Theme: Environment-1.3. Ecology and Environmental concerns

Viet Nam Bamboo Resources Conservation for Sustainable Development

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Summary

The village of Phu An, located on the bank of Saigon River, 42 km north of Saigon, one part of Iron Triangle Zone, was heavily bombed during the Viet Nam war. Phu An Bamboo Village was created in 1999 by Dr. Diep Thi My Hanh, a native of Phu An village, with the aim of conserving biodiversity of bamboo, and helping to "transform the Iron Triangle into a Green Triangle". The root of this idea was based on biodiversity conservation, environmental protection and sustainable income production for local people through basic research and application to increase the value of bamboo. Phu An Bamboo Village has been collecting bamboo taxa of Viet Nam and Indochina for classification, identification and others researches. Specimens of 198 living taxa were planted in the botanical garden and over 300 species are preserved in the herbarium. Projects and cooperations permit successfully research on: carbon fixation of bamboo, waste water treatment by phytoremediation and bamboo fiber products for thermal and sound insulation. Phu An Bamboo Village was awarded the 2010 Equatorial Prize by the UNDP and is a member of Jardins Botaniques Francophones from 2016. Phu An Bamboo Village is currently developing a bamboo conservation model for different ecological areas such as seasonal floodplain, drying and sloping land, to implement the "Bamboo Route of Bamboo" program for training, education, ecotourism and economic development from bamboo. Bamboo is a champion of sustainable development.

Phu An Bamboo Village and Viet Nam Bamboo Resources conservancy

Local and indigenous communities across the world are advancing innovative sustainable development solutions that work for people and for nature (UNDP, 2012). Phu An Bamboo Village has carried out the work of preserving bamboo genetic resources and researching bamboo environmentally-friendly products to increase the value of bamboo trees for sustainable development and was awarded the Equator Prize in 2010 by the United Nations Development Program (UNDP), an award recognizing initiatives that offer solutions to the protection of biodiversity and sustainable development, in favor of the people, the nature and the communities that have the energy to overcome all the hardships to conserve natural resources.

Phu An Bamboo Village established in 1999 by project Helvetas for conservation of natural resources and increased income for community. From 2003-2008, the four-party cooperation between Rhône-Alpes region, Binh Duong province, Pilat Natural Park and Viet Nam National University – University of Natural Sciences of Ho Chi Minh City, has built the Bamboo Ecomuseum and Phu An Botanical Gardens to conserve the diversity of the bamboos in Viet Nam. The Sud Export Plantes program (2008-2011) supported the research on bamboo collection and conservation for Indochina: Viet Nam, Laos and Cambodia. The research program of the Viet Nam National University of Ho Chi Minh City has helped in the research on conservation and sustainable development of Viet Nam bamboo genetic resources through environmentally-friendly products and help local people to adapt with climate change with green architecture from bamboo (2014-present). A new project supported by Sud Expert Plantes Developement Durable program aimed to study the genetic data and to set up educational and propaganda tools for biodiversity protection.

Located in the zone of tropical moonsoon climate, Viet Nam is one of the countries in the world with high vegetation diversity with about 11,000 plant species (Pham Hoang Ho, 2006). The bamboo in Viet Nam is diversified and distributed on different ecological regions. According to statistical data up to 2016, the total area of bamboo in Viet Nam is about 1.5 million ha, including 3 status: natural bamboo forest; mixed timber-bamboo forest and bamboo plantation, in which most of the area is mixed timber-bamboo forest with approximately 1.1 million ha, accounting for more than 75% (Map 1).

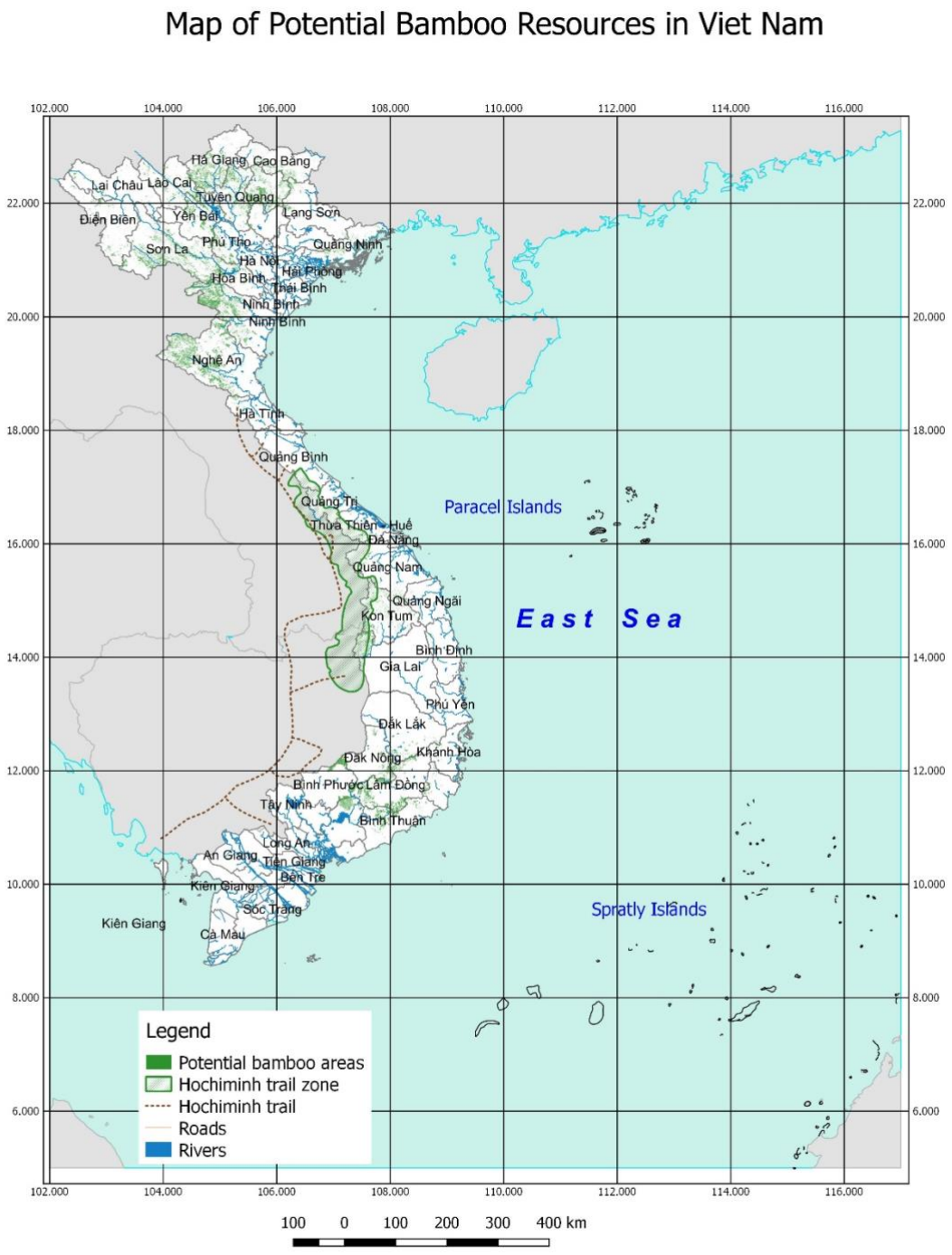
From the potential bamboo resources, collecting work has been done throughout the country for conservation purposes in Phu An or for Herbarium in the case of impossibity to collect samples for planting (Map 2). Phu An Bamboo Village contained a Living Bamboo Collection and Phu An Bamboo Herbarium (PBB code = Phu An Bambou), the resources of bamboo for research or exchanging samples. It has collected and preserved 198 living bamboo taxa, including over 1,300 bamboo clumps and 3,000 herbarium boards for 386 taxa. The list of Living Bamboo Collection and in Herbarium PBB is presented in Table 1.

Table 1: List of bamboos in Herbarium PBB and in Bamboo Conservancy.

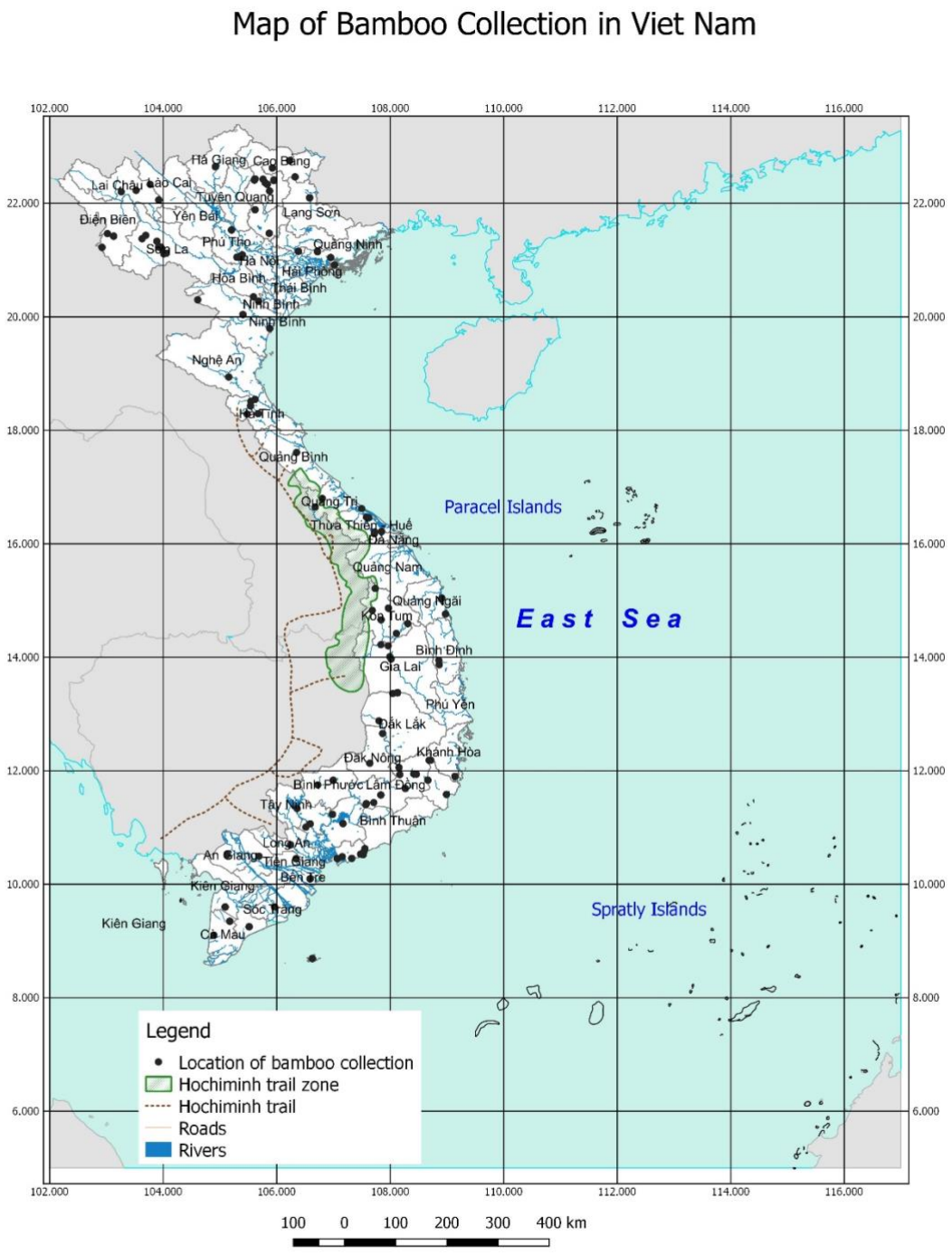
N°	Genres	Taxons in Herbarium PBB	Living Taxons in Conservancy	Notes
1	*Ampelocalamus*	1	0	*
2	*Arundinaria*	4	1	
3	*Bambusa*	156	99	**
4	*Bonia*	3	1	
5	*Cephalocalamus*	8	2	
6	*Chimonobambusa*	1	1	
7	*Dendrocalamus*	52	30	
8	*Gigantochloa*	83	36	**
9	*Indosasa*	3	1	
10	*Kinabaluchloa*	3	1	
11	*Maclurochloa*	3	1	
12	*Melocalamus*	11	3	
13	*Neohouzeaua*	10	1	
14	*Phyllostachys*	17	3	
15	*Pseudoxynanthera*	2	2	
16	*Sasa*	1	1	
17	*Schizostachyum*	17	6	**
18	*Sinocalamus*	1	1	
19	*Thyrsostachys*	3	3	
20	*Vietnamosasa*	3	3	
21	*Yushania*	4	2	
	Total	**386**	**198**	

* sample which is unable to be taken for planting

** sample which is taken for planting but not all living in the South of Vietnam.



Map 1: Potential Bamboo Resources in Viet Nam.

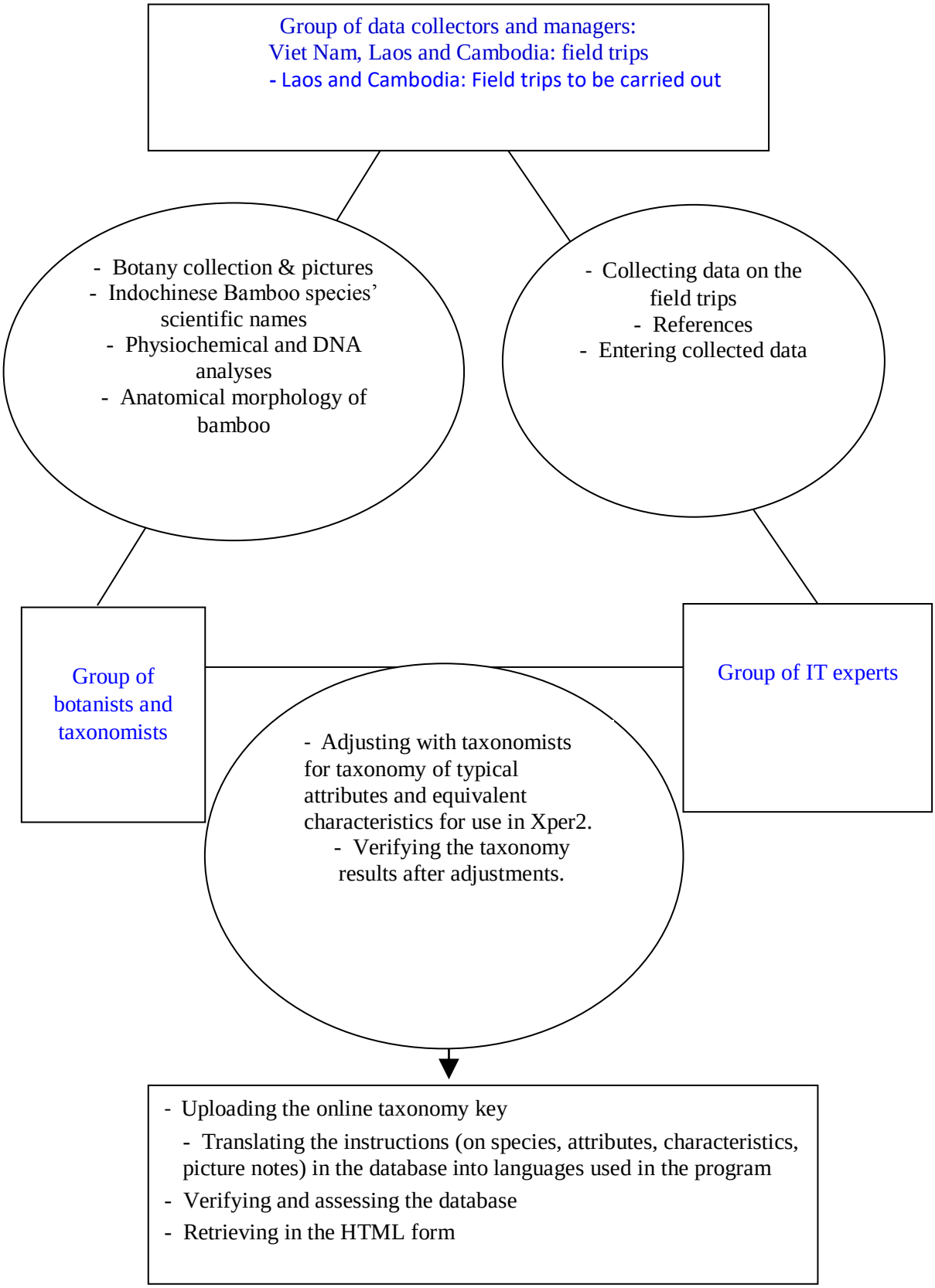


Map 2: Locations of bamboo collection in Viet Nam.

All collected taxa will be described according to a description table including 125 descriptors to be recorded in Xper3 software[1] (Vignes Lebbe et al. 2016).

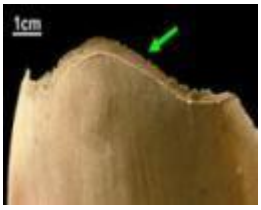
The standardized bamboo description is a challenging work because the bamboos have their particular bloom in a random manner, which makes it difficult to identify and their physiology of flowering always remains mysterious. The precise determination of the species is nevertheless necessary both for the systematic study and sustainable management and for the precise knowledge of the qualities of each species for specific, traditional and new applications.

[1] Xper2 and Xper3 are free software developed and distributed by the Laboratoire Informatique et Systématique in the Institut de Systématique, Evolution, Biodiversité- UMR 7205, MNHN, UPMC, CNRS, EPHE.



The descriptors are divided into 12 parts according to Table 2:

Table 2: Parts of bamboo: (1) rhizome; (2) shoot; (3) culm; (4) node; (5) internode; (6) culm leaf; (7) culm leaf blade; (8) culm leaf ligule; (9) culm leaf auricles; (10) branche;(11) leaves;(12) flower.

(1) Rhizome/Thân ngầm 	**(2)** Turion/ Măng/ Shoot 	**(3)** Chaume/Thân/Culm 
(4) Nœud/Mắt/Node 	(5) Entrenœud/Lóng/ Internode 	(6) Feuille de chaume/ Mo thân/ Culm leaf 
(7) Limbe de la feuille de chaume/ Lá mo thân/ Culm leaf blade 	(8) Ligule de la feuille de chaume/ Thìa lìa/ Culm leaf ligule 	(9) Oreillette de la feuille de chaume/ Tai mo thân/ Culm leaf auricles 
(10) Branche/Cành 	(11) Feuille/Lá/ Leaves 	(12) Fleur/Hoa/Flower 

From the 12 different parts of bamboo mentioned above, a list of morphological descriptors was created, one or more descriptors for each group. Each descriptor has two or more states, illustrated and saved in XPER^2 (My Hanh Diep *et al*. 2016).

Photo 1: Phu An Bamboo Village.

Photo 2: Bamboo collection in Phu An Bamboo Village.

Lộc Ngộc- *Bambusa bambos* (L.) Voss

Tre vuông- *Chimonobambusa quadrangularis*

May Khao Lam- *Cephalostachyum pergracile*, Munro.

Tầm Vông- *Thyrsostachys siamensis*, Gamble

Flowers of Tre Xiêm- *Bambusa tulda; Roxb.*

Flowers of Lồ ô vàng- *Bambusa gurgandii*- KM. Wong & M.H. Diep

Photo 3: Some varieties of bamboos in Phu An Bamboo Village.

Photo 4: Tre Nam Bộ- *Gigantochloa cochinchinensis*. A. Camus

Message for Bamboo Communities

Expand the model for sustainable development:

Phu An Bamboo Village shares its knowledge through a variety of ways such as university lectures, nature exploration trips for children, farmer seminars, guided tours for visitors from other parts of Viet Nam, articles, radio and television programs, sharing information on the website: http//:www.ecobambou-phuan.org, national or international conferences and publication of results in international journals. Phu An Bamboo Village also disseminates findings and results to other regions, national parks, conservation centers and private plantations. The dissemination of knowledge and experience has reached out to research institutes in Cambodia and Laos. For example, researchers from Phu An Bamboo Village collaborated with the Royal University of Phnom Penh and Lao Forestry University to conduct field trips with researchers from all three universities. These trips, from the left bank of the Mekong River, from Phnom Penh to Vientiane, have collected 40 samples and those in North East Laos and Northwest Viet Nam have collected 50 additional samples.

The route of Bamboo:

The "Route of Bamboo", real and virtual, connecting the small bamboos to the giant species, connecting the dry ecological, the sloping and seasonal flooded regions, will bring together goodwill for growing bamboo and constitute the heart of humanity. The "Route of Bamboo" sends the messages to the farmers, selling their back to the sky and their face to the land to feed people and to adapt with climate change, connecting communities living around the bamboo with scientists for the sustainable development and the maintenance of healthy living environment for the people.

The community has had the experience to cope with the effects of climate change, and we are calling for plenty of bamboos to be planted mainly for greening bare hills, due to the unique characteristics

of this tree: diversity allows it to adapt to many ecological conditions, easy and fast growing, substantial biomass for carbon fixation, development of new culm every year, helping to resist to climate change and promoting sustainable development (Nguyen thi Kim Phung, Dang Ngoc Quy, Diep thi My Hanh 2018).

	
Planting bamboo in farmer garden in Phu An village	"Bamboo for planet" with WBO and UNDP Equatorial winners 2015 in COP21 Paris

Photo 5: From farmers in Phu An to COP21 Paris on the route of bamboo.

Owing to its diversity, we can grow bamboo:

- in our house as ornamental plants; if each family grows a small bamboo tree in their house as decoration, we will have millions bamboo trees for fixation of carbon.
- along freeways to create a green curtain to prevent accidents as this curtain will screen the light from the opposite direction.
- in the garden to collect culms for different purposes, edible shoots, leaves as compost, etc…
- on barren land and hillside to prevent erosion.

To create an effective project for sustainable biodiversity conservation, an initiative must:

- study thoroughly the original ecosystem for bamboo;
- respect the local community and their traditions;
- link biodiversity conservation with income of the local people;
- develop research and training projects which are appropriate to the situation;
- create opportunities to find markets for new products from natural resources.

"Bamboo is a champion for sustainable development."

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