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# BACK TO THE FUTURE: COMBINGING TRADITION, TECHNOLOGY AND GLOBAL MARKETS FOR FOREST CONSERVATION IN NEW GUINEA

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***ABSTRACT:*** *The island of New Guinea is one of the planet's last bastions of cultural and biological diversity. It also contains the largest stands of tropical forest in the Pacific. Since the inhabitants of New Guinea's forests have land rights that are constitutionally protected, any conservation plan must combine the needs of local people with biodiversity conservation. This paper incorporates the indigenous knowledge of the inhabitants of New Guinea's largest inland wilderness into a dynamic conservation plan that would take advantage of the emerging international market for carbon dioxide sinks. Using indigenous knowledge to map the relationship between traditional human activity and biodiversity, this paper outlines a conservation plan for the area wherein local people can tap the global CO2 market for compensation and international donors can monitor forest cover through satellite technology.*

**Keywords :** indigenous knowledge, carbon sequestration, conservation, Papua New Guinea

## INTRODUCTION

For the past 30 years conservationists have struggled to replace the "Yellowstone model" of conservation and halt the destruction of the planet's cultural and biological diversity. To this end, they have attempted to combine conservation with development and involve local people in conservation planning. Nonetheless, the current extinction crisis continues unabated (Soule, 2001). The early reports on the ability of indigenous cultures to conserve these lands are not encouraging. Although it seems counterintuitive, the notion that tribal societies balance their needs with those of the countless other organisms in their environment is an updated version of the "noble savage" stereotype. Relying on this stereotype as a basis for conservation may actually exacerbate the current global extinction crisis. Indeed there is a growing consensus that sustainable development projects (i.e. conservation through development) have imperiled decades of conservation, by promoting the idea that strict protection of nature was misguided and parks must be economically viable development tools if they are to have any future in a world of six billion people (Soule, 2001).

This paper offers an alternative. By using indigenous knowledge (IK) as the foundation for local participation in a conservation program, it combines a proven model of sustainability with self-interest and the emerging global market for carbon sequestration, to conserve these forests. Based on 18 months of fieldwork with one of Papua New Guinea's most remote societies, the Hewa, this paper builds on their understanding of the impact of human activity on biodiversity. It then combines IK with technology to propose a dynamic and verifiable method for conserving biological and cultural diversity.

## THE HEWA PROJECT

Papua New Guinea (PNG) is in many ways unique among developing nations. PNG is one of the world's most significant centers of biodiversity and

contains some of the largest remaining wildlands on earth (Meyers et.al., 2000). Since it has retained 75% of its' primary vegetation, the island of New Guinea continues to be described by conservationists as a "good news area" (Swartzendruber, 1993). These forests contain many species found nowhere else on Earth, as well as tree-dwelling kangaroos, ostrich-like birds known as cassowaries, the world's largest pigeons and butterflies, the world's longest lizard, nearly 3,000 species of orchids and 10,000 species of flowering plants. With at least 1,000 languages spoken in New Guinea, it is one of the last bastions of cultural diversity on the planet.

This research was conducted in PNG's Central Range, at the headwaters of the Strickland River (142 30'E, 5 10'S: elevation 500 to 3000 meters). This is the infamous limestone country avoided by the colonial era expeditions sent to penetrate the Central Range. Although Papua New Guinea's 1993 Conservation Needs Assessment describes the Central Range as "wilderness with low human population," it is the homeland of the Hewa (Swartzendruber, 1993). As the description implies, the forests in this region are extensive and the landscape is a mosaic of primary and secondary growth forest. Within PNG, the Central Range was singled out as one of 16 biologically unknown areas (Swartzendruber, 1993).

Lutheran missionaries cut the first airstrip into the area in 1992. Yet, the continuing isolation of the Hewa presents an excellent opportunity to explore the relationship between traditional lifestyles and wildlands conservation. The authors of Conservation Needs Assessment are hoping that the "traditional knowledge base within Melanesian societies may hold clues for combining conservation and development" (Swartzendruber, 1993). Since PNG is committed to incorporating traditional forms of land management into conservation of its resources, the Hewa were the logical starting point for this project.

The Hewa influence biodiversity in several ways. They hunt birds, mammals and reptiles for food, adornment, and exchange. They engage in a cycle of cutting gardens and allowing each garden to lie fallow for 20 to 25 years. Like many forest gardeners, the Hewa prefer to cut secondary forest for gardens. Once an area has been cleared, the Hewa will continue to make gardens on the same land. They also prefer to garden between 700 to 1000 meters above sea level. This practice short-circuits the process of forest regeneration i.e., under ideal conditions the forest is not allowed to return to primary forest. Although these gardens eventually become patches of secondary forest while in fallow, secondary forest in New Guinea is generally poorer in avifauna (the primary agents of seed dispersal) than primary forest (Schodde, 1973). Therefore, bird conservation in New Guinea is essentially habitat conservation (Schodde, 1973).

The Hewa are especially knowledgeable concerning the birds of this region. They hunt birds for food and adornment and have an encyclopedic knowledge of the trees birds utilize for nesting and foraging. Because birds are the primary agents of seed dispersal in New Guinea, the forest is as dependent on the birds for survival as the birds are dependent upon the fruits and seeds produced by the trees. It is this dynamic, people's need to garden for survival, the resulting cultivation practices, and its effect on avian diversity, that most directly affects biodiversity conservation efforts.

So far, this research has recorded 128 Hewa categories for birds corresponding to 171 species (with three yet to be identified). Like western ornithologists, the Hewa associate species with altitude and habitat. Experience has also taught the Hewa that some species can only live in primary forest, while other birds can only make use of primary forest and the oldest secondary growth, i.e., forest that has been growing for 20 years or more. According to the Hewa, cutting the forest will eliminate 56 species of birds found here. Shortening the fallow period for the Hewa gardens is predicted to eliminate another 42 species. In all, 57 % of the species of birds native to this area are thought to be intolerant of human disturbance.

Of particular interest to conservationists is the effect of gardening on fruit- and nectar-eating birds. New Guinea's forests have twice as many fruit- and nectar-eaters as are found in the Peruvian rainforests (Beehler, 1986). According to the Hewa, their gardens create an environment that is hostile to most species of Fruit-Doves (*Ptilinopus sp.)* and Lorikeets (*Charmosyna sp.*). Both are thought to be vital to forest regeneration. Perhaps as importantly, even when accompanied by a fallow of 20 years, gardening eliminates many of the species that are identified

with New Guinea's forests. The Vulturine Parrot, Pheasant Pigeon, Blue-collared Parrot, Brush-turkey, Hornbill, Flame Bowerbird and Purple-tailed Imperial Pigeon are just some of the species that will find secondary growth incompatible with their needs. Transect counts were also conducted to determine the accuracy of the informants' data. The data obtained through these counts corresponded with informants' observations of bird habitat and altitude preferences. It also agrees with ecological studies conducted elsewhere in PNG (Schodde, 1973).

Perhaps as importantly, IK also reveals the connection between the agents of seed dispersal, ecosystem services and the conservation of primary forest. For example, consider the connection between two of the trees that are sources of food for the Hewa as well as birds that are residents of the primary forest. *Castanopsis acuminatissima* and several species of Pandanus are just two of the many trees used by the Hewa. According to Hewa informants, the seeds of *Castanopsis acuminatissima* are eaten and dispersed by sulphur-crested cockatoos, brown-collared brush-turkeys, wattled brush-turkeys, white-bibbed ground-doves and blue-collared parrots. With the exception of the cockatoo, all of theses species reside within the climax forest. Likewise, the species of Pandanus used by the Hewa are preyed upon by the Raggiana bird of paradise, the king bird of paradise, the magnificent bird of paradise as well as the trumpet and crinkle-collared manucodes. These species are able to exploit both the forest and forest edge of the primary forest and oldest secondary growth. In these instances, it seems reasonable to predict that the removal or disturbance of the primary forest will have an adverse effect upon the trees that contribute to the Hewa diet.

## DISCUSSION

The Hewa do not have a magic recipe for tropical forest conservation. However, much of the enthusiasm for the inclusion of indigenous societies in the conservation process is based on the perception that they can and will balance their needs with biodiversity conservation. The simplest interpretation of the information provided by the Hewa is that their activities are a source of ecological disturbance, not an attempt to maintain ecological balance. Most of the forest's diversity cannot be used by humans and without gardens they would starve. As far as the Hewa are concerned, their food comes from the least biologically diverse environment -- their gardens. By cutting small plots of forest and allowing them lie fallow for over 20 years, the Hewa transform the landscape into a mosaic with a greater diversity of species and environments than the original landscape. In this case, biological diversity is the by-product of gardening by a small, scattered human population. The aim of these gardeners is to scratch a living out of an otherwise inhospitable forest, not to encourage biodiversity.

Nothing was uncovered that indicates the Hewa have developed traditions that will effectively limit the scale of human disturbance if their population increases. The Hewa do not attempt to limit gardening in either primary or secondary forest. Taboos do not prohibit the consumption of birds and kinsmen may cut as many gardens as they need on clan lands. There are no sacred lands that cannot be cut for gardens. No area that the Hewa deemed sacred that was larger than a pool of water or a grove of bamboo. Areas this small would provide sanctuary for only the smallest organisms and would not meet the minimum requirement for a viable population of any bird species.

Presently, the limiting factor on human disturbance is population size. Fecundity is constrained by the traditional post-partum taboo and high mortality. The post-partum taboo requires that couples do not engage in sex while the mother is nursing the child. This can effectively space births by two to three years. In addition, an estimated 70 % of Hewa children die before their second birthday. Although there are no birth records for the Hewa, average life expectancy for men and women in the surrounding Southern Highlands communities was 36 years in 1970 and had only increased to 41 years by 1980 (Gillett, 1991). Historically, these factors have combined to keep the population below 2,000 individuals in PNG's second largest wilderness area.

## POLICY IMPLICATIONS FOR A FUTURE PRIMITIVE

This presents a dilemma for conservationists. Accustomed to invoking a wild past before the hand of man was evident on the landscape, they are now confronted with a planet whose remaining wilderness has been shaped by man. Although embracing conservation may be the only hope for the remaining indigenous people, it is in effect a deed restriction on traditional homelands. In exchange for autonomy, some income and land rights, the locals forfeit the right to unlimited population growth and the habitat disturbance it entails. While I believe that these landscapes present an opportunity to save both our cultural and biological heritage, the Hewa project certainly indicates that conservation will not be as simple as turning forest management over to the natives.

What sort of policies can be implemented and monitored on the global scale necessary to conserve traditional cultures while integrating them into the global economy and limiting the scale of human disturbance? One solution that will satisfy all of the above criteria is to engage societies like the Hewa in the emerging global market for carbon sequestration. Carbon sequestration refers to processes that result in a net removal of CO2 from the atmosphere. CO2 is the main greenhouse gas. It is a by-product of the burning of fossil fuels and one of the gases linked to global climate change.

While the planet's oceans have by far the greatest capacity for carbon sequestration, forests are also considered significant carbon sinks. The U.S. Department of Energy (DOE) estimates that the terrestrial biosphere currently sequesters approximately 2 billion metric tons of carbon per year (DOE, 2002). The global sequestration capacity of standing forests, including the carbon found in soils and leaf litter, is approximately 100 tons per year (DOE, 2002). However, clearing land for agriculture, logging, and changes in forest cover in general have become net contributors of CO2 to the atmosphere (Brown, 2002). In fact, land-based emissions for one of the planet's least developed regions, sub-Saharan Africa, are of the order of 152 million tons per year (ORNL, 2003). In order to mitigate the climatic changes that may occur with elevated atmospheric CO2, many nations are looking to their forests as natural and cost effective ways to remove CO2.

Global efforts to regulate atmospheric CO2 resulted in the 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change. Beginning in 2008, this agreement commits 37 industrialized countries, as well as 140 other nations, to reduce their CO2 emissions. Less developed countries will be able to offset fossil fuel consumption and meet their treaty obligations by using their forests as carbon sinks. One of the proposed outcomes of Kyoto was that developing nations would be able to avoid cutting their forest and generate income from intact forests, by selling their excess carbon emission credits to more developed nations (McKibben & Wilcoxen, 1999). However while a global market for carbon sequestration is emerging, details pertaining to the conservation of old growth forests, the value of forests via CO2 sequestration, payments for emission credits, and enforcement of the Kyoto Protocol have yet to be ironed out.

Since the Hewa occupy PNG's largest inland wilderness and have a lifestyle that has been compatible with biodiversity for thousands of years, they may be able to conserve their biological and cultural heritage by designating their homeland as a carbon sink. The Hewa describe their traditional activities as a source of disturbance on this landscape. Rather than recording their IK as anthropological trivia, the government of PNG should first use it as a basis for conservation planning. Since conservation is essentially a political process, this brings the Hewa into the process and makes the connection between biodiversity and forest cover clear to the majority of residents.

Secondly, PNG should link this knowledge to the visual satellite imagery so that the Hewa understand the monitoring process. This is a crucial step, because monitoring forest cover will be essential to the success of the project and both the Hewa and international conservation agencies must be able to effectively deal with the dynamic mosaic inherent to forest agriculture. Remote sensing technology, such as the Amazon Surveillance System (SIVAM) used to track smuggling and deforestation, would be more than adequate. Such systems are highly effec-

tive at tracking canopy cover and the carbon sequestration capacity of tropical forests (Brown, 2002).

Finally, using the same remote sensing technology, we must establish the value of large tracts of land as carbon sinks and harness the future of these lands to the most powerful social force on the planet, the global marketplace. Current estimates for the cost of the technological sequestration range from $100 to $300 per ton (DOE, 2002). Fortunately, World Resources International (WRI) currently has a variety of carbon sequestration forestry projects in progress that would meet this goal. For example, the Pacific Forest Stewardship project estimates that it sequesters 242,082 tons of carbon at less than one dollar per ton (WRI, 2003). Similar costs are being reported for projects in Guatemala, Costa Rica, Amazonia, Russia, Belize, Oregon and Washington (WRI, 2003). In Belize, $2.6 million has conserved over 6,000 hectares of forest at roughly $400 a hectare. Since the Hewa project would involve thousands of sparsely populated hectares, the cost per hectare of establishing the Hewa territory as a carbon sink should be less than similar projects in Central America. These projects demonstrate that forest conservation can be a cost effective, environmentally benign avenue to carbon sequestration. The technology used to assess the sequestration value of these forests must now be applied to the conservation of the remaining larger and more biologically diverse tracts of forest in New Guinea, Amazonia and the Congo basin.

If conservationists can employ market forces quickly, they have an unprecedented opportunity to conserve these lands in a manner that, politically speaking, will make conservation based/sustainable development less difficult to sell. CO2 credits have the potential to provide the local inhabitants and national governments with a quantum infusion in cash. Cash payments allow locals to make decisions concerning the fruits of the modern world they wish to enjoy. Most importantly, it gives them a reason to minimize disturbance of their lands by limiting population growth and excluding outsiders. Fewer people means more money for the project's participants, as well as a biologically diverse carbon sink.

Once the value of these lands are established, the funds from nations purchasing emission credits should be transferred to project accounts supervised by the United Nations and the interest paid out to Hewa households over a 25 year period. This will provide a substantial cash flow into an area without compromising the forest. International donors will be insured against malfeasance and the Hewa can be assured of long-term funding. In exchange for not selling their trees or converting forest to farms, they will have access to a long term source of cash (25 years) to purchase basic services. However, once services such as schools and medicine are provided the area will become a magnet, drawing people into the area, increasing the scale of disturbance and destroying the diversity these projects are designed to protect. Since indigenous societies are not typically enmeshed in national politics, the sustainability of these projects will depend on intervention by the national government.

The Kyoto Protocol was not written as a biodiversity conservation tool. However an interpretation of the "Clean Development Mechanism," that places a monetary value on biodiversity, could make it a conservation tool. Likewise, initiatives like the World Bank's $100 million BioCarbon Fund will place a value on tropical forests beyond their growing timber stock. (Katoomba, 2002). The willingness of national governments to intervene on behalf of cultural and biological diversity will most likely be based on the conservation community's ability to translate these initiatives into a monetary value for these lands.

Papua New Guinea has already enacted many of the policies that can make sustainable development possible for the Hewa. The Conservation Needs Assessment has identified the conservation of this area a priority and traditional land rights enjoy constitutional protection. While the forests and other natural resources in many countries are considered state property, PNG has decided to legally recognize traditional land rights and resource use patterns. The constitution of PNG "vests local people with the ownership of these resources, irrespective of any documentation or registration," and 97% of its total land area remains in traditional hands (Swartzendruber, 1993).

How much would this deed restriction cost? E.O. Wilson estimates the costs of saving the planet's remaining biological diversity at $30 billion per year or one cent per cup of coffee consumed worldwide

(Wilson, 2002). While biodiversity conservation may be difficult to sell, the potential impact of climate change on the global economy has spurred nations to action. For the first time in history, science can accurately portray the interconnectedness of nature, the importance of biodiversity and the value of natural processes. Technology can provide the means to monitor nature, enhance the value of life and limit habitat disturbance in carbon reserves. Most importantly, conservation may have finally found a powerful ally in the marketplace. Seizing this moment will require that we shed many cherished notions concerning indigenous people and their connection to nature. However, if we act quickly we may be able to seize this last chance to save the earth's remaining cultural and biological diversity for the price of a cup of coffee.

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