Knowledge@Terra Classrooms
地域知识课堂

K@T

Sustainable Agro-Forestry Development Practices
可持续农林发展实践

Bamboo
竹子

Territorial Landscape Ecosystems
地域景观生态系统

Exchange Interface 交流界面

Development Capacity Evaluation (DCE) of an Integrated Bamboo Development Region
一个综合竹产业地区的发展容量评估（DCE）

Knowledge@Terra Classrooms (K@T) is a series of exchange interfaces and interactive courses to explore and present territorial solutions in regional planning, that support green transition and carbon neutral progress. **Green Gold Dialogues (GGD)** is a multi-actor dialogue to promote green transition exchanges in one region or between more regions.

As a technical tool of Knowledge@Terra Classrooms and Green Gold Dialogues, **Development Capacity Evaluation (DCE)** is an research, evaluation and reporting mechanism for **nature-based regional, sectoral and plot-based green transition plans**. DCE is designed to include various standards and systems and to support multi-actor cooperation.

Supported by the International Bamboo and Rattan Organisation (INBAR), this Exchange Interface provides all stakeholders a preliminary **Development Capacity Evaluation of a bamboo development region**.

地域知识课堂（K@T）是系列交流界面和互动课程；研究和展示在地区规划中，支持绿色转型和碳中和进程的地域解决方案；**绿金访谈（GGD）**是多个地区之间交流绿色转型的多角色对话。

作为地域知识课堂和绿金访谈的技术工具，**发展容量评估（DCE）**是一个发展评估和报告体系，用于研究和评估**以自然为基础的地区、行业和地块转型计划，**可包容多项标准和系统，支持相关各方的协作。

在国际竹藤组织（INBAR）的支持下，本界面为相关各方展示**一个竹产业发展地区的初步发展容量评估**。

INBAR K@T

K@T

Knowledge@Terra Classrooms
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Green Gold Dialogues
绿金访谈

NATURE HERIT 自然颖源

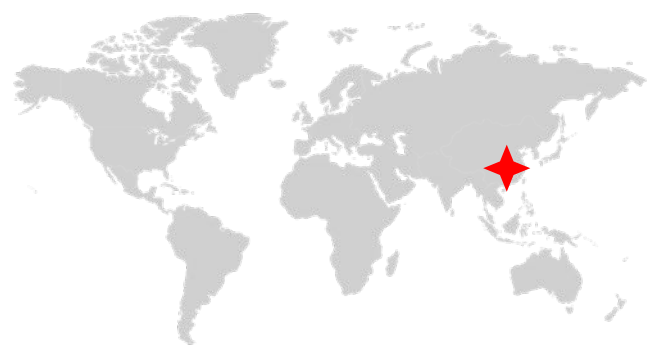
Sustainable Agro-Forestry Development Practices
可持续农林发展实践

Case Region:

Tianmu Mountain Range and Surrounding Areas, Yangtze River Delta, China

案例地区：

中国长江三角洲天目山地区及周边地区



Main Bamboo & Agro-Forestry Related Sectors
主要竹与农林相关产业

Property Research, Agro-Forestry Management, Food Production, Daily & Art Products, Processing & Machineries, Building & Construction, Bioenergy & -products, Carbon Capture & Trade, Education & Awareness, Regional Leisure & Tourism
特性研究，农林复合经营，食品生产，日用品和艺术品，加工与机械，建筑和构筑，生物质能源和产品，碳存储和交易，教育与意识，区域休闲旅游

Territorial Solution Examples (Lin'an District, Hangzhou City)
地域解决方案举例（杭州市临安区）

Sustainable & High-Value Bamboo Shoot Cultivation Solutions ★ A High Value Bamboo Shoot Cultivation Method ★ Typical Food Initial Processing Technology for Bamboo Shoots ★ Nature-based soil remediation for more bio-diversity in bamboo integrated forests
可持续和高价值的农林实践解决方案 ★ 一种高价值的竹笋种植技术 ★ 典型竹笋食品初加工技术 ★ 以自然为基础的土壤修复，丰富竹林的生物多样性

More than 1600 species of bamboo and 600 species of rattan grow in 80 countries worldwide. Because of their great features and multiple benefits, **agro-forestry management and green sectors for bamboo-rattan integrated territorial landscape ecosystems** are among the most sustainable development solutions, providing energy, food, products, resources and ecosystem services for multiple sectoral development, while reducing carbon emissions enormously. 在全球约80多个国家生长着1600多种竹和600多种藤。由于它们的优良特征和多重效益，**农林经营模式和绿色产业**保持**融合竹藤的地域景观生态系统，**是最可持续的发展解决方案之一，提供能源、食品、产品和多种产业发展的资源和生态系统服务，并大大减少碳排放。

Bamboo
竹子

Bamboo forest and farms contribute to land restoration and erosion prevention and support bio-diversity. The cultivation and harvests provide construction material, alternative timber, bio-materials, fibre, energy, food, feed and fodder.

竹林和竹园有助于土地修复、防止侵蚀和支持生物多样性。竹子的种植和收获提供建筑材料、替代木材和生物材料、纤维、能源、食品、饲料和饲草。

Territorial Landscape Ecosystems
地域景观生态系统

Bamboo-Integrated Territorial Landscape Ecosystems include forest, agroforestry, farmland, gardens, protected areas and water-wetland eco systems with bamboo species in tropical, sub-tropical and temperate (partial) regions. These systems provide a wide range of natural products (from food, timber, fibre to energy), and eco system services (erosion, floods and drought prevention, carbon storage, climate regulation, climate-resilient agriculture supports, bio-diversity, cultural landscape and healthy environment etc.).

融合竹子的地域景观生态系统是指在热带、亚热带和温带（部分）地区，包涵竹子的森林、农林、农田、园林、保护区和水体湿地生态系统。它们提供广泛的自然产品（从食品、木材、纤维到能源）和生态系统服务（防止侵蚀、洪水和干旱，碳储存，调节气候，支持气候适应性农业、生物多样性、自然文化景观和健康环境等）。

Image Source INBAR | https://www.chinasage.info/bamboo.htm | Internet | Luc Boeraeve
图片来源：国际竹藤组织 | 网络 | Luc Boeraeve

Notes
注释

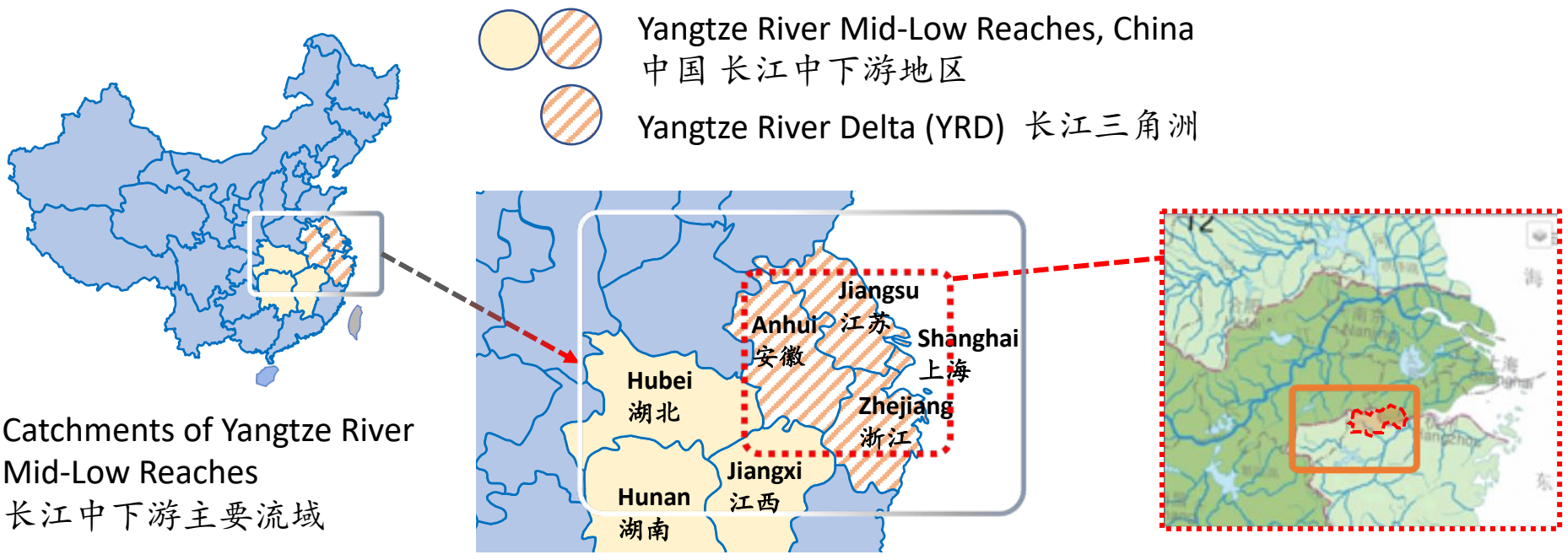
1. Please contact training@inbar.int, xyliu@natureherit.com for any questions on Knowledge@Terra Classrooms and Green Gold Dialogues, as well as the usage of Exchange Interfaces "Sustainable Agro-Forestry Development Practices". 关于地域知识课堂和绿金访谈，以及"可持续农林发展实践"主题界面的信息使用的任何问题，请联系 training@inbar.int, xyliu@natureherit.com

2. With kind thanks to Prof. Zhu Zhaohua, Prof. Wang Anguo, Bureau of Agriculture & Rural Affair, Lin'an District, International Centre for Bamboo and Rattan (ICBR) and other institutions and individuals for their substantial contributions. 衷心感谢临安区农业农村局、国际竹藤中心、竺肇华教授、王安国总工程师等机构和个人的大力支持。

Sustainable Agro-Forestry Development Practices
可持续农林发展实践

Case Region: Tianmu Mountain Range and Surrounding Areas, Yangtze River Delta, China 案例地区：中国长江三角洲天目山地区及周边地区

Geographic Location, Territorial Features & Related Policies 地理区位、地域特征和相关政策



Tianmu & Yellow Mountain Range proximate scope
天目山和黄山地区大致范围

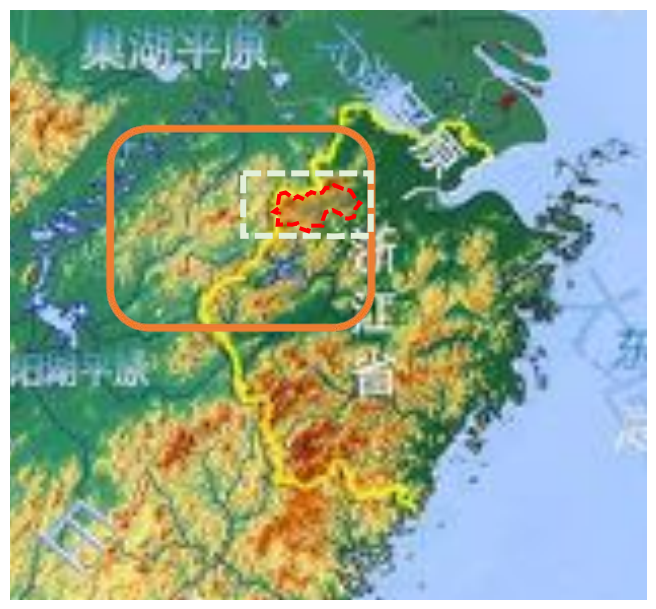
Zhejiang Province
浙江省

Taihu Lake Catchment (TLC) / Qiantang River Catchment (QRC)
太湖流域 / 钱塘江流域

Lin'an District (Tianmu Mountain central area)
临安区范围（天目山区中心地区）

As the main case of this interface, the Lin'an District is located in the hilly area and plain valley of Tianmu Mountain and to the west of Hangzhou city. Its total area is 3119 km^2. Since the 1980s, based on local natural conditions, Lin'an established local agroforestry systems, applying nature-oriented management, and protected a rational forest structure (natural, economic and timber forest). Until 2018, the terrestrial landscape ecosystem was stably recovered with the forest coverage of 81.9%.
Through continuous efforts in developing multiple functions of the forest, Lin'an successfully boosted a number of environment-friendly sectors, such as non-timber forest products (bamboo, hickory and tea, etc.), eco-tourism, and the related leisure and cultural sectors. It was transformed from a poor, depleted mountainous county to one of China's most prosperous mountainous counties (districts). It realized preliminary urban-rural integration and entered a high-quality development stage during this modernization process.
作为本界面的主要案例，临安区位于杭州市区西部，天目山的丘陵地带和山谷的平原上，面积3119km2。自上世纪80年代起，临安根据本地自然条件建立了地方农林复合体系，从而保护森林的合理结构（包括天然林、经济林和人工用材林），逐步实施近自然经营，使森林覆被率达到81.9%，恢复了稳定的陆地景观生态系统。
由于不断地开发森林的多功能效益，形成了以非木质林产品（包括竹子、山核桃、茶叶等）、生态旅游，以及相关的休闲文化产业为主的环境友好型产业。从穷乡僻壤转变成全国最富裕的山区县区之一，实现了城乡基本融合，通过这个现代化过程进入了高质量发展阶段。

Water of the Taihu Lake Catchment area (TLC), Yangtze River Delta, originates from the Tianmu Mountain and other mountains. Tianmu also nurtures water of Qiantang River Catchment (QRC).
长江三角洲太湖流域发源于天目山区和其他山地。钱塘江流域的水资源也发源于天目山区。



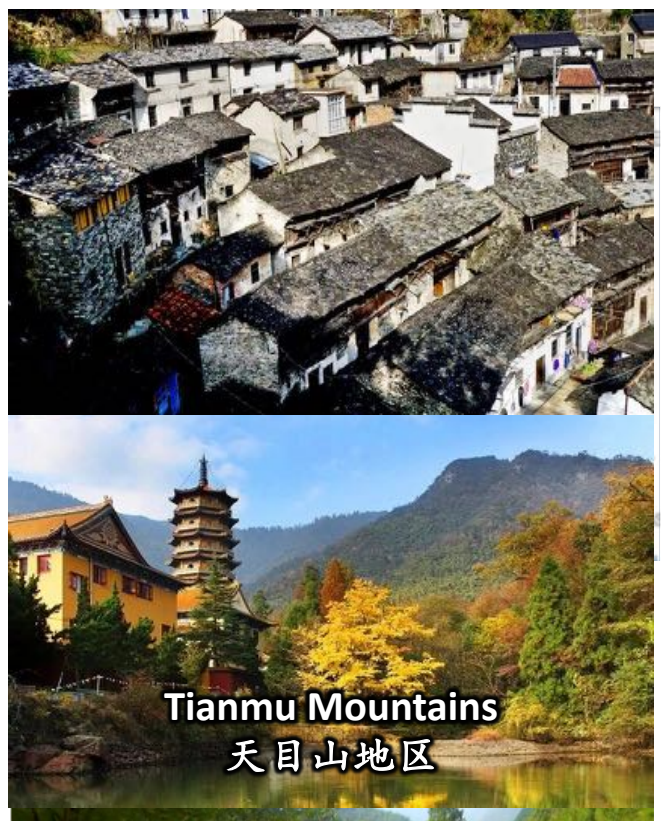


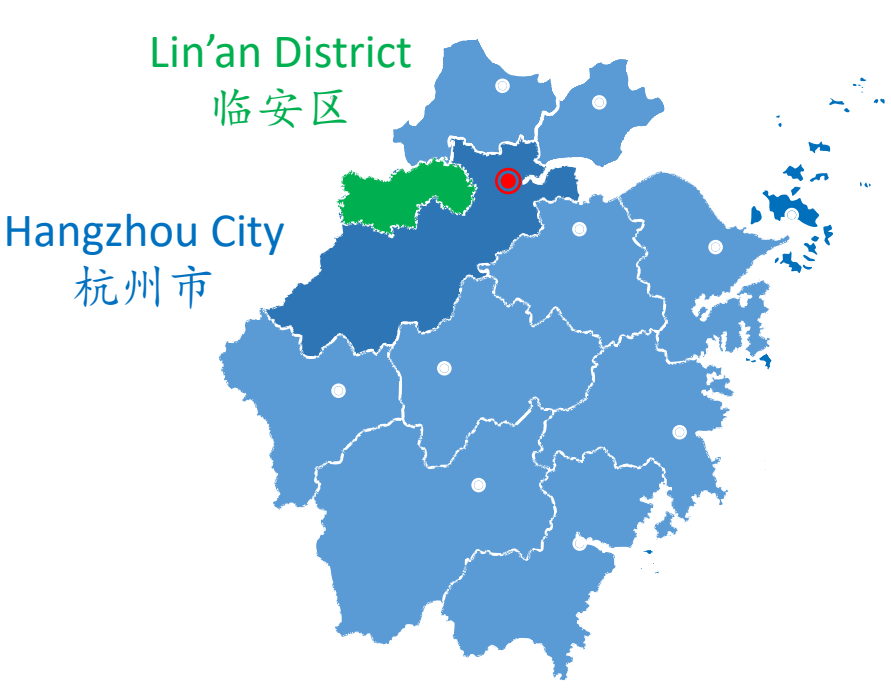
Image Source Baisha Village Administration | OSGeo China Centre | Internet
来源：白沙村政府 | OSGeo中国中心 | 网络

Sustainable Agro-Forestry Development Practices
可持续农林发展实践

INBAR

Case Region: Tianmu Mountain Range and Surrounding Areas, Yangtze River Delta, China 案例地区：中国长江三角洲天目山地区及周边地区

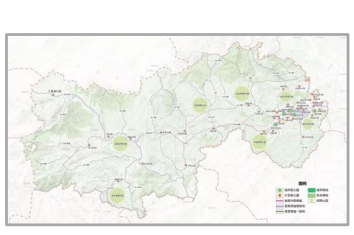
Geographic Location, Territorial Features & Related Policies 地理区位、地域特征和相关政策



Zhejiang Province
浙江省

Lin'an District scope (Tianmu Mountain central area)
临安区范围（天目山区中心地区）

Lower image source: Internet 下图来源：网络



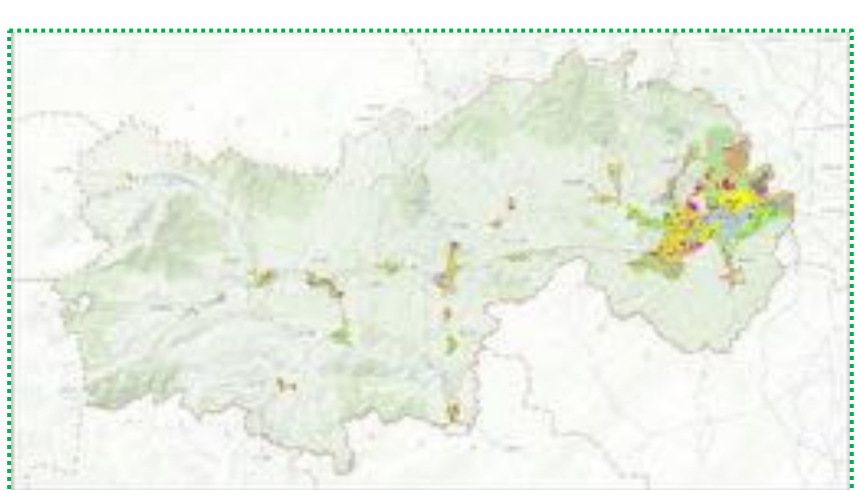


Image source: Bureau of Forestry, Agriculture & Rural Affair, Lin'an District, Hangzhou City, Zhejiang Province | Internet
图片来源：浙江省杭州市临安区农业农村局 | 网络

Integrated territorial agro-forestry management and related sectors in most rural townships. Above: Township administrative location map, planning location of forestry parks, forestry protection classification location map. 在绝大多数农村乡镇中地域复合农林管理和相关产业。上左：乡镇行政位置图、森林公园规划布局图；上右：林地保护等级分布图。

Lin'an Urban-Rural Master Plan 2018, urban and rural settlements are scattered in the mountain zone combined with nature reserves and agro-forestry management areas. 临安2018年城乡规划，城市乡村散落在生态保护和复合经营区相结合的山林中。

Laws and Regulations Related to Territorial Agro-Forestry Systems and Green Sectors
与地域农林系统和绿色产业相关的法律法规

Legislation and Regulation 法律法规	Responsible Govt Institutions 负责政府机构
《Forest Law》, other Laws & Regulations over Integrated Agro-Forestry Management 《森林法》、其他关于农林复合经营管理的法律法规	Ministry / Dept. of Agriculture & Rural Affairs / National Bureau for Forestry & Grassland 农业农村部 /厅 / 局，林业和草原局
《 Soil Pollution Control & Prevention Law》, Soil Survey (Agro) 《土壤污染防治法》，土壤普查（农业）	Ministry / Dept. of Eco Environment, Agriculture & Rural Affairs 生态环境部 /厅 / 局，农业农村部 / 局
《 Agricultural Law》,《Basic Farmland Protection Regulation》, Spatial Landuse Planning, Rural Land Circulation 《农业法》，《基本农田保护条例》，国土空间规划， 农村土地流转	Ministry / Dept. of Nature Resources, Agriculture & Rural Affairs, Water Resources 自然资源部 /厅 / 局，农业农村部 /厅局，水利部 /厅 / 局
《Water-Soil Preservation Law》, Eco Recovery Planning & Management, Sponge City Subsidy《水土保持法》生态修复规划治理，海绵城市建设补助项目	Ministry / Dept. of Water Resources, Housing & Urban-Rural Development 水利部 /厅 / 局，住建部/厅 / 局
《Water Law》《River Management Regulation》, River Master Scheme | 《Water Pollution Prevention Law》|《Taihu Basin Regulation》, Water Environmental Integral Management 《水法》《河道管理条例》河长制 | 《水污染防治法》|《太湖流域管理条例》水环境综合治理	Ministry / Dept. of Water Resources, Eco Environment, 水利部 /厅 / 局，生态环境部 /厅 / 局

Sustainable Agro-Forestry Development Practices
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Geographic Location, Territorial Features & Related Policies 地理区位、地域特征和相关政策

Soil 土壤

Five main soil types: Red, yellow, lithological, chao, paddy
五大类土壤：红壤、地方五大类土壤：黄壤、岩性土、潮土、水稻土

< 30-cm soil layers, including plant roots and rocks
土层薄（<30cm厚度）的土壤层，包括植被根系和岩石。

Mountain slopes 山体坡度：< 25° > 25°

Water 水

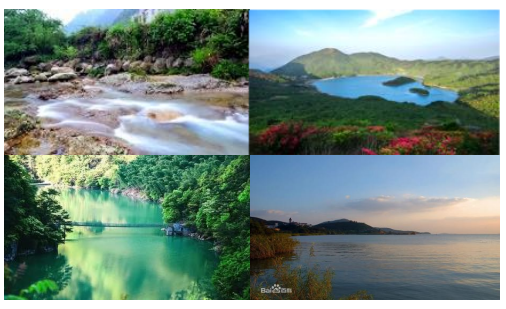


Image source: Lin'an District Government, Hangzhou City, Zhejiang Province | Baidu Encyclopedia | Internet 图片来源：浙江省杭州市临安区政府 | 百度百科 | 网络

Watershed: The water origin is located between Taihu Lake, Yangtze River and Qiantang River 流域：位于太湖-长江流域和钱塘江流域之间，为两大水系之源头之一。

Surface and underground water quality and quantity: Controlled through River Master System, Class IV-II (Lin'an District, 2020) in average. No water shortage. Extreme rainfall is increasing. 地表和地下水水质和水量：由河长制管理，平均在二-四类水之间（2020临安区）。无缺水现象。极端暴雨增加。

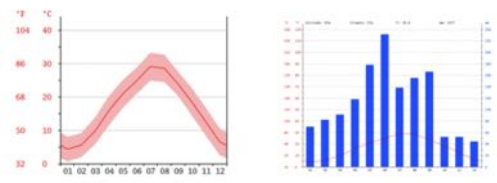
Land 土地

Image source: Internet
图片来源：网络

Topography: Ca. 70% mountain areas, ca. 25% area is flat (< 10 ° C). 地形地貌：山地约70%，平原20%左右（<10 ° C）。

Ecosystems: Terrestrial (mountain and plain), water and wetland eco systems. Tianmu Mountain area is one of the oldest subtropical forest ecosystems in the world. 生态系统：陆地（山地和平原）、水生和湿地生态系统。天目山地区是最古老的亚热带森林生态系统之一。

Climate 气候



Source: OSGeo China Centre weather network https://en.climate-data.org
来源： OSGeo中国中心，天气网络 https://en.climate-data.org

The annual average temperature of Hangzhou City, Zhejiang Province (1951-2016) has a gradual rise; monthly temperature and rainfall both peak in summer. 浙江省杭州市逐年升高的年平均气温（1951-2016），年-月气温图（左下）和气温图（中下）显示气温和降雨量均在夏季达到高峰。

The study region has humid subtropical weather in Chinese climate zones.
案例地区在中国气候分区中属于亚热带季风气候。

Image Source Baisha Village Administration
图片来源：白沙村政府

Because of the integrated agro-forestry management practices with bamboo and other trees, from 1988 to 2020, floods, landslides and forest fires have declined, notwithstanding increasing rainfall. | 1988-2020年，由于竹子与其他树种的农林复合经营，虽雨量增大，水灾、山体滑坡和森林火灾减少。

Major National and Regional Policy-Planning Measures
主要国家和地区的政策规划措施

Policy-Planning Measures 政策-规划措施	Responsible Govt Institutions 负责政府机构
Regional Water-Soil Conservation Planning 地区水土保持规划	Ministry (Bureau-Dept.) of Water Resources, Housing & Urban-Rural Development 水利和住建部（厅-局）
Rural Revitalization National Strategic Plan (2018-2022), Targeted Poverty Alleviation & Rural Development, Beautiful Village Action Plan of Zhejiang Province 乡村振兴国家战略计划（2018-2022）/精准扶贫和乡村振兴 / 浙江省美丽乡村行动计划 | Soil Testing & Tailored Fertilization Subsidy Policy 测土配方补贴政策 | Well-Facilitated Farmland Action 高标准农田建设 | Green Food Development & Eco Agricultural Services 绿色食品发展和生态农业技术服务 | Water, Soil and Air Pollution Prevention Action 水土气污染防治攻坚战	Ministry (Bureau-Dept.) of Eco Environment, Agriculture & Rural Affairs, Nature Resources, National Bureau for Forestry & Grassland, National Development & Reform Commission 生态环境部，农业农村部，自然资源部（厅-局），林业和草原局，发改委
Climate Actions, Carbon Peak & Neutral Plans, Carbon Emission Targets & Trade (policies in process) 气候行动、碳达峰和中和计划、碳减排目标和交易	Ministry (Bureau-Dept.) of Eco Environment, National Development & Reform Commission, all related ministries / institutions 生态环境部（厅-局），发改委，以及所有相关部委
Policy actions on Application of Green Tech & Finance (Green Bonds etc.), Catalogue of Green Bond supporting projects (2020 Edition, draft for comments) (policies in process) 绿色技术金融（绿色债券等）推广应用的政策行动，《绿色债券支持项目目录（2020年版，征求意见稿）（制定完善中）	Ministry (Bureau-Dept.) of Science & Technology and related ministries People's Bank of China and China Securities Regulatory Commission, bank and insurance institutions 科技部（厅-局），和相关部委，中国人民银行和证监会，银行和保险部门
Spatial-Landuse Planning on Provincial, City, District-County and Township Levels (in process) 省、市、区县和乡镇的的国土空间规划（进行中）	Ministry (Bureau-Dept.) of Natural Resources and related ministries and institutions 自然资源部（厅-局）和相关部委

Sustainable Agro-Forestry Development Practices
可持续农林发展实践

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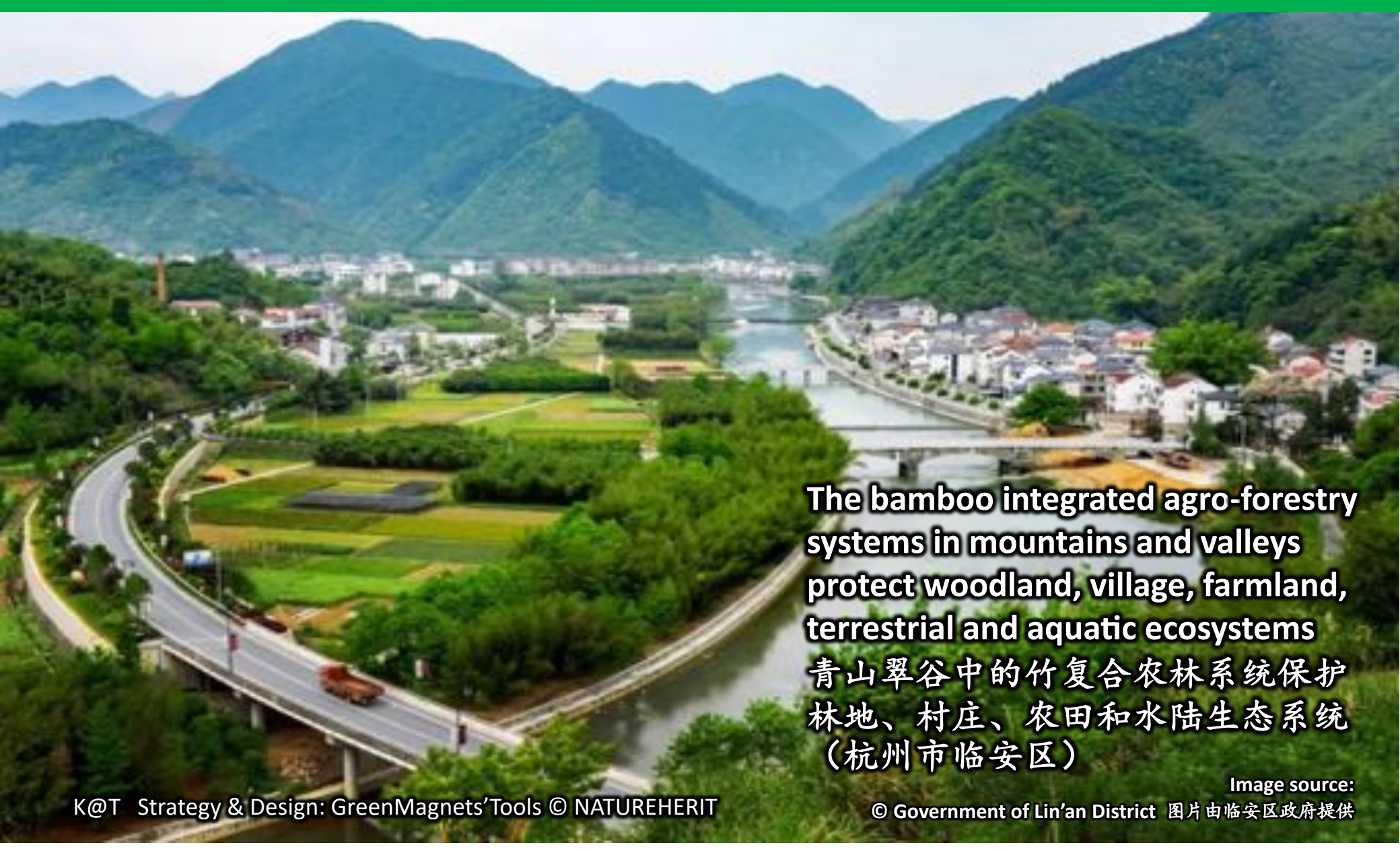
Agro-Forestry Eco System Data Panels (DP-AFES), Tianmu Mountain
农林生态系统信息纵览，天目山地区



Through bamboo integrated agro-forestry model and soil-water conservation projects on different slopes - including closed hillsides to facilitate afforestation and protect natural forests - each forestry plot strives for sustainable spatial and cultivation patterns to ensure eco protection, rural livelihood and regional safety in the mountain areas. The integrated agro-forestry model involves site-specific, multi-layered and biodiverse plantation schemes. Forest farmers manage trees, bamboo, shrubs, cover plants and intercropping agro-systems. The water-soil preservation engineering measures include reforestation, water reservoirs, irrigation and flood control systems that improve soil and water quality.

通过不同坡度的农林复合经营模式和水土保持工程，包括保护林地的封山育林措施，每块林地都力求可持续的空间利用和种植模式，以确保山区的生态保护、农村生计和地区安全。
农林复合经营模式是针对特定地块、兼顾生物多样性的立体种植方案。由林农管理包括树木、竹子、灌木、覆盖植物和农业轮作系统。水土保持工程措施包括改善土壤质量和水质的植树造林、水库、灌溉和防洪系统等。

0<75º
At mountain top
Seal and protect forests;

在山顶
封山育林保护林地；

0<75º
At mountain foot and strategic mountain sides
"Erosion-Resilient Forest Belts";

在山脚和山腰的策略地带
构筑"防护侵蚀林带"；

10<25º
At more gentle slopes (<25º)
Develop bamboo shoot, hickory nut, tea & medicinal cultivation & economy;

在缓坡低丘（<25º）
发展竹笋、山核桃、茶叶和中药材等经济作物种殖；

>25º
At steep slopes (>25º) with thin soil layers (<30cm thick)
Cultivate bamboo-hickory-torreya combined forest or bamboo forest.

土层薄（<30cm厚）的陡坡（>25º）
组团种植竹-山核桃-香榧复合林或者竹林。

Image source: Bureau of Forestry, Agriculture & Rural Affair, Lin'an District, Hangzhou City, Zhejiang Province 图片来源：浙江省杭州市临安区农业农村局

Image source: Internet
图片来源：网络

In 1980's Lin'an set up an integrated regional expert team on "multi-layered agroforestry management" to improve farmer lives and water-soil erosion control and reduction through the "Three Treasures of Lin'an" (bamboo shoot, hickory nut, tea) and other non-timber-forest products. 临安区从20世纪80年代起，组成了地区专家组，通过临安三宝（竹笋、山核桃、茶叶）等非木质林产品，建立农民生计和水土流失防治的"立体农林复合经营"。

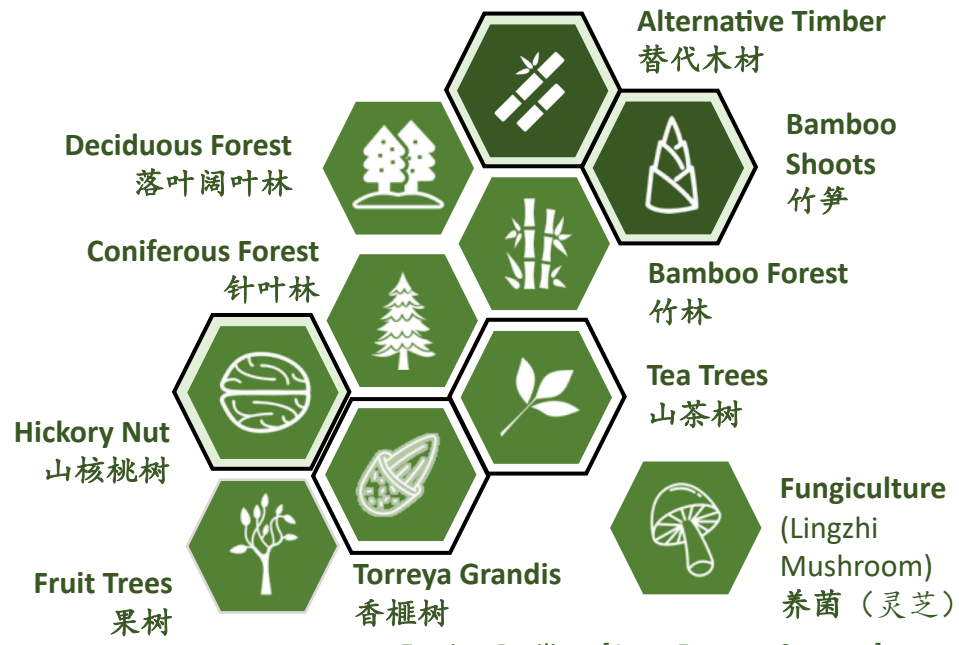
Sustainable Agro-Forestry Development Practices
可持续农林发展实践

INBAR

Case Region: Tianmu Mountain Range and Surrounding Areas, Yangtze River Delta, China 案例地区：中国长江三角洲天目山地区及周边地区

Agro-Forestry Eco System Data Panels (DP-AFES), Tianmu Mountain
农林生态系统信息纵览，天目山地区

Forests & Bamboo Forest 森林&竹林



Erosion-Resilient [Agro-Forestry Systems]

Grass Species (protected) 草本植物（受保护）

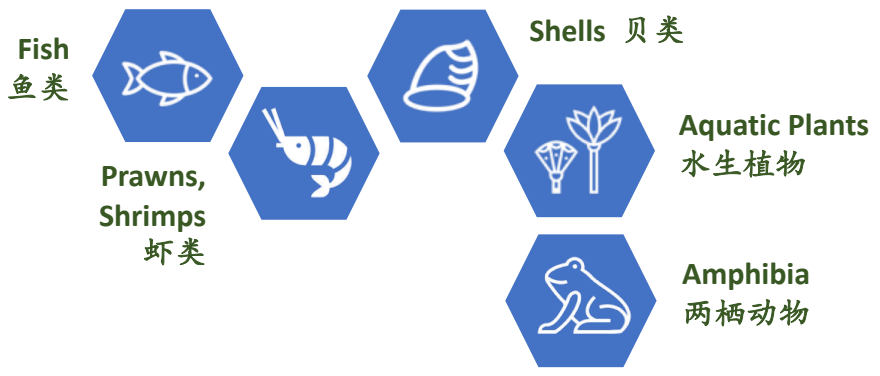
Terrestrial and Wetland Grass 陆地和湿地草生植物

Flowers 花卉

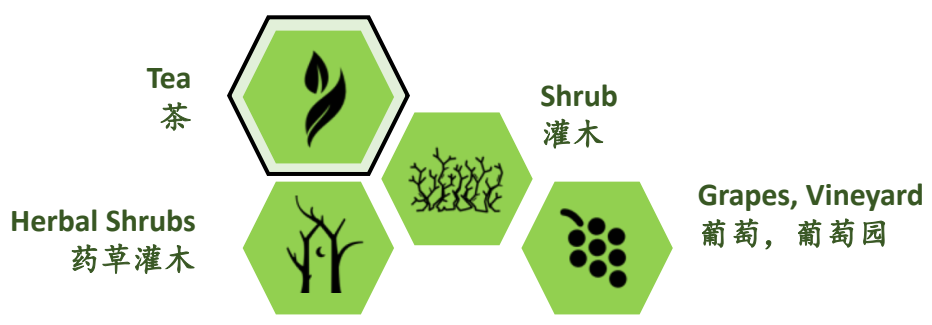
Cereal Crops [Primary cropland] 谷类 [基本农田]

Paddy Rice 水稻

Freshwater Eco Systems 淡水生态系统



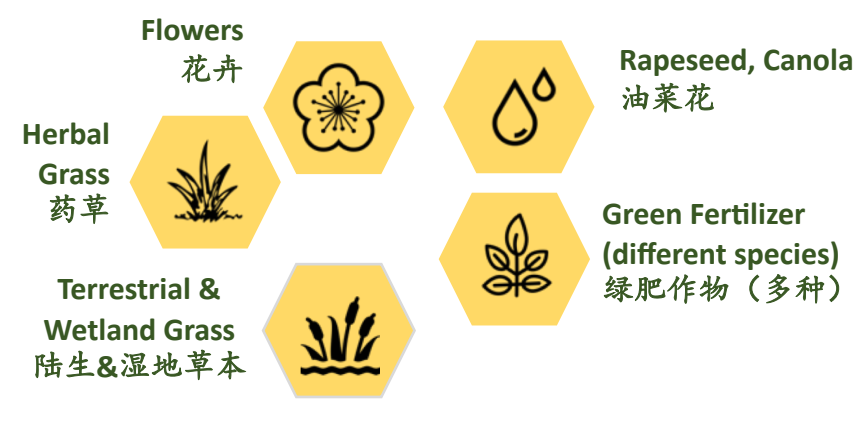
Shrubs & Fruit Shrubs 灌木&灌木类果树



Livestock, Birds, Insects 家禽、鸟类、昆虫

[Intercropping with Agro-Forestry Systems]

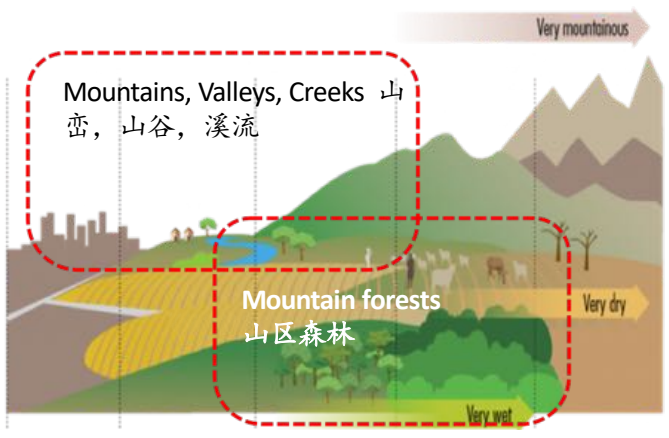
Herbs & Other Grass Crops 药草&其他草本作物

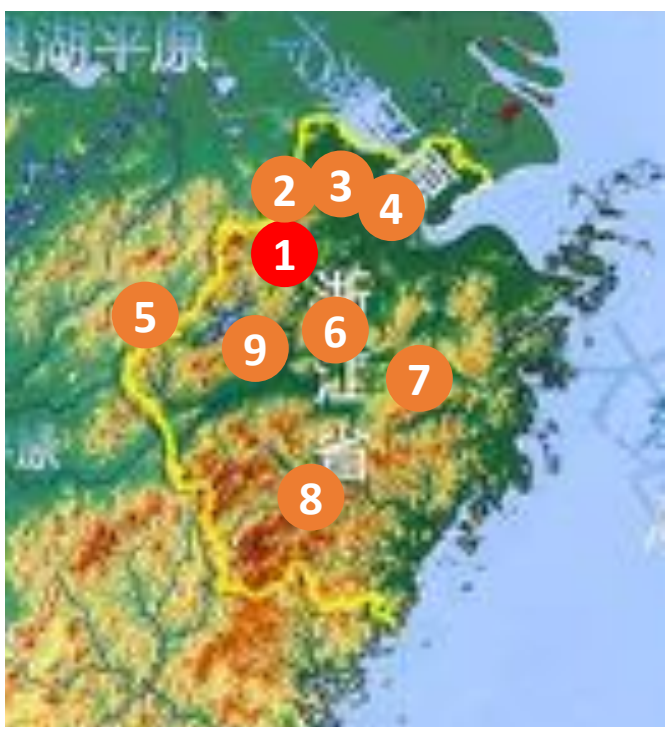


[Intercropping with Agro-Forestry Systems]

Green & Bean Vegetables 绿叶&豆类蔬菜

Geographic Location & Climate Change
地理位置与气候变化

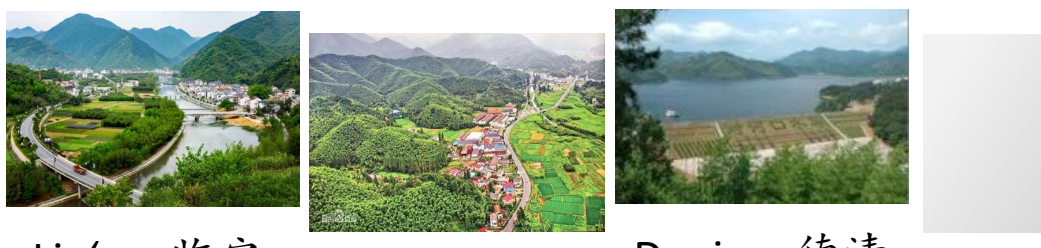




Top image source 上图来源: Hancock (2006) based on work of Dixon, Gulliver and Gibbon (2001), from Ending extreme poverty in *rural areas – Sustaining livelihoods to leave no one behind.* Rome, FAO. 2018.
Bottom image source: Internet 下图来源：网络

Lin'an District is located in the Tianmu Mountain Area between land and sea. Its geographical location is greatly affected by climate change. The protective management of agriculture, forestry and ecosystem pays attention to transformation and protection, uses nature-, technology- and green-finance-based solutions to deal with climate change and carbon neutrality and to establish a secured system backed up by the entire society, regional and international exchanges.
临安区位于海陆之间的天目山地区，区域地理位置受气候变暖的影响较大，农林和生态系统的保护性经营注重转化和保护，以自然、科技和绿色金融解决方案应对气候变化和碳中和、建立全社会的、地区国际交流的保障措施体系。

Comparable places for Bamboo Integrated Agro-Forestry in the mountain and hilly areas in Zhejiang and Anhui Provinces include the following 浙江、安徽两省的山地丘陵区竹农林复合经营可比较以下地区：
1. Lin'an 临安；2. Anji 安吉；3. Deqing 德清；4. Yuhang 余杭；5. Huangshan (Yellow Mountain) 黄山；6. Fuyang 富阳；7. Zhuji 诸暨；8. Lishui 丽水；9. Chun'an 淳安。



Lin'an 临安　Anji 安吉　Deqing 德清

Image source: Internet 图片来源：网络

Sustainable Agro-Forestry Development Practices
可持续农林发展实践

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Agro-Forestry Eco System Data Panels (DP-AFES), Tianmu Mountain
农林生态系统信息纵览，天目山地区

NTFP along Slight Slopes
缓坡地非木质农产品

Cropland and Villages in the Valley
山谷中的农地和村庄

NTFP & Protective Forest on Steep Slope
陡坡地非木质农产品和生态防护林

Mountain Slopes & Valley 山坡和山谷

Image source: Internet
图片来源：网络

Protected Eco Forest and Wetland for Water Preservation on Mountain Top 山顶生态防护林和湿地涵养水源

Mountain Top 山顶

Image source: Lin'an District Government, Hangzhou City, Zhejiang Province | Baidu Encyclopedia | Internet 图片来源：浙江省杭州市临安区政府 | 百度百科 | 网络

Eco Protective Forest, Bamboo Forest and Wetland at Mountain Foot and Lake 山脚和湖边的生态防护林、竹林和湿地

Mountain Foot 山脚

Image source: Internet
图片来源：网络

Sustainable Agro-Forestry Development Practices
可持续农林发展实践

Case Region: Tianmu Mountain Range and Surrounding Areas, Yangtze River Delta, China 案例地区：中国长江三角洲天目山地区及周边地区

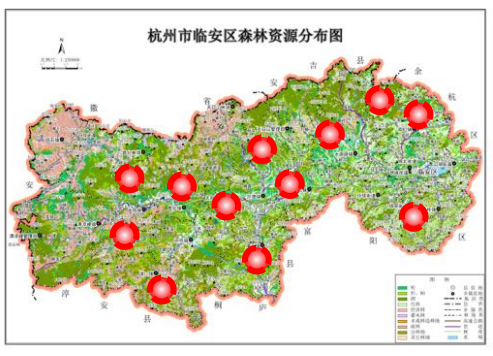
Sustainable & High-Value Bamboo Shoot Cultivation Solutions
可持续和高价值的农林实践解决方案

Bamboo Shoots
竹笋

★ Thunder Bamboo Forest Shoot Cultivation: Mulching-Rotation Cultivation Method & Technology
雷竹林竹笋种植：覆盖轮休种植方法和技术

A cultivation technology, called **bamboo mulching-rotation cultivation technology**, was discovered by a farmer in Lin'an to harvest thunder bamboo (Phyllostachys violascens) shoots in three seasons (spring, autumn and winter) instead of one (spring). With a three-year mulching and harvesting scheme, it is the secret to sustainable management of local high-quality bamboo shoots and increased farmer income. In early winter, the soil of the bamboo forest is covered for 2-3 months in multiple layers. The lower layer is made up of chopped straw, manure and soil mix. Water is added for fermentation, and then the upper layer of bamboo leaves, chaff or straw is added. The total thickness of the cover is 25-30cm.
Sustainable soil management is upgraded through this technology and formula organic fertilizer is added after soil testing. Integrated technologies from soil, fertilization and water management, shoot harvesting to pest control are summarized as a standardized production method.
雷竹笋林覆盖种植技术被一位临安的林农发现。通过该技术来生产竹笋可增加收获季节，从春季一季到春秋冬三季，采用三年二覆盖的生产模式，是实现雷竹笋林可持续经营和农民增收的秘诀之一。在初冬对竹林土层进行2-3个月的覆盖。下层以切短的稻草、厩肥等洒水覆盖发酵增温，上层以竹叶、谷壳或稻草等覆盖，总厚度25-30cm。
该技术与测土配方和有机肥配合，提升土壤可持续管理，与土耕、施肥、水分管理、竹笋采挖和病虫害防治等综合技术形成标准化生产法。

Agro-forestry map of Lin'an District, Hangzhou City, Zhejiang
浙江省杭州市临安区农林布局图



Cultivation case and map source:: Bureau of Agriculture & Rural Affair, Lin'an District; Other Image source: Zhejiang Province Forestry Technology Promotion Station, China
种植案例和地图来源：临安区农业农村局；其他图片：中国浙江省林业技术推广总站。

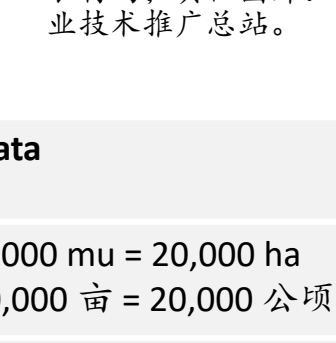
	Social-Economic Indicators for Cultivation 种植社会经济参数	Evidences & Data 依据和信息
	Location & total size 位置布局&总面积	12 towns, 300,000 mu = 20,000 ha 12 个 镇，300,000 亩 = 20,000 公顷
	Bamboo forest unit size with technical treatment 运用技术的单位竹林面积	0.4-20mu = 0.02-1.3 ha 0.4-20亩 = 0.02-1.3 ha
	Regular Labor / Seasonal Labor 常年劳力 / 季节性劳力	1-4 / 2-10
	Monitoring of crop & environment 作物和环境监测	Partially 有部分
	Bamboo shoot output per mu|ha 每亩 / 公顷竹笋产量	Ca. 3,500 | 52,500 kg 约. 3,500 / 52,500 kg
	Annual net income per mu (15 mu=1 ha) * 每亩竹笋年产值 (15 mu=1 ha)	17590-23660 RMB ~ 1,172-2,958 Euro (8:1) 17590-23660 元 ~ 1,172-2,958 欧元 (8:1)
	Food Quality Certification 食品质量认证和标准	

* The data does not represent the average annual income of farmers. (in 2020, the average annual income of farmers in Lin'an was ca. 35816 yuan = 4500 euros).
此数据不代表农民平均年收入（2020年，临安地区农民平均年收入为35816元=4500欧元）

★ Typical Initial Processing Technology for Bamboo Shoots 典型竹笋初加工技术

The typical initial processing of bamboo shoot for food includes cutting, peeling, boiling, seasoning, baking, souping and grading. The process is required to make the bamboo roots ready for packaging. 典型**竹笋食品初加工技术**包括削、剥、煮、配料、烘、汤、分级。完成这一过程是进行竹笋包装的前提。

Image source: Asian-Pacific Model Forestry Network, internet images
图片来源：亚太示范林网络；网络图片



【Lin'an Tianmu Mountain Bamboo Shoot 临安天目山雷竹笋】

Geographic Indication for Agro Products
农产品地理标志

Edible Agro-Food Qualification
食用农产品合格证

"Tianmu Shanbao" Agrifood Regional Public Brand
"天目山宝"农产品区域公共品牌

Sustainable Agro-Forestry Development Practices
可持续农林发展实践

Case Region: Tianmu Mountain Range and Surrounding Areas, Yangtze River Delta, China 案例地区：中国长江三角洲天目山地区及周边地区

Sustainable & High-Value Bamboo Shoot Cultivation Solutions
可持续和高价值的农林实践解决方案

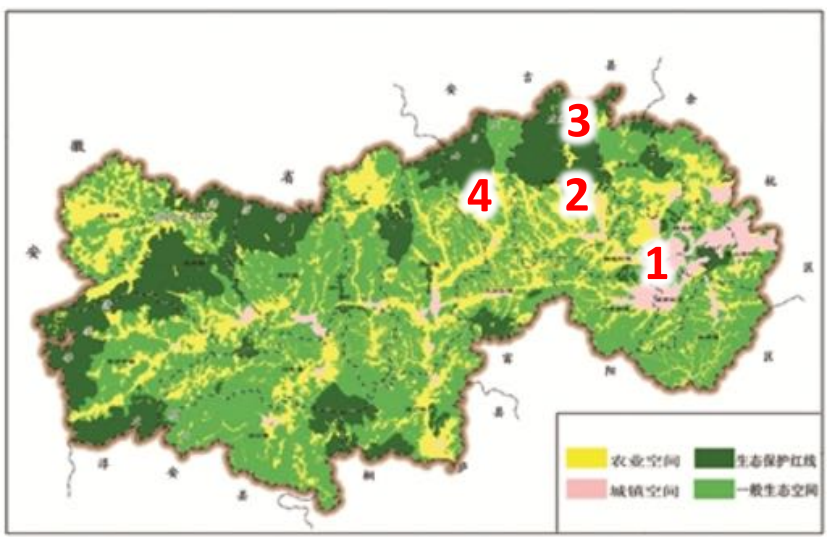


Image source: Bureau of Agriculture & Rural Affair, Lin'an District 图片来源：临安区农业农村局

★ Nature-based bamboo and woody forestry (agro-forestry system) upgrading, soil remediation upgrading practice for more bio-diversity
以自然为基础的竹林和森林（农林系统）提升实践、土壤修复案例，丰富生物多样性

Bamboo shoot and hickory tree farms are Lin'an farmers' favourite crops. However, as it happened in several towns, the cultivated forest soil degrades and acidifies. Government-led technical teams guided the adjustment of the cultivation and provided manuals for change towards better practices, such as a **mix of hickory and torreya on degraded bamboo forests, resulting in the soil health recovery with increasing organic matter and carbon storage**. Agro-forestry and climate management training-exchange could be combined with steadily developing eco leisure-tourism and relevant harvests, such as organic Tianmu Green Tea as collected wild tea.
竹笋和山核桃林场是临安林农最喜欢的选择。然而，在一些城镇，农林园的土壤发生了退化和酸化现象。由政府主导的技术团队指导了栽培调整技术，修复了相关的土壤参数，并总结了指导手册。例如**在原竹林上混种山核桃和香榧，增加有机质和固碳能力，恢复土壤健康**。农林和气候管理培训交流可与稳步发展的生态休闲旅游共赢，结合其他山林产品，如天然采摘的有机天目绿茶。

Combinable with a climate-carbon education and eco tourism route as below:
可结合如下气候碳教育和生态旅游路线

1	Lin'an City Centre 临安市区	Visit & exchange 游览和交流
2	Baisha Village etc, Taihuyuan Town 白沙村等，太湖源镇	Visit / participate in cultivation work 参观参与种植劳动
3	Organic Tea Site in Dongkeng Village 东坑村有机茶基地	Visit site 参观基地
4	Tianmu Mountain Nature Reserve, UNESCO-MAB Program site. 天目山自然保护区，联合国教科文组织人与生物圈计划保护地	Visit protected mountain top (Tianchi), admin. authority, protection station. 参观保护区天池山顶、管理局、保护站。

Image source: Bureau of Agriculture & Rural Affair, Lin'an District, Asian-Pacific Model Forestry Network, internet images
图片来源：临安区农业农村局，亚太示范林网络；网络图片

Asia-Pacific Model Forestry & Lin'an Agro-Forestry Practice Experience & Technology Exchange, Application, Transfer & Broadcasting
亚太示范林和临安地区农林实践经验和技术交流、应用、转换和传播

Chart analysis made by NATUREHERIT according to various info; 分析图由自然颖源汇聚多方信息完成 | Base Map Source 背景地图来源：www.freeworldmaps.net

Since 1992,.UN officials and technical researchers from various continents and 70 countries have visited Lin'an and surrounding regions to learn about the local agroforestry system. 1992年起，联合国官员、各大洲和大约70个国家的技术研究人员访问了临安及其周边地区，学习农林学。

- Asia-Pacific Model Forests -- Proximate Scope of Hilly Agroforestry in South China 亚太示范林--中国南方丘陵的农林实践的大致地区
- Model Forest Mountain Regions and their surrounding areas: 1. Lin'an, with Anji, Deqing, Lishui and Zhuji; 2. Qingyang, with Jing, Jingde, Tongling and Huangshan Mountain Area
  示范林山区和它们的周围区域：1. 浙江临安和安吉、德清、丽水、诸暨等；2. 安徽青阳，还包括泾县、旌德、铜陵和黄山地区等。
- From Lin'an: Bamboo & Edible Forestry Peer Learning Exchanges in Sichuan, Shanxi, Guangxi, Hainan and Chongqing. 从临安：竹林与可食林结对学习交流，在四川、陕西、广西、海南、重庆等地。
- From Lin'an: An entrepreneur-driven rural technical service with soil tests and tailored bio-organic fertilizer formula in multiple southern regions. 从临安：企业主导的测土配方生物有机肥乡村技术服务，在南方多地。
- Extended Yangtze River Delta (cities: Hangzhou, Huzhou, Shanghai, Suzhou, Wuxi, Nanjing & Huangshan etc.
  长江三角洲和扩大地区（城市包括杭州，湖州、上海、苏州、无锡、南京和黄山等）。

Sustainable Agro-Forestry Development Practices
可持续农林发展实践

发展容量评估 Development Capacity Evaluation [DCE]

发展容量评估（DCE）是可自我改进的可持续发展评估和报告体系，可包容多项标准和系统，如绿色债券原则等。作为地域知识课堂的一部分，为各级政府部门和相关各方**提供紧凑的信息和行动基础，参与绿色转型具体计划，包括以自然为基础的地区发展、行业和服务。DCE评估和报告系统可用于研究和评估一个地区、产业或项目的发展容量，报告和披露多种可持续项目的投资管理和绿色金融机制**，如生态系统修复、空间和产业的综合绿色转型、环境气候和碳中和行动等。**从当地条件和管理水平的七个基本面出发，DCE报告系统包括主要结论、更详细的依据、指标和数据，以及量身定做的技术依据分析。**根据目标读者的背景情况，DCE可从主体简述拓展到更详细的技术评估，并支持多语种的报告和设计。

为了人员、企业、技术和资金在本地区和跨地区高效和愉悦地进行合作，DCE的评估验证可委托第三方机构进行，也可通过多方参与（结合能力建设活动）完成有依据的评估结果，建议由中立的专业机构全程参与、终审和发布。
以下举例说明一个地区竹产业发展容量评估的主要结论：

○ 地区竹产业发展容量评估（DCE）--主要结论

Lin'an District, Hangzhou City, Zhejiang Province, Yangtze River Delta, China
中国长江三角洲浙江省杭州市临安区

Current Local Conditions 当地现状条件

☆ Environmental-Geographic Conditions 地理环境条件

EG

Integrated in natural and cultivated forests, parks and gardens, bamboo prevents soil erosion and land degradation. Various bamboo growth models are integrated in agro-forestry management, building materials, bamboo products and food etc. 竹子与自然环境、人工林、公园和花园等融为一体，防治水土流失和土地退化。在农林经营、建材、竹制品、食品等领域发展了多种竹类复合生长模式。

☆ Socio-Cultural Conditions 社会文化条件

SC

Bamboo has a long cultivation, utilization and cultural history in different fields between cultivation and industrialization. Public awareness and involvement of multi-actors exist in wide social-economic activities, education and regional practices. 竹子在栽培和工业化的不同领域有着悠久的栽培、利用和文化历史。在广泛的社会经济、教育和地区实践活动中有公众意识和多方行动者的参与。

☆ Economic-Infrastructural Conditions 经济设施条件

EI

Conditions like transport, human resources, technology providers, market access are fulfilled for sustainable exploitation of bamboo resources. Further growth of bamboo related cultivation and industries can increase profitable livelihood for all involved. 可持续利用竹资源的交通、人力资源、技术供应商、市场渠道等条件已满足。与竹子相关的种植和工业增长可为所有相关者提供更高收益的生计。

Operational-Management Levels 操作管理水平

☆ Spatial Policy Measures 空间政策措施

S

Spatial planning policy and practices need upgrading to guide bamboo related territorial development, tighten relation to Primary Farmland, incl. agroforestry farms, forest parks & public-private gardens with multiple functions of bamboo. 空间规划政策实践需要提升与竹子相关的地域发展，并加强其与基本农田的关系，包括具有竹子多种功能的经营性复合农林农场、森林公园和公私园林。

☆ Territorial Solutions & Skills 地域解决方案和技能

T

The region inherits holistic knowledge on bamboo forest management and industrial development with a wide products. A few national and international standards are set up. Cross communication can be further strengthened. 地区具有建立在广泛产品上的，关于竹林经营和产业发展的全面知识。一些国家和国际标准已或正在建立。多方位交流需进一步加强。

☆ Investment-Financial Tools 投资金融工具

I

Investment-financial tools for green-climate investment & management need to be established holistically. Market info systems are available while need to be strengthened and improved. Carbon trade with bamboo-related forest to be refined. 绿色-气候投资与管理的投资金融工具需全面建立。现有市场信息系统需加强和改进，与竹相关的碳交易机制需深化。

☆ Green-Tech Value Chains 绿色科技价值链

G

Transfer platforms and consulting mechanism for agroforestry cultivation and industrial technologies are available in local regions. Integration with territorial solutions, skill management and investment-finance need to be strengthened in international and domestic context. 本地有农林种植和产业技术的转让平台和咨询机制有待加强，与地域解决方案、技能管理和国际国内的投资金融平台充分结合。

Sustainable Agro-Forestry Development Practices
可持续农林发展实践

Development Capacity Evaluation [DCE]

Development Capacity Evaluation (DCE) is a self-improvement evaluation and reporting mechanism for development that can include different standards and systems, such as Green Bond Principles. As part of Knowledge@Terra Classrooms, DCE **provides a compact info and action basis** for different government departments, levels and stakeholders to participate in **green transition plans for nature-based sectors, industries and services**.

DCE can be used to research and assess the development capacity of a region, a sector or a project, and to report and inform management, investment and green financial mechanisms of sustainable projects, such as ecosystem restoration, integrated green transition of sectors and spatial-land-use, environmental-climate carbon neutral actions etc. **Based on seven primary aspects of local conditions and management levels, the DCE report system includes major findings, more detailed evidences, indicators and data and customized technical evidence analysis.** According to the background of the targeted readers, DCE is expandable from brief summaries to more detailed technical evaluations, supporting multi-lingual reporting and designs.

To ensure efficient and agreeable processes for cooperation between people, business, technology and capital within and across regions, the evaluation verification can be done by a third party, or through a participatory process (combining capacity building activities) to achieve evidence-based evaluation results. A neutral and professional organisation is suggested for participating in the process, finalizing and releasing the results.

As an example, below are the major findings of DCE regarding the **bamboo sectoral development of a region**:

○ DCE for Regional Bamboo Sectors - Major Findings

Lin'an District, Hangzhou City, Zhejiang Province, Yangtze River Delta, China
中国长江三角洲浙江省杭州市临安区

Current Local Conditions 当地现状条件

☆ Environmental-Geographic Conditions 地理环境条件

EG

Integrated in natural and cultivated forests, parks and gardens, bamboo prevents soil erosion and land degradation. Various bamboo growth models are integrated in agro-forestry management, building materials, bamboo products and food etc. 竹子与自然环境、人工林、公园和花园等融为一体，防治水土流失和土地退化。在农林经营、建材、竹制品、食品等领域发展了多种竹类复合生长模式。

☆ Socio-Cultural Conditions 社会文化条件

SC

Bamboo has a long cultivation, utilization and cultural history in different fields from cultivation to industrialization. Public awareness and involvement of multi-actors occurs in a wide range of socio-economic activities, education and regional practices. 竹子在栽培和工业化的不同领域有着悠久的栽培、利用和文化历史。在广泛的社会经济、教育和地区实践活动中有公众意识和多方行动者的参与。

☆ Economic-Infrastructural Conditions 经济设施条件

EI

Conditions like transport, human resources, technology providers and market access are fulfilled for sustainable exploitation of bamboo resources. Further growth of bamboo-related cultivation and industries can increase the profitable livelihood for all involved. 可持续利用竹资源的交通、人力资源、技术供应商、市场渠道等条件已满足。与竹相关的种植和产业增长可为所有相关者增加生计收益。

Operational-Management Levels 操作管理水平

☆ Spatial Policy Measures 空间政策措施

S

Spatial planning policy and practices need upgrading to guide bamboo-related territorial development and tighten the relation to primary farmlands, including agroforestry farms, forest parks and public-private gardens with multiple functions of bamboo. 空间规划政策实践需要提升与竹子相关的地域发展，加强其与基本农田的关系，包括具有竹子多种功能的经营性复合农林农场、森林公园和公私园林。

☆ Territorial Solutions & Skills 地域解决方案和技能

T

The region inherits holistic knowledge on bamboo forest management and industrial development with a wide range of products. A few national and international standards are set up. Cross communication can be further strengthened. 地区具有建立在广泛产品上的，关于竹林经营和产业发展的全面知识。一些国家和国际标准已或正在建立。多方位交流需进一步加强。

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