Forest and Human Health
Changing the Health Worker’s Paradigm – Riches from the Forest

A synthesis from Brazil, Cameroon, Ethiopia and Indonesia

The linkages between human health and tropical forests are complex. Many factors, such as diet, poverty, land-use practices, population density and movements, types of forest, forest disturbance and connections to wildlife and disease vectors influence these linkages. Forests provide an array of ecosystem services such as prevention of soil erosion, they filter and regulate fresh water, sequestrate carbon and provide food, medicine, fodder, timber and fiber for millions of people (Vinceti at al. 2008). Complexity of linkages between human health and forest is particularly acute with regards to pathogens: on one hand the latitudinal species diversity gradient shows that the richness in parasitic and infectious species increases with latitudinal proximity to the equator (Guernier et al., 2004) On the other hand, a protective function of the biodiversity hosted by forests consists of maintaining the balance among predators and preys, and among vectors and parasite (Chivian, 2001), thus controlling the emergence and spread of infections diseases in pathogen-rich forest environment. Forest communities are, however, often affected by diseases that are common in the tropics, such as malaria. But due to forest communities’ remoteness, often far from cities and in areas with low population density, formal health care is sparse; and therefore those communities are often more exposed and vulnerable than communities living closer to urban areas. Hundreds of millions of people live in or near forests (Colfer et al, 2006b), but the importance of forests for people varies along a range from hunter-gatherers to swidden farmers, to recent in-migrants, to settled farmers, and to urban dwellers.

Many researchers, including those at the Center for International Forestry Research (CIFOR), have called for better cooperation among a host of actors at all levels in the efforts to identify opportunities and deal with emerging problems, as the Center strive to improve human health and forest management. Forest community groups, for example, need to work closely with both health professionals and foresters; and researchers and policy-makers from all administrative levels and from all disciplines need to collaborate more effectively (Colfer et al. 2006a).

In view of this, the CIFOR with funding from the SIDA funded initiative, the Swedish International Biodiversity Programme (SwedBio), organized four workshops during 2007 in Brazil, Cameroon, Ethiopia and Indonesia. From 30-60 people participated in each of the workshops and included health workers, civil society organizations, forestry professionals, researchers and national policy makers. The purpose of these two-day events was to disseminate knowledge, facilitate dialogue between various stakeholders, and plan how to place forest and human health issues on the national and international agendas. In order to communicate the outcomes from Brazil, Cameroon, Ethiopia and Indonesia, these national workshops will be, during 2008, followed by three meetings with an international perspective in Geneva, Stockholm and Washington DC. The aim is to initiate dialogue between policy makers from various disciplines and to stimulate
actions for improving the health situation for the people living in, or adjacent to, forests in developing countries.

The 2007 workshops were organized around four themes: 1) Logging and Human Health, including direct and indirect impacts on people’s livelihoods; 2) Plant Based Medicines; 3) Nutrition; and 4) Policies, both formal and customary that support or impede public health care. The four countries were selected because of CIFOR’s well established networks there and due to their geographical spread over three continents.

This paper is structured around the four themes. Under each theme, outcomes from the workshops are presented, along with facts and figures about forest and human health linkages. The paper starts with some basic forest and health statistics in the four countries.

**Basic Health and Forest Statistics**

By way of background, an overview of selected forest statistics and health indicators for Brazil, Cameroon, Ethiopia and Indonesia are presented in Table 1. According to the Food and Agricultural Organization (FAO, 2007), the deforestation rate in all four countries has increased in the five year period from 2000 to 2005, as compared with the earlier ten year period (1990-2000). Brazil has the lowest annual change (-0.6%) in percent of forest loss of the four countries, but due to the country’s vast forest area of almost 4.8 million square kilometres, even this deforestation rate means the absolute number of square kilometres deforested is very high.

The under-five mortality rate is high in both Ethiopia and Cameroon at 164 and 149, respectively, per 1000 live births, while in Indonesia and Brazil the mortality rate is much lower at 36 and 33 respectively. (Table1). Unlike developed countries most developing countries, have very few medical doctors, dentists or nurses compared to the size or the national populations (Cunningham et al, 2008). In Ethiopia there are only 0.03 physicians per 1000 inhabitants, in Indonesia 0.13, in Cameroon 0.19. Brazil has 1.15 formal trained doctors, which is considerably higher than the other three countries, but still significantly lower than the average of 3.13 doctors in the 23 richest OECD countries (UNDP, 2008).

**Table 1. Selected forest statistics and health indicators for Brazil, Cameroon, Ethiopia and Indonesia**

<table>
<thead>
<tr>
<th>Forest Statistics</th>
<th>Brazil</th>
<th>Cameroon</th>
<th>Ethiopia</th>
<th>Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total forest area sq km 2005</td>
<td>4,776,980</td>
<td>212,450</td>
<td>130,000</td>
<td>884,960</td>
</tr>
<tr>
<td>Forest cover % of land 2005</td>
<td>57.2</td>
<td>45.6</td>
<td>11.9</td>
<td>48.8</td>
</tr>
<tr>
<td>Annual change 1990-2000 %</td>
<td>-0.5</td>
<td>-0.9</td>
<td>-1.0</td>
<td>-1.7</td>
</tr>
<tr>
<td>Annual change 2000-2005 %</td>
<td>-0.6</td>
<td>-1.1</td>
<td>-1.1</td>
<td>-2.0 (-3.9</td>
</tr>
<tr>
<td>Health Indicators (national average)</td>
<td></td>
<td></td>
<td></td>
<td>Borneo island)</td>
</tr>
<tr>
<td>Under-5 mortality rate</td>
<td>33</td>
<td>164</td>
<td>149</td>
<td>36</td>
</tr>
<tr>
<td>Nurses per 1000 population</td>
<td>1.11 (2000)</td>
<td>0.00 Total in country 93(2003)</td>
<td>0.01 (2004)</td>
<td>0.03 (2003)</td>
</tr>
</tbody>
</table>

* Probability of dying per 1000 live birth. *Years in parentheses are WHO’s latest available statistics.*


### Impact of logging / deforestation on health and livelihoods

Changes in land use, for example forest logging, impact every part of the local ecosystem: microclimate, soil and water resources, and flora and fauna. These factors in turn will affect the breeding and living environment for human disease vectors and parasites (Butler, 2008). Many of the linkages between ecosystem changes and vector born diseases, however, remain unclear.

Even though the population growth, as a percentage, peaked in the 1960s, the world’s population of currently almost 6.7 billion people grows by at least 70 million per year (Butler, 2008). Population growth, which will mostly occur in developing countries, will likely increase further deforestation due to increased demand for agricultural land, infrastructure and development of urban areas.

Viral diseases pose major threats to both human and wildlife populations and in forested areas vector-borne diseases are particularly common. Although the outcome of ecological disturbances is different for different vectors and ailments, deforestation appears often to increase the incidence of diseases to humans (Colfer et al. 2006a).

Approximately 300 million people in the tropics are infected with malaria every year, causing about 2 million deaths annually. Malaria is spread by mosquitoes infected by the parasite Plasmodium; this disease is particularly influenced by changes in the ecosystem as mosquitoes are very susceptible to alterations in their environment. But the linkages between deforestation and the incidence of malaria are difficult to assess as the vectors require different habitats: some of the species require water bodies in shade, while others prefer sunny breeding places. Thus, ecosystem changes, such as deforestation, agricultural activities, plantations, logging, fuelwood collection, urbanization and road construction may either improve or destroy the mosquitoes’ habitat (Subhrendu and Yasuoka, 2008). Also, the very same type of land conversion can create different
outcomes depending on the geographical location and ecology of the local vector and the local environment.

Ebola, which was first identified in 1976, is a disease caused by a virus that exists in tropical forests in Africa (WWF, 2008). About 1500 cases have been reported since discovery with approximately 1000 deaths. The sick have either been infected by handling contaminated bush-meat, or have treated infected people. Contrary to the HIV virus that left the forest long time ago, Ebola remains a strictly forest-associated disease (Butler, 2008).

**Excerpts from workshop findings**

This theme, impact of logging/deforestation on health and livelihoods, was discussed to various degrees at all four workshops. The following are excerpts from Indonesia, Ethiopia and Cameroon.

The participants in West Kalimantan, Indonesia reported that oil palm and logging involve chemicals that leach into water bodies, which result in contaminated drinking water and is affecting fish supplies. Moreover, logging and other kinds of forest clearing and disturbance reduce the availability of foods, medicines and other economic resources that local people use, with reduced incomes as a consequence. Since income generating opportunities are reduced, people are forced to move to other areas or have no other alternatives but to take resources in national parks and protected areas. It was also noted that farmers are plagued with more pests on their crops and that wildlife has decreased in the area. Benefits from forest clearing are inequitably distributed, with companies and other powerful stakeholders benefiting substantially more than local communities.

Deforestation can also affect the hydrological cycle and cause water shortages, as the participants in Ethiopia verified. Poor water quality and quantity result in inadequate hygiene and increased incidences of water-borne diseases. In some areas in Ethiopia, farmers use Moringa tree branches to serve as water cleansing agents besides its use as food and medicine (more on http://www.moringnews.org).

**Plant based medicine**

Numerous plants and animals in the forest produce various biologically active substances such as fungicides and antibiotics as defence mechanisms, of which many have medicinal uses in both traditional health care and formal medicine (Colfer et al. 2006b).

Plant based medicine is the focus of the present paper, but medicinal products originating from animals are commonly used also. For example, bear gall bladder, reptile skins, snake fat, monkey bezoar stone, bird horns, swift nests, and above all, the many uses of insects (Motte-Florac and Thomas, 2003).

In many parts of the world, gathered non-timber forest products (NFTP) comprise an important part of people’s subsistence living. Among the NFTP collected, medicinal
plants make up a significant portion that is for subsistence use as well as domestic markets, and growing export markets (Schippmann et al., 2003).

Given the increasing demand for herbal medicine all over the world, many species are threatened, along with deforestation for logging and other land conversion purposes (Schippmann et al., 2003). Some medicinal plants are threatened globally due to over-harvest, slow-growth patterns, or in some cases traditional systems of management may have been lost (Colfer et al., 2006a).

**Number of plants used, traded and threatened**

Schippmann et al. (2003) estimate that more than 50,000 plant species currently are utilized for medicinal purposes around the world, of which more than 4000 are under threat, while the International Union for the Conservation of Nature (IUCN) estimates higher figures. The IUCN estimates that there are more than 70,000 plant species utilized for medicinal purposes and that up to 15,000 of those are under threat due to habitat loss or over-harvest. Based on studies of medicinal plants in trade, Schippmann et al. (2003) that about 2500 plant species are international traded.

Approximately 50 percent of prescription drugs contain components derived from plants (Hawkins, 2008). For example, *Catharanthus roseus* is used to treat leukaemia and Hodgkin’s disease, aspirin was found in willow bark (*Salix spp.*), while the malaria treatment quinine comes from the cinchona tree. Modern medicine will continue to rely on biological material and nature’s unique sources of molecular diversity. The demand for medicinal plants is increasing in both developing and developed countries, due to substantial population growth in the former and because of increased interest in using natural medicine in the latter. In Europe, North America and Asia the market is growing by 8-15 percent annually (Schippmann et al., 2003). The World Bank estimates that the international trade in medicinal plants is worth USD60 billion annually and that the market is growing 7 percent per year (Hawkins, 2008).

In many countries, cultivation of medicinal plants is increasing, as pharmaceutical and herb companies tend to prefer the quantity and quality consistency of cultivated material, which can also be certified as biodynamic or organic (Schippmann et al. 2003). Nonetheless, the bulk of the medicinal plants are harvested from the wild. Hawkins (2008) estimates that only about 20-30 percent of traded medicinal plants are cultivated. Many of these plants are found in abundance; some could even be classified as weeds, but some are rare and over-harvested (Cunningham et al, 2008). There are many examples of over-harvested plant species: e.g., *Prunus africana* in West Africa, *Warburgia salutaris* in southern Africa and *Saussurea costus* in the Himalaya. Especially threatened are plants that are habitat specific, slow-growing and harvested for their bark, roots or the entire plant. Small scale production in home gardens of medicinal plants for household consumption and for sale can give households both remedies and a diversified income (Schippmann et al., 2003).

Schippmann et al. (2003) suggest that for threatened plants that are not economically feasible to cultivate, public domestication programs are needed. On the other hand, for
plants that are not threatened the priority should be to harvest sustainably from wild growing plants. In so doing, there is an incentive to protect and conserve the ecosystem where the valuable plant grows. Some species are, also, very difficult to domesticate due to biological traits or requirements of specific ecological conditions, which are difficult to obtain. Another important aspect to take into account is of course the economical feasibility of cultivation.

**Poor people’s reliance on medicinal plants**

Often, traditional medicine and healers are the only alternatives for people in developing countries due to lack of formal health care systems, especially in rural areas (Cunningham et al., 2008). However, even in urban areas where formal medicine may be more accessible, demand for traditional medicine and care is still high. Only 15 percent of the pharmaceutical drug supply in the world is consumed in developing countries, and the World Health Organization (WHO) estimates that 80 percent of the world’s population uses traditional medicine for their primary medical care (Hawkins, 2008). Extinction of medicinal plants through over-exploitation, land changes and deforestation, is a significant threat to the rural poor who not only mainly rely on traditional medicine for their health care, but very often also for income generation. For poor landless people, harvesting of medicinal plants can compose an important source of income, despite low prices often paid by traders for unprocessed material (Schippmann et al., 2003).

There are numerous examples of “conflict-of-use” species (trees that are valuable for both timber and non-timber use) in tropical Africa, and South and Central America (Cunningham et al., 2008). For example, in eastern Amazonia, eight of the most important tree species for fruit and medicine, are extracted for timber (Shanley and Luz, 2003). In West and East Africa, *Prunus africana*, valuable for its medicinal bark, is also logged heavily. *Prunus africana* is listed under Appendix 2 of the Convention on International Trade in Endangered Species (CITES). Community-based management plans for sustainable bark harvest from Mt Cameroon have failed. The outcomes CITES listing have also been mixed, and have not protected remaining populations of this tree in Cameroon or Madagascar, leading to a recent EU ban on importation of *Prunus africana* bark from Cameroon.

A wide range of forest dwellers (migrant populations, former hunter-gatherers) are confronted to increased inefficiency of their traditional healing systems when they encounter diseases that are new to them (Voeks and Sercombe, 2000; Dounias and Froment, 2006).

**Adverse effect**

Medicinal plants can pose adverse effects if they are not properly harvested, prepared and stored (Cunningham et al, 2008). In a study carried out in Asia it was found that some herbal medicines contained arsenic, lead and mercury with toxic levels higher than public health guidelines, while the herbal medicine tested in another study in Nigeria contained heavy metals. Another problem with medicinal plants is that plant species may look similar to collectors, who gather plants that may have properties that can cause harm to
humans and livestock. Due to scarcity of certain plants, collectors may substitute species, which might have other properties.

**Excerpts from workshop findings**

By far, the medicinal plant theme received most interest at all four national workshops. The following are some of the findings that the participants in Brazil, Ethiopia, Cameroon and Indonesia consideration important factors.

There is still plenty of skepticism about traditional medicines in Brazil. One reason is the lack of any quality control or certifying agency for herbal medicines, certainly increasing negative perceptions of traditional medicines. In general, despite some positive dissemination progress, information about traditional medicinal plants is very limited.

In Indonesia, the participants also highlighted the importance of medicinal plants in areas where there are no formal doctors or modern medicines, and they emphasized the availability, speed, and inexpensiveness of such medications. The group also recognized that some plants are poisonous and that knowledge of such plants is not widespread. Habitat loss due to deforestation; over-harvesting of medicinal plants by industry; local people’s collection of forest products; growing ignorance of traditional medical knowledge; and over-reliance on traditional medicine alone were other concerns that were discussed.

Eighty to 90 percent of the Ethiopian population uses traditional medicine for primary health care. Its diverse agro-ecological zones has meant that the country is well endowed with medicinal plants. So far, about 1000 species have been documented. These are used in the traditional health care system and treat some 300 diseases. Around 92 percent of the plant material is collected from the wild. Mander et al. (2006) report that approximately 48 million people in Ethiopia annually consume 56,000 tons of medicinal plants, which was, in 2005, worth USD220 million.

**Nutrition**

Forests provide important food supplements to people, especially during times of difficulty like drought, war, and famine (Vinceti et al., 2008). For millions of people, wild foods provide the major source of animal fats, protein and minerals in their diets. Some of the most common nutritional problems in forested areas in developing countries are vitamin A, iodine and iron deficiency.

Forest foods such as leaves, roots, mushrooms, fruits and nuts are valuable sources of micronutrients and serve therefore as important complements to staple foods, which often lack many essential nutrients (Vinceti, et al., 2008). However, the nutritional content of wild species has not been well documented. It has been observed that the loss of traditional knowledge about forest biodiversity has resulted in simplification of people’s diets. As a consequence, some forest foods may be viewed as unfashionable and conservative. Bioversity International launched a successful public awareness campaign to encourage people to produce and eat the many African leafy vegetables that provide
valuable nutrition. A counter example is bracken ferns that contains carcinogenic secondary compounds that are source of more frequent stomach cancers.

Some of the most commonly consumed forest foods are leaves that are either dried, fresh or fermented and are mixed into soups, stews or relishes and eaten together with staple foods (Vinceti, et al., 2008). The baobab tree (*Adansonia* spp) in Africa is a well documented example of such use, and is consumed throughout the African drylands. The genus *Gnetum* is another well known species that is found throughout the tropics in Asia, South America and Central Africa. In Cameroon, the *Gnetum* is over-harvested due to an increased export demand for the leaves. The tree is also sometimes uprooted when harvested.

Fruits and nut trees are the best studied species with regard to their nutritional value (Vinceti, et al., 2008). Fruits are usually rich in fructose and other sugars, vitamins, minerals and dietary fiber. Orange-fleshed fruits, for example mangoes and papaya, are significant sources of carotene (vitamin A), which is often lacking in tropical diets. Almond, pecan, pistachio and walnut are examples of nut trees that are rich in essential amino acids, hence important dietary supplements of high-quality proteins. In addition, nuts are rich in fiber, vitamin-E, minerals and essential fatty acids.

Wild roots and tubers have high starch content and are an important food source in forest areas. There are numerous edible roots and tubers in the tropical humid forests and woodlands. Forest yams, for example, are consumed in Africa, Australia and Asia (Vinceti et al., 2008). Among many South East Asian forest dwellers, basic source of starch is sago palm.

Mushrooms are consumed in most cultures, but the potential of mushrooms is often overlooked in developing countries (Vinceti, et al., 2008). In Southern Africa, however, several studies have shown that up to 60 different species of edible mushrooms are sold at local markets. Palms can also provide important nutrition to forest dwellers, especially in the humid tropics. For example, mesocarps of some palm fruits contain vitamin A. Forests can also be important “kitchen cupboards” for livestock. Leaves, fruits and seed pods from trees can be significant supplement to grass and other fodder. Many palm trees offer an indirect source of many edible insects (Dounias, 2003), and some species have been domesticated in Latin America for this particular purpose (Chagnon, 1968; Berlin and Berlin, 1979).

Forests’ plants produce many other valuable sources of nutrition for humans. For example liquids, edible oils, and plants that are reduced to ash for salt (naturally occurring inorganic substances, including iodine, that prevent from goiter) (Dounias and Colfer, 2008) Bushmeat, insects, and freshwater aquafauna (fish, shellfish) are other valuable sources of food from the forest (Colfer et al., 2006a).

Beyond food and medicinal plants, there are plenty of forest resources which are selected and used in a way that contributes to create a healthy environment. For instance, many
plant material (bark, resins, latex, wood, leaves) used for housing act as repellent against insects that are vectors of pathogens (mosquitoes, flies, fleas, louses, mites, ticks). Some plants keep away flies from stored food, some others delay the decay of a dead body, many woods are resistant to termite attack and enable to protect the crops against vermin inside lofts. Some shading trees keep away mosquitoes or rodents, some act as repellent against snakes, some aromatic resins serve to light at night, they keep away mosquitoes and have aromatherapy properties, etc (Dounias, 2000).

Excerpts from workshop findings
The following excerpt is from the workshops in Ethiopia, Cameroon and Indonesia.

In southern Ethiopia, consumption of wild food plants seems to have become more common in recent years due to the increase of droughts and floods. Of the estimated 6000–7000 higher plant species, about 8-10 percent is believed to be edible for humans. Some tree species provide both food and medicine. An example of such multi-purpose tree species is *B. rotundifolia*. Its fruits, including the kernels, are edible, while its leaves and seeds are used for treating malaria and tuberculosis, and its root is used as a remedy for stomach-aches. The leaves are also browsed by camels and goats.

Despite the availability of a diversity of foodstuffs in Cameroon, malnutrition remains a serious problem. To achieve the Millennium Development Goals by 2015, the malnutrition rate must be reduced by half while the child mortality rate should be reduced by 2/3. Forest resources provide a great part of the micro nutrients, fibers and bioactive elements needed to be healthy. As feeding habits with time shift due to changes in people’s preferences, most traditional diets composed of forest foods are progressively abandoned.

In West Kalimantan, harvests of wild honey used to make an important income for the communities, but frequent forest fires have destroyed many of the bees’ nests. It was also noted that despite degraded forests, people could still obtain some food in those forests.

Policies
Pharmaceutical companies are frequently accused for collecting significant benefits from forest peoples’ knowledge. The Convention on Biological Diversity (CBD) as a legal framework is intended to support benefit-sharing rights (Colfer et al. 2006b). Intellectual property rights issues are complex, however, and in many developing countries mechanisms for protection are often lacking.

Excerpts from workshop findings
Various traditional and formal polices that impede or enhance forest peoples’ health were discussed at all four workshops and the following are some of the points that were brought up.

The participants in Brazil highlighted that the poor communication between various decision makers at all administrative levels is seriously interfering with the resolution of
important forest and health issues. For example, training programs about traditional knowledge for health practitioners and people working with food security, as well as the implementation of many policies are not put in place due to inadequate coordination among different municipal councils.

In Indonesia, in general, there is a unique level of respect for traditional healers. The traditional rules (adat) that relate to all aspects of life are still functioning in many areas of West Kalimantan, but in other places adat has lost its importance. According to some of the participants, the forest is properly managed where the local rules are still strong and where the forest is considered shared property. Traditional sanctions within the adat, which rely on social relations, may be more effective and closer to people’s hearts than formal laws, which in Indonesia are often unclear or contradictory and often not monitored.

Several initiatives have been introduced in Ethiopia that aim to enhance the status of traditional medicine: the 5-year (2004-2008) strategic plan that will effectively integrate traditional medicine with the national health care system and that supports research on medicinal plants; the biodiversity action plan, which recognizes medicinal plants as important components of Ethiopia’s natural heritage; and the project “Conservation and Sustainable use of Medicinal Plants”, in which property rights have been evaluated, and research has been conducted on several plants and their medicinal properties. There are, however, still many technical and legal problems to overcome regarding medicinal plants. Also, in 1994 the Ethiopian Government identified 58 biodiversity hot spot forests as National Forest Protection Priority Areas. These forests are protected by the state and recently efforts have been made to engage communities to sustainably manage these forests.

In 1994, a new forest law was passed in Cameroon that includes forestry, fisheries and wildlife. The law, which is compatible with several international and regional conventions, should lead to economic, ecological and social development through integrated management, including local actors. This law favors the development of community management of forest resources, and recognizes forest communities’ right to collect forest products for subsistence use in both permanent and non-permanent forests.

In Cameroon, medicinal plants tend to be neglected in forest resource management policies. But this may change with the new national health strategy, which aims to integrate traditional medicine into the national health strategy by 2015. Under this strategy, certificates for traditional healers will be issued. This certification will guarantee certain quality standards for handling medicines, and healers are limited to specialization in five diseases at most. Other components of the strategy contain mechanisms for intellectual property protection, research promotion, local production development, and recognition of traditional knowledge.
Conclusions
The four workshops were truly unique meetings in all four countries. The participants stressed the importance of the cross discipline dialogues that were facilitated through these meetings. It is expected that these workshops will increase awareness among stakeholders with improved interactions between different actors at various administrative levels.

The workshops made many recommendations for enhancing the health for people living nearby forests. Most of the ideas and suggestions were similar across the four workshops. Below are some of the recommendations that were highlighted at all four meetings.

- Education: enhance peoples’s knowledge of the importance of traditional medicine.
- Improve collaboration among various stakeholders, for example between different ministries, research institutions, development organizations and non-governmental organizations.
- Improve data collection of medicinal plant use and support research on medicinal plants along with research on traditional medicine and documentation of indigenous peoples’ knowledge.
- Create guidelines for traditional medicine production: harvesting, storage and processing for safe medicinal products.
- Support domestication and cultivation of medicinal plants.
- Harmonize traditional and modern medicine.
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