XTBG

Annual Report 2012

Xishuangbanna Tropical Botanical Garden
Chinese Academy of Sciences

Cover photos, anti-clockwise:

1. Research experimental platform;
2. A Joint Initiative for setting up CUBG won support during the annual conference of Chinese botanical gardens;
3. Root pressure leads to guttation in bamboos;
4. Green stone forest;
5. The 2012 annual meeting of the Association for Tropical Biology and Conservation Asia-Pacific Chapter;
6. A corner of liana plants collection;
7. Educational program for kindergarten kids.

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February 29, 2013

Xishuangbanna Tropical Botanical Garden (XTBG), Chinese Academy of Sciences is a non-profit, comprehensive botanical garden involved in scientific research, plant diversity conservation and public science education, affiliated directly to the Chinese Academy of Sciences.

XTBG's vision:
Desirable base for plant diversity conservation and ecological studies.
Noah's Ark for tropical plants.

XTBG's mission:
Promote science development and environmental conservation through implementing scientific research on ecology and plant diversity conservation, horticultural exhibition, and public education.

Photo by LI Jianwu

CONTENTS

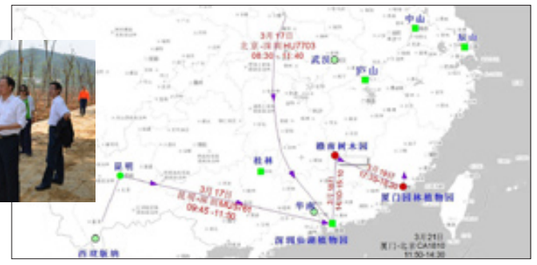
Science

Photo by DUAN Qiwu

In 2012, XTBG received 38.63 million Yuan in research funds from
73 new projects:
26 projects funded by the National Natural Science Foundation of China;
4 projects supported by the Ministry of Science and Technology;
5 projects supported by other Ministries in China;
9 projects funded by Yunnan Provincial Fund for Natural Sciences;
18 projects supported by the Chinese Academy of Sciences;
5 projects funded by the CAS “Light in Western China” program;
5 projects funded by local government, enterprises and international agencies;
1 international project.

In 2012, XTBG researchers have achieved the following:
139 research articles published on internationally peer-reviewed scientific journals (Source Journals of ISI Web of Science);
68 research articles published on CSCD (Chinese Science Citation Database) refereed journals;
1 published monograph;
10 patented inventions;
2 registered new plant varieties.



FROM LEFT: Plenary meeting 2012 of working committee of CAS BGs; Investigating in BGs; Investigation roadmap.

Project Development

"One Major Orientation, Three Significant Breakthroughs, and Five Important Fostering Directions" Project

"One Major Orientation, Three Significant Breakthroughs, and Five Important Fostering Directions" Project ("1-3-5" project for short) was launched in 2012 and has been carried out smoothly. The "1-3-5" Project provisions of organizational management and implementation had been discussed and defined. In March, May and June, XTBG held three plenary sessions of the Academic Committee respectively to deliberate on the CAS Innovation 2020 Program and the XTBG Development Planning in the 12th Five-year Plan Period, and to consult on the action plans for the "1-3-5" Project. Newly-built research teams of the "1-3-5" Project signed responsibility pledges with XTBG and have available funds. Meanwhile, XTBG established a "1-3-5" Project special column on the XTBG website for reporting the latest research progress.

Preparatory efforts to establish Chinese Union of Botanical Gardens

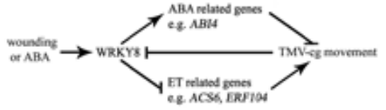
Bearing in mind the motion of CAS President BAI Chunli to establish a nation-wide union of botanical gardens, the working committee of CAS botanical gardens, led by CHEN Jin, made several visits to different types of botanical gardens in different eco-regions, between March and early May. They tried to learn the current situation, the difficulties and immediate needs of each garden. All the garden leaders expressed their strong desire to set up a workable nation-wide Union of Botanical Gardens.

Later in May and August, the working committee of CAS botanical gardens held several discussion meetings, and decided to explore the idea of creating, working together with other relevant associations, an initiative to set up a new organization, the Chinese Union of Botanical Gardens (CUBG). In November, the Joint Initiative was announced during the Annual Conference of Chinese Botanical Gardens held in Chongqing, it was well supported by the participating gardens from all over China. CHEN Jin's further reports to CAS about the plans to set up CUBG was adopted and well supported.

LEFT: The 2012 Annual Conference of Chinese Botanic Gardens.
RIGHT: Prof. CHEN Jin proposing to set up CUBG; The Joint Initiative for setting up CUBG.

Science Foundation of the Ministry of Agriculture of the Peoples' Republic of China Grant 2009ZX08009-066B achieved its goal

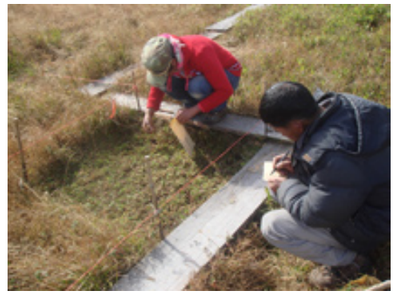
Supported by the Science Foundation of the Ministry of Agriculture of the Peoples' Republic of China (2009ZX08009-066B),and after three years' well-conducted research with great concentration and according to the goals of the research project, Prof. YU Diqiu's team has demonstrated that *WRKY8*, *WRKY48*, three of WRKY8's downstream target genes (*ABI4*, *ACS6*, and *ERF104*), as well as a WRKY8's interacting partner (*ATG8i*), all play important roles in the regulation of plant virus infection and subsequent movement from one cell to the next, including long-distance movement. These genes positively or negatively participate in the biological process during plant-virus interactions, and may enhance the plants' antivirus ability when applied in agricultural production through transgenic technology. Therefore, the six genes mined by the research project can effectively regulate some important biological processes during plant-virus interactions. They may be used as important gene resources to breed novel transgenic crop varieties with anti-virus ability. Further, they can be used as model systems for breeding novel anti-virus transgenic crop varieties. The results of this research project also provide a novel research approach for the effective prevention and cure of plant virus infection in agriculture production. Finally, the six genes with novel functions constitute an important genetic resource with proprietary intellectual property rights.



A simplified model for the function of WRKY8 during TMV-cg-Arabidopsis interaction. Wounding or ABA treatment induces WRKY8 expression, while infection by TMV-cg inhibits its expression. WRKY8 participates in the TMV-cg defense response by both activating the expression of ABI4 and repressing ET-related genes, such as ACS6 and ERF104, during TMV-cg-Arabidopsis interaction.

CAS Strategic Priority Research Program – Climate Change: Carbon Budget and Relevant Issues (XDA05090000) make significant progress

Progress on carbon sequestration of grassland ecosystems in Yunnan Province: actual and potential carbon sequestration was measured in 57 grassland ecosystems throughout the province. The key driving factors and dynamics of carbon in the grasslands of the Ailao Mountains in Yunnan Province were evaluated. Four treatments were carried out in the grasslands of Ailao Mountains: no enclosure, shrub grassland, increased nitrogen and classic grassland. Ecosystem respiration (ER), net ecosystem CO_2 exchange (NEE) and soil respiration (Rs) were measured in the daytime in these four treatments twice a month in the growing season (Apr.-Oct.), and once a month in the non-growth growth seasons (Nov.-Mar. of the following year).



Progress on CH_4 and N_2O emission in tropical forests: temperate, subtropical and tropical forests: In addition to comparing the different types of forests, tropical seasonal rainforest in Xishuangbanna was also compared to rubber plantations. One of the main objectives is to create a database of GHGs in China and CH_4, and N_2O emission rates, as well as important controlling factors in different forests. Results will be compared with those obtained in the associated, ongoing study for other climate zones (sub-tropical and temperate). The data have been collected and further data collection in tropical forests at XSBN will extend the researchers' understanding further about tropical forests. These data may also help scientists understand if land use and climate change play different roles in different climate systems, with different soil types and different forest types. The overall objective is to improve the understanding and regional quantification of climate-change-induced perturbations of GHGs emissions.

Progress on carbon sequestration in rubber tree plantation ecosystem: The newly built 6.7 ha demonstration site in XTBG illustrates intercropped young rubber trees with green manures, banana and other crops. Three demonstration sites in the plantations of the Yunnan Institute of Tropical Crops, the Yunnan Institute of Tropical Forest and Jingtai Ltd. Co., were interplanted with tree species under old rubber trees. Research was conducted on the effects of nitrogen and phosphorus addition on CO_2 efflux and rubber tree growth. Biochar was added to a rubber tree plantation to investigate its effect on growth and production.

LEFT Tropical seasonal rainforest.
RIGHT Rubber plantation.

ABOVE: Flemingia macrophylla intercropped with rubber trees.
LEFT: Biochar addition in rubber plantation.

Technological innovation and development of lab equipment project

In 2012, XTBG has been funded by the "Technological innovation and development of lab equipment project" for a second time. The two funded projects are named "Research and development of the function of ultra-high performance liquid chromatography for the quantitative analysis of a variety of plant hormones." (RMB300,000) and "The applications and improvements of elemental analyzer in soil / plant carbon and nitrogen determination" (RMB300,000). The former will enhance the functionality of quantitative quadrupole time-of-flight tandem mass spectrometry and develop a better method for plant hormones quantitative analysis. The latter will provide a theoretical basis and data support to substitute traditional methods of elemental analysis within a certain range, while establishing the optimal method for determination of total nitrogen and organic carbon content in the samples of different soil types.

Establishment of three permanent altitudinal forest transects in Yunnan

A total of 60 field sites, each 20×20 m, were organized and established in three altitudinal transects in Yunnan Province, with the purpose of monitoring the response of species in different ecosystem types to environmental change. The tropical transect lies within Mengla County Section of Xishuangbanna National Nature Reserve. Four elevations (800, 1000, 1200, 1400 m a.s.l.) within this transect with five survey sites at each level were sampled. This transect includes tropical seasonal rain forests and south subtropical evergreen broadleaved forests. The subtropical transect lies within Zhenyuan Country Section of Ailaoshan National Nature Reserve. The same number of elevations and survey sites in this transect (2000, 2200, 2400, 2600 m a.s.l.) were also sampled, representing subtropical evergreen broadleaved forests in middle Yunnan. The subalpine transect lies within Yunlong Snow Mountain, located in Lijiang Prefecture. Four elevations (3200, 3400, 3600, 3800 m a.s.l.) were chosen to be sampled, representing alpine coniferous forests. Plants including epiphytes and ecologically important insect taxa were surveyed in each site using a variety of census and trapping techniques.

TOP LEFT: Transects location map.
ABOVE: Setting insect traps in subalpine transect.

The project was supported by Queenland-Chinese Academy of Science (QCAS) Biotechnology Fund.

Advances in DNA barcoding of Trees in Xishuangbanna and Ailaoshan National-level Nature Reserves, Yunnan

The correct identification of a species is of critical importance in conserving and utilizing biodiversity, but it may be hindered by the lack of taxonomic expertise, especially in high-diversity tropical regions. DNA barcodes provide a diagnostic identification of one species quickly and relatively cheaply. Prof. LI Jie and his colleagues collected leaf or bark samples of about 800 trees in forest plots and barcoded the trees using four DNA fragments- *rbcL*, *mat*K, *trn*H-*psb*A and ITS in 2012. Their ultimate objective is to build a local tree barcoding database with information on specimens, leaf materials, DNA samples, barcode sequences and photos by 2016. The work will have relevant outcomes for future studies and applications in forest ecosystems, such as in the advancement of community ecology studies and local biodiversity surveys. The project was supported by The Ministry of Science and Technology of the People's Republic of China (No. 2012FY110400).

Preparing specimen in the field.

Research Progress and Outreach Highlights

Root pressure leads to guttation in bamboos.

The maximum height of grasses is determined by roots

Bamboos, the tallest of grass species, are a critically important group of plants both ecologically and economically. They can grow up to 32 m in height, but their physiology is little known and the processes that constrain plant height in this important group have never been investigated.

Prof. CAO Kunfang and his students hypothesized that root pressure-dependent refilling of vessels in stems and leaves may limit the maximum height of grass species due to the magnitude of their root pressure. They examined the relationship between maximum height and root pressure in bamboo species. Bamboo species provide an excellent opportunity to examine the relationship between plant height and root pressure because they are highly speciose and encompass an enormous size range, from dwarf species <1 m tall to tropical species reported to reach heights of almost 40 m.

The study was conducted in two of the most comprehensive living collections of bamboos in China, XTBG and Anji Bamboo Expo Park in Zhejiang Province.

The study showed that maximum size in bamboo species was determined below ground by the maximum pressure that can be generated in roots overnight. It demonstrated that water transport in the bamboo species was dependent on root pressure to repair hydraulic dysfunction sustained during normal diurnal gas exchange.

The remarkable observation puts an entirely novel perspective on the processes that limit plant size, particularly in grasses, and places considerable emphasis on the importance of root pressure for the function and development of plant species.

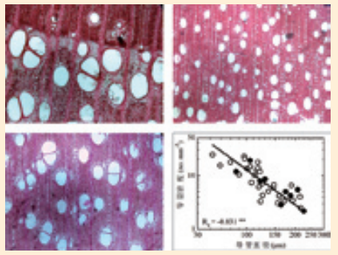
The study entitled "The maximum height of grasses is determined by roots" has been published in *Ecology Letters*.

The study was funded by the Australian Research Council (FT1010237 and DP120101686) and a visiting scholarship from XTBG to Dr. Tim J. BRODRIBB.

Xylem traits outperform wood density as predictors of tree growth and stature

Stem xylem characteristics have a great impact on growth and adult stature of trees because of their role in mechanical support, long-distance water transport and whole-plant carbon allocation.

In order to determine whether xylem traits outperform wood density as predictors of tree growth and stature, Dr. FAN Zexin and his colleagues collected xylem anatomical features of 40 tropical tree species, and compared these wood properties with growth data recorded from permanent plots. The researchers evaluate the covariation among wood density, xylem anatomical traits, tree diameter growth rate and adult stature across species across phylogenetically independent contrasts.



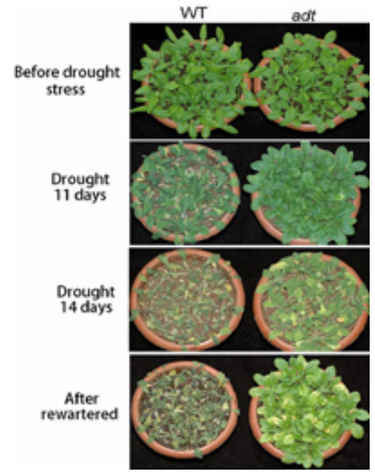
Different xylem anatomical properties showing combination of vessel size and number.

They found that tree diameter growth rate and adult stature were positively correlated with vessel lumen diameter and potential hydraulic conductivity, but not with wood density. The findings suggest that xylem anatomical traits have a more significant influence on whole-plant performance due to their direct association with stem hydraulic conductivity, whereas wood density is decoupled from hydraulic function due to complex variations in xylem components. These results entitled "Hydraulic conductivity traits predict growth rates and adult stature of 40 Asian tropical tree species better than wood density" have been published in *Journal of Ecology*.

Activated expression of *WRKY57* confers drought tolerance in *Arabidopsis*

Drought is one of the most serious environmental factors limiting the productivity of crops in agriculture worldwide. However, the mechanism underlying drought tolerance in plants is unclear. WRKY transcription factors have been identified that function in adaptation to abiotic stresses. By screening a pool of WRKY-associated T-DNA insertion mutants, Prof. YU Diqiu's lab of XTBG isolated a gain-of-function mutant, "acquired drought tolerance (*adt*)", showing improved drought tolerance. Under drought stress conditions, *adt* accumulated higher levels of ABA than wild type plants. Stomatal aperture analysis indicated that *adt* was more sensitive to ABA than wild type plants. Molecular genetic analysis revealed that a T-DNA insertion in *adt* led to activated expression of a WRKY transcription factor which encodes WRKR57 protein. Moreover, constitutive expression of *WRKY57* also conferred similar drought tolerance. Consistent with the high ABA levels and enhanced drought tolerance, three stress responsive genes (*RD29A*, *NCED3*, and *ABA3*) were up-regulated in *adt*. ChIP assays demonstrated that *WRKY57* directly binds the W-box of RD29A and NCED3 promoter sequences. In addition, during ABA treatment, seed germination and early seedling growth of were inhibited, whereas under high osmotic conditions, *adt* showed higher seed germination rate.

This evidence suggests that the altered expression pattern of the *WRKY57* gene has allowed *WRKY57* to gain a novel function in drought tolerance. This viewpoint is consistent with the hypothesis that regulatory mutations play a predominant role in organism evolution. This finding may reveal a new mechanism by which plants evolve drought tolerance and the establishment of *WRKY57* functions enables us to improve plant drought tolerance through gene manipulation approaches.

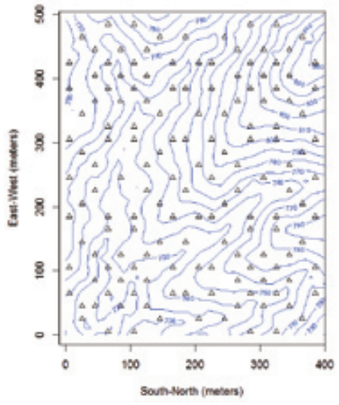


The adt mutant shows improved drought tolerance.

The study entitled "Activated expression of *WRKY57* confers drought tolerance in *Arabidopsis*" has been published in *Molecular Plant*.

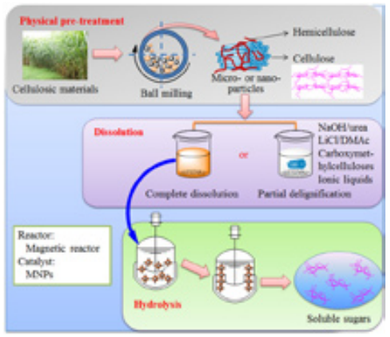
Strength of density-dependent seedling survival varies between seasons and among species in tropical forests

Across the 20-ha Xishuangbanna tropical seasonal rainforest dynamics plot, which has distinct dry and wet seasons, Dr. LIN Luxiang and his colleagues monitored seedling survival in 453 1-m^2 quadrats over two years. Density dependence was assessed using generalized linear mixed models with crossed random effects. At the community level, the proportion of conspecific seedling neighbours had a significant negative effect in the dry season, but not in the wet season. At the species level, the effects of conspecific tree and seedling neighbours varied widely among species in the community and were significantly positively related to population basal area over the dry-season interval. Overall community- and species-level results suggest that local-scale negative density dependence tends to be stronger in the dry season in contrast to the wet season in the tropical forest of Xishuangbanna. At the scale of the 20-ha plot, the research team found a community compensatory trend (CCT), in which rare species had relatively higher seedling survival than common species in both the wet and dry seasons. A positive association between potential negative density dependence and population basal area suggests that the CCT results from local-scale negative density dependence, specifically due to negative effects of conspecific tree neighbours. Their results demonstrate that the strength of density-dependent seedling survival can vary between seasons and among species in tropical forests. The work entitled "Seasonal differentiation in density-dependent seedling survival in a tropical rain forest" has been published in *Journal of Ecology*.



151 seedling monitoring units in the 20-ha Xishuangbanna tropical seasonal rainforest dynamics plot.

Using solid acid catalysts to hydrolyze biomass for producing biofuels



Hydrolysis of cellulosic material into soluble sugars by paramagnetic nanoparticle solid acid catalysts.

Recent advances in biomass hydrolysis with solid acid catalysts have shown that solid acid catalysts, which have favorable characteristics such as efficient activity, high selectivity, long catalyst life and ease in recovery and reuse, have great potential for efficiently transforming lignocellulosic biomass into biofuels, and can replace many conventional liquid acids for hydrolysis and pretreatment. The development of novel highly acidic solid catalysts with special characteristics (e.g., magnetic properties) and nanometer size is a key issue for the effective hydrolysis of biomass.

Prof. FANG Zhen of XTBG was invited by Prof. N.A. CHIGIER, Editor of *Progress in Energy and Combustion Science* (PECS) to contribute a review paper in this area.

Dr. GUO Feng and Prof. FANG Zhen summarized and analyzed current achievements in the hydrolysis of cellulose using solid acid catalysts in an article published in *PECS*. They reviewed biomass hydrolysis with H-form zeolites, transition-metal oxides, cation-exchange resins, supported solid acids, and heteropoly compounds in detail. It was concluded that the highest yields that have been achieved with solid acid catalysts are those that have had a modest surface area and acid amount along with a high catalytic site concentration. Methods to promote reaction efficiency or increase selectivities such as microwave, ultrasonication and nanotechnology are also introduced. However, separation of solid catalysts from solid biomass residues after hydrolysis for reuse tends to be difficult.

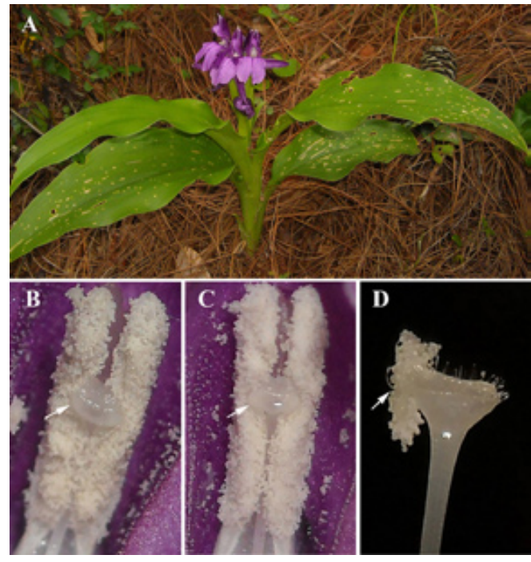
The researchers suggest that incorporating paramagnetic nanoparticles into the carbonaceous carriers is a practicable method to improve the separation and reuse of solid catalysts. Moreover, nanoparticle solid catalysts could provide new methods of efficiently transforming lignocellulisc biomass into sugars for further biorefining to biofuels. In the near future, through the combination of green solvents, nanoparticle techniques, and functional solid acid catalysts, it can be expected that the chemical processes based on the catalysis of biomass will begin to replace petroleum-based processes so that new bio-economic industries will emerge.

The review entitled "Solid Acid Mediated Hydrolysis of Biomass for Producing Biofuels" has been published in *Progress in Energy and Combustion Science*.

Delayed self-pollination ensures reproduction in *Roscoea debilis* (Zingiberaceae)

Delayed selfing is the predominant mode of autonomous self-pollination in flowering plants. However, few delayed selfing mechanisms have been documented. Dr. FAN Yongli and his supervisor Prof. LI Qingjun reported a novel delayed selfing mechanism induced by stigmatic fluid in *Roscoea debilis* (Zingiberaceae), a small perennial ginger with a floral longevity of three days. Autonomous selfing occurs after the flowers wilt. The stigmatic fluid forms a globule on the stigma on the third day of flowering. The enlarged globule seeps into the nearby pollen grains on the fourth flowering day, and induces pollen germination. Pollen tubes then elongate and penetrate into the stigma, thus achieving self-pollination. *Roscoea debilis* retains the characteristics of insect-pollinated flowers, such as the purple, zygomorphic flowers with a landing platform, the lever-like anther appendage and nectar rewards. However, it receives few pollinator visits in the wild and relies primarily on delayed selfing for reproduction, which suggests that this species has made the transition from outcrossing to selfing.

The study entitled "Stigmatic fluid aids self-pollination in *Roscoea debilis* (Zingiberaceae): a new delayed selfing mechanism" has been published in *Annals of Botany*.



(A) Roscoea debilis in the field; (B-C) The process of autonomous selfing.

Reproductive features of the deceptive orchid Acampe rigida. (A) Inflorescence with vertically orientated, bowl-shaped, spirally arranged flowers. (B) Infructescence illustrating high fruit-set. (C) Flower with fleshy sepals and petals. (D) The structure of the pollinarium and stigma.

Rain pollination provides reproductive assurance in a deceptive orchid

Abiotic pollination by wind or water is well established in flowering plants. In some species pollination by rain splashes, a condition known as ombrophily, has been proposed as a floral strategy. However, evidence for this type of abiotic pollination has remained controversial and many reported cases have subsequently been shown to be false. XTBG Plant reproductive biologist GAO Jiangyun and his colleagues spent 4 years studying *Acampe rigida* in the wild and in the lab. The researchers filmed the flowers during a rain shower (as well as under an actual showerhead), and discovered a curious effect: when rain splashes on the orchid's male sexual organs, it flicks a tethered, pollen-laden bundle upward. As the bundle bounces back on the tether, it lands exactly where it needs to be to pollinate the flower. Plants shielded from rain, on the other hand, produce no fruit.

News of the Week of *Science* reported on this first solid demonstration of ombrophily in an article with the title of "Raindrops keep falling on my…" just the day after GAO's paper was published in *Annals of Botany*. A few other plants can be pollinated in the rain, but *A. rigida* seems to be the first discovered that really depends on rain to do this job. "I think it is likely to make plant reproductive biologists appreciate that rain is not always detrimental for flowers, causing damage, but in some cases can actually aid in promoting reproductive success," says co-author Spencer BARRETT, a botanist at the University of Toronto, St. George, in Canada.

Response of non-vascular epiphytes to global change in subtropical montane evergreen broad-leaved forests

Interest in the potential effects of global change on forest ecosystems is increasing, but little is known about their effects on canopy communities. Prof. LIU Wenyao and his Ph.D. candidate SONG Liang conducted 2 field manipulation experiments to assess the potential impacts of predicted climate change and increasing N deposition on non-vascular epiphytes in subtropical montane evergreen broad-leaved forests in southwestern China. The results show that even slight changes in climate resulted in remarkably reduced rates of growth and detrimental effects on the health of the transplanted epiphyte species over 2 years (Fig. a, b). Epiphytic bryophytes are very sensitive to increasing N deposition (Fig. c, d) and often difficult to recover once they have been destroyed. These research achievements have gained attention worldwide after their publications in *Biological Conservation* and *Oecologia*. The study was supported by the National Natural Science Foundation of China (Nos. U1133605, 30870437) and the CAS135 Program (XTBG-F01).

SONG Liang was honored with Dean's Award 2012 of Chinese Academy of Sciences based on his outstanding performance in this study on the response to global change by epiphytes as a Ph. D. candidate.

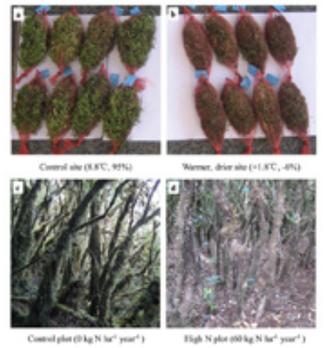


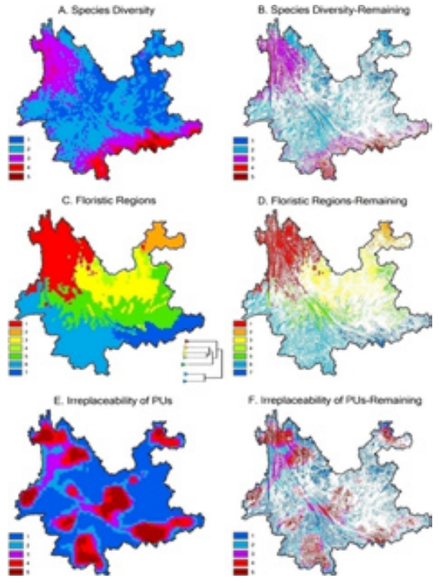
Fig. Visual treatment effects of simulated climate change (a. control site, b. warmer, drier site) and nitrogen deposition (c. control plot, d. high N plot) on nonvascular epiphytes

XTBG proposes a conservation network to protect biodiversity in Yunnan

Yunnan province, SW China is one of the botanically most diverse terrestrial regions, particularly in the wide range of natural forest types it features, and is included as part of the Himalaya biodiversity hotspot. The forest types are under considerable conversion pressure as land use intensifies with expanding human population and economic development.

In a program supervised by Prof. J. W. Frederik SLIK and Prof. ZHOU Zhekun of XTBG, Dr. ZHANG Minggang modeled all the woody species collected in Yunnan. The research team used a null model approach to remove collection biases. The total spatial distribution of 1996 species was modeled to reveal significant non-random habitat preferences Based on those significantly non-random species, three species diversity hotspots and seven major floristic regions were recognized. A better protected area network was proposed that can be relatively easily linked via a corridor system, which would make the network resilient to global change. Since the proposed network was explicitly designed to be space-conserving, it provides an optimal conservation strategy that leaves room for economic development.

The study entitled "Using species distribution modeling to improve conservation and land use planning of Yunnan, China" has been published in *Biological Conservation*.



Maps: (A) The five quartiles of species diversity (1 = the lowest group; 5 = the highest group); (B) the five quartiles of species diversity still covered by forest; (C) the seven floristic regions of Yunnan and their compositional relationships (dendrogram in left lower corner); (D) forest remaining in the seven floristic regions; (E) the five quartiles of 'irreplaceability' score of planning units; (F) the five quartiles of 'irreplaceability' score of planning units still covered by forest.

XTBG investigates the correlated evolution between leaf life span and hydraulic traits

The co-occurrence of evergreen and deciduous angiosperms in Asian tropical dry forests on karst substrates suggests the existence of different water use strategies among species. Under the supervision of Prof. CAO Kunfang, Dr. FU Peili and his colleagues compared stem hydraulic conductivity, drought tolerance, wood anatomy, leaf life span and photosynthetic capacity of six evergreen and six deciduous tree species co-occurring in a tropical dry karst forest in SW China.

They found that the deciduous trees had higher stem hydraulic efficiency, greater xylem vessel diameter and higher photosynthetic rate, whereas the evergreen species had greater xylem cavitation resistance, lower leaf turgor loss point water potential and higher bulk modulus of elasticity. There were evolutionary correlations between leaf longevity and stem hydraulic efficiency, photosynthetic rate and drought tolerance. Both wood density and leaf density were closely correlated with leaf water-stress tolerance and photosynthetic rate. The results reveal clear distinctions in stem hydraulic traits and leaf water-stress tolerance between the co-occurring evergreen and deciduous angiosperm trees in an Asian dry karst forest. They demonstrate a novel pattern linking leaf longevity with stem hydraulic efficiency and leaf water-stress tolerance. Their results entitled "Stem hydraulic traits and leaf water-stress tolerance are co-ordinated with the leaf phenology of angiosperm trees in an Asian tropical dry karst forest" have been published in *Annals of Botany*.

XTBG revise taxonomy of the genus *Lasianthus* for Malesian species

Lasianthus is a large genus of the Rubiaceae with more than 180 species, predominantly in the Old World. *Lasianthus* species are usually present in large numbers in the tropical forests of Asia and may therefore represent an ecologically important element of the Asian flora. The species of *Lasianthus* also show remarkable distribution patterns, which are of special interest for the study of the biogeography of tropical Asia and of prevailing speciation models in tropical rainforests.

Front cover of Blumea.

Prof. ZHU Hua and his colleagues from the Netherlands made a taxonomic revision on the genus *Lasianthus*, based on herbarium collections. They recognized 131 species from the Malesian region, of which 41 species, 3 subspecies and 3 varieties were described as new, and 3 new combinations were made for varieties. 22 species names and 15 variety names were reduced to synonyms. 10 species names and 2 varieties were treated as dubious mainly because their types could not be traced. Additionally, 11 species were excluded from *Lasianthus*. All species were described and a key to Malesian *Lasianthus* was given.
The study entitled "A taxonomic revision of the Malesian species of *Lasianthus* (Rubiaceae)" has been published in *Blumea*.

Yunnan Provincial Natural Science Award

Yunnan provincial government conducted a ceremony to commend science and technology award winners in Kunming on July 16. The ceremony was attended by top governors and officials of Yunnan province.
Accomplishing "Studies on tropical forest vegetation and floristic composition in Yunnan", Prof. ZHU Hua of XTBG was honored with the second prize of Yunnan provincial Natural Science Awards.
Dr. YANG Qing of XTBG and his colleagues were honored the third prize of Science & Technology Progress Awards for finishing "Research of key technology on screening and breeding of paper-pulp bamboo species".

Certificates of Award.

New Book: *Native Seed Plants in Xishuangbanna of Yunnan*

Xishuangbanna of southern Yunnan is an area with the largest cover of tropical forests in China, especially with the tropical rain forest of SE Asia. It is also a biodiversity rich region. Based on identifications of more than 90,000 specimens collected from the region and floristic studies, Prof. ZHU Hua and his colleague Dr. YAN Lichun compiled native seed plant checklist of Xishuangbanna. It recorded 3,856 species, 38 subspecies and 252 varieties of 1,242 genera and 188 families of native seed plants.
The checklist entitled "*Native Seed Plants in Xishuangbanna of Yunnan*" has been published by Science Press in 2012.

Cover pages of Native Seed Plants in Xishuangbanna of Yunnan.

Improvement of Research Facility

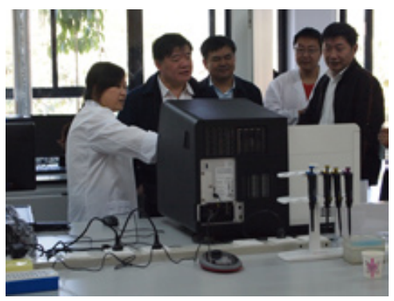
“Ecological Process Experimental Platform” passes acceptance check

On September 15, 2012, an expert panel organized by the CAS Bureau of Planning and Finance came to XTBG to check the project of "ecological process experimental platform” which was supported by the special funds of renovation and purchase in 2011. Through on-spot check and consulting documentation, the expert panel highly appraised the practice and gave high marks of “6A”, which indicated that the platform construction passed acceptance check.

Acceptance check meeting.

Construction of “Resource plant research and development experimental platform" and “Molecular biology research experimental platform (Institute-level platform)”

A total of six sets of equipment, including gene sequencing machines, living donor imaging system, fluorescence quantitative PCR, confocal microscopy, scanning electron microscopy, and morphological and anatomical systems have been newly purchased for the resource plant research and development experimental platform. By the end of December 2012, the installation and commissioning of gene sequencing machines, living donor imaging systems, quantitative PCR had been completed in the Central Laboratory of XTBG.
The installation and commissioning of confocal microscopy, scanning electron microscopy, morphological and anatomical systems are in progress.
A total of 18 sets of equipment, including a gene gun system, gel imaging system (2 sets); centrifuges, fast gradient PCR (5 sets); multifunctional fluorescence microplate, shaker(4 sets); ultraviolet spectrophotometer, ultra-low temperature refrigerator (4 sets); LED plant incubator, autoclave (3 sets) have been newly purchased for the molecular biology research experimental platform. By the end of December 2012, the installation and commissioning of the equipment have been completed and all have been put into use in the Central Laboratory of XTBG.



Health Minister CHEN Zhu checking the run of Miseq.

Metrology Accreditation Certificate conferred to XTBG Biogeochemistry Laboratory

On December 1, an expert panel appointed by the Administration of Quality & Technology Supervision of Yunnan Province came to XTBG Biogeochemistry Laboratory to conduct the laboratory accreditation re-assessment of on-site inspection. Strictly following the Assessment Criteria for Laboratory Accreditation, the Provincial Administration of Quality & Technology Supervision ratified that the XTBG Biogeochemistry Laboratory met all requirements and issued an accreditation certificate to it. The Laboratory continues to be a provincially certified analytical laboratory.

Metrology Accreditation Certificate.

Institutional Repository (XTBG-IR) construction

Institutional Repository of XTBG.

This year, XTBG applied to the National Science Library (NSL) of CAS for building the Institutional Repository (IR) of XTBG. IR is an online locus for collecting, preserving, and disseminating, in digital form, the intellectual output of XTBG. Up to now, a total of 3,400 items of journal papers, theses, and patents in full text have been uploaded to the system. The backtracking of most of the data since the establishment of XTBG in 1959 has been completed. XTBG-IR has got more than 320,000 visits, and more than 120,000 papers have been read or downloaded.

Network infrastructure construction

Special construction projects: The implementation of the major part of IPv6 (Internet Protocol version 6) construction project, approved by CAS, has been completed. All network equipments of XTBG Kunming Division was updated. A new batch of equipment, including high-end switching systems, servers, UPS systems, network management systems, with a total value of 75 million Yuan, has been put into use.
IPv6 communication functions were opened, which helps improve the network performance and control means in a comprehensive manner. Construction of IPv6 environment network of Ailaoshan Ecological Station has been completed and is now under the unified management of the XTBG network. Meanwhile, IPv6 environment networking of Yuanjiang Station has also been completed. When high-speed network access conditions are obtained, the Yuanjiang station can be incorporated into the XTBG full network integration management platform.

ATBC-Asia Pacific Chapter 2012 Annual Meeting.

Conferences and Symposia

The 2012 annual meeting of the Association for Tropical Biology and Conservation Asia-Pacific Chapter

174 people from 21 countries and areas, among which Australia, Canada, Cambodia, Denmark, Germany, India, Indonesia, Japan, Lao, Malaysia, Myanmar, Netherlands, Panama, Philippines, Singapore, Thailand, UK, USA, Vietnam and Hong Kong, met from March 24-27 in Xishuangbanna, southwest China, for the 2012 annual meeting of the Association for Tropical Biology and Conservation Asia-Pacific Chapter, which was hosted by XTBG. The annual meeting was themed “understanding and mitigating the impacts of global change in tropical Asia”. The conference covered such topics as forest dynamics, plant-animal conservation, functional traits, tropical forest restoration, peat swamps, soil dynamics and carbon, future of taxonomy, biogeography, insect-plant evolutionary ecology, *etc*.

During the course of the conference, over 116 oral presentations and 29 posters were given.

The opening ceremony of the Annual Meeting was chaired by Prof. CAO Min. The welcome address was given by Prof. CHEN Jin. The chairman of the ATBC Asia-Pacific Chapter, Dr. Mochamad INDRAWAM, delivered an opening speech.

The four-day meeting provided a platform for the scientists to have academic exchanges and discussions. The scientists from the nations of tropical Asia urged understanding and mitigating the impacts of global change. Scientists themselves should play a leading role in promoting the studies on forest biology and conservation in tropical Asia.

The Association for Tropical Biology and Conservation is the world's largest professional society devoted to the furtherance of tropical biology and tropical conservation. It was founded in 1963 to promote research and to foster the exchange of ideas among biologists working in tropical environments. ATBC has grown into a truly global organization with members from over 100 countries. In 2006, an Asia-Pacific Chapter was formed to further these objectives in this region. Prof. CHEN Jin, director of XTBG, was elected as founding chairman of the Chapter.

ATBC-Asia Pacific Chapter 2012 Annual Meeting.

Workshop on Tropical Biodiversity and Genomics 2012

The second Workshop on Tropical Biodiversity and Genomics at XTBG started on June 4 with 36 participants from seven countries. This workshop was organized in two sessions: a series of lectures and discussions with all participants, followed by two days of focused analysis of participant data, closing on June 9. Prof. Chuck CANNON of XTBG and Texas Tech University, Graham STONE of University of Edinburgh, Prof. RUAN Jue of Beijing Institute of Genomics, Prof. SHI Suhua of San Yat Sen University, Prof. WU Chung-I of Beijing Institute of Genomics, and many more distinguished scientists attended the workshop.

The Ecological Evolution group at XTBG has whole genome Illumina sequence data from numerous species of tropical trees, primarily in the genus *Ficus* (figs) and the family Fagaceae (oaks, stone oaks, chestnuts and beeches), and has several analyses and collaborations in progress. The group has primarily been developing reference-free analyses of this data for comparative and phylogenetic purposes.

Participants of the 2012 WTBG@XTBG.

The 4th Symposium on Tropical Forest Ecology

The 4th Symposium on Tropical Forest Ecology was convened in Guilin, Guangxi during August 16-19. The meeting brought together more than 150 researchers and students involved in ecology studies, from XTBG, Hainan University, Guangxi University, Guangxi Institute of Botany, and some nature reserve administrations of Guangxi.

The theme of the symposium was “Tropical forest ecology and global change”. Prof. CAO Min and Prof. CAO Kunfang of XTBG were invited as keynote speakers at the meeting.

The symposium covered two major topics: “Tropical and subtropical plant resources and biodiversity monitoring” and “Response and adaptation of tropical and subtropical forests to global change”. 37 presentations were made.

After the symposium, a discussion meeting was held at Guangxi Institute of Botany. The meeting was chaired by Prof. CAO Min, deputy director of XTBG. Leaders of the participating institutions gathered together to discuss how to expand the influence of studies on tropical forest ecology, and enhance cooperation in personnel training.

Group photo.

TOP : Opening ceremony.
ABOVE: Prof. CHEN Jin issuing Yeni Widyana Nurchahyani Ratnaningrum of Indonesia with Certificate of Completion.

International Training Program on Biodiversity and its Sustainable Development for Developing Countries

During September 9 to 23, XTBG organized the International Training Program on Biodiversity and its Sustainable Development for Developing Countries. 15 trainees from Laos, Cambodia, Vietnam, Myanmar, Indonesia and Malaysia participated in the program. This training program was sponsored by the Bureau of International Cooperation, Chinese Academy of Sciences.
During the course, trainees learned about the Global Strategy for Plant Conservation, plant and human life, ethnobotany, seed storage and germination, plants and the environment, energy plants: current status and future prospects, plant introduction and cultivation, plants and soil, tropical rain forest of China and its biodiversity conservation, how to establish forest dynamics plot, *etc*.
After the course, they visited the XTBG herbarium, seed bank, living plant collections, and the Xishuangbanna Tropical Rainforest Dynamics Plot.
On September 19, the completion of this training program was held in XTBG. Prof. CHEN Jin issued International Training Program Completion Certificates to all trainees accompanying with a blessing.

Plants of Tropical Asia – XTBG Field Botany Course 2012

During March 28 to April 15, XTBG hosted the first Field Botany Course. 22 trainees from 13 countries participated in the course. The course was for non-plant taxonomy majors and aimed at arming students with an ability to identify plants in the field, thereby enhancing the quality of observations they may make in the course of their research.
Prof. Jim LAFRANKIE, and Prof. Frederik SLIK of XTBG, two renowned tropical Asia ecologists and botanists, were the major lecturers for the course.
Other guest lecturers from XTBG included Prof. CAO Kunfang, Prof. TANG Yong, Prof. XU Zengfu, and Dr. FAN Zexin, each teaching components on their focal taxa or expertise.
The participants got a chance to learn the diverse plant species of tropical Southeast Asia. They learnt how to make good quality plant collections, how to describe field characters, and how to recognize the important plant families and genera.
During the course, students learned to recognize about 200 plant species in 137 genera, belonging to 43 plant families.
For more information, please visit XTBG-Botany, a special website for the field course, http://xtbg-botany.wikispaces.com /.

XTBG Field Botany Course 2012.

Advanced Fieldcourse in Ecology and Conservation - XTBG 2012

The symposium of the Advance Fieldcourse in Ecology and Conservation – XTBG (AFEC-X) 2012 was held at XTBG on Nov 29, which marked the completion of a six-week intensive training course. Course participants presented the findings from their independent research projects conducted in Bulong Nature Reserve, Xishuangbanna, SW China. A panel of judges comprised of Prof. CHEN Jin, Prof. Richard CORLETT and Prof. Frederik SLIK were impressed by the quality of the work. Besides the course participants and instructors, more than 30 XTBG staff and students attended the symposium.
The Best Research Project prize went to “Shifting baselines on a forest frontier: decline of indigenous knowledge about biodiversity among the Akka people,” Presented by ZHANG Kai, Teoh Shu WOAN, and LI Jie).
Twenty-five participants from 12 countries attended AFEC-X 2012. They were from Thailand, Vietnam, Myanmar, Laos, Malaysia, Indonesia, Philippines, India, Sri Lanka, US, Cameroon and China. Four MSc students from XTBG were among the Chinese students who participated in the course. Building on the success of AFEC-X 2009, 2010 and 2011, this year’s course extended the training to six weeks to help the participants gain more from the training. It was especially useful to have a longer period in the field site at Mengsong, so that participants could collect solid field data, which led to better results of their research projects. Certainly, the most valuable asset of the field course is the resource staff. Sixteen researchers taught in the course, including Prof. Kaoru KITAJIMA from the University of Florida. Resource staffs from XTBG were Prof. CHEN Jin, Prof. Ferry SLIK, Dr. Eben GOODALE, Prof. Rhett HARRISON, Assoc. Prof. Doug SCHAEFER, Dr. Uromi GOODALE and Ms. SHI Lingling. Other resource staff were Prof. Doug YU (Kunming Institute of Zoology, CAS), Dr. Bosco CHAN (Kadoorie Farm & Botanic Garden, Hong Kong).
AFEC-X was supported by XTBG and the Bureau of International Co-operation, Chinese Academy of Sciences.

AFEC-X 2012 group photo.

Green Hope Action

Co-organized by XTBG, the Institute for Earth Education of the University of Arizona, and Friends of Nature, an environmental education workshop named “Green Hope Action” was held during March 16-19. The workshop brought together over 30 participants nationwide. With Mr. Mike MAYER, a veteran environmental teacher from the University of Arizona, as principal trainer, the workshop offered a series of special programs and activities, such as “waste recycling”, “nature awareness”, and “understanding energy flow”. He taught the participants how to help the public interact with the planet earth and emphasized the importance of reward, reinforcement, and relatedness in environmental education.

Green Hope Action.

The 32nd International Geographical Congress

Dr. FAN Zexin of XTBG moderated the session entitled “Environmental history and climate change in the high mountain ecosystems of Monsoon Asia during the Late Holocene” with Dr. Jussi GRIESSINGER from the University of Erlangen-Nuramberg at the 32nd International Geographical Congress, Cologne, August 26-30, 2012. Dr. FAN Zexin gave two special section presentations entitled “Growth-climate responses of various sub-tropical tree species in the Ailao Mountains, southwestern China” and “Tree ring recorded May-August temperature variations since A.D. 1585 in the Gaoligong Mountains, southeastern Tibetan Plateau”.

The 13th Conference of the International Association of Botanical Gardens

The 13th Conference of the International Association of Botanical Gardens (IABG) was held in Guangzhou, November 13-15. More than 300 representatives from 30 countries and regions participated in the conference. Prof. CHEN Jin, director of XTBG, was invited to chair the symposium entitled “Botanical gardens’ role in overcoming nature deficit disorder in this rapid urbanizing world”.

Prof. GAO Jiangyun of XTBG and Dr. LIU Hong of Florida International University co-chaired the workshop “Newly emerged plant reintroduction guidelines – taking climate change into consideration” and the symposium “Plant reintroduction in Asia – case studies”.

Some other XTBG scientists and students participated in the conference. The 13th Conference of IABG was themed “Exchange and collaboration: the roles of botanical gardens in plant sciences and ecology”. It was composed of a plenary session and 13 Symposia & Workshops.

The 6th International Canopy Conference

The 6th International Canopy Conference was held in Oaxaca, Mexico during October 24 - 27. The conference focused on the impact of human activities on the function, structure and permanence of canopies around the world, themed with “Anthropogenic Influence on Forest Canopies”. The conference brought together 293 participants, including biologists, zoologists, climate change scientists, environmental managers, policymakers, social scientists, and students, from 19 countries, all interested in the many facets of canopy research. Prof. LIU Wenyao, leader of the Restoration Ecology Group in XTBG, together with Dr. SONG Liang, were invited to attend the conference. They made a presentation, entitled “Potential impacts of climate change on non-vascular epiphytes: an experimental approach”, which demonstrated their research achievements in ecology of epiphytic plants in a changing world.

Horticulture


Photo by WU Fuchuan

New plant collections

Green Stone Forest

The 1st phase of the project of Xishuangbanna lime mountain rainforest recovery came to an end in early December 2012, with the opening of the Green Stone Forest to the public. On December 12, an opening ceremony for the Green Stone Forest scenic spot was held, with officials of local government, leaders and staff members of XTBG present. The ceremony was presided over by Prof. LI Qingjun, deputy director of XTBG. "The opening of the Green Stone Forest to the public is another event for XTBG since its entitlement of National 5A Tourist Attraction. It marks new progress in public education and species conservation, and contributes to scientific research" said Prof. CHEN Jin in his address. "It is also conducive for making Xishuangbanna a first-class and well-known eco-tourism destination," added CHEN Jin.

The Green Stone Forest lies due east of the gourd-shaped island of XTBG. It is home to a lush limestone seasonal rainforest. Encompassing a great diversity of habitat and topography, the forest is home to more than 1,000 vascular plant species and a wide array wildlife. It covers an area of 225 ha and its forest coverage is above 90 %. On the slopes of the forest, plants and unique stones complement one another, forming a picturesque scenery described as "forest growing on the stone." As the original habitat of hornbills, monkeys, gibbons and orchids, the Green Stone Forest now serves as an important site for reintroduction of these rare animal and plant species.


Wooden walkway.


Viewing platform.

Liana plants collection

In 2012, the new liana plants collection was built, which encompasses an area of 4.8 ha. It was divided into five main functional subareas: integrated service subarea, horticulture liana subarea, pendency and climbing plant subarea, nature habitat liana subarea. In this special functional collection, more than 500 liana species are contained. It was open to the public on the National Day in 2012. The establishment of the liana collection not only provides an impotent base for liana species collection, conservation, research and displaying, but also provides a new important platform for expanding and deepening public education.

A corner of liana plants collection.

South Medicinal Herb (SMH) collection

In 2012, the southern medicine Herb collection was enlarged from 2 ha to 3.3 ha. The medicinal plants now displayed in this garden have increased to more than 500 species. The plants of the medicine Herb collection are organized into five landscapes by their cultural characteristics. These five different functional subareas are: medicine pavilion, Dai medicine subarea, functional food plant subarea, plants that demonstrate the analogy between medicine and tea, classic prescription subarea. In addition, XTBG also improved both the road system and the irrigatation system.

ABOVE RIGHT: Medicine pavilion.
RIGHT: Medicine planting beds.

TOP: The new greenhouse.
ABOVE: Cutting propagation shed.

Enhancing the Capability for Plant Conservation

In 2012, the species conservation facilities have been effectively improved. First, XTBG built a new 460.8 m^2 greenhouse, and continued to improve its service functions. Second, The cutting propagation shed was improved to extend to 480 m^2 and provide several horticultural facilities. Third, species propagation and conservation has been effectively improved by operating of the following three function facilities: the new species conservation greenhouse, the cutting propagation shed, and a further new shade shed.

After two years' technical research and practice, the lake settling filter belt technology was greatly improved by planting species such as *Acorus calamus* and *Myriophyllum verticillatum* at the entrance of the lakes to act as a filter belt to accelerate sediment deposition and water purification. Additionally, scientifically selected aquatic plants in the lake and other associated techniques were developed to control the spread of *Gymnodinium mukimotoi*. This method is effective in controlling *G. mukimotoi*, which has become more and more prevalent over several years. In 2012, there were no reports of large algal blooms on the surface of the lakes in the flower garden and the water quality of the lakes has been largely improved. The improvement of this technology also has saved a large amount of labor: now there is little or no maintenance required for the lakes.

ANTI-CLOCKWISE FROM ABOVE: Settling filter belt with Myriophyllum verticillatum, and Acorus calamus; Waterchestnut on the surface of the lake.

XTBG scientists investigate plant diversity in Laos

Prof. CAO Min and Prof. ZHOU Zhekun, deputy directors of XTBG, led a 9-person team to investigate plant diversity in Laos during December 6-16. The investigation tour was at the invitation of the Traditional Medicine Research Center (TMRC) of Laos. The aim was to further cooperation by conducting joint investigations and probe the distribution patterns of plant diversity in Laos, while implementing the scientific cooperation agreement signed between the two sides in 2009.

On December 7, the XTBG delegation visited the Pha Tad Ke Garden in Luang Prabang. On December 9, Dr. Bounhong SOUTHAVONG, director of TMRC, met XTBG delegation and had a discussion with CAO Min. CAO Min proposed to enhance specimen exchange and introduced International Training Program on Biodiversity and its Sustainable Development for Developing Countries. Staff members of TMRC are welcomed to participate in the program. ZHOU Zhekun encouraged staff members of TMRC to have graduate studies at XTBG. During December 10-15, the XTBG delegation explored tropical seasonal rainforest and secondary forests in Laos. The tasks of plant diversity investigation in Laos were fully accomplished. Further cooperation between XTBG and Laos will be extended.

Hailstone damages landscape plants in XTBG

An unexpected hailstorm fell at Menglun in the afternoon on December 26, which brought severe damage to landscape plants in XTBG.

Hail injury to the tropical rainforest is really an uncommon occurrence. “I have never seen such a heavy hail storm in Xishuangbanna”, a local Dai girl said. The hailstone ripped and shredded leaves, defoliated branches on the trees, tore barks on young, thin-barked trees. Many aquatic plants such as *Victoria amazonica*, lotuses, herbal plants, and succulent plants were severely damaged.

Upon the hail stopped, XTBG organized the staff to check the damage and try to reduce loss. The restoration work is still ongoing.

Hailstone at XTBG.

New Plant Breeding

After three years’ struggles and experiments, this year XTBG got two new genetically stable double *Bauhinia* germplasms, through constant breeding and hybridization using a mutant *Bauhinia*.

ABOVE: Pink double Bauhinia germplasm.
LEFT: Red double Bauhinia germplasm.

Damaged Victoria amazonica.

Plants after a hail storm.

Public Education

Photo by DUAN Qiwu

Facts:
Total annual visitors to the garden: 631,353
Total annual visitors to the museum: 335,206
Special educational programs: 34
Total annual hits to the garden website: 3,935,849

Festivals highlight biodiversity conservation

The new year of 2012 was celebrated with the second Bird Fair in XTBG. The fair invited 18 bird-related conservation organizations from Beijing, Zhejiang, Jiangxi, Henan and other places to exhibit their work on bird conservation and education and attracted over 3,000 visitors in just two days. Meanwhile, many birders came to XTBG to watch birds and gain knowledge concerning bird conservation.

From April 22 to June 5, the first Firefly Festival was held. The visitors from all around China enjoyed their wonderful night with fireflies and learned about some tips of welcoming fireflies to their backyard. The exhibition of “The shining life of fireflies” inside the museum also impressed the visitors greatly.

On May 22, International Biodiversity Day, XTBG offered visitors the activity of “Expert as Tour guide”, an opportunity to communicate with botanists and ecologists. The activity has been held for four successive years and many visitors appreciated the chance to tour with experts at XTBG. At the present time, biodiversity conversation has become one of the common topics of our public educational activities at XTBG and these festivals are expected to help the public understand conservation’s importance to our daily life.

Poster of 1st Firefly Festival.

LEFT: Students in bird fair.
RIGHT: International Biodiversity Day.

Novel activities enrich tours in XTBG

Children play an important role during the summer vacation season in XTBG. The "Little guide" activity was launched in mid-July. After a week of intensive training, children worked as volunteer guides at the Tropical Rainforest and Ethnic Culture Museum. Many visitors were impressed at being guided by the little guides. Satisfied with the guiding service by the children, the visitors expressed much interest in the program.

A second program, “Boating in a king lotus” provided children less than 30 kilograms a chance to sit on the leaf of Giant Water Lilies (*Victoria amazonica*), the biggest leafed species among aquatic plants. The kids on the leaf were all happy and their parents couldn’t wait to take photos from all angles.

The photographic exhibition of “Biodiversity beauty” caught the visitors’ attention in the last quarter of 2012. In this collection of photographs from photographers throughout China taken at XTBG, numerous species were shown: orchids, gingers, spiders, butterflies, fireflies, frogs, and birds. The rich biodiversity in XTBG amazed the visitors and helped raise awareness and concern for the beautiful creatures in the rainforest.

Little guide.

Educational program for kindergarten children on track

In the morning of May 18, the silent forest was no longer silent, when about 20 kids from the kindergarten in XTBG came here to “Embrace my tree”. With the guidance of the staff of public education, each child picked his/her favorite tree and then touched, smelt and embraced it. The children’s curiosity towards nature burst out and they treated the trees like they were their close friends.

From then on, the educational program for kindergarten kids has been on track. The activities were carried out each month and 18 games involving nature were conducted in 2012, such as “The story of ants”, “Searching for the fall in the garden” and “From waste to wealth”. Most activities were selected from the classic literature on infant education, like *SHARING NATURE with CHILDREN*, modified to suit the tropical surroundings. With the purpose of optimizing educational efficiency, an international cooperation project is under discussion between XTBG and Council for Environmental Education, an international non-profit organization that promotes conservation awareness.

Smell my tree.

International communication widens and deepens the public education

Olympic wreath winner.

The year of 2012 witnessed an extension of our international communication about public education in XTBG. The wreath picture sent by XTBG to commemorate the Olympic games won the 10th place in the global competition held by Botanical Garden Conservation International and Fairchild Tropical Botanical Garden.

For the first Fascination of Plants Day, various activities were carried out to help visitors and local residents learn about fascinating plants and two essays sent by XTBG won awards in the Essay Competition.

Earth Hour came to XTBG this year and the night hike on March 31 gave the participants a chance to feel the beauty of darkness. More people "joined" the hike on line with our microblog and the activity achieved a lot of positive feedback.

Winter & Summer Camp welcomed more participants

Over 2,000 students from all over China took part in winter & summer camp in XTBG. For some schools, it was the third time they sent students to XTBG. Various activities have been prepared for the campers: "Rainforest trek", "Hand-in-Hand with scientists", "Green orientation", "Surveying native vegetables at the local market", "Night hike", *etc*. It is expected that these activities may influence the students' interests and career pursuits in the future.

LEFT: Scientific research.
RIGHT: Plant art.

Microblog shines in online public education & tourism

During its 18-month development, the official microblog of XTBG (http://e.weibo.com/xtbgcas?ref=http%3A%2F%2Fwww.xtbg.cas.cn%2F) has accumulated over 10,000 fans. Each day, at least one message is tweeted on the microblog and the fans know current information about touring, scientific research and gardening.

Sina microblog.

With the microblog, the garden can interact with the fans at any time. Their questions can be answered immediately and their suggestions/advice can be collected to improve our work. The promotion about XTBG by microblog turned out to be effective and more and more people have been following our microblog as time goes on.

Environmental education research papers published

Three articles were published in professional journals by staff of the Education & Tourism Department in 2012. A paper entitled "Educational and enjoyment benefits of visitor education centers at botanical gardens" was published in *Biological Conservation*, which focuses on the educational function of visitor education centers inside botanical gardens. In the paper "Local Dai people's attitude towards biodiversity conservation in Xishuangbanna", the authors suggest the Dai people clearly understand the importance of the forest and the adverse environmental effects of rubber expansion, but most people continue to pursue rubber growth due to economic development. The paper "Environmental interpretation: practical applications in botanical gardens" discussed methods of environmental interpretation, including some practical examples applied at XTBG.

Partnership

Domestic

Jingdong, Yunnan

On October 1, a foundation stone laying ceremony of Jingdong Subtropical Botanical Garden was held in Jingdong County, and the construction of the subtropical botanical garden was officially launched.

The foundation stone laying ceremony was attended by officials from local government and leaders of XTBG and some CAS institutes.

Academician WU Zhengyi, top science award winner, gave his inscription for the name of the botanical garden.

The construction of Jingdong Subtropical Botanical Garden will be carried out by XTBG in cooperation with Jingdong local government. According to the master plan, the subtropical botanical garden is expected to cover an area of 866.7 ha, composed of 17 living collections themed with Lauraceae, Fagaceae, Magnoliaceae, and Camellia, *etc*. More than 5,000 subtropical plant species will be under *ex situ* conservation within the garden. The total investment will be RMB 870 million.

Foundation stone.

Jingdong Subtropical Botanical Garden is expected to be act as a center for biological resource and biodiversity conservation, scientific research, ecotourism, and science popularization in subtropical Yunnan.

Foundation stone laying ceremony.

Xishuangbanna, Yunnan

Xishuangbanna Vocational Technical College

XTBG and Xishuangbanna Vocational Technical College (XVTC) signed a Cooperation Framework Agreement on March 7. The agreement will facilitate cooperation between XTBG and XVTC, taking advantage of the different Institutional strengths of the two organizations.

As representatives of the two sides, Prof. CHEN Jin, director of XTBG and Mr. LI Yongyi, principal of XVTC, signed the agreement.

The signing ceremony was presided over by Prof. LI Qingjun, deputy director of XTBG. Some officials of Xishuangbanna local government and XTBG leaders were present at the signing ceremony.

Signing cooperation agreement.

Local enterprises

Two cooperation agreements on “Establishing experiment and demonstration base of environmentally-friendly rubber plantations” were signed between XTBG and two local enterprises on July 25.

Signing cooperation agreements.

According to the agreements, the two enterprises will provide XTBG with 280 ha and 466.7 ha for the test and demonstration of environmentally-friendly rubber plantations for a time span of at least 10 years. XTBG will conduct experiments on vegetation restoration, including protection and reforestation in mountain valleys, ravines, and water reservoir forests. Meanwhile, XTBG will help design new cropping models and plantation communities’ construction . XTBG will also monitor soils, plants and environmental factors in these rubber plantation landscapes.

Abroad

United States of America

Between September 3 and 12, Prof. CHEN Jin headed up a 4-person delegation invited to the USA. The XTBG delegation had academic visits and signed cooperation agreements with University of Florida and Florida International University, respectively.

The XTBG delegation included Profs. CHEN Jin, CAO Kunfang, GAO Jiangyun and ZHANG Ling.

The XTBG delegation visited the International Center of the University of Florida, its Natural History Museum, and its Butterfly Conservatory. A memorandum of understanding was signed between XTBG and the University of Florida. On behalf of the two sides, Prof. CHEN Jin and Dr. David SAMMONS signed the agreement, respectively. The MoU focused on the possible development of projects of mutual interest in tropical biology, conservation biology, and environmental education.

Another memorandum of understanding was signed between XTBG and Florida International University. The authorized signatory of the two sides were Prof. CHEN Jin and Dr. Mark ROSENBERG, respectively. The MoU focused on tropical botany and conservation.

Both of the two MoUs take effect in September 2012 and will last for 5 years.

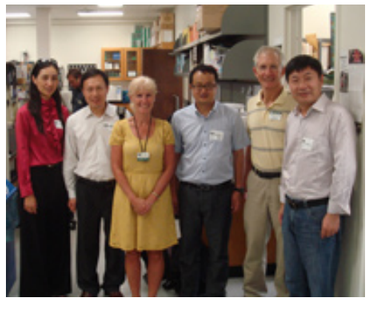
At the University of Florida, Prof. CHEN Jin delivered a lecture entitled “Integrative conservation in Southwest China’s biodiversity hotspot: past efforts and future perspective”.

Prof. CHEN Jin and Dr. Mark B. ROSENBERG of FIU sign the MoU.

At the Florida International University, Prof. CAO Kunfang delivered a lecture entitled “Correlation of plant hydraulic traits with plant physiology”.

During their stay in the USA, the XTBG delegation visited the University of California, Los Angeles (UCLA). They met with Profs. Victoria SORK and Lawren SACK.

They also visited the University of Miami, Fairchild Tropical Botanic Garden, and Montgomery Botanical Center.



LEFT: UF Provost Dr. Joseph GLOVER (middle) meets XTBG delegation.
RIGHT: Visit the Soltis Lab.

Germany

Prof. Achim BRÄUNING and his students investigating land use type in Ailao Mountains.

Under the support of the Fund of Robert-Bosch entitled "Monsoon variability, climate change, tree ecology and sustainable land use in the Ailao Mountains, Yunnan Province, China", Dr. FAN Zexin visited the Institute of Geography, University of Erlangen-Nürnberg between August 22 to November 15. He conducted research on tree-ring isotope analyses for tropical and subtropical trees in SW China. Further field work for this project was carried out between September 27 – October 10, by a Sino-German joint project. Professor Achim BRÄUNING accompanied by 7 students from University of Erlangen-Nürnberg undertook this field work in Ailao Mountain, Dali, Lijiang and Shangri-La in Yunnan Province. They investigated forest types, land use and glacier geomorphology in northwestern Yunnan, China.

Thailand

An Agreement for Scientific and Education Cooperation was signed between XTBG and the Faculty of Science, Chiang Mai University, Thailand on February 14. On behalf of the two sides, Prof. CHEN Jin and Dr. Sampan SINGHARAJWARAPAN, Dean of Faculty of Science signed the Agreement, respectively. The Agreement focused on joint research activities and publications, invitations to scholars for lectures, talks and the sharing of experiences, and invitations to scholars to participate in conferences, colloquia and symposia. Overall, the agreement will encourage interchange between faculty members and students from the two institutions for studying, teaching and research in the coming five years.

Photo by HE Ruihua

Talent Training and Team Building

Photo by HE Ruihua

Postgraduate Education

XTBG authorized to confer doctoral degrees in Biology and Ecology

In 2012, XTBG has been authorized to confer doctoral degrees in two first-level disciplines, Biology and Ecology.
XTBG highly values the quality of graduate education in academic degree programs. As an institute of the Chinese Academy of Sciences, XTBG offers a complete educational system of master's and doctoral programs in Biology and Ecology. Being able to confer degrees in both Biology and Ecology allows XTBG to be a leading institution in the life and environmental sciences.

Graduation celebration 2012

Congratulations to the 42 XTBG graduates of 2012! 30 of them were conferred with Master degrees and 12 were given Ph.D. degrees.
On June 20, the graduates and their supervisors gathered together to celebrate the completion of graduate studies at XTBG's headquarter campus. A ceremony was held to honor the hard work and dedication of the graduates.
Pterospermum menglunense, a critically endangered plant species native to Yunnan, was planted in front of the students' apartment by the graduates and their supervisors for memory. As expressed in Prof. CHEN Jin' speech, entitled "Growth", living and studying in XTBG is a process of growing for the students. After a few years of studying in XTBG, the students have shown growth in many different aspects of their lives, and their education here will serve as a foundation for their personal development in the future.

Two XTBG graduates supported by Harvard postdoctoral fellowships

Dr. ZHANG Yongjiang, a XTBG graduate, has been supported by postdoctoral fellowships of Harvard University. He will go to Harvard University for one year to conduct studies on "The importance of fog in maintaining tropical rainforests in SW China: physiological and hydrological basis for forest conservation and sustainable development".
Moreover, Dr. HAO Guangyou, who received postdoctoral fellowships from Harvard University in 2010, will be financed by a postdoctoral fellowship of the Arnold Arboretum of Harvard to study "Xylem hydraulic structure and cold resistance of gymnosperms". His faculty host at Harvard is Prof. N. Michele HOLBROOK. Prof. CAO Kunfang was supervisor of ZHANG and HAO for their studies at XTBG.

Talent Training

Gardening training course 2012

TOP: A trainee practicing cutting weed. ABOVE: XTBG gardener explaining how to use the weed cut machine.

A gardening training course of CAS Botanical Gardens was organized by the Work Committee of Botanical Gardens of the Chinese Academy of Sciences during October 10 - 23. More than 30 gardeners from 12 botanical gardens nationwide participated in the course.

The opening ceremony of the training course was held in Kunming Botanical Garden on October 11.

"China is lacking in professional horticulturists and gardeners" said Prof. CHEN Jin at the opening ceremony. "Some famous botanical gardens like Kew Royal Botanical Garden and Missouri Botanical Garden offer professional horticulture training courses to improve skills of the gardeners. The Work Committee of CAS Botanical Gardens would like to provide a platform and organize a series of activities to complement it", added CHEN Jin.

The training course was divided into two parts. The first part (October 11-19) in Kunming Botanical Garden focused on "garden design and construction of small garden ornaments", "pest and disease control in the garden", "tree census and management", "ground cover flora, landscape construction, and garden management".

During October 21-22, the trainees travelled to XTBG to learn "use, care, and maintenance of garden machines". During the course, the participants were first introduced to essential theories of horticulture and then were encouraged to learn and hone practical skills by themselves and in small groups.

Team Building

China regional representative of IOP

Prof. ZHOU Zhekun, deputy director of XTBG, has been elected as regional representative of China for the International Organization of Palaeobotany (IOP). His tenure is for four years.

IOP promotes international co-operation in the study of palaeobotany including palaeo-palynology. This is achieved through the publication of an informative newsletter and organization of international conferences focusing on all aspects of palaeobotany. Organizational activities include collaboration with other international organizations to ensure the continued development of palaoebotany as a scientific discipline.

Associate Editor for *Biotechnology for Biofuels*

Prof. FANG Zhen of XTBG has been appointed as an Associate Editor for the peer-reviewed scientific journal *Biotechnology for Biofuels*, after being an Editorial Board Member of this journal for a few months.

In addition, Prof. FANG Zhen has been invited to be an advisory board member of the peer-reviewed scientific journal *Biofuels, Bioproducts and Biorefining*. Appointments to the editorial board are for two years.

Prof. FANG Zhen has a strong background in both bioenergy and nanotechnology. He has 23 years experience in bioenergy, and more than 13 years experience in hydrothermal, nanotechnology and diamond anvil cell techniques, working at top universities and institutes in China, Canada, Japan and Spain.

Special Allowance by Yunnan Provincial Government

Prof. ZHANG Ling of XTBG is awarded with the special provincial government allowance of 2012 by the People's Government of Yunnan Province. The allowance is awarded in recognition of her academic achievement and outstanding contribution to tropical botanical studies.

Prof. Zhang Ling studies the phylogeography and reproductive biology of Taccaceae and Zingiberaceae plants. Her research focuses on the systematics and evolution of reproductive traits, the adaptive radiation and evolution of morphological traits, and the reproductive biology and population genetics structure of *Tacca*. She is now attempting to use DNA barcoding and an understanding of species' geographic distributions to better understand the ecology and evolution of these two plant families.

Wong Kuan-Cheng Education Foundation

Prof. PENG Yanqiong of XTBG has been granted the "CAS Wang Kuancheng Award for Outstanding Achievements to Western Scholars". She is one of 20 young scientists who won the honor in 2012. Peng Yanqiong has focused her studies on the co-evolution of figs and fig wasps and has published her research in many international peer-reviewed journals. Previously, four XTBG scientists (FENG Yulong, LIU Wenjie, ZHANG Shibao and PENG Yanqiong) have won the honor.

Dr. WANG Li won the CAS Wang Kuancheng Award for Excellent Postdoctoral Fellows. He is the third scientist from XTBG to win this honor. The other two were CAO Guoxing and XING Yaowu.

Prof. ZHOU Zhekun and Prof. ZHANG Yiping were funded by Wong Kuan-Cheng Education Foundation for International Academic Exchange to participate in the International Palynological Congress (IPC-XIII 2012) and 9th International Organization of Palaeobotany (IOPC IX 2012), and Eco Summit 2012 respectively.

Visits

WU Guanzheng

Mr. WU Guanzheng, a former member of the Standing Committee of the Political Bureau of the Communist Party of China (CPC) Central Committee, paid an inspection tour to XTBG on February 29. His tour was accompanied by Mr. XIN Weiguan, Secretary of Yunnan Provincial Commission for Discipline Inspection.

He visited the living collections and research facilities within XTBG. He also planted a memorial tree, *Cephalotaxus mannii*, in the Commemorative Plant Collection.

ZHENG Wantong

Mr. ZHENG Wantong, vice chairman of the Chinese People's Political Consultative Conference (CPPCC), paid an inspection tour to XTBG on May 11. He headed up a CPPCC delegation for speeding up the opening and development in western border regions of China. Xishuangbanna was one stop for the delegation.

Prof. CHEN Jin briefed the officials on the development of XTBG and showed them around the living collections and the museum.

ZHENG Wantong was deeply impressed by the rich collection of rare plant species and the beautiful landscapes. He commended XTBG on the directions it has taken in its development.

Accompanying the tour were vice Governor Luo Zhengfu of Yunnan Province and other officials.

HUANG Mengfu

Mr. HUANG Mengfu, vice chairman of the 11th National Committee of the Chinese People's Political Consultative Conference and chairman of All-China Industry and Commerce Federation, paid an inspection tour to XTBG on June 7.

Vice chairman HUANG Mengfu enjoyed the sights attentively and listened carefully throughout the journey. He was briefed on the advances in scientific research and species conservation.

WANG Ercheng

Mr. WANG Ercheng, vice minister of the Organization Department of the Chinese Communist Party Central Committee, paid an inspection tour to XTBG on February 4. The tour focused on checking the work of introduction and management of senior talents.

Prof. CHEN Jin, director of XTBG, briefed the major tasks, development planning, and talents strategy to the vice minister.

The visiting officials were shown around the Flower Garden, Energy Plant Collection, Distinctive Plant Collection, Palm Garden, and the Tropical Rainforest within XTBG. They also visited the Central Laboratory.

The tour of the vice minister was accompanied by Mr. LIU Weijia, director of the Organization Department of CPC Yunnan Provincial Committee, and some other officials of local governments.

CHEN Zhu

Academician CHEN Zhu, health minister of China, paid an inspection tour to XTBG on December 29. He inspected the cultivation bases of physic nut tree (*Jatropha curcas* L.) and Inca peanut (*Plukenetia volubilis* L.) and the Central Laboratory.

Prof. CHEN Jin, director of XTBG, made a work report regarding achievements over the past five years and development planning for the next five years to the health minister, who's also former vice president of the Chinese Academy of Sciences.

"Great changes have taken place in this robust botanical garden with good tradition and scientific accumulation", CHEN Zhu said. "As a research institution engaged in regional biodiversity conservation and a well-known botanical garden, XTBG is a real scientific botanical garden", he added.

"Studies on resource protection and sustainable utilization can directly do benefit to health. Inca peanut is a plant for functional food and dietary supplement in the future. Physic nut is a resource plant for renewable biomass energy. All these have connections with human health." CHEN Zhu made these remarks while talking with XTBG scientists and leaders.

CHEN Zhu encouraged promoting more connections between ecological protection and human health among botanical gardens in China in the future.

ZHANG Yaping

Academician ZHANG Yaping, vice president of the Chinese Academy of Sciences, headed up a group of CAS officials to XTBG on April 14. Their tour was for investigation and work guidance and looked into the implementation progress of the “Innovation 2020” and “One-Three-Five” plans (one positioning, three great breakthroughs and five major development directions)” of the Botanical Garden.

Prof. CHEN Jin, director of XTBG, made a work report concerning the overall status of the Garden, its “One-Three-Five” development plan, its development direction and the existing problems.

ZHANG Yaping gave high marks to Chen’s work report. He approved XTBG’s recent achievements in the planning of development. He encouraged XTBG to strive to become a world reknown, first-class botanical garden, and a high-level research base for plant diversity and ecology, which can contribute to the protection and utilization of tropical biological resources.

ZHANG Yaping had in-depth discussions with all leaders, research scientists, and heads of management and supporting departments on such issues as talent introduction and cultivation, personnel education system, platform construction, raising primitive innovation capacity, and improving comprehensive competitiveness, *etc*.

Moreover, XTBG leaders accompanied ZHANG Yaping to visit the living collections, cultivation base of resource plants, and tropical rainforest within the garden.

SUN Zhigang

Mr. SUN Zhigang, deputy director of National Development and Reform Commission (NDRC) and director of the State Council Office of Medical Reform, paid a visit to XTBG on May 26.

Mr. LI Hongwei, CPC secretary and deputy director of XTBG, briefed the development of XTBG over the past years to the visiting officials and showed them around the living collections and museum.

KONG Chuizhu

Mr. KONG Chuizhu, vice governor of Yunnan Province, made a special tour to XTBG to inspect the development of Inca peanut (*Plukenetia volubilis*) on October 24. His tour was accompanied by governor DAO Linyin of Xishuangbanna and other officials of local governments.

KONG Chuizhu made a field inspection of the experiment base of *P. volubilis* within XTBG and reviewed some documentation about its development.

Prof. ZHOU Zhekun, deputy director of XTBG, discussed the progress in introduction, cultivation, scientific research, large-scale plantation and development of *P. volubilis*.

The vice governor was also briefed on XTBG's cooperation in industrialization research on *P. volubilis* with Laos.

Other Visitors

January

5 Dr. LV Youqing, Chinese ambassador to Tanzania. Republic of China.

February

1 Dr. LIANG Naishen, Senior Researcher, Center for Global Environmental Research, National Institute for Environmental Studies, Japan.

7 Dr. Brendan BUCKLEY, Lamont-Doherty Earth Observatory of Columbia University, USA.

11 LIU Yanguo, Deputy Administrator, State Administration of Foreign Experts Affairs, P. R. China and a 8-person delegation.

14 Dr. Robert EFIRD, Seattle University, USA.

15 Prof. TANG Ming, Institute of Geology and Geophysics, Chinese Academy of Sciences.

16 GAO Guilong, CPC secretary, ZHANG Hongliang, Vice President and a 10-person delegation of Guizhou Academy of Sciences.

24 CHEN Xiaoya, Vice Minister, Ministry of Science and Technology.

25 WANG Xiaochu, Vice Minister, Ministry of Human Resources and Social Security.

March

3 LV Xianzhi, Deputy Director, National Science and Technology Infrastructure Center, Ministry of Science and Technology and a 5-person delegation.

6 Dr. Michael de Leighton BROOKE, University of Cambridge, UK.

7 JIANG Pusheng, CPC secretary of Xishuangbanna, CHEN Qizhong, Vice Governor of Xishuangbanna and LI Yongyi, Director of Xishuangbanna Vocational and Technical Institute.

17 Academician DING Zhongli, Vice President, Chinese Academy of Sciences.

20 Dr. Mahua GHARA, Indian Institute of Science, India.

April

10 Dr. James LAFRANKIE, University of the Philippines, The Philippines.

12 XING Shuying, Deputy Director, Bureau of Capital Construction, Chinese Academy of Sciences.

23 Dr. Micheline SKEFFINGTON, National University of Ireland, Ireland.

24 Dr. Ed GRUMBINE, Kunming Institute of Botany, CAS.

27 SUN Dianyi, Deputy Director, Bureau of Academy-Locality Cooperation, Chinese Academy of Sciences.

May

8 Dr. Olesya BONDARENKO, Institute of Biology and Soil Science, Far Eastern Branch of Russian Academy of Sciences.

9 WU Jianguo, Vice Secretaries-General, Chinese Academy of Sciences and a 9-person delegation.

10 Academician GUO Aike, Institute of Neuroscience, Shanghai Institutes for Biological Sciences, CAS and Institute of Biophysics, CAS, and Prof. MA Yuanye, Kunming Institute of Zoology, CAS.

15 Dr. Eben GOODALE, University of California, San Diego, USA.

18 Dr. Peter H. RAVEN, President Emeritus, Missouri Botanical Garden.

20 Mr. Graham SMITH, president of Azalea Society of New Zealand and former director of Pukeiti Botanic Garden, New Plymouth, and a 27-person delegation.

21 A 80-member delegation of editors and journalists from 40 Chinese leading online medias, People's Daily Online, China Youth International, SINA, cnwest.com, Yunnan.cn, and communication officers from Shanghai, Jiangsu, Inner Mongolia, Heilongjiang, and Yunnan.

22 Prof. Spencer C. BARRETT, University of Toronto, Canada.

28 Dr. John Michael BISHOP, co-winner of 1989 Nobel Prize in Physiology or Medicine and Dr. Elizabeth F. NEUFELD, winner of 1982 Albert Lasker Award for Clinical Medical Research.

29 Dr. Michael MAUNDER, Florida International University, USA and Dr. Hong LIU, Florida International University, and Fairchild Tropical Botanic Garden, USA.

31 Prof. PEI Shengji, board chairman, Center for Biodiversity and Cultural Diversity Conservation, and a 23-person delegation of the International Symposium on Biocultural Conservation.

June

1 Dr. Rodney MAURICIO, University of Georgia, USA.

3 Dr. George XIAN, U. S. Geological Survey, USA.

4 Prof. Carol BASKIN and Prof. Jerry BASKIN, University of Kentucky, USA.

5 Dr. Graham STONE, University of Edinburgh, UK.

7 Dr. Torsten UTESCHER, Steinmann Institute of Bonn University, Germany.

12 Prof. LIU Yusheng, East Tennessee State University, USA and a 4-person delegation.

14 Prof. Xiang-Qun (Sean) XIE, University of Pittsburgh, USA.

July

3 Dr. Robert EFIRD, Seattle University, USA.

17 Dr. Hong LIU, Florida International University, and Fairchild Tropical Botanic Garden, USA.

24 Dr. Matteo POLITI, Interdisciplinary Organization for Development and Health, Italy.

26 Mr. Petipong Pungbun Na AYUDHYA, president, Biodiversity-Based Economy Development Office (Public Organization), Thailand, and a 9-person delegation.

26 Mr. CHEN Xinhua, deputy CPC secretary, Chenshan Botanical Garden, Shanghai, China, and a 11-person delegation.

29 Dr. Antonio F. C. TOMBOLATO, Director, Instituto Agronômico Botanical Garden, Brazil.

August

2 Somkeo MANIVANH, Head of Department of Agriculture and Forestry, Oudomxay Province, Lao PDR.

11 Prof. XU Jianping, McMaster University, Canada, and a 19-person delegation.

29 Dr. Ashley N. EGAN, Herbarium Curator, East Carolina University, USA.

September

4 Dr. Stefan WANKE, Technische Universität Dresden, Germany.

14 Prof. Ju CHOU, National Taiwan Normal University, Taiwan.

30 Prof. Achim BRAEUNING, University of Erlangen-Nürnberg, Germany and a 13-person delegation.

October

16 Dr. Michael B. THOMAS, curator, Joseph F. Rock Herbarium, University of Hawaii, USA.

30 Dr. Jianghua CHEN, The Samuel Roberts Noble Foundation Inc., USA.

31 Kykeo SINGNAVONG, assistant minister, National Ministry of Agriculture and Forestry, Lao PDR, and a 6-person delegation.

November

5 Dr. Si HE, Curator of Missouri Botanical Garden, USA and Ms. Somsanith BOUAMANIVON, Director of Ecology Division and Curator of National Herbarium, Ministry of Science and Technology, Lao PDR and a 6-person delegation.

5 ZENG Hua, Vice President, Yunnan Normal University, China.

11 KIM Chhai Hieng, Vice Governor, Siem Reap Province, Camboida and a 3-person delegation.

12 WANG Xuezhi, Vice Chairman, Yunnan Provincial Committee of the Chinese People's Political Consultative Conference.

13 Dr. Kaoru KITAJIMA, University of Florida, USA.

17 Prof. MA Yuan, Tongji University, China.

20 Dr. Joyce MASCHINSKI, Fairchild Tropical Botanic Garden, USA.

20 Dr. XIE Yan, Institute of Zoology, Chinese Academy of Sciences.

22 Pany YATHOTOU, Chairwoman of the National Assembly, Lao PDR and a 8-person delegation.

December

2 Prof. ZHU Zuoyan, academician of Chinese Academy of Sciences (CAS).

20 Dr. Thomas HAEVERMANS, French National Herbarium, French National Museum of Natural History, France.

Income and Expenditure (Million Yuan)

	Categories	FY2010	FY2011	FY2012
INCOME				
	Government Grants	30.155	31.803	84.253
	Infrastructure	0	0	0
	Admissions & Services	31.919	36.692	46.688
	Grants for research	31.506	55.217	70.841
	Miscellaneous	0.526	1.236	0.274
	Sum	94.106	124.948	202.056
EXPENDITURE				
	Staff costs	52.590	67.303	74.629
	Maintenance	0.220	0.139	2.352
	General and Admin. Expense	1.581	1.872	16.853
	Infrastructure	0	4.631	0
	Equipment	25.211	23.326	60.384
	Research & Horticulture	24.195	32.020	35.552
	Miscellaneous	0.080	0	0
	Sum	103.877	129.291	189.77

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