



WWF

REPORT

DECEMBER

2010

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ESTABLISHING A SUSTAINABLE PRODUCTION SYSTEM OF
RATTAN PRODUCTS IN CAMBODIA, LAOS, AND VIETNAM

RESEARCH AND CASE STUDIES

December 2010

POTENTIAL ASSESSMENT AND PROPOSING CLEANER
PRODUCTION SOLUTION FOR RATTAN SECTOR IN CAMBODIA

PROJECT PREPARATION REPORT

“Establishing a Sustainable Production System for Rattan Products in Cambodia, Laos and Vietnam”

POTENTIAL ASSESSMENT AND PROPOSING CLEANER PRODUCTION SOLUTION FOR RATTAN SECTOR IN INDOCHINA

GENERAL INFORMATION OF RATTAN IN CAMBODIA

1.1. Current situation of rattan in Cambodia

Rattan is one of among other Non-Timber Forest Products (NTFPs) which has been increasingly recognized as economical and socio-cultural importance in the world and Cambodian have also been considered rattan as social economic and cultural important for local communities who have been practiced using this material for over a century. These days, rattan remains significant important for their culture and improving their livelihood including food, shelter and furniture, providing extra income beside agricultural activities.

21 species have been identified by Hourt¹ and five of them are commercial species both local and internal used and the rattan resource in Cambodia is available in many provinces around the country such as in Kompot, Preah Sihanouk, Koh Kong, Pursat, Odormeanchey, Preah Vihear, Rattakiri, Mondulkiri, Krotie, Stung Treng, Kompong Thom. Over-harvesting of rattan, poor environmental management and a lack of international quality standards along the supply chain is depleting the nation's rattan stocks at an unsustainable rate and three main threats have been indicated by Mr. Vuthy². Firstly, Forest land conversion, most of rattan species prefer inhabiting in semi-evergreen and evergreen forest but the soil of these forest types transferred into large plantation, paddy rice field and shifting cultivation. Then, over harvesting of rattan and harvesting rattan in unsustainable way. Finally, deforestation mostly where rattan areas are and as the results rattan is not able to grow well in association with tall trees of primary forest whenever taller trees have been cut. Moreover, Mr. Vuthy showed that at least 58,570 tons and 15,842 tons of rattan canes are exported from Cambodia to Vietnam and Thailand annually respectively.

Rattan is also an important commodity in international trade, but these days, the Cambodian rattan industry cannot compete with other rattan manufacturing countries. Two main rattan productions have been classified in Cambodia namely: basket and furniture. The majority of rattan products in Cambodia are furniture account approximately 70 per cent of total rattan products and the rest are baskets. Most of rattan furniture products are from rattan association of Cambodia with the average annual turnover of amount *USD690 000* and the total of rattan furniture through out Cambodia approximately *USD1 million*. The majority of rattan basket products are from Siem Riep province using Lpeak (*Calamus salicifolius*) at the present the main lpeak resources are from Kampong Thom and some provinces around Tonle Sap Great Lake. The average of rattan basket product turnover is around *USD 500, 000* and only the rattan baskets export to Thailand around 50 per cent of the total turnover of rattan basket products in Cambodia, which accounts

¹ Khou Eang Hourt (2008) Rattan Field Guide of Cambodia, WWF Greater Mekong Cambodia Programme, Phnom Penh.

² Lic Vuthy & Khou Eang Hourt (2006) Cambodia Status Progress Report: A Switch to Rattan Harvest and Production, WWF Greater Mekong Cambodia Programme, Phnom Penh.

approximately 80³ per cent of total basket productions in Siem Reap Province in 2009. Overall, the total of rattan production turnover in Cambodia is approximately USD 1.5 million.

1.2. Policy and related document to rattan sector

There is no law/Prakas on rattan resources, but on non timber forest products which usually falls by default under the Forestry Law as rattan is considered a non-timber forest product. Communities have the right to harvest for their own use in demarcated areas in accordance with the community agreement, community protected areas and community forestry management plan. Art. 13 of the Community Forestry Sub-Decree implemented in 2003 states that “royalties and premiums should be set after consultation with the local community in order to support community development, equitable benefit sharing, and poverty alleviation”.

The policies of the Royal Government of Cambodia are aimed to guarantee sustainable use of forestry resources and secure legal rights of local communities⁴ to manage and use forest resources under the framework of food security and poverty alleviation consideration. Though there is no specific policy on rattan management or trade, rattan is defined as a non-timber forest product in the Law on Forestry in 2002 and Sub-degree on Community Forestry Management in 2003 of Cambodia as an un-prohibited sub-forestry product. Law on Natural Protected Areas (LNPA) and SDCFM are the main legislation governing sustainability forest management in Cambodia today. These policies empower local communities and indigenous people (*as defined in article 9 of the SDCFM and article 22, Section 6, LNPA*) to obtain a Community Forest (CF) or a National Community Protecting Area (CPA) management agreement over traditional lands and manage, use and gain benefits from the forest resources, including rattan, within community forest areas for poverty alleviation and decentralization purposes. Rattan products are permitted to export. In addition, the Royal Government of Cambodia (RGC) has a strategic plan to promote processing technologies and processing forestry and by-forest products.

Article 53 of the LF, MAFF permits the reduction or waiver royalties and fees for Forest Products & By-products collected from the Permanent Forest Reserve for local use and scientific purposes or to create an economic incentive to efficiently use Forest Products & By-products. Today, staff of the RGC, especially Ministry of Agriculture, Forestry and Fishery and Ministry of Commerce, are aware of these policies and attempts are made to enforce it, but there remains the need to make much more of an effort to implement and enforce the legislation regarding the use and management of rattan and NTFPs.

Below are the related governmental departments and their relevant roles for companies or traders to obtain license to process rattans and permits to trade and

³ Davies, K & Mould, A (2010) A Study on Ways of Stabilizing the Lpeak (*Calamus salicifolius* Becc.) Raw Material Production in Siem Reap Province and Developing Concepts for Sustainable Raw Material Supply; prepared for GTZ - Regional Economic Development Program (RED) – Green Belt

⁴ Sotha, (2010) Rattan Gap Policy Analysis

export. In Cambodia there are total 424 communities forestry sites cover 398,600 hectares of the forest land. In legalization of the community forestry of the community forestry establishment, the Ministry of Agriculture, Forestry, and Fisheries (MAFF) has approved 145 community forestry sites that cover 149,932 hectares of forest land. Among these, 94 CF sites have signed agreements with the government that covers 113,544 hectares of forest land. Only 4 CF sites that have forestry management plans that cover 433 forest land. In 1993, the Cambodian Royal Decree on the Designation and Creation of Protected Areas established 23 Protected Areas (PAs) in Cambodia under the management of the Ministry of Environment, Department of Nature Conservation and Protection. As a result, 18.23% of the total area of Cambodia is officially declared as Protected Areas. This represents 3,273,200 hectares, or 30.76% of the nation's forests. The intensive protected area management experiences in Cambodia, the Royal Government of Cambodia, especially the Ministry of Environment, have been established 91 CPAs cover a total area of 115 616 ha by August 2009.

The existing policies support the food security and poverty alleviation framework of the RGC. Besides from the positive policy, Cambodia still needs to face a huge challenge in implementing its forestry policies rather than adaptation of any existing policy, especially addressing un-required fee and building capacity of the rattan traders technically, financially and in business management skills to be able to compete in the free and international markets. The implementation of the policy should include making sure that the both related governmental officials and the people follow the law. The government needs to ensure that the third party who transports sub-forestry forestry is permitted to transport and run sub-forestry products. Based on the policy, there is a need for the FA to put more efforts in improving forestry products and create international markets for the people and rattan companies. This can be achieved by a close collaboration with other actors, i.e., the government related ministries, private sector and NGOs. The creation of this collaboration is likely possible due to direction of the existing good governmental forestry policies, and there is a common interest between the governmental ministries, NGOs and even the private sector.

1.3. Project and program supporting to rattan sector

Guiding local communities towards sustainable rattan harvesting and production by selecting pilot area in Prek Thnot community protected area, Kampot province, to practice sustainable rattan management under IKEA and WWF funding since 2006. The project introduced villagers to sustainable ways of rattan management and harvesting, established rattan permanence plot, rattan nursery, and rattan plantation in the community. Moreover, the project also provided trainings on rattan processing techniques to enable the community to manufacture more profitable rattan-products independently. Beside training and developing sustainable rattan production model, the project also study on rattan value chains in Cambodia and developed rattan field guide of Cambodia and sustainable rattan model. After establishing the model the project has been scaled up the project to other village with the total of 4900 families in the five provinces namely: Kampot, Koh Kong, Preah Sihanouk, Kampong Thom, and Preah Vihear provinces.

The Livelihood Diversification and Natural Resource Management project is funded by the OPEC and implemented by FAO Cambodia and Ministry of Agriculture, Forestry and Fisheries (MAFF) with collaboration with Ministry of Women's affairs. The project is under the national program for food security and poverty reduction and is support rattan activities in Pursat province. It focuses on rattan handicraft and management and it has been implemented in Cambodia from 2006 to 2009.

The Creative Industries Support Programme (CISP) project is designed to preserve and promote Cambodia's cultural heritage, resulting in better livelihoods among the poor in the most remote areas of four provinces, with a strong focus on Cambodian indigenous peoples. It also focuses on handicrafts, especially rattan and bamboo basket weaving. The CISP is a joint programme involving four UN agencies namely: the United Nations Education Scientific and Cultural Organization (UNESCO), the UN Development Programme (UNDP), the International Labour Organization (ILO) and the Food and Agriculture Organization (FAO). The programme focuses on remote areas in Mondulkiri, Rattanakiri, Preah Vihear and Kampong Thom provinces. It aims to improve the capacity of national institutions to preserve and develop Cambodia's cultural heritage and living arts, to improve employment opportunities and income generation in the creative industries, to improve the commercialisation of local cultural products and services, and to empower women and indigenous peoples. The project has been implemented in Cambodia from 2008 to 2011.

CHAPTER II. ANALYSIS AND ASSESSMENT ON UNSUSTAINABLE ISSUES IN CAMBODIA'S RATTAN SECTOR

1. Raw materials



Raw material resources are not the current problem in Cambodia. The shortage of supply just only is caused by the bad weather and fluctuation of the demand-supply relation. The demand of raw material for domestic use in Cambodia is not high, comparing to Vietnam.. There is no purchase specification based on Raw Materials Dimension, size, color, infection like fungal infection etc. Rattan purchase is based on experience and payment sometime is based on visual

inspection of green rattan. There is no facility for measuring % age moisture in Rattan received.

The rattan in Cambodia does not seem as white as in Laos. The rattan harvested from forest is also not very straight, comparing to planted rattan, which reduces the commercial values.

2. Transportation



It is required additional surveys and evaluations with more specific data. According to the observation in the companies, the rattan seems to be transported in high moisture content. This may cause more expenditure and extra emission in transportation.

3. Pre-treatment

Lack of pre-treatment of rattan in the forest at harvesting site for reducing fungal staining. It is reported that within 24 hrs of harvesting fungal attack starts and continue to grow within internal cortical tissues and become evident in a week time. Pre-treatment on harvesting site or intermediate storage facility is non-existing in Cambodia

Sanding: Bigger dimension canes mainly used for frames and bodies of furniture are subjected to sanding process to make the smooth surface. It was observed that only one size sand paper of medium grain is used and often sanding is done 2-3 time depending on cane quality and product requirement.

Pre-treatment before transportation: The project should address the need of pre-treatment of canes before transporting to processing unit, therefore, cane harvesters are required to be educated in cane harvesting, pre-processing essentially to improve the product quality. Some recommendations on site are as below:

- Sorting and grading is a crucial step in rattan processing due to diversity on properties, quality, dimensions and hardness etc, therefore harvested canes have to be sorted before transported to manufacturing unit. Sorting shall be

done based on a) Diameter class b) Length class c) Strength class d) end use class.

- For sorting purpose important is to consider taper, inter-nodal length and defects. As far as possible purchase shall be effected for canes having taper less than 3 mm for a length of 4.5 meter and inter-nodal length shall be minimum 50 mm. Defects like decay, worm holes, broken canes shall not be purchased and other defects shall be considered as per end use requirement.
- As far as possible first stage of drying shall be done in field or intermediate storage place to reduce fungal infection.
- After cutting cane in desired size bundles need to be stacked vertically for 1 hr to drain out the sap from fresh cut ends.
- Rattan is severely infected and discolored before processing therefore, it is important to do antifungal treatment (prophylactic treatment) immediately after extraction in the field itself to get stain and blemish free rattan.

Cans soaking can be done in simple low cost dipping vat or dipping pits on the ground lined with polythene sheets. (Details of various pre-treatment practices followed will be provided during detailed CP assessment and implementation phase).

Oil Curing (termed as boiling) under optimized condition is very important to reduce the moisture content to prevent fungal infection and to improve quality, utilizable yield and durability of rattan and rattan products. However, curing should be done as soon as possible and delays due to transportation & intermediate storage should be avoided which will adversely affect the quality.

4.Oil boiling



Raw materials used to be boiled in the solution of water and diesel, with varied water-diesel ratio. In order to increase the treatment cost, these days most of companies has been skipped this stage causing very poor quality in rattan raw materials. It's observed that only one Rattan Company keeps boiling raw rattan in diesel of some species. No use of palm oil or other plant oils were found. In any case, this is harmful for workers, esp. for poor ventilating conditions as found in companies. Boiling is done using very primitive method without sorting and temperature control in different zones of boiling chamber. Wood is used as fuel and uncontrolled natural draft for combustion. Waste generated from processing is not used due to perceived fear of fast burning and uncontrolled temperature. In contrast rattan waste is burnt in open leading to waste of resource and also contributing in air pollution.

This shows a big potential of transferring and adopting the plant oil technique from Vietnam. Optimization of the boiling is also important to minimize the use of plant oil and fuel. Note that the proper boiling does not cause waste water and waste oil.

5. Drying/Grading

No cane sorting and drying is done in the field which might allows germination of the fungal spore during intermediate storage, transportation and storage before processing in the factory.

The most sustainable solution would be drying by solar energy in the storage by greenhouse effect. But it needs to test first in Vietnam, and then to transfer the standardized design to Cambodia.

Grading is a crucial step in procurement of Rattan, processing, product quality, durability. In addition to dimensional specifications, size, colour other important parameters for sorting are:

- Hardness: Hard rattan, moderately hard rattan and soft rattan

- Defects: Discoloration, pinholes/borers, bruise, checks, shakes decay, worm holes, breakages etc
 - Taper and inter-nodal length:
- Colour: After processing 2nd level of grading is mainly done on basis of surface colour viz.; High Grade- White, yellowish and cream colour, bright and luster (Glossy surface) Lower Grade: Brown, grey in colour, black spots, dull and non lustrous surface.

6. Preservation and storage



Most of the company storages are dark and hot. But the rattan is well kept in high shelves, which is dry. No sulfur usage shows a good sign for a cleaner rattan industry comparing to Vietnam. This is also thanks to the drier climate in Cambodia. But the loss of material and final product, or even the take-back of sold products caused by insect and fungi is also frequent issue.

This is not a problem now for both companies and buyers so far. But if Cambodian companies would like to export as they intend to do so, the proper storage is important.

The most sustainable solution would be drying by solar energy in the storage by greenhouse effect. But it needs to test first in Vietnam, and then to transfer the standardised design to Cambodia.

7. Splitting and sizing



The machines use for splitting and sizing are mostly old and obsolete machines made originally in Taiwan resulting in high wastage, improper peeling, splitting, uneven surface (rough splits adversely affecting finished product quality, finish and comforts). Peeling at the tapered end of rattan is observed to be poor and some discoloration is seen which might effect the product quality and excessive loss of pre treated raw material. Energy consumption in node cutting, peeling and splitting is also appears to be very high. Motor used is old having low efficiency and V belts having different tensions resulting in high friction losses.

Due to soft metal dies (Non Chrome hardened material) material loss and breakage is high as well as surface smoothness is adversely affected. Soft unsharpened dies also results in higher consumption of electrical energy.

8. **Processing** (bending, making frame, weaving, finishing)



Signing: During product weaving burning of extra fiber is done to make the surface smooth by using flame (hand operated LPG burner). The burners are old having long flame and also some time yellow flame rather than V shape or fish tail shape blue flame for better signing and less consumption of LPG.

Bending and framing: Bending of *larger* diameter cane is done by softening the cane by heating using either kerosene oil flame or LPG. It was observed during visits at significant percentage of cane during bending break/cracks which are either repaired crudely or wasted. Bends become normally black color due to soot formation during heating. No steam generation facilities were seen therefore, steam bending is not practiced.

Weaving: Weaving is the major labor oriented job and is mainly done by workers principally ladies sitting on the floor using conventional skills. No workstation with proper height tables were seen in any of the unit visited. The sizes of rattan splits used for weaving are cut randomly without proper production plan and sizing as per product requirement. During factory visit water soaking tanks were seen and it was reported that Wickers used for weaving are sometime soaked in water to make them soft and flexible for easy weaving. However, excess moisture (due to dipping in water) at this stage might lead to hydrolysis which could lead to accelerated degradation of rattan and durability of furniture.

Jointing: Jointing is a crucial step in rattan product, therefore, jointing is done to hide the ends and also for tight and evenly woven mat. Jointing is done using nailing and pinning using compressed air.

Wood cutting and planning: For cutting, trimming, corners making and planning (Surface smoothening) is done by a single machine using saw planner and use diesel engine to drive the machine. The operating time is very low and machine keep running/idling most of the time

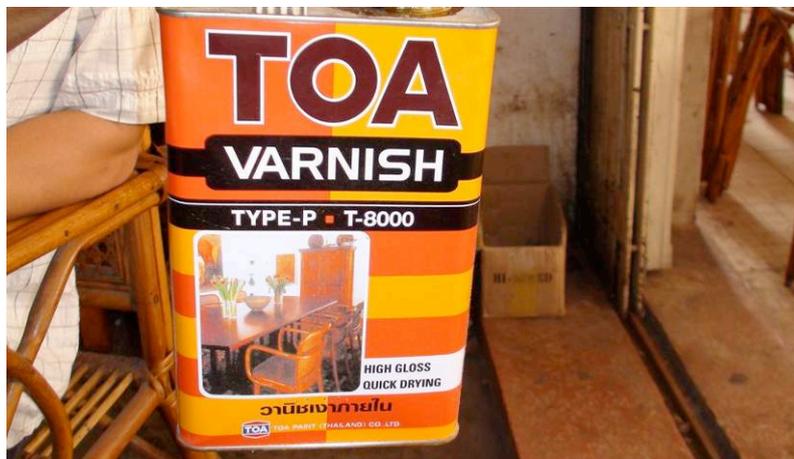
In this stage the main interests are the problems of training workers, normalizing processes, quality control, 5S (A Kaizen tool developed by Japanese), safety, ventilation, thermal isolation and lighting. Labor productivity and quality depend a lot on skills of workers, working position, working conditions (lighting, temperature, the air ventilation, working posture). In Vietnam, many companies use the model of outsourcing: hiring craft villagers to weave at home; companies provide (or sell) materials, do the quality control, design, the standards and training support. This model has the advantages that there is no need to build big factories and other expenses. But in Cambodia, the capacity is limited due to the lack of skilled craft villagers. This implies the need for skill training, supported or subsidized by the government. In this, Vietnam goes much further than its Indochina neighbors. The other alternative can be the skill transfer done by companies as usual business.

9. Washing and whitening



Based on market order selected products is bleached using crude method of mixing 50% solution of Hydrogen Peroxide, detergent and water. Bleaching solution is applied using brush and piece of cloth and left for sun drying. Bleaching of finished product having weaving thread will adversely affect the maximum compressive stress (MCS) and Ultimate tensile strength (UTS). It is generally reported that bleaching process results in reduction of almost 50% strength hence durability as well as product stability is adversely affected. However, modern rattan Company has reported no bleaching practice compared to other units visited.

10. Surface finishing (painting, carbonizing, dyeing)



- Finishing of product is done as per requirement/ market demand. It was reported that bleaching is not done in the unit but painting and lacquering is done for major product either manually or using spray techniques. The existing practice is very inefficient and wastage to environment is more than going into product. In addition due to painting done in open area there is no possibility and provision for suction and removal of paint and solvent

emissions resulting in poor working environment and exposure of workers to solvents.

- Painting/lacquering techniques need to be changed. As reported consumption of Lacquer/ varnish is high due to wastage as well as purposely done to fill the weaving gap and make it smooth feeling. The consistency of Varnish to be applied need to be optimized based on required application. This will be studied in more details during CP assessment and practices followed in neighboring countries shall be studied and compiled which are relevant to Cambodian product.
- Feasibility studies for Cleaner Technologies like Dip Dyeing, Carbonizing, and steam based moulding/bending shall be done when Cambodian product is particularly aiming for export market.
- Technical support for eco-friendly product designing is required and relevant expertise shall be made available either by project or entrepreneur himself /herself shall find out and contract.

Feasibility studies to enter into ecotourism sector and design and manufacture eco-friendly HOUSE BOATS from Rattan. In Cambodia this could be a very attractive business due to growing tourism sector.

11. Packaging

The distance to cover is not far for domestic market. This implies that the companies do not yet pay attention to packaging: how to minimize the volume for transportation, or how to use the packaging material. Drop-test is not familiar in Cambodia.

12. Design and product development

It can be said that this stage is the most potential aspect. Cambodia has big resource of rattan, but not yet exports any rattan products. Surprisingly, many products are well-designed by companies and national designers. Copying the design from international catalogs, internet, client designs, or from each other is commonly observed.

There are more than twenty rattan species in Cambodia forest with 12 species are local commercial species. During our visits, only four species are observed as commonly used. With proper product innovation and treating process, other rattans can be good commercial resource.

Making use of the design and marketing of the project and collaborating with the SPIN project (Sustainable Product Innovation in Vietnam, Lao and Cambodia, EC funded), which begins in 2010 might be a good start.

An urgent problem is to develop products using rattan outer layer to reduce the waste

Another solution is to combine all kinds of different materials, including rattans, in new products. There are some combinations found in the company Cambodia Modern Rattan

13. Auxiliary system and equipment

1. Electricity Generation efficiency: Unit is currently employing 4 old inefficient Diesel engines to generate electricity. Though there is no energy meter but it is estimated that generation efficiency is very low. On an average 900 litres of DO is used monthly which shall generate >2500 KWhr of electricity resulting into less than 20% efficiency compared to 30% efficiency of diesel generators. A detailed audit of generation and distribution efficiency is required and old engines shall be replaced by 2 new and efficient engines with proper cooling device.
2. Diesel engines used for other purposes like wood processing, water pumping etc. shall be replaced by electrical motors and electricity from DG set shall be used to reduce operating costs, environmental pollution and noise pollution in the factory.
3. Production planning shall be done not only according to market demand but also based on generated energy. Different size of DG set shall be used for heavy energy consuming processes (fixed time and duration) and for normal lighting requirement etc. small capacity DG set shall be used.
4. Nailing and pinning using compressed air shall be done on a schedule time to reduce the operating hours of Compressors and as far as possible only 1 or 2 compressor shall be operational to reduce energy consumption due to idle running and leakage of compressed air.
5. For signing operation flame used need to be modified. The burner of hand hold flame shall be flat having wide blue flame to cover more surface area for signing. Regular cleaning of soot from burner is necessary to get good flame to avoid soot deposit on product.
6. Provision of SKYLITE (Transparent roof sheets) to improve the Lux and lumen for better working as well as to reduce the electricity consumption for lighting. The selection of material for roof sheets shall be done carefully and low cost plastic sheets shall be avoided. Resin based sheets having long life and resistant to fire shall be used.
7. Technology for Wood cutting, planning, grinding need to be substituted. Existing technology is not only energy intensive but also environmentally and socially unacceptable. Provisions for safety and occupational health shall be made to avoid any accident in this section.

8. Proper design of boiling furnace with provision of air control is must. To control uniform temperature and reduce stack heat losses proper air: fuel ratio need to be maintained using a simple pre calibrated damper.

Hot water generated from Diesel engine cooling activity can be used for rattan curing (boiling) process to reduce fuel consumption, environmental protection as well as better efficiency of Diesel generators due to proper cooling. Present cooling efficiency using 200 liters barrel for recycling is very poor.

14. Relationships in the supply chain and the role of associations, consult units, government

- The technical requirements for rattan materials (humidity, rattan age, diameter,...) need normalizing, the measurement system should be based on length rather than weight.
- There is a Cambodia Rattan Association, but it is not in operation yet. This shows the low competition but implies the weak cooperation too.

A. Suggestion

- Offer technical support for harvesting techniques for harvesters
- Rattan Association to be put into operation as soon as possible.
- Support policy from government for training and skill/technique investments.
- Develop industrial design
- Establish a training system



Why we are here.

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

www.panda.org/rattan