinary traditions, are palatable and nutritious, and meet processing and storage requirements. Several studies show that, even when women do not produce crops, men take women's preferences and criteria into account when selecting varieties. However, researchers mostly neglect these criteria since they are not directly related to agroecological field conditions.

Very frequently, women are also responsible for seed storage, preservation and exchange. Informal seed exchange systems are often female domains and include mechanisms such as the bride price, gift giving and kinship obligations, as well as market and barter transactions. Women's predominance in seed management activities is often explained by the close relation that this has with post-harvest and domestic work, since seed selection is often done at the same time that harvestable produce is processed and stored. It is also related to cultural beliefs about women, seeds and fertility, where women are seen to be the appropriate 'repository' of seed.

WOMEN AND RIGHTS TO PLANT GENETIC RESOURCES

Worldwide, discussions are going on about intellectual property rights to plants and the conservation and exploitation of plant biodiversity. Most now acknowledge that indigenous farmers and forest dwellers should have rights to the genetic material that they have developed and should be compensated for its private or public use. However, what these international systems of rights and discussions have largely failed to acknowledge is that native peoples have their own concepts of intellectual property at individual or group level based on factors such as residence, kinship, gender and ethnicity (Box 3). These indigenous systems serve to manage and conserve plant biodiversity. Leading experts in this field acknowledge that little is known about these 'indigenous' rights regimes and that research in this area should be a priority (Cleveland & Murray, 1997; Mgbeoji, 2002; see also Howard, 2003).

If indigenous rights (and women's rights) to plants are not recognised, they can readily be usurped. While women constitute the majority of those gardeners, gatherers, herbalists and plant breeders who have developed agrobiodiversity and identified useful plants, gender bias means they are likely to be the last to have their rights recognised and therefore to benefit from related development or compensa-

Box 3. Gender and indigenous rights to plants

Some studies show that, among indigenous populations, rights to gather plants are strictly regulated and are passed from mother to daughter. For example, gathered acorns were the most important dietary staple among California Indians, and “*The rights to gather plants from a specific area ... were inherited matrilineally*” (Dick-Bissonnette, 2003). Married daughters gathered seeds from their mothers’ seed localities but not from their mother-in-laws’ localities. Rights were established through continuous use and by marking out gathering locations. These rights were taken very seriously: “*If another woman tried to take resources ahead of a claimant, a fight would ensue that sometimes led to a family feud*” (Dick-Bissonnette, 2003). Across the globe, among the Igbos in Nigeria, an indigenous vegetable, *Telfairia occidentalis* (fluted pumpkin), is grown in women’s homegardens and is considered to be a ‘women’s crop’. Women cannot cut *Telfairia* plants belonging to others; this means that each woman must plant her own field (Akoroda, 1990). Price’s work (2003) on women’s traditional gathering rights to wild plants in Thailand is perhaps the most in-depth research to date on this topic.

tion schemes. Assuming that the rights or compensation given to ‘indigenous groups’ or ‘farmers’ will reach women is incorrect. If we really want compensation mechanisms to benefit the provider of these resources and to stimulate their continued conservation, we must consider carefully how women’s rights in particular can be respected.

GENDER BIAS IN ETHNOBOTANY AND RELATED SCIENCES

Ethnobotany is the study of people-plant relationships. A significant methodological shortcoming of much ethnobotanical research is that it assumes that the plant knowledge of a few people represents the knowledge of entire cultures. Most ethnobotanists tend to be blind to gender differences, even though, as we have seen, the knowledge and use of plant biodiversity is everywhere gender-differentiated. There are three associated errors:

1. The failure to research women’s knowledge and use of plants. Ethnobotanists often simply assume that men (particularly senior men) are adequate representatives of the collective ethnobotanical knowledge of their communities or that these men have superior ethnobotanical knowledge. The knowledge that women specifically hold is simply bypassed. Where women have more knowledge of plants than men, not interviewing them means that these species and varieties will be omitted, thus under-estimating biological diversity and its uses.
2. The use of poorly-informed sources, leading to the improper identification of plants, their management, characteristics, uses or names. Numerous studies have shown that women are often better able to correctly identify these parameters

than men, particularly for plants that fall more directly into their domains (eg. Zimmerer, 1991). One leading ethnobotanist recognised that “*Most of the ethnobotanical writings on female health issues were by foreign men, interpreting native men in turn interpreting native women*” (Duke and Vasquez, 1994).

3. The misunderstanding of people-plant relationships, since a critical component of these relationships is not revealed (see Box 4).

Box 4. Gender relations and Andean cultivar diversity loss

Stephen Brush and colleagues (1992) thought that male outmigration in the Andes might provide additional income that could be used to preserve traditional crops, but they also thought it could lead to genetic erosion since the farmers' knowledge would not be available to maintain these cultivars. They tested this hypothesis and found a negative correlation between on-farm diversity and off-farm occupations, which they thought was due to the fact that farmers earned more by working off-farm than by maintaining their native cultivars. But Zimmerer (1991) found in one of the same communities that Brush *et al.* studied that cultivar loss was not due to the absence of the male farmer who has the principal expertise. Male emigration doesn't decrease the expertise available since women hold most of this expertise in the first place. Rather, the 'feminisation of agriculture' is occurring due to temporary male emigration. Women-headed farm households don't have enough labour available to maintain all of the diverse cultivars.

It is often difficult to determine whether the first two errors have been committed. Research is presented in such a way that it is impossible to know whether women have been included as interviewees since references are to gender-neutral descriptors such as 'farmers', 'dwellers', 'experts', tribal names, etc.. In the majority of cases where it is made explicit that women were included in the research, the data are nevertheless not presented in a sex-disaggregated fashion.

If women are the main managers of plant biodiversity, then research should consider how they may specifically be affected by genetic erosion, such as the diffusion of modern varieties and increasing commoditisation of plant resources, decreasing access to common land and changing consumption patterns. Gender relations are also changing and, with them, women's incentives and management practices, which in turn affect biodiversity management.

GENDER, BIODIVERSITY LOSS AND CONSERVATION

Can women's needs, interests, knowledge and drives to conserve plant biodiversity be fully and equitably dealt with in conservation and development initiatives? There are some examples to say that they can.

The first comes from research in Guangxi province in Southwest China (Song and Jiggins, 2003) where male out-migration means that women now represent 80-90% of farm heads. While women here have always been mainly responsible for varietal selection and seed management, gender bias has meant that this role has not been recognised by the government. However, a new participatory plant breeding and varietal selection project is being carried out with women farmers in Guangxi State, developed by Song in response to the situation that she encountered in her research. In this project, maize breeding trials are conducted jointly between publicly-employed agricultural extension workers based at grassroots extension stations and village based farmer technicians, mainly women who are known local expert maize breeders:

Over time, the knowledge, skills, and attitudes of the breeders and extensionists, on the one hand, and the farmers, on the other, are drawing closer together, which strengthens all participants. Routinely, seventy to eighty per cent of the participants in the collaborative activities are women, with the women professionals taking a lead role in ensuring that their male colleagues 'listen to and learn from' the women farmers (Song and Jiggins, 2003).

Collaboration in maize varietal selection and breeding has linked women farmer maize breeders to the wider range of materials held by the research station, and has strengthened biodiversity conservation '*by widening the collection of materials accessible to farmer breeders . . . [and] by increasing the range of parental lines used by the formal breeders*' (Song and Jiggins, 2003). While the project cannot change the processes that have led to the feminisation of agriculture in the first place, the authors conclude that '*the lessons learned offer promise that women farmers' experience, skills, and needs will be more respected as agricultural modernization proceeds*' (Song and Jiggins, 2003).

A second example is Mapuche women's efforts to preserve plant biodiversity in Chile (Aguilar, 2001). In the forests of the Araucanía range in southern Chile, a multitude of medicinal and aromatic herbs are collected and used by Mapuche women in their roles as shamans (Machi) and food providers. But nowadays the Mapuche diet has been 'modernised' and they are forgetting how to prepare traditional foods. However, indigenous food will soon be featured on the menus of the most refined restaurants in Chile, offered by chefs who are members of the international 'top chefs' society, Les Toques Blanches. These chefs, interested in rescuing the culinary heritage of their country, made contact with an environmental

NGO, the Center for Research and Technology (CET), which supports women who cultivate native seed in Araucanía. The chefs met with 15 indigenous and peasant women who prepared for them the recipes that they conserve in their families. The Mapuche women not only prepare the food: they also cultivate the ingredients used in their recipes. The NGO calls them *curadoras* or ‘seed curators’; those who, in each community, are responsible for collecting samples of native seeds and storing and cultivating them at the appropriate time. Women cultivate wild species in their gardens to keep them from disappearing. The chefs think that, if enough demand is created, the peasant women will have to find the means to preserve and distribute the foods. They assume that a free market for these goods will make everyone happy: the gourmets who eat well and the women, who will become small entrepreneurs. But this remains to be seen.

This example shows that outsiders who seek to conserve biodiversity are able to recognise women’s knowledge and work, and to promote indigenous cultures and women’s status and welfare, while at the same time conserving the biodiversity that constitutes their wealth. However, it raises the question of whether creating markets for plant biodiversity will ensure these ends. Market expansion often shifts women’s traditional control over land and plant-based resources to men as these resources become more valuable. It can also stimulate over-exploitation in the absence of strong systems of indigenous resource control (see eg. Price, 2003; Wooten, 2003). It is not economic incentives that have created and sustained these biologically and culturally rich ethnoecosystems – rather, market forces tend to render them valueless because they cannot be readily monetised. When they do become monetised, the threat of their neglect or destruction increases.

CONCLUSIONS AND RECOMMENDATIONS

The Convention on Biological Diversity (CBD) explicitly states that the major custodians of the world’s biodiversity are those people who directly depend upon it for their livelihoods and cultural integrity.² This in turn implies that the preservation of biological diversity must be instrumental to achieving human welfare, where ‘human welfare’ is defined not only according to biophysical absolutes, but also to cultural values. In order to conserve much of the world’s biological diversity, then, the benefits of such conservation should accrue principally to those who help to create and sustain it. Conservation efforts should focus on maintaining the integrity of local cultural and agro-ecological (ethnoecological) systems, not only to pre-serve exist-

2. See for example, Article 8(j) (CBD, 1992).

ing biodiversity, but also to ensure its continual evolution *in situ*. This cannot, however, imply that 'poor' indigenous farmers and rural forest dwellers should be cordoned off in culture-nature reserves and expected to maintain biodiversity for the benefit of humankind and of the plant and animal kingdom, while the rest of the globe enjoys the genetic and aesthetic by-products of their knowledge and labour. Rather, it is the forces that are driving the loss of biological diversity as well as eroding the majority of human cultures that must be addressed.

Another objective of the CBD is to ensure the "*fair and equitable sharing of the benefits*" from the use of biological diversity (CBD, 1992). This cannot be addressed at all without considering the importance of women and gender relations in biodiversity management at the local level, and the presence of gender inequalities and gender bias in local, regional, national, and international systems that develop norms and regulations around biodiversity conservation. There is still often a failure to even acknowledge the importance of women or gender relations in the literature and in policy documents dealing with biodiversity conservation; even where acknowledgement is made, such as in the Convention on Biodiversity, it is recognised that "*much more still needs to be done in relation to increasing the participation of women in the work of the Convention*" (UNEP, 2000). If women's roles and needs are overlooked, then the costs and benefits of biodiversity depletion and conservation will not be accurately understood or estimated. If women's values and uses in particular are overlooked, then the costs to women of genetic erosion and the benefits that they derive from conservation will also be poorly estimated. Drawing from historical experience, the costs and benefits to women are overlooked because their activities are often unpaid, linked to the domestic sphere, and 'invisible' to economists, planners and scientists. Gender-sensitive approaches to estimating the costs and benefits of biodiversity conservation and to assessing their distribution and their impacts on human welfare are not an ill-affordable luxury – rather they are *sine qua non*.

Further, the significance of gender relations in plant biodiversity management not only has implications for research and practice concerned with biodiversity conservation, but is also crucial to problems such as food security, health, poverty, agriculture, trade and technology development. Hamdallah Zedan, the Secretary to the Convention on Biological Diversity, recently highlighted the need to implement the Convention across all sectors (personal communication 2002). This paper has emphasised and analysed some of the interconnections that must be dealt with in these many different spheres of development policy and intervention (see also Howard, 2003).

It is certain that more resources should be invested in examining the effects of plant biodiversity conservation initiatives on women. However, such individual conservation initiatives will not be enough. Productivist, globalised agro-food systems and an economic and social order that devalues women and the domestic sphere are socially, environmentally and economically unsustainable. The conservation of the world's remaining plant biodiversity requires that agriculture and biological resource management be 're-localised' and that the co-evolutionary relationships between culture and nature be re-established. This in turn implies that local people will have to be enabled and empowered, including through the recognition of their rights to access, control and knowledge. This is impossible to accomplish without ensuring that these resource managers, particularly women, are able to achieve a culturally and physically acceptable level of welfare from their interactions with the environment and society. The 'sustainable use' and 'fair and equitable sharing of the benefits' from the use of biological diversity cannot be addressed at all without considering the importance of women, the domestic sphere, and equity in gender relations in plant biodiversity management at local level. These can be ravaged in a single generation by commoditisation and acculturation processes that place little value on them.

Positive steps to ensure that women's contributions to biodiversity management and conservation are taken into account, and that their reliance on plant genetic resources for their livelihoods, status and welfare are recognised, include:

- Prioritising the conservation of plant genetic resources that are of the greatest importance to the women who are their principal curators; this means giving much greater attention to the non-monetary values of these resources and reversing the dynamics that are leading to their erosion, such as changing culinary habits and pressure on women's time and land resources;
- Recognising and documenting the value of women's indigenous technical knowledge of plant resources and promoting its use and transmission in all appropriate spheres, including formal and informal education, training and extension;
- Recognising indigenous rights systems to plants and the fact that these rights systems are differentiated by sex; endeavouring to ensure that any changes to these systems respect women's rights and compensate women directly and that women have a proportionate voice;
- Ensuring indigenous women's full participation and decision-making capacity in conservation and management efforts and policies that affect them; and monitoring such efforts for their effects on these women's rights, status and welfare;
- Promoting and disseminating research that increases our knowledge of women's relations to plants and plants' relations to women's status and welfare.

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