

The Fate of the Butterflie:
**The Efficacy of Butterfly Farming as a
Conservation Tool.**

“I sing of deadly dolorous debate.....” (*The Fate of the Butterflie, Edmund Spencer*)

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Table of Content

Introduction

Why Butterfly Raising

Overview of Butterfly Products

High Volume/low value deadstock

Low Volume/high value deadstock

Medium volume/medium value livestock

Overview of Butterfly Raising Systems

Harvesting

Ranching

Farming

CITES

Butterfly Industry versus Butterfly Conservation

Profit run Butterfly Farms

Projects run for Conservation

USAID-Funded Case Studies

Lore Lindu

Arfak

USAID Impact

Case study of a non USAID Funded Project

QAP

Findings

Advantages of Butterfly Farming/Ranching

Recommendations

Wildlife Farming: Criteria for Success

Summation of Factors

Introduction

There is much debate in the conservation community on the subject of sustainable use. Should the conservation of an animal species mean total protection or can its conservation involve use? And if animals are used, how should they be used? And does the adoption of wildlife farming systems work to conserve either the species or the habitat that they live in?

These are controversial issues, which can be discussed using the sustainable use of butterflies as a springboard to help us create some guiding principles for wildlife utilization in general.

Why Butterfly Raising?

The rationale for butterfly raising is based on several premises:

There is currently (and has been historically) a demand for butterfly products, both dead and alive, which estimates, made in 1992, put at \$100 million per annum (Parsons 1992).

There is little entomological evidence that over-collecting alone has ever threatened the existence of a butterfly species anywhere in the world, except perhaps in an relictual or island ecology (Orsak). This premise was tested by two biologists who purposely tried to over-collect a localized eastern United States butterfly and failed (Orsak). It is important to remember that insects have far greater reproduction rates than vertebrates.

Habitat loss is by far the most critical issue in butterfly conservation, given the extreme specificity of their niches and their fragile nature (and thus sensitivity to environmental disasters). There are very few, if any, butterfly conservation programs that focus purely on species conservation, without any thought of habitat conservation. And thus, projects that have focussed solely on species conservation have, in general, failed because they have not taken into consideration habitat change (Soukup 1998).

As a result, it has been suggested that butterfly harvesting, farming, or ranching could encourage the conservation of butterfly species and butterfly habitats by:

- encouraging community development of forest communities living in close proximity to targeted butterfly populations, emphasizing the value of butterfly conservation to these communities
- giving value to a less protected or less disturbed butterfly habit, in order to compete with more destructive land-use systems such as forestry, mining, and agriculture
- promoting butterfly preservation of endangered species by relieving pressure from natural populations and through a better understanding of their biology and ecology

Overview of Butterfly Products

There are three components of the butterfly trade.

- 1) High volume/low value trade in deadstock.

In much of the developing world there is a high demand for pictures, lampshades, and other decorative objects made from butterflies wings. This element of the butterfly trade has traditionally comprised the greatest portion of international butterfly exports, notably from Taiwan. Estimates in 1983 calculated that annual sales varied from 15 to 500 million butterflies (NRC 1983).

High volume/low value deadstock involves the harvesting of decorative butterflies, using the most common species that can be obtained in large number with relative ease. The wings are the only part of the butterfly that are used in this instance. However, as the wings are only used for their decorative value, there is little concern as to whether they are chipped. For this reason, there is little need for sensitive handling and transport of high volume/low value deadstock.

2) Low volume/high value trade in deadstock:

Since the craze for butterfly collection first began in Victorian England, there has been a small but keen group of people interested in collecting butterflies from around the world. People have been known to pay thousands of dollars for a single butterfly.

These butterflies are often of interest to collectors, scientists, museums and, more recently, the general public (largely in developed countries) who purchase mounted butterfly displays as decoration. There is a growing market for butterflies for presentation or ornamental frames. The demand is for colorful, unusual and cheap butterflies, which can be advertised as farm produced (even when it makes little economic sense) (Neville, personal communication, Dec 22, 1998).

The butterflies are harvested whole and handled with great care so as not to damage the specimen in any way. Quality of the product determines both the price and the nature of the clientele. However, price is also dependent on the species' rarity and wing size (Sloan et al. 1997).

3) Medium value/ medium volume livestock:

In 1977, the first butterfly aviary (display house) was opened on the island of Guernsey, United Kingdom. In the 1980s the butterfly aviary industry exploded in the United Kingdom. The butterfly display business started to grow in the States in the early 1990s, and is currently growing in popularity worldwide. Recently, an aviary was built in St. Louis at a cost of \$10 million (Southard, personal communication, December 1998). Butterfly livestock is now big business and has taken over the high volume/low value trade as the greatest butterfly export product (Toone, personal communication, Dec 1998).

Butterfly pupae are the final product of butterfly livestock, sent out to butterfly aviaries around the world. As livestock butterflies are bred for display, the criteria for selection are that they be slow flying, hardy (long lived), brightly colored, or marked with unusual patterns (hardiness is especially important if butterfly houses want to keep down their replacement expenses). Most of these butterflies originate from disturbed forest environments; of the 60 odd species of butterfly displayed in the States, only a few are from a primary forest environment (i.e., a butterfly rich habitat), and none of these are endangered (Southard, personal communication). Trade in endangered butterflies (live or dead) would be extremely difficult given CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) restrictions (Weissman et al. 1995).

Butterflies have an average life-span of two to four weeks. In general every butterfly house receives two shipments of pupae per week (Neville). It would be feasible to farm exotic butterflies in the country of display, and it is rumored that some aviaries have started to do this (D. Southard, personal communication). However, given the specific food stock of most larvae, the need for continual refreshment of genetic stock, the bureaucratic impediments of importing governments, and a desire to keep costs down, it makes more sense to raise butterflies in their country of origin, despite the transportation costs this might incur.

Butterfly Raising Systems

The three methods of raising butterflies largely match up with the three different butterfly products:

Harvesting

Harvesting is effectively butterfly hunting. This is to say that butterflies are not artificially “raised,” nor are their populations promoted by human intervention in any way.

The high volume/low value trade is traditionally made up of harvested butterflies, as is some of the low volume/high value trade, often the illegal black market trade. In the past all low volume/ high value stock was harvested; however, this is not the case now due to the increased risk of damaging the final product. A sizeable portion of low volume/high value stock is still harvested (70 percent in Papua New Guinea [PNG]), given that demand is diverse and knowledge of many butterfly ecologies is limited (Parsons 1992). Also, if the butterflies in demand are common, then it is often cheaper to harvest them than to farm them (Neville, personal communication).

Ranching

In 1974, the *Insect Farming and Trading Agency* (IFTA) was created in PNG by the then governing Australian Administration, to promote and control the sale of insects (primarily butterflies). Shortly after independence, this program was expanded and PNG became the first nation to treat their insects as a natural resource. However, much of the insect trade managed by IFTA still consists of harvested (not ranched) butterflies, but given that all insect trade in PNG is regulated by IFTA, harvesting is carried out in a sustainable manner.

Butterfly ranching “involves the artificial manipulation of the natural density of caterpillar host-plants” in order to attract and concentrate targeted butterflies into a delimited area (Weintraub 1995, pg. 1). Often the ranches are “almost indistinguishable from secondary vegetation... a loose form of butterfly gardening and habitat enrichment”(Parsons, 1995). The breeding stock is free, and the butterflies are never fully captive, except as pupae. Thus, ranching is a moderately intensive agricultural system with limited set-up costs; however, there is effectively very little protection against both predation and disease. Thus ranching is generally more suitable for larvae with few pests, i.e. those that store or metabolize plant poisons for protection (Neville, personal communication).

This system is well adapted to the low volume/high value market, which focuses on rare or spectacular species of butterflies sought by collectors, for two reasons. Firstly, it is performed in the rain forest habitats with access to many different species of butterflies. Secondly, the end product is dead and does not require immediate transport.

Farming

Butterfly farming practices are more intensive and controlled than ranching systems; this intensification involves additional expense. For this reason butterfly farming is better adapted to the more profitable livestock market. It also means that farmers need to have access to some capital for start-up costs, which limits this activity to a certain section of the population.

In farming systems, butterflies are enclosed in cages to protect both adults and ova from predation in order to increase viability and to improve the quality of the product. The cages are first stocked with the butterflies and their specific food source. When the ova are laid, they are carefully gathered and placed in a secure location. These are then placed on the appropriate food plants and left to grow. The cages are regularly cleaned to avoid disease. Once the larvae pupate, the pupae are harvested and shipped as soon as possible, insuring that the pupae arrive in the country of display before metamorphosis occurs. Thus the pupae then have a window of approximately 10 days to travel from farmer to broker to distributor to aviary.

Given the limited shelf-life of the pupae, there is an economic advantage attached to decreasing transportation time and expense. As a result, more and more farms have moved from the forest to metropolitan/suburban areas. This is particularly the case in Central and Latin American farms, which didn't develop from the PNG ranching model and which primarily target the livestock. However, there are several disadvantages to this relocation. Firstly, it is more difficult to refresh the genetic stock as wild butterflies are not readily available. Secondly, the larvae are often forced to eat a generic food not normally of their choosing. Neither of these factors are particularly good for the health of the animals and introduce an unwanted element of biological unsustainability into the equation. Fortunately, the species raised for livestock are often adapted to disturbed habitats and tend to be hardier and more flexible than those from non-disturbed forest areas.

CITES

Based on the premise that trade has become a major factor in the decline of certain species viability, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), was implemented on July 1, 1975 and now has a membership of 144 countries. These countries ban commercial international trade in an agreed list of endangered species and regulate and monitor trade in others that might become endangered, for example trade in rhino horns or tiger parts.

While there is agreement among conservationists that trade in highly endangered species could increase the risk of extinction, especially if populations were both small and scattered (Parsons 1992), there is an equal but opposite belief that being undervalued is as much of a danger as being over-valued (Orsak). This belief is bolstered by both the increasing acceptance of Ricardian theory, which states that the increased rarity of a product leads to an increase in price, which in turn usually results in a decrease in demand¹, and a growing distaste for the inflexibility and inefficacy of environmental legislation².

¹ “By supplying the demand for the ‘rarer’ species, a beneficial decrease in their desirability, at least to ‘acceptable’ levels, can be expected (Parsons 1992, pg. 25)

² “No legislative action in the world has show to halt the extinction of a species where its very home is under steady elimination due to commercial development. (Parson 1992, pg. 25)”

The problem with Ricardian logic comes when prices do not rise fast enough for biological systems to recover. An example of this being the oft-cited fate of the carrier pigeon. There is, thus, little doubt that there needs to be some form of control on trade of endangered animals, however this control needs to be founded on logic rather than fear and general assumption.

Butterfly Industry versus Butterfly Conservation

1) Profit run butterfly farms

It is estimated by Xerxes, an insect conservation organization, that over ninety percent of the butterfly farms/ranches worldwide are for-profit suburbanized "farms." These "farms" only contribute towards conservation in that they provide a symbolic if vague focus for butterfly conservation work. However, they do not give value to, nor protect in any way, butterfly habitats. Neither do they protect threatened species, as the species used are generally quite common. In some instances they might actually threaten certain species of morphids (*morpho spp.*) (Southard, personal communication). With a huge demand for breeding stock, a limited understanding of the natural population dynamics, a poor feeding regime, and an increased potential for in-breeding and hybridization, these farms contribute little, if anything, towards the conservation of butterflies.

The situation has come to the point that Xerxes has outlined a plan to grade and label butterfly farms on how they meet environmental objectives; a plan that has received a great deal of obstruction by an increasingly powerful livestock butterfly industry.

2) Projects run for conservation

It is ironic that there are relatively few butterfly farming/ranching projects that are run with conservation as their main objective, given that IFTA, one of the first organizations promoting the farming of butterflies for profit, was a pioneer in the field of habitat and species conservation.

The reasons for this funding gap are unclear. However, it has been postulated that this might be due to the fact that:

- There are difficulties in finding funding for insect farming projects (Parsons 1992). Butterfly ranching/farming projects are too expensive for individuals to fund and yet too lightweight for larger organizations (Southard, personal communication)
- Butterfly ranching projects need to be part of a larger holistic project in order to give enough value to butterfly rich habitats to compete with more destructive land-use systems (Parsons 1992).
- Butterflies have a lesser public existence value than do larger mammals.

There appear to be eight large funded butterfly projects with conservation objectives (with one project pending):

1) Lore Lindu National Park, Sulawesi Indonesia

Biodiversity Conservation Network (BCN) Grant: 8/1/95 through 12/31/98

Budget: \$584,892 grant

Activities: Beekeeping, butterfly farming, rafting, Non Timber Forest Products (NTFPs)

- Product: Livestock to Bali display house
Participants: Habitat community members
- 2) ***Irian Jaya, Arfak Mountains Nature Reserve, Indonesia***
BCN Grant: 4/1/94 through 12/31/98 (Project started in 1990)
Budget: \$179,632 grant
Activities: Butterfly ranching
Product: High value/low value deadstock
Participants: Habitat community members
 - 3) ***Lakekamu Basin, Papua New Guinea***
BCN Grant Budget: \$355,487 grant
Activities: Tourism, butterfly farming, NTFP production
Product: Limited output, high value deadstock
Participants: Habitat community members
 - 4) ***Montes Azules, Lacandona Rainforest, Mexico***
Conservation International (first funded by USAID grant no. 598-0784-523-0037). Started butterfly farming 1994
Activities: Extensive butterfly ranching, edible mushroom farming embroidery, products, woodcrafts, essential oils.
Product: Dead stock
Participants: Habitat community members
 - 5) ***Queen Alexandria Birdwing Butterfly Project, Oro, PNG***
AUSAID, World Bank, 3/95 to 4/00
Budget: Aus\$ 4.2 million.
Activities: Community development to preserve butterflies but not butterfly farming yet
Product: Rural development
Participants: Habitat community members
 - 6) ***Kipepeo, Arabuko-Sokoke Forest, Kenya***
IUCN, UNDP, GEF, 1993
Budget: US \$136,000
Activities: Butterfly farming
Product: Livestock
Participants: Habitat community members
 - 7) ***Barra del Colorado, Costa Rica.***
Xerxes, San Diego Zoo.
Budget: unknown
Activities: Butterfly farming
Product: Livestock
Participants: Habitat community members (schools targeted)
 - 8) ***IFTA, Bulolo, PNG***
Wau Ecology Institute, 1974
Budget: Nonprofit organization, with external grants for extension activities
Activities: Butterfly farming and sales
Product: Dead stock
Participants: Habitat community members
 - 9) ***Masoala National Park, Madagascar***
USAID, IMF, World Bank, Xerxes, etc.
Not yet started.

USAID-Funded Case Studies

i) Lore Lindu National Park, Sulawesi Indonesia, (B. Cordes, personal communication, Nov 1998; Neville personal communication)

- In Lore Lindu butterflies are farmed.
- Butterfly selection criteria is color, size and variety (hardiness, slow flying)

- The butterflies are raised primarily as livestock marketed within Indonesia, with a very limited deadstock supply, sold internationally.
- The local population previously did not approve of forest conservation projects, but project staff found that butterfly farming has led to a more participatory approach to forest conservation. Now people are more willing to participate in monitoring and protection of the habitat, as they can see the benefits.
- It costs approximately \$40 - 75 to start up for each farmer.
- The butterfly project is not yet financially viable. It is covering variable costs, but not covering fixed costs.
- It is thought that farming would still continue, albeit at a lower level if funding were discontinued, but that farming activities would not be practiced as sustainably.
- For a short period in 1996 it was forbidden to export live pupae from Indonesia, in an attempt to stem the flow of genetic wealth and heritage out of the country. This ruling has been overturned but the bureaucracy has still to be completely rectified, hence it must export its pupae to a butterfly house in Bali as opposed to the big houses in Europe or United States.
- There are many local laws and regulations that make it very difficult for Lore Lindu to establish a viable sustainable enterprise, even at the farmer level, although butterflies are a potentially lucrative income source. This is aside from international governing bodies like CITES and the like, which have further restrictions.
- The project is currently in the process of quantifying its monitoring system to better evaluate the effectiveness of butterfly farming.

ii) *Irian Jaya, Arfak Nature Reserve. Indonesia* (B. Cordes, personal communication; Neville personal communication)

- In Arfak, butterfly ranching activities are targeted.
- The criteria for butterfly selection is beauty, size, and rarity.
- They produce High value/low volume deadstock: sometimes mounted, sometimes not
- In the 8 years that birdwings have been ranched, there has been no change on the CITES list. However, CITES has approved the export of birdwings ranched on the Arfak project.
- There is no hard evidence that it has either a negative or positive affect on habitat at the moment. However, as farmers are turning to butterfly farming as a source of income, there is a move away from other more environmentally destructive agricultural practices. Most ranching activities are carried out in the buffer zone, so the forest itself is not directly affected, except to gather new genetic stock.
- The local population previously did not approve of conservation projects, but project staff found that butterfly farming has led to a more participatory approach to forest conservation. Now people are more willing to participate in monitoring and protection, as they can see the benefits.
- Ranching start-up costs in Arfak amount to about \$5 - 8.
- The project is close to being financially viable. It is covering variable costs, but not covering fixed costs yet.
- Farmers make from \$0.65 to \$130 per annum, averaging about \$26- 40.
- Most households make 40-50 percent of their cash income from butterflies.
- The project turns over \$100,000 per year.
- It is thought that farming would still continue, albeit at a lower level if funding were discontinued, but that farming activities would not be practiced as sustainably.

- There are many local laws and regulations that make it very difficult for Arfak to establish a viable sustainable enterprise, even at the farmer level, although butterflies are a potentially lucrative income source. This is aside from international governing bodies like CITES and the like, which have further restrictions.
- The project is currently in the process of quantifying its monitoring system to better evaluate the effectiveness of butterfly farming.

USAID Impact

- USAID has funded four of the eight projects noted. Aid funding tends to inject butterfly projects with environmental goals, and make them:
 - * more sustainable
 - * more focused on threatened butterflies
 - * more profitable to communities living in butterfly rich habitats.
- Thus, USAID activities seem to contribute to the effectiveness of butterfly raising activities, albeit in a limited manner.

Case Study of a non USAID Funded Project

Queen Alexandra Birdwing Project, Oro, PNG, (AusAID) (Hibberd 1997; Green 1996)

- Given that the Queen Alexandra Birdwing is an Appendix I species, all trade is prohibited by CITES.
- There has been some discussion on the possibilities farming Queen Alexandra for profit, but at this moment these have not been realized.
- Due to the Appendix I status of this species, the focus of this project has been on rural development to provide alternatives to palm oil plantations, and thus protect the Queen Alexandra Birdwing's habitat. This project shows that not all butterfly conservation projects must involve "use."
- This project involves other rural development activities, ecotourism, gardening, and improving the ability of local communities to market coffee and cardamon.
- Another development activity includes ranching of other less-threatened birdwing butterflies. This is an instance where the preservation of a nonthreatened butterfly species might serve to protect a threatened one.

Findings

- There is little or no hard data showing whether butterfly farming/ranching projects have been an effective conservation vehicle (Neville, personal communication; Cordes, personal communication; Greenquist, personal communication). However, neither is there evidence to the contrary.
- The only example encountered of a butterfly species conserved by butterfly farming is the Schaus Swallowtail, an American butterfly, which was raised in research-run butterfly farms with more emphasis on preservation than marketability (T. Emmel, personal communication, December 1998).

- In-situ rather than ex-situ protection is more effective (Parsons 1992, D. Southard pers. comm. 1998). There is evidence that ex situ protection of endangered butterflies re-introduced into their habitat do not succeed (Soukup 1998).
- Over ninety percent of the butterfly farms have absolutely no conservation impact.
- There are very few aid- or conservation-funded butterfly projects.
- Butterfly projects funded by aid or conservation agencies tend to have an environmental agenda.
- Butterfly projects in and of themselves will not completely protect the habitat.
- The world market for butterflies is growing, however it is also fluctuates wildly, and there is some concern that the market will drop if expendable income decreases (Neville, personal communication).
- The inter-governmental (CITES) and intra-governmental (export restrictions, agricultural import laws, customs) restrictions on trade are often stringent (Neville, personal communication). In fact, CITES restrictions often limit or retard the adoption of butterfly farms of rare butterfly species.
- There is some evidence that the availability of CITES legal specimens has led to the collapse of the black market trade in some areas (Neville, 1993).
- Ranching involves less initial investment, tends to target the high value/low volume trade (which are often the at-risk species), and is more adapted to natural butterfly habitats. Farming involves more investment, tends to target the bigger market to cover expenses (in this case livestock), and is generally more suited to locations outside of habitat.
- Asian and South American exports exceed those from Africa. The livestock market is the greatest market because of the constant turnover of specimens. (Toone, personal communication, Dec 1998)
- Deadstock is more adapted to isolated environments with poorer infrastructure, and livestock are more adapted to less isolated environments with better infrastructure.

Advantages of Butterfly Farming/Ranching

- In funded in-situ farms local communities are making money from butterflies without further decreasing threatened butterfly populations. This adds value to butterfly habitats, encourages the participation and the responsibility of local populations in environmental activities.
- There is evidence that butterfly ranching projects have encouraged local inhabitants to abandon more destructive land use systems (ranching or slash and burn agriculture) (Cordes, personal communication).

- Prices for farmed deadstock are substantially cheaper than black market butterflies; this must discourage the poaching of butterflies (Slone et al. 1997).
- In a general sense, there is now a spotlight on butterfly conservation that did not exist before. How effectively this translates into effective conservation methods is still questionable.
- The knowledge gained from butterfly ranching/farming projects has contributed to the general knowledge of butterfly ecology, reproduction, and feeding strategies. This is the first step in any conservation program (Emmel 1995).

Disadvantages of Butterfly Farming/Ranching

- It is said that in farming situations where insects are forced to live in crowded situations, the probability of disease rises. There is the risk of epidemics if captive butterflies are released back to the wild, either as a reintroduction scheme or to purge leftover stock. However, there is some debate on this subject (E. Greenquist, personal communication, December 1998; D. Post, personal communication, December 1998).
- There can sometime be over-harvesting of larval food-plants associated with ranching or farming activities (Neville, personal communication).
- In for-profit livestock farms there is an increased chance of hybridization due to the lack of genetic regeneration and the increased probability of crossbreeding (Southard, personal communication). Sometimes there is even a deliberate attempt to create hybrids (Neville, personal communication).
- There is some concern that uninformed livestock farmers trying to meet the huge demand for *Morphos* might threaten their viability (Southard, personal communication).
- Some entomologists believe that by selecting the good stock for sale and releasing the damaged stock back to the wild, farmers are in effect breeding for “weakness” (Young 1980).
- With the rise in butterfly display units, there is a possibility that we might come to confuse the conservation of a common species with the conservation of threatened species, which in turn might detract from the conservation of more threatened species.

Recommendations

- In-situ ranching for high value/low volume deadstock seems to be the most sustainable method of conservation. Using Barbier’s criteria for sustainability, butterfly ranching is biologically, economically and socially sustainable, “an almost perfect expression of the ‘conservation through development’ strategy (Orsak).”
- It might be economically beneficial to intensify ranching, to reduce loss due to parasite disease and produce better stock (Southard, personal communication)

- Because income from butterfly farming is noncompetitive with income from timber, a broad package of income sources is usually necessary to compete (Sloan et al. 1997; Parsons 1992).
- National insect trade groups should be encouraged to gauge market activity, control illegal sales, and monitor farming activities.

Wildlife Farming: Criteria for Success

The effectiveness of a wildlife-farming venture can be viewed in seven terms:

1) Choice of species.

Is the species threatened or common?

If a species is common, then there is no real conservation need. However, if a species is highly threatened, farming or ranching could pose serious risks to that species survival if demand could not meet supply. It is for this reason that Queen Alexandra butterflies have not yet been farmed (Parsons 1992). In addition, profitable trade of threatened species would be made more difficult by international trade regulations (CITES) or environmental pressure groups. Moderate or potential vulnerability would appear to be the best criteria for species selection.

Is the species used symbolic of a larger, more threatened subset?

Some species are confused by the public for another species, genus, or even a family, which might not be threatened. This is the case with butterflies. Common butterflies are generally raised for what are claimed to be “conservation reasons,” obscuring the fate of many rarer butterflies.

Does the species have a high existence value?

It might be difficult to farm tigers or elephants given their great existence value and their high profile with the public and environmental groups. On the other hand species with low existence value can rarely garner enough funds to fuel conservation projects.

Size and reproductive rate (ranching)

Small species that reproduce quickly are often difficult to monitor, while larger animals that reproduce slowly are easier to monitor. However, larger animals with slower reproduction rates are more likely to have small populations. If small animal populations are farmed or ranched effectively, this activity will have to be a communal venture. This does not in itself preclude success, however it does require a different set of management guidelines.

2) Biological Feasibility

Is it possible to raise the animal? Some animals have limited reproductive ability in captivity (pangolin, duiker) Some have very complex diets that are difficult or impossible to reproduce (several species of birdwing butterflies). In these cases wildlife farming would not be feasible.

3) Economic Feasibility

Does the investment made into the wildlife farm/ranch surpass the profits? Do profits account for the labor invested? Take the example of cane rats. In humid West Africa there is a large market for cane rat bushmeat. Hence, several funding agencies have developed projects to raise cane rats for food. However, cane rats have very strong teeth and can escape from most simple cages. Hence a cane rat house needs to be very sturdy. This can be both expensive and time consuming for an average farmer. Ultimately cane rat farming is demonstrating moderate success because costs are not readily covered by profits.

4) Traditional Use of Product in Habitat Area

Is the product traditionally used in the habitat area? Certain “sustainable use” projects promote products, like butterflies, which possess only a limited traditional use, while other projects work with products, like bushmeat, which possess a greater traditional use. If demand for the animal is located in or around that animal's habitat the probability is that it has both a cultural and dietary significance, and its survival is of some relevance to local communities. This introduces an element of sustainability to the product's use.

5) Type of Market

Is the market for the species local, national, or international? The further away the market moves from the habitat of the animal, the less sustainable the project tends to be. On the other hand, the further away the market moves from the habitat, the more profitable the project tends to be.

If the market (or demand) for the product is very localized, this generally means that it is a subsistence food with no market value. In this situation it is usually easier and cheaper for consumers to continue hunting their product, as opposed to farming it.

On the other hand, if the product is marketed internationally, and the product has little or no local market, there is little cultural incentive to maintain sustainability or curb demand, and trade becomes consumer driven. International markets are created by brokers, retailers, and consumers who tend to have a limited interest in the in-situ conservation of any given species.

If, however, there is a national (and local) market for the animal product, there is an increased likelihood of both sustainability and profitability. Perhaps the optimal solution is if the product is fixed in a certain habitat (wildlife safari or hunting) and consumers are forced to relocate to the product in order to “consume” it, encouraging international markets while maintaining control and preserving local sustainability.

6) Replicability

Is this a product that can be reproduced in the country of consumption? Is in-country reproduction cheaper than import?

This is one of the weaknesses in the argument for valuation by NTFPs. As soon as a “miracle product” is discovered it is promptly replicated in the country of consumption; the greater the value of the product, the greater the likelihood of replication. This deprives the host country of benefits and more importantly deprives the habitat of added value. Cultural property rights are a sticking

point in most international trade and environment discussions, and there seems little chance that host countries will be reimbursed for the “rights” to produce certain products ex-situ.

7) Hunting as a Cultural Trait

In many instances, particularly in humid forest environments, hunting, not cultivation, is a significant social and cultural activity for men; frequently a rite of passage. It might be a fallacy to assume that men might want to trade in hunting for cultivation. If this were the case it might be best either to limit activities to the more extensive ranching or in the case of wildlife farming, to target youth or women (M. Mackey, personal communication, December 1998; Southard, personal communication). This was one reason why WWF focused on ranching rather than farming butterflies in the Arfak Mountains: the Hatam villagers had no tradition of animal husbandry (Neville, 1993).

8) Structure /Organization

There needs to be some national body, like IFTA, to oversee wildlife farming/ranching activities, to help with marketing, provide some sense of environmental control and aid with the extension of new technical methods. This controlling agency is important. A butterfly farming project in Xishuangbanna, funded by WWF, failed largely because there was no “administrative mechanism available for handling export documentation,” despite the fact that none of the butterfly were CITES listed (Melville, personal communication, 1998).

It is important to note that “a fine balance must exist between the business of the venture and its conservation aims. This may be difficult to reconcile within the government structure since government departments are invariably divided strictly on their relevance to either conservation or commerce, rarely both”(Parsons 1992). For conservation objectives to be achieved in the long-term, the managing agency itself must be sustainable and farmers must receive an income which is linked to the conservation area (Neville, 1993). Most importantly a good portion of the profits must be redirected to the producers. This is what has made organizations like CAMPFIRE and IFTA successful.

Summation of Factors

Wildlife farming is generally an effective conservation tool, however projects work best when:

- Medium or potential risk animals are targeted.
- Farming/ranching of targeted species is biologically and economically feasible.
- Markets for the animal products are national.
- Production is limited to the local habitat for any international market.
- Women or children are included in the project design.
- There is a national or communal controlling body.

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