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One last chance: tapping indigenous knowledge to produce sustainable conservation policies

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Abstract

Sustainable development projects that were supposed to insure the future of the earth's biological inheritance are currently being criticized for compromising biodiversity. Drawing on sixteen months of fieldwork with one of Papua New Guinea's most remote societies, this paper argues that more productive conservation policies will emerge when indigenous activities are viewed as disturbance and not as vehicles for establishing equilibrium with the environment. This research demonstrates that although the Hewa play a significant role in shaping this environment, their traditions are not always compatible with biodiversity conservation. Finally, policy recommendations based on indigenous knowledge research are offered.

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1. Introduction

“We suspect that the international conservation movement is in for a second major revolution based on shock therapy in the face of harsh reality. It is not quite so easy to harmonize natural protection, cultural preservation and true rural development for residential peoples” [1].

Sadly, ten years after West and Brechin's warning and 20 years of experience with combining conservation with development, the current extinction crisis continues unabated [2]. The early reports on the ability of indigenous cultures to conserve their

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homelands are not encouraging. Science still knows very little about the relationship between indigenous people and the resources they exploit. Mounting archaeological and historical evidence indicates that these societies are capable of dramatically altering their environment. Although politically correct, the notion that tribal societies can balance their needs with those of the countless other organisms in their environment seems to be an updated version of the “noble savage” stereotype.

Likewise, relying on this stereotype as a basis for sustainable development (i.e. conservation through development) may exacerbate the current global extinction crisis. Indeed there is a growing consensus that sustainable development projects 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 [2]. While the future of conservation through sustainable development is far from certain, such programs amount to a planetary wager on mankind’s ability to manage nature. Since the fate of our remaining wild lands will depend on an accurate portrayal of the relationship between indigenous societies and their environment, this bet will have real consequences for future generations. These wild lands represent humanity’s last chance to save a significant portion of the planet in its natural state. It is vital that they are not sacrificed to political correctness.

As an anthropologist who studies the potential contributions of traditional societies to the conservation, I have conducted over 16 months of research near the headwaters of the Strickland River in Papua New Guinea’s Central Range. This is one of the most remote wilderness areas on Earth. In 1993, the government of Papua New Guinea (PNG) and conservation organizations such as the World Wildlife Fund and The Nature Conservancy conducted a national Conservation Needs Assessment (CNA). They described the Central Range as “unexplored” and listed this area as the second highest conservation priority for the nation [3]. The most rugged area of the Central Range, stretching from the spine of New Guinea to the Sepik foothills, is the homeland of the Hewa (pronounced Heywa), a tribe so remote that they are still accused of cannibalism by their neighbors.

New Guinea contains some of the largest tracts of tropical forest in the world. These forests are the homelands of the thousands of cultures that inhabit the island. This makes most of these areas difficult to squeeze into the US definition of “wilderness.” Many of New Guinea’s forest dwellers live as scattered households and do not seem to dominate the landscape. Nevertheless humans are an integral component of forest ecosystems and their activities help to shape the diversity of organisms found there. Whether traditional land use practices such as these can be employed as blueprints for biodiversity conservation remains to be seen.

The focus of my research has been recording the knowledge of the Hewa concerning the effect of traditional activities on biodiversity. Most researchers accept that indigenous knowledge (IK) can be an effective tool for conducting biological inventories. However, while IK is seen as rich in understanding individual components of an ecosystem, many ecologists describe IK as weak in understanding ecological processes [4]. I hope to change this perception. By using IK to predict the impact of forest clearing on biodiversity and comparing these predictions with conventional

ecological studies, I hope to unlock the secrets of these forests and explore the possibility that indigenous lifestyles can become templates for conservation.

2. A new conservation paradigm

Traditional resource use strategies are often described as not only benign and sustainable, but as an appropriate foundation upon which to develop a modern conservation strategy [5]. However, this new approach to conservation is based largely on the untested assertion that indigenous people, because of their long association with the land, have developed lifestyles or adaptations that allow them to live in “balance” with their environment. According to this line of reasoning, indigenous people, unlike western societies, actively manage their lands to maintain environmental equilibrium [6].

While this idea has popular appeal, it has recently come under fire from both anthropologists and conservationists. As of yet, we know very little about how these ecosystems function. References to “stability” and “balance” are not only vague, but also based on outdated concepts borrowed from ecology [7]. In the latest ecological paradigm, the balance of nature concept is described as non-scientific [8]. Although advocates continue to portray traditional societies as “in balance” or describe a practice as “adaptive,” this use of terms drawn from ecology and evolutionary biology is often outmoded [9]. Unfortunately, this shift has gone unrecognized by many anthropologists [10].

Current research has focused on the role of nonequilibrium factors, commonly referred to as disturbance, in the enhancement of biodiversity [11]. Ecologists define a disturbance as any “relatively discrete event that disrupts a population, community or ecosystem and changes resources available” [12]. Unlike predation which is “intrinsic to the life of the prey species, which can and does adapt to it,” disturbance is unpredictable and nonselective [11]. It can come in any size, at any time and produce effects that will vary from minutes to centuries in duration.

Although disturbance may kill or displace individual organisms, it generally creates the patchiness that characterizes many environments. This patchiness creates the niches that present opportunities for colonization by new species. For example, a windstorm that downs trees in the forest creates gaps. Although the physical environment of the patch will determine the scale of the disturbance, disturbance clears the way for new species capable of colonizing these gaps, thus increasing the biological diversity of the area [11]. However, at either extreme of the disturbance continuum, environments that are either undisturbed or wracked by severe disturbances will eventually be dominated by a few species [13].

Therefore, in terms of its ability to generate biodiversity, disturbance is a *scale related* phenomenon. Too much or too little disturbance produces environments that are not as diverse as those continually subjected to minor disturbances. Moreover minor disturbances create “patchiness” and are perhaps as crucial as more dramatic disturbances in promoting biological diversity. This “intermediate disturbance hypothesis” argues that intermediate disturbance promotes the high degree of species

richness by creating a mosaic of environments that, in turn, prevents the extinction of competing species [14].

3. The Hewa Project

My research was conducted in PNG's Central Range, at the headwaters of the Strickland River (142°30'E, 5°10'S; elevation 500–3000 meters). Within PNG, the Central Range was singled out as one of 16 biologically unknown areas [3]. This is the infamous limestone country avoided by the colonial era expeditions sent to penetrate the Central Range. Although the Conservation Needs Assessment describes the Central Range as "wilderness with low human population," it is the homeland of the Hewa [15]. As the description implies, the forests in this region are extensive. Unlike the landscapes in many developing countries, this land is dominated by a mosaic of primary and secondary growth forest, not isolated islands of forest in an otherwise agricultural landscape. There have been no previous studies of the forests in the Hewa territory. The area surrounding the headwaters of the Strickland River has no formal conservation status. There are no roads into this region and no bridges span the Strickland, the Om, or the Lagaip rivers in the Hewa territory. The isolation of the Hewa presents an excellent opportunity to explore the relationship between traditional lifestyles and wildlands conservation.

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 [3]. 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" [3]. 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 three 3000 species of orchids and 10,000 species of flowering plants. With at least 1000 languages spoken in New Guinea, it is also one of the last bastions of cultural diversity on the planet.

PNG has accepted the idea that human activity and conservation can be compatible and is committed to incorporating traditional forms of land management into conservation of its resources. Therefore the Hewa were the logical starting point for this project. They affect 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 20–25 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 700–1000 m 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 [16]. 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. As a result, it is the dynamic between gardening and avian diversity that most directly affects biodiversity conservation, i.e. bird conservation in New Guinea is essentially habitat conservation [16].

So far, my research has recorded 128 Hewa categories for birds (three of which I have yet to identify), corresponding to 171 species. 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 [17]. 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. During my research, I conducted transect counts to determine the accuracy of my informants' data. The data obtained through these counts corresponded with my informants' observations of bird habitat and altitude preferences.

4. Discussion

Rather than searching for clues to our human ability to balance a system that may have no inherent tendency toward balance, traditional activities should be examined as sources of disturbance. The key to the relationship between the Hewa (and I suspect all residents of the tropical forest) is their ability to produce small-scale disturbances that enhance rather than compromise biodiversity. The Hewa actually increase the biodiversity of their lands when they cut gardens. By felling the forest, they create a mosaic of primary forest, secondary forest, grasslands, gardens and the various phases of succession growth (gamma diversity). They also create habitats for organisms that cannot survive in the primary forest (alpha diversity), like the birds inhabit the grasslands and succession communities created by the Hewa. Therefore, by cutting a garden in the forest, it is possible for the Hewa to increase two measures of biodiversity (alpha and gamma), while creating areas that are lower in biodiversity (beta) than the surrounding forest.

Today, it is common to read conservation proposals extolling the potential of IK. For example, noting that alternative strategies for the sustainable use of resources

must be developed, the authors of Papua New Guinea's 1993 Conservation Needs Assessment are hoping that the "traditional knowledge base within Melanesian societies may hold clues as to how this can be done" [18]. Such statements reflect the urgent need for research that will unravel the complexities associated with the conservation of entire ecosystems [7]. This is especially true for areas that are remote and unexplored, where scientists lack even basic information [19]. These concerns have renewed interest in the accumulated environmental wisdom of indigenous people and IK is emerging as a viable tool for unraveling the connections between organisms in an environment.

My informants put Hewa IK and traditions in a new light. By using IK in protocols that mirror ongoing research in other disciplines and other regions, conservationists can obtain information on forest dynamics that would require decades to gather by conventional research methods. At least with respect to avian diversity, my informants provided similar information to that produced by conventional studies conducted by researchers in other regions (J. Diamond, Personal communication). Given the similarity between Hewa IK and the findings of these and other researchers, I believe that IK can be directly translated into conservation action. The same knowledge and observation skills that allow my informants to hunt successfully can identify the underlying dynamics of the forest and provide the basis for sound conservation planning.

Rather than portraying themselves as capable of balancing their needs with the needs of the other organisms in their environment, the Hewa describe themselves as a source of disturbance and, coincidentally, a source of biological diversity. A forest containing the type of small-scale gardening currently practiced by the Hewa is a mosaic of many types of biological communities. The combination of gardens, grasslands, the various stages of forest succession is more biologically diverse than the climax forest alone. Some species, like humans, are better adapted to take advantage of the succession stages of forest produced by disturbance. Their knowledge of this dynamic provides an important insight into the ability of indigenous man to use the environment without compromising the biological diversity.

Through gardening, the Hewa create a series of forest succession communities each more useful to humans, but less diverse than primary forest. While the present level of gardening increases biodiversity, this diversity will decline if too much primary forest is converted to gardens. Likewise, the Hewa system of land tenure is designed not for conservation, but to provide flexible access to land for kinsmen. When combined with a low population density and the ability of gardeners to move to more fertile land, the present system promotes biodiversity. However, if the population increases or families are unable to safely move to more fertile ground, this same system can allow more intensive gardening. Employing the traditional Hewa gardening techniques more intensively will result in an increase in the scale of human disturbance and consequently larger areas of less diverse plant growth.

The Hewa do not have a magic recipe for tropical forest conservation and much of the enthusiasm for the inclusion of indigenous societies in the conservation process is based on the perception that they will balance their needs with biodiversity conservation. However, 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.

Presently, the limiting factor on human disturbance is population size. Nothing I uncovered indicates that 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. I was unable to find an area 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. 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 [20]. Historically, these factors have combined to keep the population below 2000 individuals in PNG's second largest wilderness area.

5. Policy implications for conserving cultural and biological diversity within a global framework

What sort of policies can be implemented on the scale necessary to conserve traditional cultures while integrating them into the global economy? The Hewa blueprint for cultural and biological conservation boils down to this: Limit the scale of human disturbance. However, their blueprint was developed in a pre-contact state. It has proven sustainable when employed by a small, mobile population, scattered over a large area. Any policy for the conservation of cultural and biological diversity must deal with the political realities of incorporating mobile autonomous people, into the global economy of a world with an expanding population, facing a shortage of arable land. Neither the Hewa nor the government of PNG will accept a conservation program that requires the Hewa to remain frozen in this pre-contact state. 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.

To be successful, any policy aimed at cultural and biological conservation must first recognize the land rights of indigenous people and the dynamic relationship between traditional life and biological diversity. In addition, local people must participate in the development of land use policy. Finally, to be effective, these policies should connect indigenous people to the global economy in a sustainable fashion, allowing the benefits of market participation to flow in both directions.

Fortunately, a model already exists for local participation in conservation. Community-based Wildlife Management (CWM) is an approach to wildlife conservation that has developed over the past 20 years in response to the failure of the traditional park/protected areas system of wildlife refuges to protect wildlife. Local communities become stewards of their lands and the regulated use of wildlife and ecosystems is permitted. CWM has had a significant impact on both wildlife and rural income in southern Africa [21]. However, the global market for wildlife products and tourism is limited. Most of the nations with large tracts of undeveloped land are relatively poor and the lands in question are difficult to get to. While tourism may contribute, it is unlikely that there is a sufficient market for truly undeveloped habitats to compete with the dollars available from forestry.

Although many of the largest remaining tracts of forest are hard to reach and presently unprofitable to log, the global market has the potential to come to the rescue in the form of CO₂ emission credits. I believe that the only solution that satisfies all of the above criteria is carbon sequestration. According to the US Department of Energy (DOE), effective techniques for carbon sequestration *must* be cost effective, provide stable long-term storage and be environmentally benign [22]. Since the Hewa occupy PNG's largest inland wilderness and have a lifestyle that has been compatible with biodiversity for thousands of years, their territory is a natural carbon sink. Here is my proposal.

First, the Hewa have told us that they are a source of disturbance on this landscape. Rather than recording their IK as anthropological trivia, use it as a basis for conservation planning. This brings the Hewa into the process and makes the connection between biodiversity and forest cover clear to the majority of residents. Secondly, 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. A system like the Amazon Surveillance System (SIVAM), used to track smuggling and deforestation, would be more than adequate.

Finally, we must establish the value of large tracts of land by harnessing the future of these lands to the most powerful social force on the planet, the global marketplace. Long-term conservation will require a large infusion of cash in the near term. CO₂ credits have the potential to provide the local inhabitants and national governments with a quantum infusion in cash, while promoting forest cover. 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 is established, the funds should be deposited in an account and the interest paid out to Hewa households over a 25 year period. This will provide a substantial cash flow. 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 (at least 25 year) source of cash 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. I believe their willingness to intervene will be based on the value of the land.

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” [23]. Today, 97% of its total land area remains in traditional hands [23].

How much would this deed restriction cost? E.O. Wilson estimates \$30 billion per year or one cent per cup of coffee consumed worldwide [23]. If we do not use the forces of globalism in concert with nature soon, we run the risk of losing much of our biological and cultural heritage. For the first time in history science can accurately portray the interconnectedness of nature, the importance of biodiversity, the value of natural processes. Technology has disseminated this information and provides the means to monitor nature, enhance the value of life and limit habitat disturbance. Most importantly, conservation may have found an 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.

References

- [1] P. West, S. Brechin, National parks, protected areas, and resident peoples: A comparative assessment and integration, in: P. West, S. Brechin (Eds.), *Resident Peoples and National Parks*, University of Arizona Press, Tucson, AZ, 1991, pp. 363–400.
- [2] M. Soule, Does Sustainable Development Help Nature?, *Wild Earth* 10 (4) (2001) 56–63.

- [3] J.F. Swartzendruber, Papua New Guinea Conservation Needs Assessment. USAID, Washington D.C., 1993.
- [4] G. Baines, South Pacific Conservation Program. World Wildlife Fund, Washington D.C., 1990.
- [5] B. Rajasekaran, D.M. Warren, IK for socioeconomic development and biodiversity conservation: the Kolli Hills, *Indigenous Knowledge and Development Monitor* 2 (2) (1994) 13–17.
- [6] M. Harris, *Cows, Pigs, Wars and Witches: the Riddles of Culture*, Random House, New York, 1974.
- [7] S. Pimm, Food web patterns and their consequences, *Nature* 350 (1991) 669–674.
- [8] S. Pickett, V. Parker, P. Fiedler, The new paradigm in ecology, in: P. Fiedler, S. Jain (Eds.), *Conservation Biology*, Chapman and Hall, New York, 1991, pp. 65–88.
- [9] R. Hames, Wildlife conservation in tribal societies, in: M. Oldfield, J. Alcorn (Eds.), *Biodiversity: Culture, Conservation and Ecodevelopment*, Westview, 1991.
- [10] E.A. Smith, Anthropology, evolutionary ecology and the explanatory poverty of the ecosystem concept, in: E. Moran (Ed.), *The Ecosystem Concept in Anthropology*, Oxford University Press, New York, 1985, pp. 279–411.
- [11] S. Reice, Nonequilibrium determinants of biological community structure, *American Scientist* 82 (5) (1994) 424–435.
- [12] S.T.A. Pickett, P.S. White (Eds.), *The Ecology of Natural Disturbance and Patch Dynamics*, Academic Press, New York, 1985.
- [13] J. Terborgh, *Diversity and the Tropical Rainforest*, Scientific American Library, New York, 1992.
- [14] J.H. Connell, Diversity in tropical rainforests and coral reefs, *Science* 199 (1978) 1302–1310.
- [15] N. Meyers, R. Mittermeier, C. Mittermeier, G. da Fonseca, J. Kent, Biodiversity hotspots for conservation priorities, *Nature* 403 (2000) 853–858.
- [16] R. Schodde, General problems of fauna conservation of vegetation in New Guinea, in: A.B. Costin, R. Groves (Eds.), *Nature Conservation in the Pacific*, ANU Press, Canberra, 1973, pp. 123–144.
- [17] B. Beehler, T. Pratt, D. Zimmerman, *Birds of New Guinea*, Princeton University Press, Princeton NJ, 1986.
- [18] N. Meyers, Environmental unknowns, *Science* 269 (2 July) (1995) 358–360.
- [19] B. Walker, Diversity and stability in ecosystem conservation, in: D. Western, M. Pearl (Eds.), *Conservation for the Twenty-first Century*, Oxford University Press, New York, 1989, pp. 121–130.
- [20] J.E. Gillett, *The Health of Women in Papua New Guinea*. Papua New Guinea Institute of Medical Research, Monograph No. 9, 1991.
- [21] D. Roe, *Community-based Wildlife Management: Improved Livelihoods and Wildlife Conservation?* iied, London, 2001.
- [22] United States Department of Energy. www.fe.doe.gov/sequestration. 2002.
- [23] E.O. Wilson, *The Future of Life*, Alfred Knopf, New York, 2001.