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No Longer Nomadic: Changing Punan Tubu Lifestyle Requires New Health Strategies

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Over the past half-century tropical humid forests have undergone unprecedented pressure to make way for people, often at the cost of ecological functions that may affect human health. The role of deforestation in the increase in infectious diseases is the most obvious direct health impact, but more indirect consequences should not be underestimated. In the long term, deforestation causes losses of potential medicines and increases in pollutants. It also contributes to global climate change and has negative effects on health (Taylor 1997).

One critically important service of natural ecosystems is controlling the emergence and spread of infectious diseases by maintaining balance among predators and prey, and among vectors and parasites in plants, animals, and humans. Human biological and psychological factors contribute to a society's vulnerability to disease, but ecological and global systems are also important, as are economics and access to health care (Epstein 1997).

The experience of the Punan Tubu in Borneo has helped scientists assess how sedentarization affects the health of formerly nomadic forest hunter-gatherers. A team of scientists from the Center for International Forestry Research and the French Research Institute for Development carried out a study on nutritional ecology with the Punan Tubu that revealed many problems associated with sedentarization. Nutritional ecology is the interaction of diet, somatic maintenance, physical activity, and pathogenic agents as they relate to growth, body composition, development, and function in a changing social, political, and natural environment (Jenike 2001).

The Indonesian province of East Kalimantan is home to some 10,000 Punan hunter-gatherers. The Punan Tubu (nearly 800 people) live in small hamlets scattered in the Tubu watershed that is part of the district of Malinau. They are no longer nomads, but those living far upstream in the remotest part of the Tubu watershed still seasonally leave their recently permanent settlements and migrate into the forest to hunt wild boar and gather a wide range of forest products for sale and for their own subsistence. Those living downstream were strongly encouraged by the government to resettle near Malinau city almost 30 years ago and have definitively given up their nomadic way of life. Today they practice lowland rice cultivation and their economy depends on market opportunities, off-farm activities, and fees paid by concessionaires in return for the right to exploit timber and coal.

Changes in the Malinau district such as economic growth and regional autonomy drastically modified the availability and accessibility of forest resources. Such changes have negative ecological and social consequences, but undoubtedly offer new—although sometimes ephemeral—economic opportunities (Levang *et al.* 2004).

Nutritional ecology research questions the ability of humans to adapt to the changes of the environment. Throughout history, the Punan have had to adapt to changing forest environments. But the changes they deal with today are much more brutal and radical than what they ever faced in the past. Deforestation, drastic modification of resource availability, and invasive influence of modernity intervene so rapidly that they compromise the adjustment of social, cultural, economic,

and political systems. The Punan are now forced to respond in ways that are not validated by long-term experience, and that may squander their ecological success.

Diets and diseases are sensitive, hence precious indicators of the ecological and cultural costs these societies pay to get their share of modernity. Social change may not necessarily be accompanied by a well-balanced biological optimum—it may sometimes invalidate defense mechanisms and nutritional status. The imbalanced biological side may in return compromise the social and cultural integrity of the community.

Problems of Sedentarization

Like many Southeast Asian deforested areas, Borneo is experiencing an epidemiological transition from infectious diseases toward non-communicable diseases that were totally absent a few decades ago. This transition is particularly pronounced in urban settlements where life expectancies have increased and mortality rates decreased, especially among high-risk groups. Tropical diseases remain significant, malaria and dengue have worsened, and long-distance travels have increased the severity of epidemics like influenza and measles.

There is strong consensus among anthropologists who work among recently settled hunter-gatherers that the shift from nomadic to sedentary lifestyle generally compromises health and well-being. Hunter-gatherers typically have poorer access to education and health services than sedentary people, but the sedentary Punan living upstream in remote villages have no better access than when they were nomadic. And now they suffer the epidemiological disadvantages of living in permanent villages:

- Poor sanitation brings increased contact with human and animal waste. Standing water due to removal of vegetation near habitats attracts disease-carrying insects. It also increases the presence of rodents and the probability to contract rodent-borne disease.
- Permanent habitat encourages more intimate contact with a broader range of domesticated animals, and also exerts a higher probability of inter-species pathogen transferal.
- Like many other nomadic forest dwellers, the Punan were less exposed to pathogens when nearly naked. Now urged by missionaries to wear clothes that are dirty most of the time, they are victims of skin diseases.
- Heavy alcoholism and smoking impair health directly (intoxication) and indirectly (emergence of tuberculosis). The conversion of the Punan to Christian religions has undisputedly limited the impact of alcoholism. But increased emphysema and cancer are probable consequences of heavy cigarette smoking. Other social chronic ailments like violence, drug addiction, depression, and suicide are slowly emerging among urban Punan who are losing the protective benefit of their original social structure based on mutual aid and reciprocal assistance, which still prevails in remote villages.
- As temporary camps transform into permanent villages, the growth in the size of settlement increases fecal pollution. Intestinal parasites cause anemia and possible growth delay, which may have dramatic consequences on the psychic development of children. Fecal pollution is also a source of bacterial as well as viral infections of the gut, which are major causes of malnutrition, infectious diarrheas, and child mortality. The relatively high mobility of hunter-gatherers used to protect them from high rates of parasitic load. These rates have increased for the Punan since sedentarization, but they still suffer lower rates of parasitic loads (47 percent) than other groups such as the Pygmies in southern Cameroon (see page 36 this issue). These relatively low rates could be attributed to the sanitary use of rivers.

- Demographic concentration of settlement also encourages the spread of “crowd diseases” like smallpox, measles, mumps, cholera, rubella, diphtheria, and influenza, as the pathogen agents meet sufficient critical mass of inhabitants to propagate. The nomadic Punan had less trouble with smallpox because they practiced silent barter, in which they exchanged products with neighbors by depositing goods at a fixed place, as a strategy to avoid contact with each other in times of epidemics. Today, recourse to protective silent barter or migrating further inland is no longer possible. Among the re-emerging infectious diseases, tuberculosis is the greatest contributor to human mortality.
- By contrast with previous small-sized nomadic groups, permanent settlements increase the visibility of humans to vector-borne diseases. Low population density of nomadic groups “diluted” hosts in the environment from vector-borne parasites. As nomads, Punan were less prone to malaria because they constantly moved outside the flight range of mosquitoes before parasites were able to reproduce (Knapen 1998). Julian de Zulueta, who examined malaria among foragers and swidden cultivators in Sarawak, discovered that nomadic Penan exhibited lower rates of spleen enlargement and parasites than neighboring swidden groups. The development and landscape alterations that accompany the resettlement of foraging societies—like the building of roads, lumber and mining exploitation, and construction of plantations—lead to outbreaks of malaria.
- Other blood parasites like filariasis, transmitted via insect bites, are increasing in permanent villages.

Changes in Nutrition

Industrialization and urbanization of previously forested lands bring in their wake changes in a population’s dietary habits. Such changes are observed among urban Punan and tend toward an excess intake of energy-dense foods that are rich in fat and sugar, but low in complex carbohydrates. Studies have shown a link between such a diet and the risk of degenerative chronic diseases in middle and later adult life, particularly cardiovascular disease and certain types of cancer. Other nutritional disorders such as anemia, obesity, hypertension, elevated cholesterol levels, and diabetes also appear because of dietary imbalance.

Domesticated plant and animal food sources differ from their wild counterparts in that they are often more energy-dense because domestication and breeding favors higher concentrations of fats and carbohydrates. Consequently, wild plants have higher concentrations of fibers, vitamins, minerals, and phytochemicals of potential nutritional significance.

Punan’s diets vary seasonally, depending on external factors like temperature and rainfall, and therefore on plant and animal productivity. Seasonality is a critical issue in the forests of East Kalimantan where the dominant Dipterocarp trees have adapted to mammal predation by fruiting simultaneously and massively following an erratic and unpredictable pattern. Such phenomenon, described as “mast-fruiting,” induces periods of severe shortage in availability of edible fruits and joint migrations of wild boar herds, whose diets highly depend on Dipterocarp fruits. Consequently, seasons in which game animals are low in fat are often also the seasons in which the nutrient-rich parts of plants are least available. In remote villages, the proportion of meals including meat or fish varies highly according to seasons. Such fluctuation is less pronounced among urban Punan who can easily buy meat, freshwater, and sea fishes on local markets.

In 2003, the quarter of heaviest energy consumption by humans immediately followed the quarter of lowest consumption, providing an opportunity to quickly replenish body stores that were depleted during the season of lower food availability. Nutritionists have pointed out the efficiency with which humans absorb micronutrients is responsive to levels of nutrients that are already

circulating and stored, allowing the body to adapt to temporary food shortages. But periods of shortage remain critical if they coincide with the peak of disease occurrence. In 2002 a severe malaria outbreak killed 28 children in two remote villages located on the Kalun affluent of the Tubu River, during a period drastically lacking rice and wild boar meat. When low food consumption occurs, poorly fed individuals, especially those at high risk like pregnant women and children, may adopt compensatory strategies. Snacks are one of them, but their nutritional value is not correctly assessed by the standard protocol of quantitative food consumption surveys that focus on dishes and thus underestimate the value of food consumed outside of meals. The remote sedentary Punan cultivate upland rice swidden fields with poor yields and are far from being self-sufficient in rice. They seasonally depend on cassava cultivated in small plots near habitat, and on wild-sago starch when they camp in the forest. Downriver, their urban relatives are almost self-sufficient in rice.

Body mass index (BMI) is one of the many indicators widely used to estimate nutritional condition and to predict risk for disease. Its low correlation with height facilitates meaningful comparison of the body weights of populations with different statures. An 18.5 kilogram-per-square meter BMI is recognized as an indicator of chronic energy deficiency (Jenike 2001). The BMI of both male and female Punan stand far above this limit in every location and even during periods of food shortage. But remote male villagers appear to have a much better nutritional condition than their male urban relatives. Differences between the two types of settlement are less significant among women. The profound differences in the nutritional profiles between men and women and between people in remote and urban settlements demonstrate that daily activity and the gender division of labor affects nutrition, and indirectly may influence people's susceptibility to disease.

The occurrence of cases of severe underweight also fluctuates seasonally but affects remote and urban Punan indifferently. By contrast, obesity affects exclusively the urban Punan and touches mainly women.

Lost in Transition

Historical reconstruction and contemporary observation widely support the assumption that nomadic foraging was a relatively healthy mode of subsistence. Past forest foragers had a healthier way of life; a good diet and physical exercise; virtually no salt, alcohol or tobacco; no pollution; fewer cancers; and a life span and child mortality that was not as dramatic as what is generally assumed (Eaton and Eaton 1999). Current sedentary context is much less enthusiastic.

Former nomadic hunter-gatherers are attracted by the most materialistic and superficial "charms" of modernity, but they neglect or underestimate the more profound and insidious cost imposed by Westernization. The health consequences are most dramatic for the remote sedentary Punan. They lost the protection provided by their previous nomadic life, they are victims of more diseases, and their traditional healing practices are inefficient to treat these new impairments. On the other hand, they did not win in access to medical care because of their isolation and remoteness. The remote sedentarized Punan have a much better nutritional condition than urban Punan because they maintain high physical activity and forest products still massively contribute to their diet. Urban Punan look more healthy, probably a matter of better access to public health services; but they suffer from new non-communicable degenerative diseases due to imbalanced diet.

Prior to settlement, it appears that the Punan treated their limited suite of illnesses with a narrow range of plant medicines. Professors Robert Voeks and Peter Sercombe found that the Punan have developed a relatively limited medical system, and suggested this might be due to a low level of exposure to and risk from disease. The Punan developed neither the elaborate healing rituals and divination methods nor the extensive collection of pharmaceutical plants possessed by their Dayak

neighbors. Moreover, their egalitarian social structure is inconsistent with the existence of a specialized shaman class, which might otherwise have encouraged the development and maintenance of a body of specialized medicinal knowledge.

Modern medical care has become necessary to avoid misery or failure of development plans generally implemented to alleviate poverty, and to compensate for the inefficiency of traditional healing in the face of new diseases brought by the sedentary lifestyle.

For the Punan and many indigenous minorities, transition to modernity—often forced by government incentives and induced loss of home range—is synonymous with increased poverty. In urban settlements, social regulations like mutual aid, collective activities, and food sharing decline and give place to more individualist attitudes that facilitate social disorders like alcoholism, drug addiction, violence, and suicides. As long as distinctive physical features remain visible, these former nomads are still viewed as “savages” by their neighboring Dayak agriculturalists and by local authorities, whatever their attempt to disappear into the mass of incognito citizens. One positive consequence of this segregation is the low occurrence of AIDS and other sexually transmitted diseases that are exploding among city dwellers. The biological consequences of modernity for the sedentary Punan rely mainly on the revolution of social justice, which should provide better access to school, better affluence and health facilities, and better recognition of traditional rights and land tenure.

Sustained biomedical research may contribute not only to an evolutionary perspective on health and culture, but may also illuminate sensitive socio-political problems that require urgent intervention.

Edmond Dounias, Misa Kishi, Audrey Selzner, Iwan Kurniawan, and Patrice Levang form a multidisciplinary team of scientists specializing in the study of the knowledge of forest dwellers—mainly former hunter-gatherers—in forest landscapes and agroecosystems.

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