中国生态农业的发展
The Development of Agroecology in China

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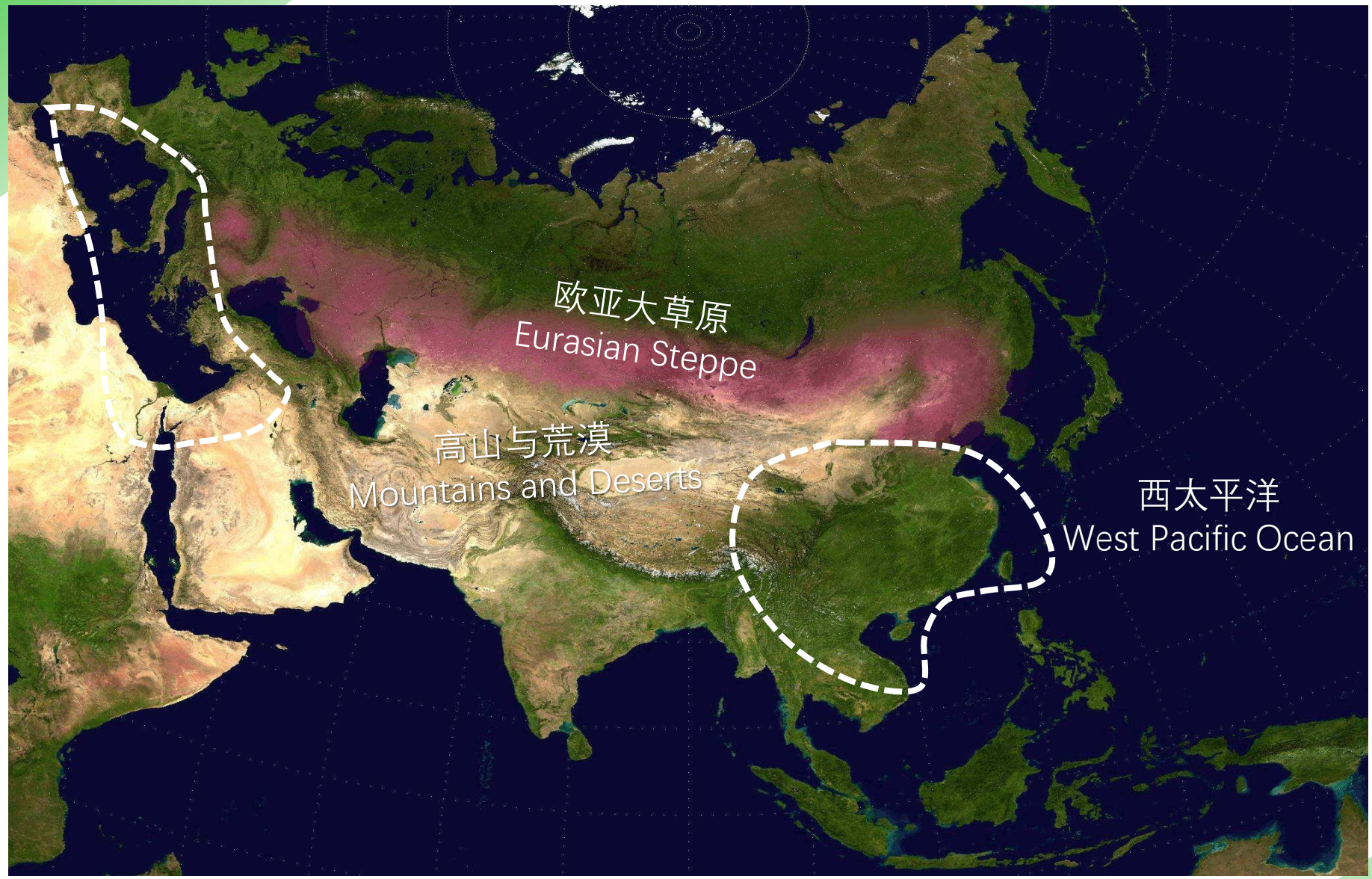
1.中国传统农业的生态萌芽
Agroecology Practices appeared in traditional stage (from about 5000 years' ago')

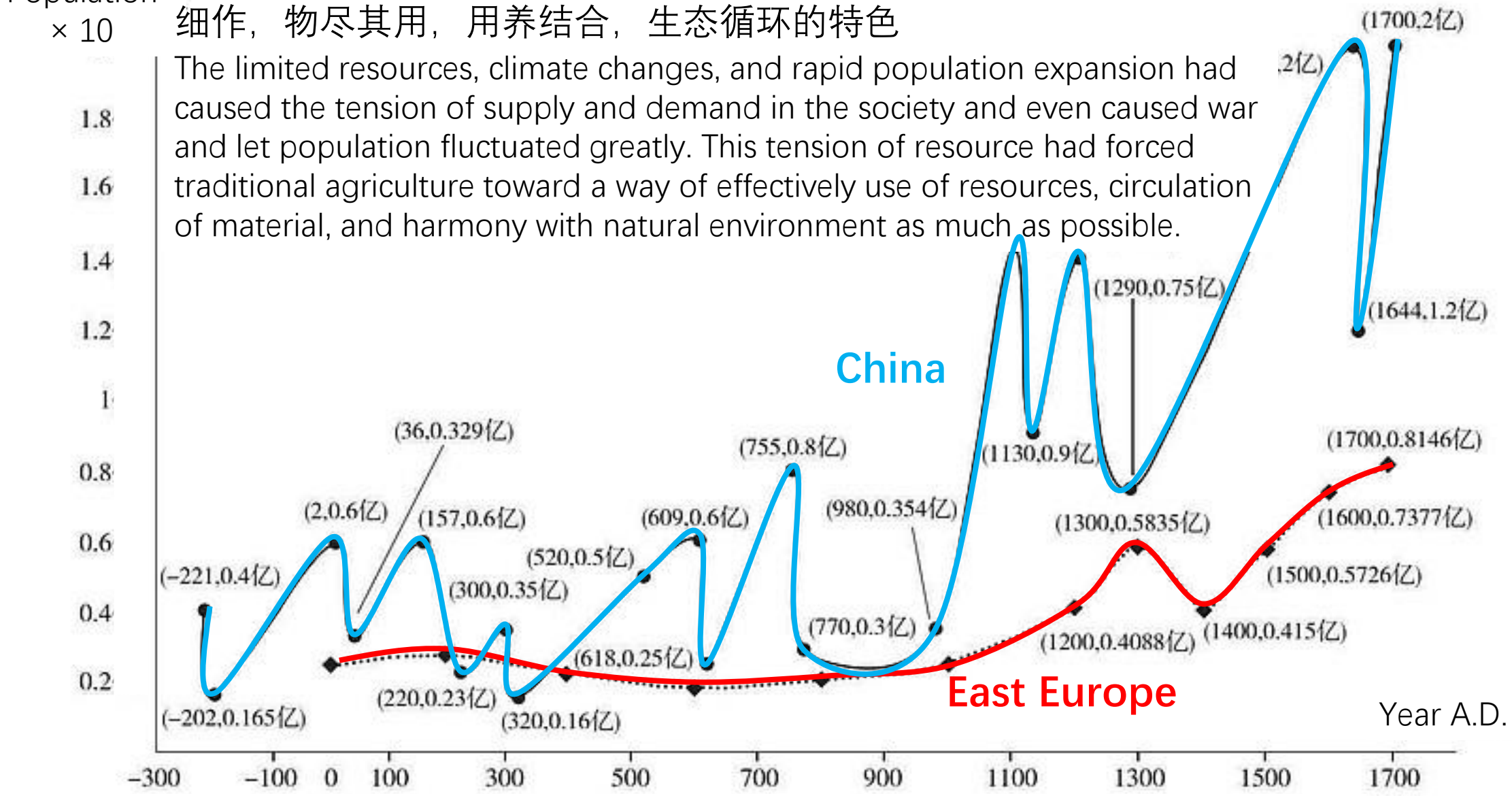


欧亚大陆东西两端的历史发展有很大差异，东方是乡村聚居的精耕细作农耕传统，西方是游牧、商业和海洋依赖性很强的文化传统

The traditional village farming as the majority in the east and nomadism, commerce, and sea dependence in the west nurtured different cultural tradition between east and west of Eurasia.

历史上中国社会发展一直受到资源有限、气候波动、人口剧增造成的供求矛盾，因而也造成社会震荡，迫使农业逐步形成了一条精耕细作，物尽其用，用养结合，生态循环的特色

The limited resources, climate changes, and rapid population expansion had caused the tension of supply and demand in the society and even caused war and let population fluctuated greatly. This tension of resource had forced traditional agriculture toward a way of effectively use of resources, circulation of material, and harmony with natural environment as much as possible.

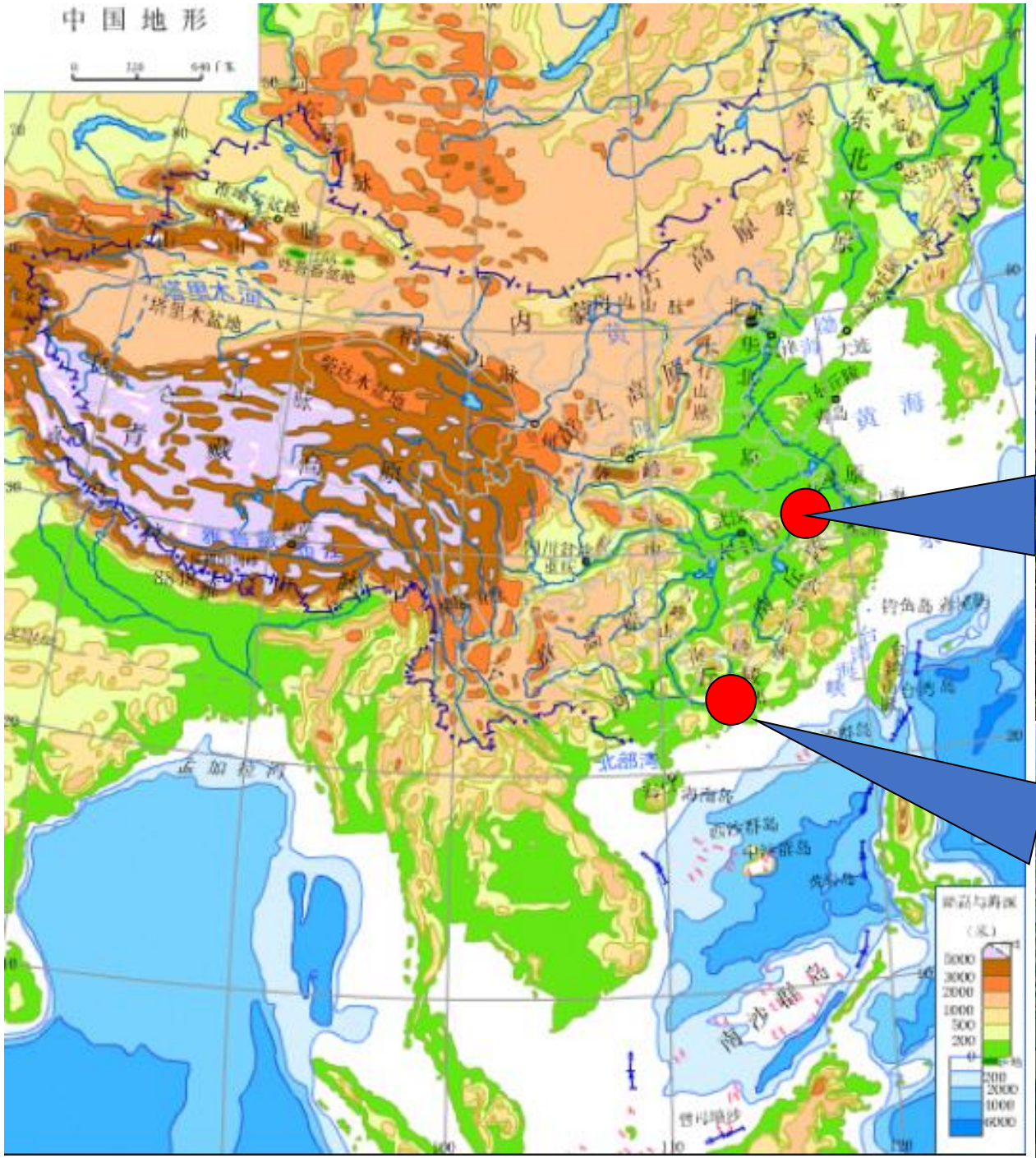


中国传统农业中的生态智慧

The eco-wisdom in traditional Chinese agriculture

例1：传统基塘系统

EXP 1. Traditional Dike - Pond System



浙江湖州桑基鱼塘系统有2500年历史

珠三角基塘系统也有600年历史

The history of dike-pond system in Huzhou, Zhejiang Province has a history of 2,500 yr. The dike-pond system in South China has a history of 600 yr.

基塘系统的景观布局-充分利用江河下游地下水位高的冲击平原

Landscape arrangement of dike-pond system within the lower reaches of the major rivers.
It changed the high-water table wetland into a highly productive food production region.

基塘系统实施的循环体系

Circulation system of the mulberry dike – fishpond system

桑基 mulberry dike

蚕 silkworm

蚕沙 silkworm waste

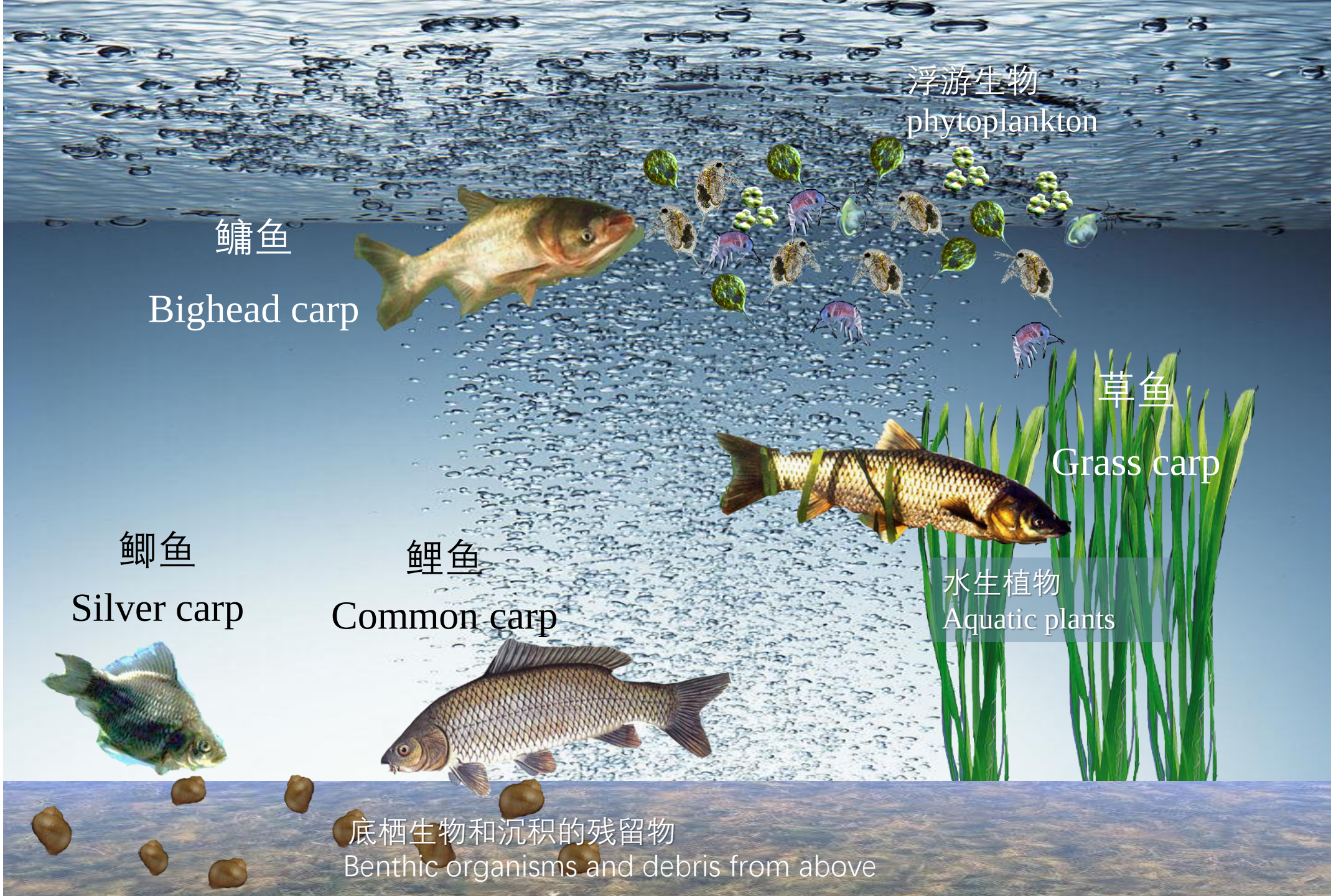
NPK

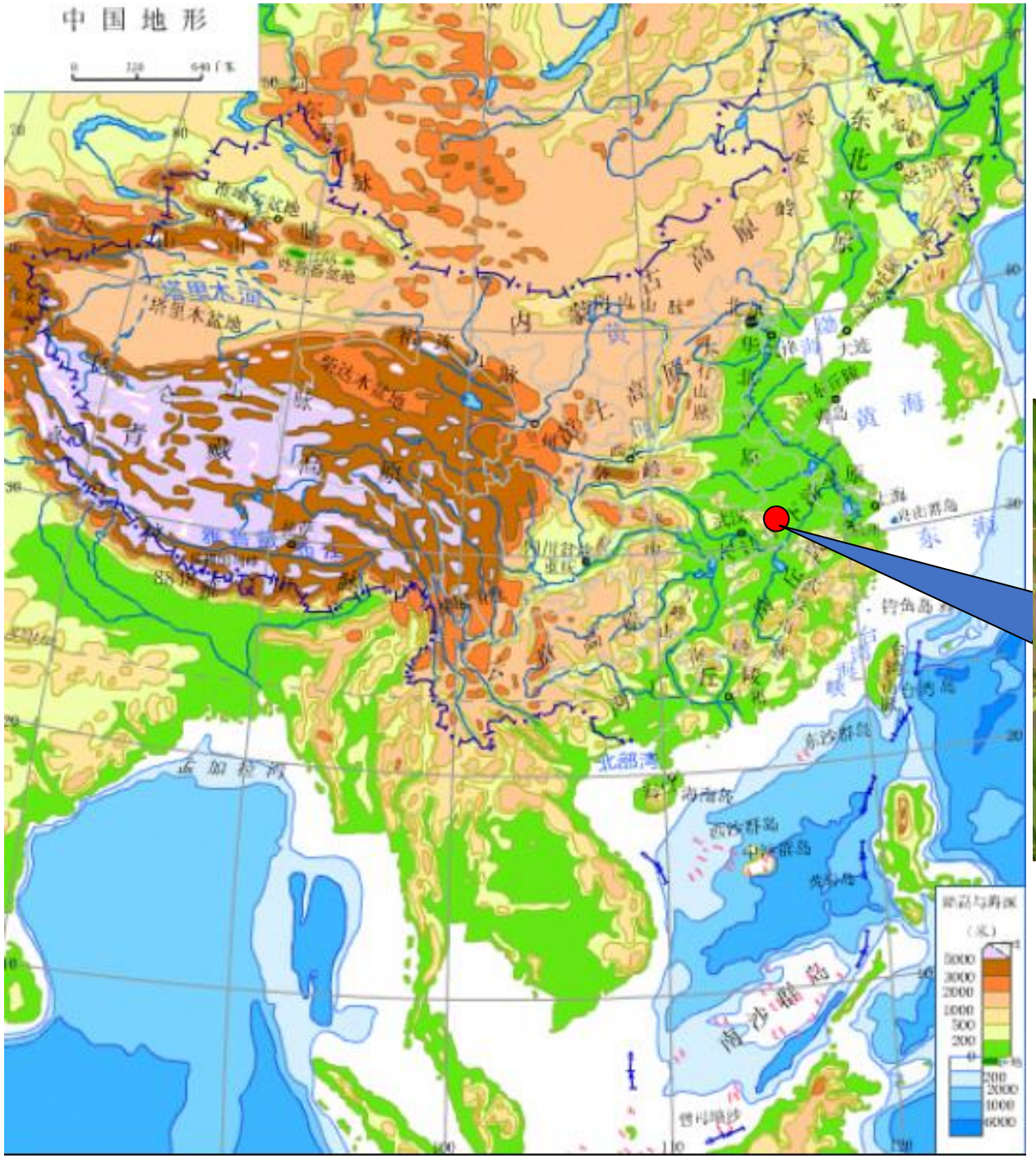
上塘泥 returning pond-mud to dike

挖塘泥 raising pond mud

基塘系统的
生物多样性

Biodiversity
in fishpond





中国传统农业中的生态智慧

The eco-wisdom in traditional Chinese agriculture

例2：浙江青田稻田养鱼

EXP 2. Rice-Fish co-culture system

大约1200年历史

with history
about 1200 years

Food and Agriculture Organization of the United Nations

Globally Important AGRICULTURAL HERITAGE Systems

GIAHS
Globally Important Agricultural Heritage Systems

森林 Forestry

水 water

村落 Village

水 water

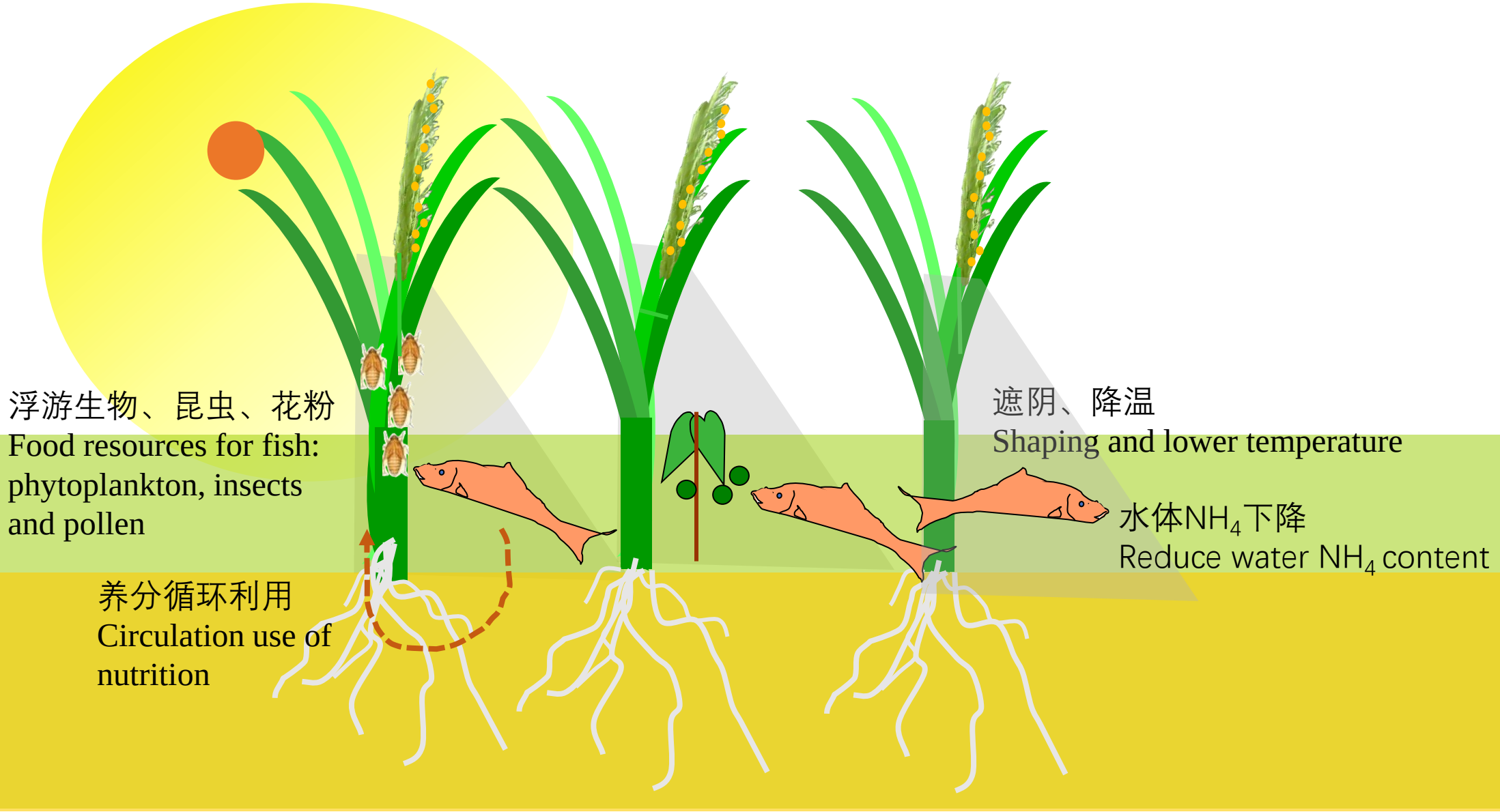
梯田 Terrace

景观布局对于稳定而清洁的水源至关重要

Landscape arrangement is essential for stable and clean water resource.

田鱼的基因、表型和食性都呈现出多样性

Biodiversity
in paddy fish



Mutual benefits between rice and fish

水稻与田鱼的多重互惠关系

—来自浙江大学陈欣团队研究结果

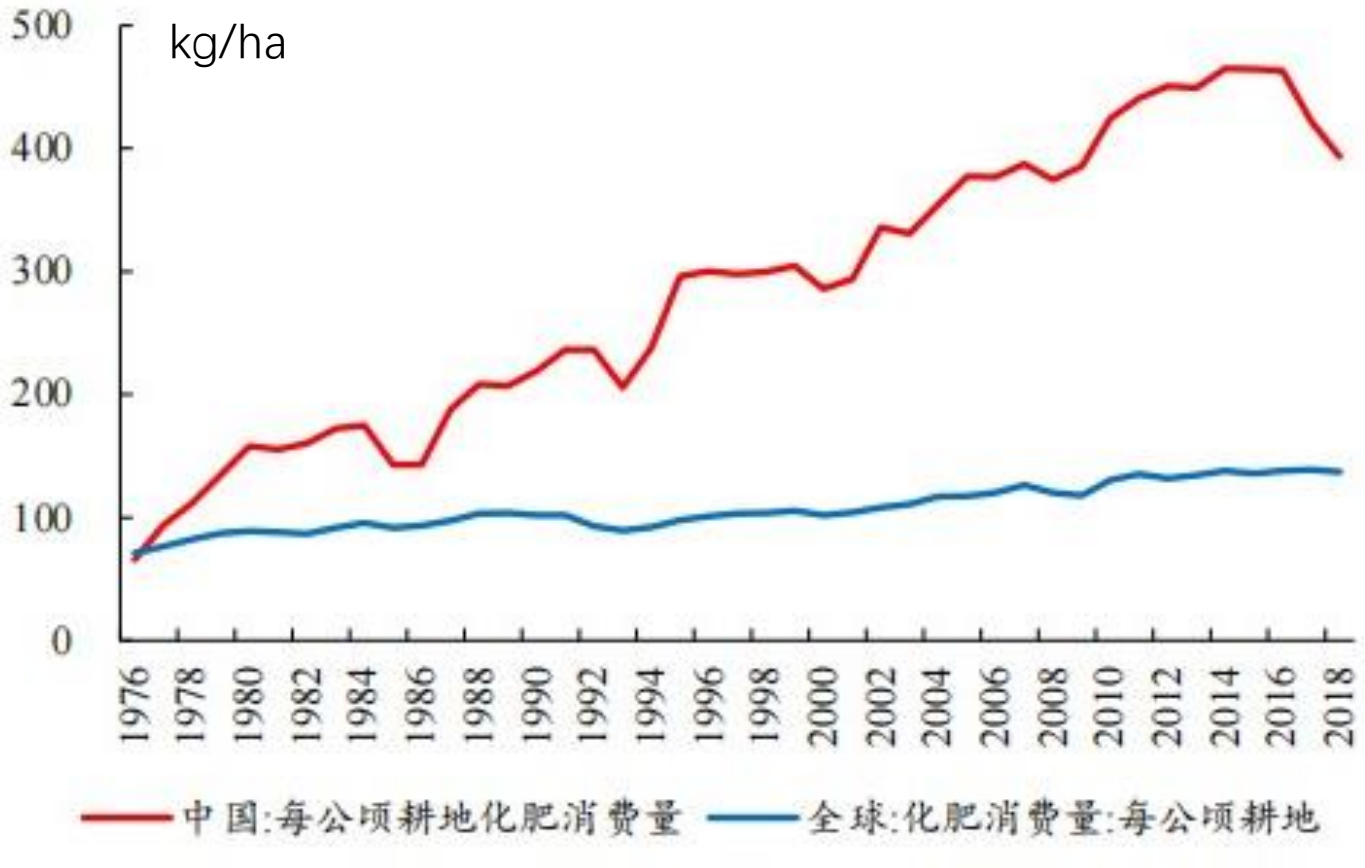
FAO从2005年启动，到2021年为止全球重要农业文化遗产65个，中国18项，亚州44个，其余非洲10个，南美3个，中美洲1个，欧洲7个

There are 65 Globally Important Agricultural Systems recognized by FAO so far. There are 44 (67.7%) within Asia and 18 (27.7%) within China.

2. 寻求农业工业化阶段
Stage to make effort for Agriculture Industrialization (1949-1979)

农业现代化= 良种化+化学化+机械化+电气化+水利化

Agricultural modernization
= seed improvement + chemicalization + mechanization + electrification + irrigation



中国单位面积化肥使用量

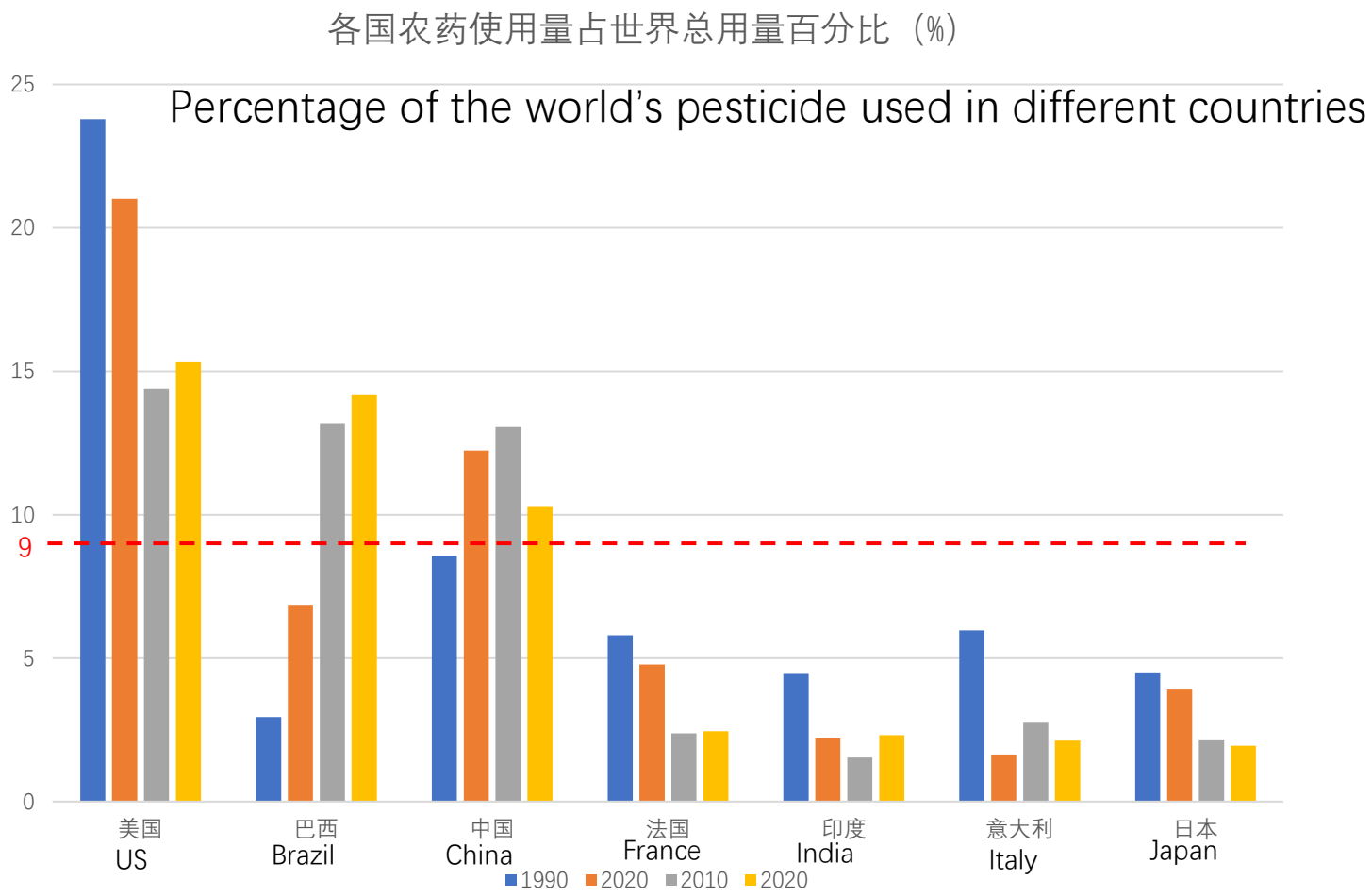
从1980s开始就一直远超世界平均使用水平

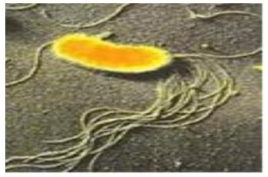
不仅造成水土环境污染还增加了温室气体排放

Chemical fertilizer use in China (red line) comparing with the world average (blue line)

2007年太湖蓝藻爆发，污染源中一半以上来自农业

Algae bloom in Taihu Lake in 2007. More than half of the nutrition input came from agricultural sector.



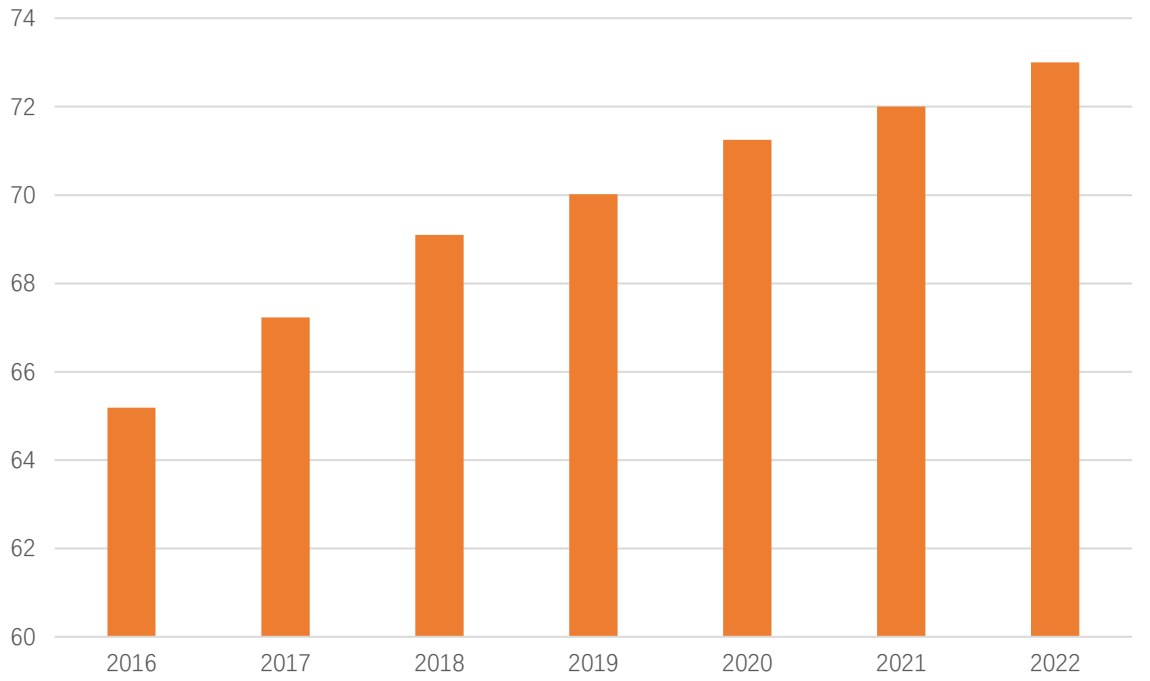


中国耕地占世界大约9%，但是农药使用量在2010年一度占世界的13.06%，不仅引起田间生物多样性减少，而且直接危害到食品安全

There are only about 9% of the world's farmland in China, but more than 13% of the world's pesticide was used in China in 2010.

Amount of Agricultural Machinery ($\times 10^8$)

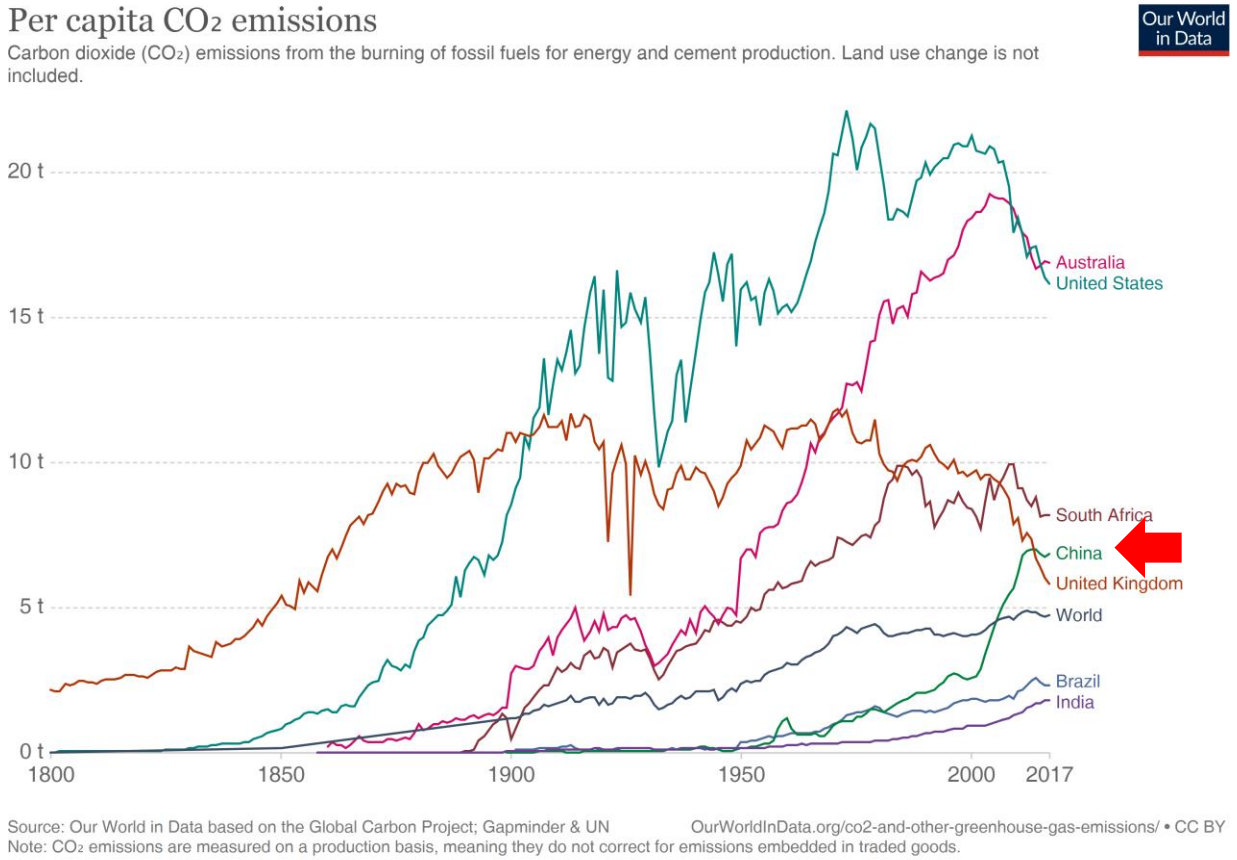
Mechanization rate of crop production in China

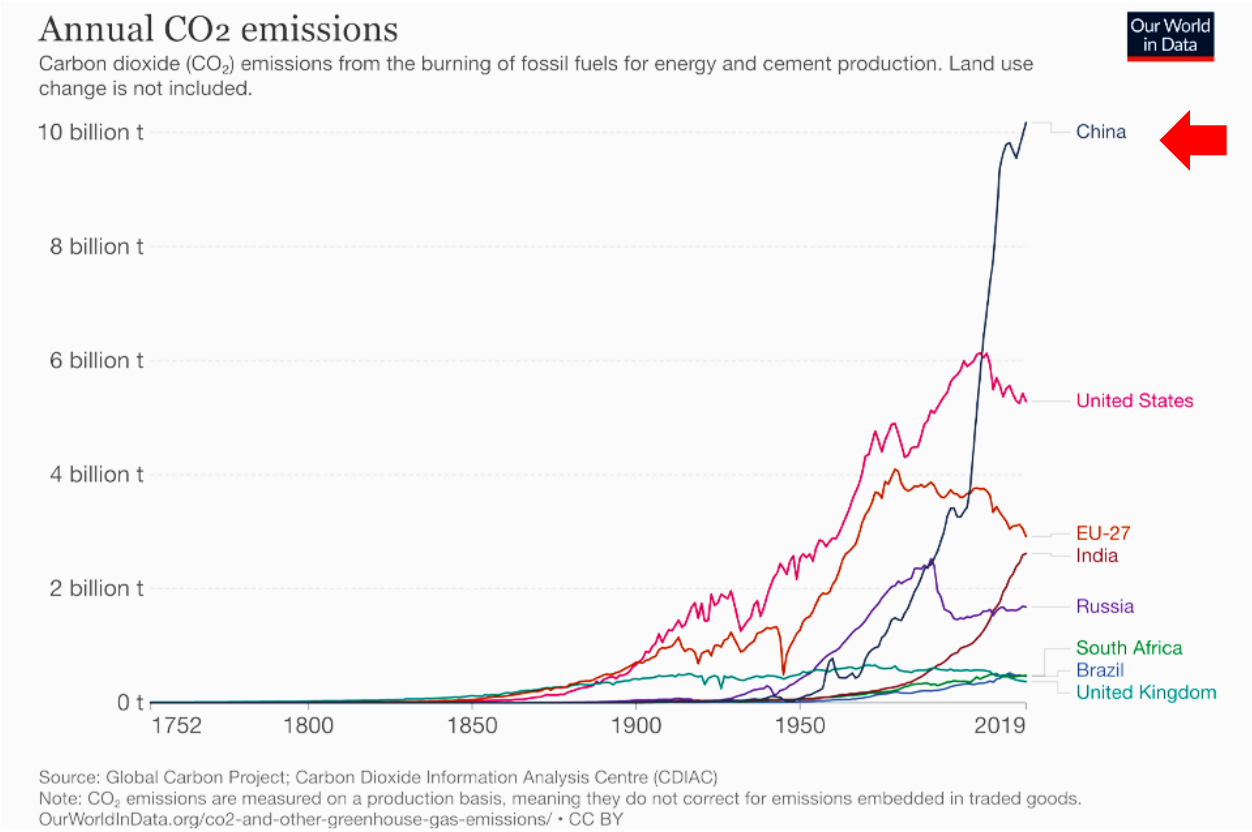


温室气体排放

中国人均排放低于好几个国家，历史累积排放低于世界平均，然而目前年度排放居世界第一。

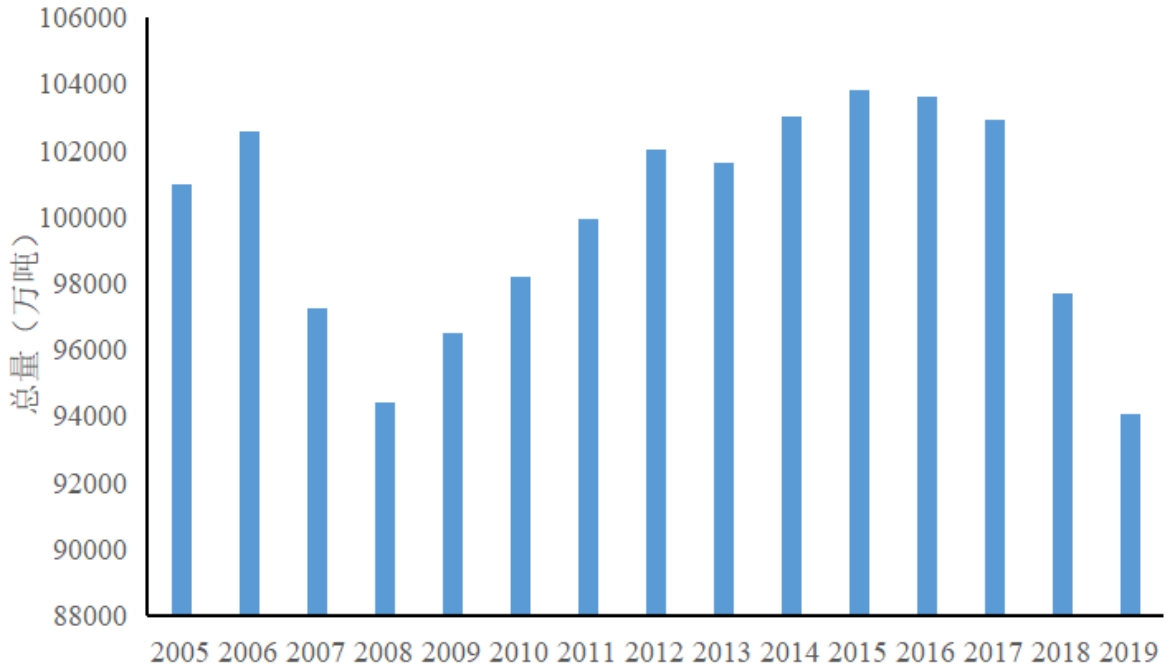
Although per capita emission and total historical emission in China is still less than some countries, the annual emission in recent years in China is the highest in the world.





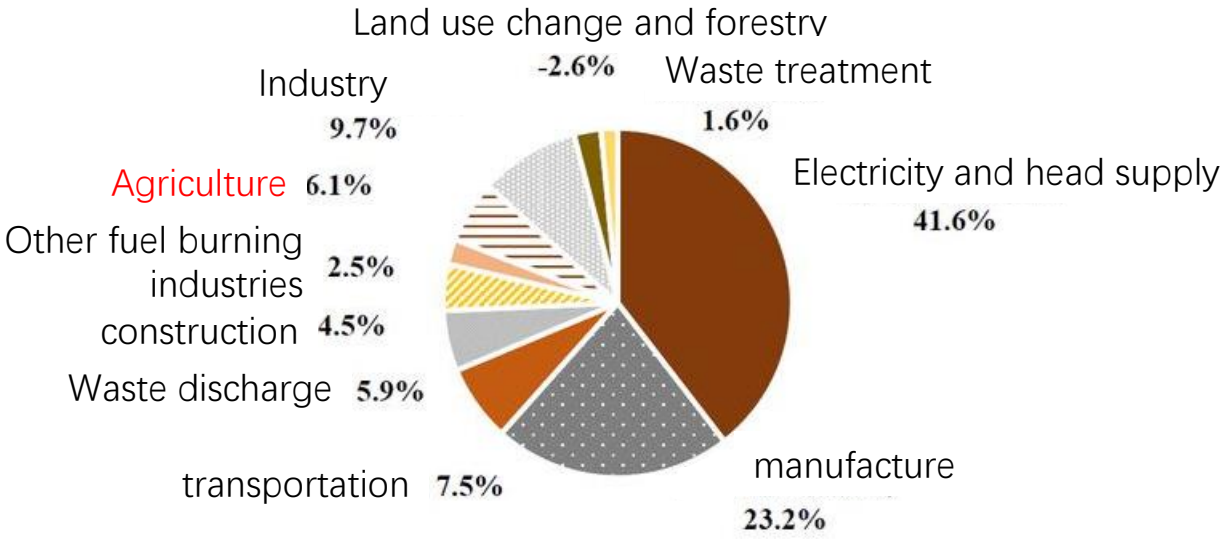
农业碳排放不可忽视

The amount of carbon emission directly from agriculture (6-7%) shouldn't be neglected



我国农业碳排放年度变化（数据来自田云、尹忞昊）

Agriculture carbon emission amount ($\times 10^5$ ton)



Carbon emission sources in China (2017)

中国农业温室气体排放来源

The sources of greenhouse gas emitted from agriculture in China

当前我国农业温室气体排放以“非二氧化碳”为主，甲烷、氧化亚氮两类温室气体排放占比超过70%；在农业源总排放中，种植业占58.4%（稻田产甲烷22.6%、氮肥产氧化亚氮34.7%和田间焚烧1.1%），养殖业占比41.6%（动物肠道产甲烷24.9%和粪便排放16.7%）。由于农业机械化的发展，碳排放来源从种植业、养殖业各占“半壁江山”逐步发展为种植业、养殖业、能源消耗“三分天下”。截至2018年，能源消耗带来的碳排放占比已达到农业碳排放的27.18%。

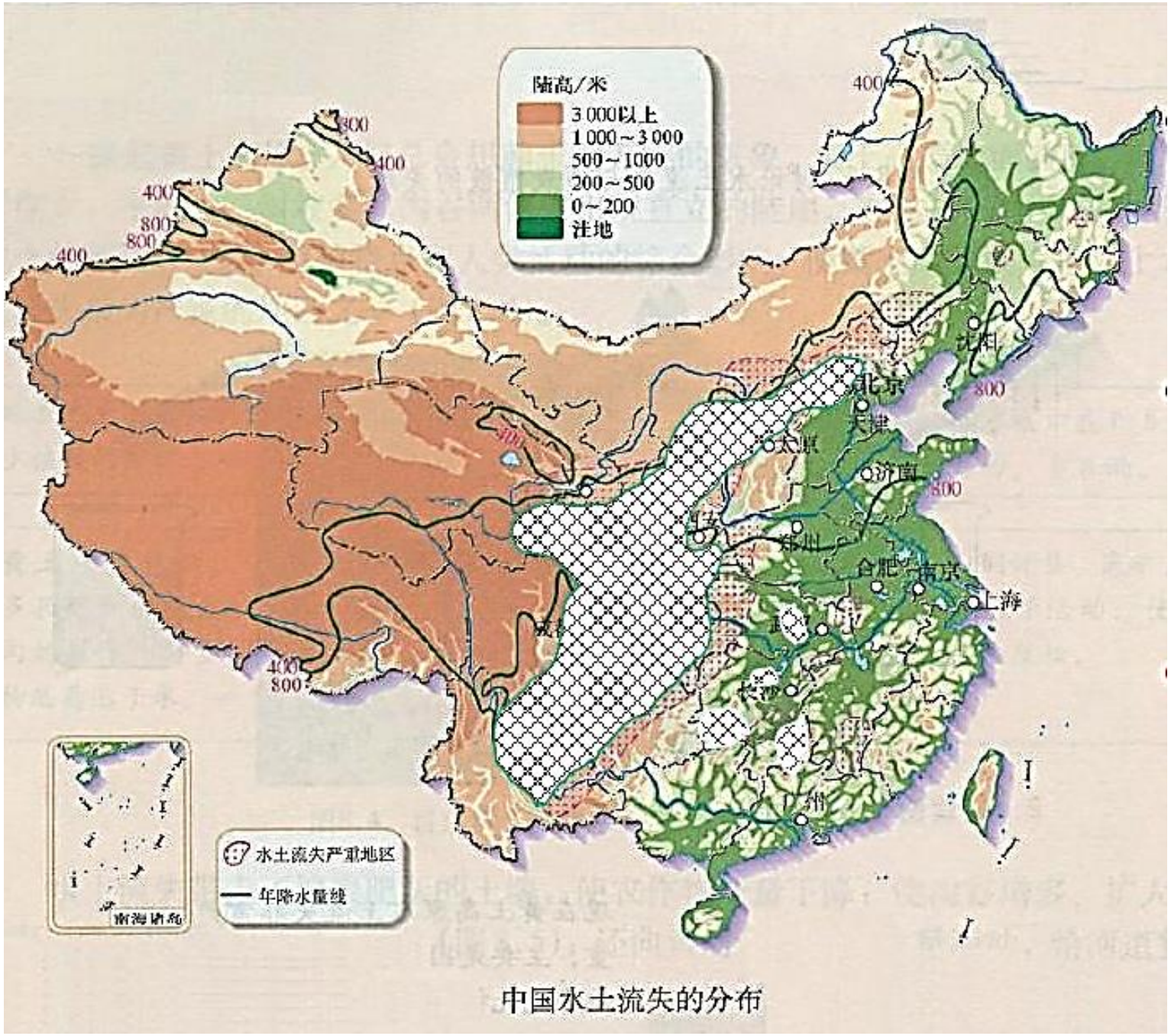
- Crop production 58.4% (Paddy Rice CH_4 22.6%, N_2O 34.7%, Straw burning 1.1%)
- Animal Production 41.6% (digestive organ CH_4 24.9%, Fecal discharge 16.7%)
- In recent years, direct energy consumption in agriculture increased to 27.18% both for crop and animal production.

杭州绿碳咨询管理 2022-12-12

水土流失 Soil Erosion

水土流失面积从1985年的974.6万平方公里降至2020年的210.0万平方公里（印度面积298万平方公里）

Area of soil erosion in China was 9.746 million km^2, which could cover about 3.3 times of the area of India. But it decreased to 2.1 million km^2 in 2020.



中国水土流失的分布

草原过牧与退化

Grassland Overgrazing and Degradation

我国草原总面积约3.53×108hm^2，可利用的约3.1×108hm^2，占国土面积的40%以上，居世界第四位。但是由于长期以来对草原资源采取自然粗放式经营，我国牧场退化情况很严重。过牧超载、重用轻养，乱开滥垦，使草原破坏严重，以致草原退化、沙化和碱化面积日益发展，生产力不断下降。上个世纪后期，我国草地退化面积占可利用草地面积的1/3，并有继续扩展之势。内蒙古和青海许多牧场的产草量比20世纪50年代下降了1/3至1/2，而且质量变劣。

Because of over-grazing, about 1/3 of grassland was degraded. The grass production in many area also reduced 1/3 to 1/2. The exposed sand and soil particle became sources of sandstorm in North China.

耕地受到工矿重金属污染

Farmland contaminated by heavy metal through mining and factory

有调查显示，我国受重金属污染的耕地面积已达2000万公顷，占全国总耕地面积的1/6。据环保部门统计，全国每年因重金属污染的粮食高达1200万吨，造成的直接经济损失超过200亿元

Investigation showed that 20 million ha of farmland, which was 1/6 of the total farmland in China, had been contaminated by heavy metal in late 1990s.

3. 认识推动的生态农业发展阶段
Agroecology Development pushed by Intellectual Recognition (1980-2020)

Since late 1970s and early 1980s, a group of ecologists, agronomists, and agro-economists proposed the approach of eco-agriculture development in China. Under the support of the Ministry of Agriculture, more than 100 demonstration sites were set up.

自觉提出建设生态农业则是在上个世纪七十年代后期到八十年代初，由一批生态学家、农学家和农业经济学家陆续提出来的。

– 这个时期以科学家为基础着力建立农业生态学学科体系，开展生态农业相关的研究与实践试点，总结传统农业的生态经验

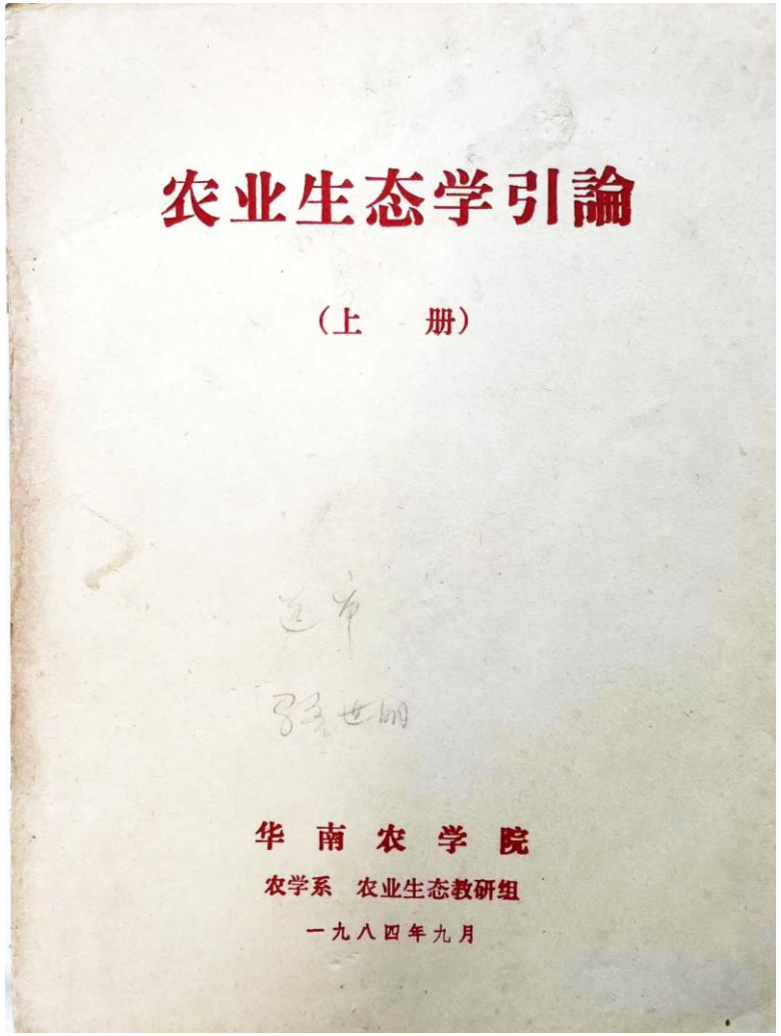
– 当时农业部非常支持学者们关于生态农业的思路，在八十年代和九十年代就开展了生态农业建设相关试点工作，1993年指导51个县的生态农业示范县建设，在1994年还颁布了《生态农业示范区建设技术规范》

构建农业生态学的学科体系

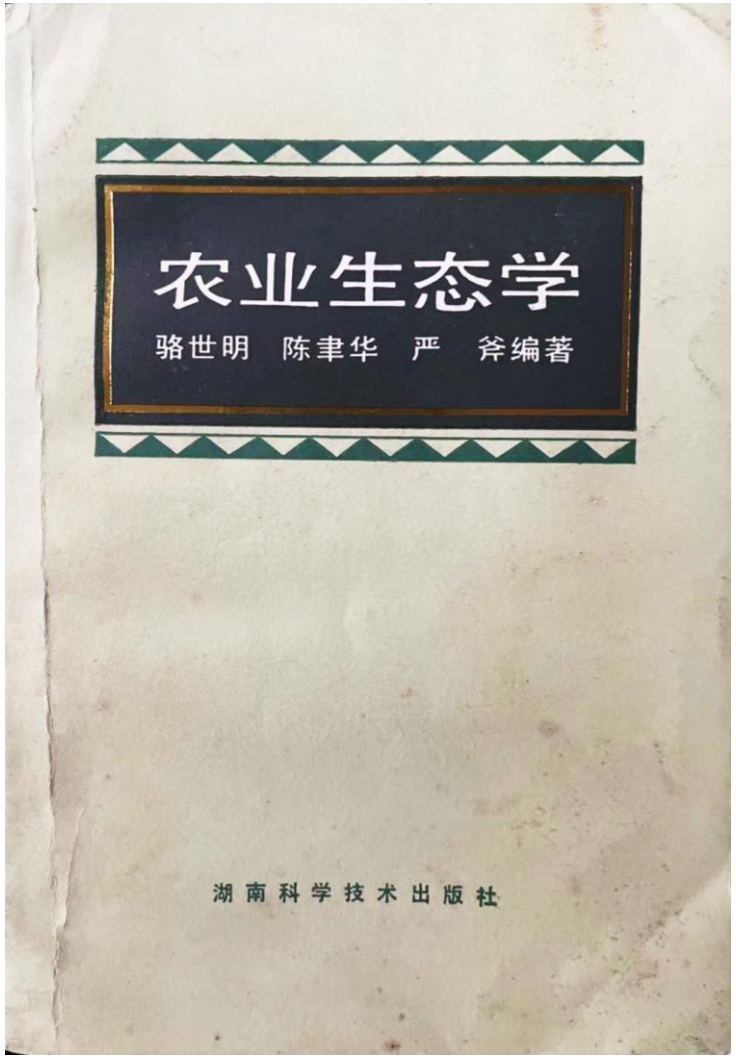
The Development of Agroecology as a scientific discipline

骆世明主编的不同版本的农业生态学教材

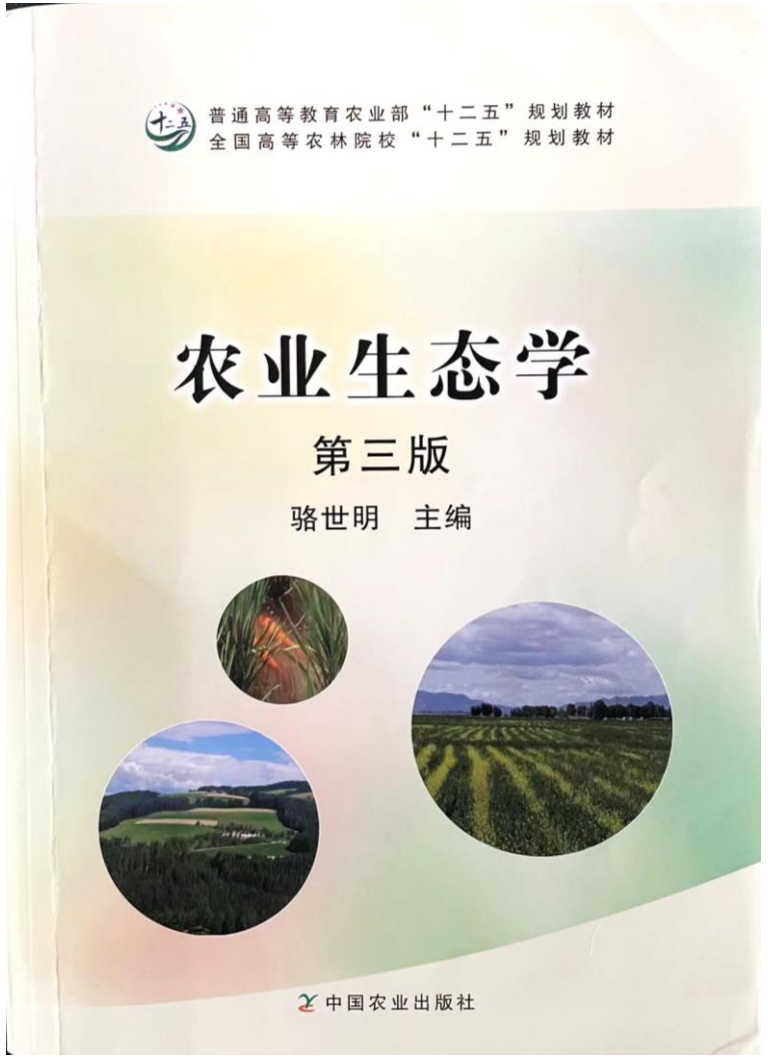
The textbooks of Agroecology edited by Luo Shiming in different years.



1984

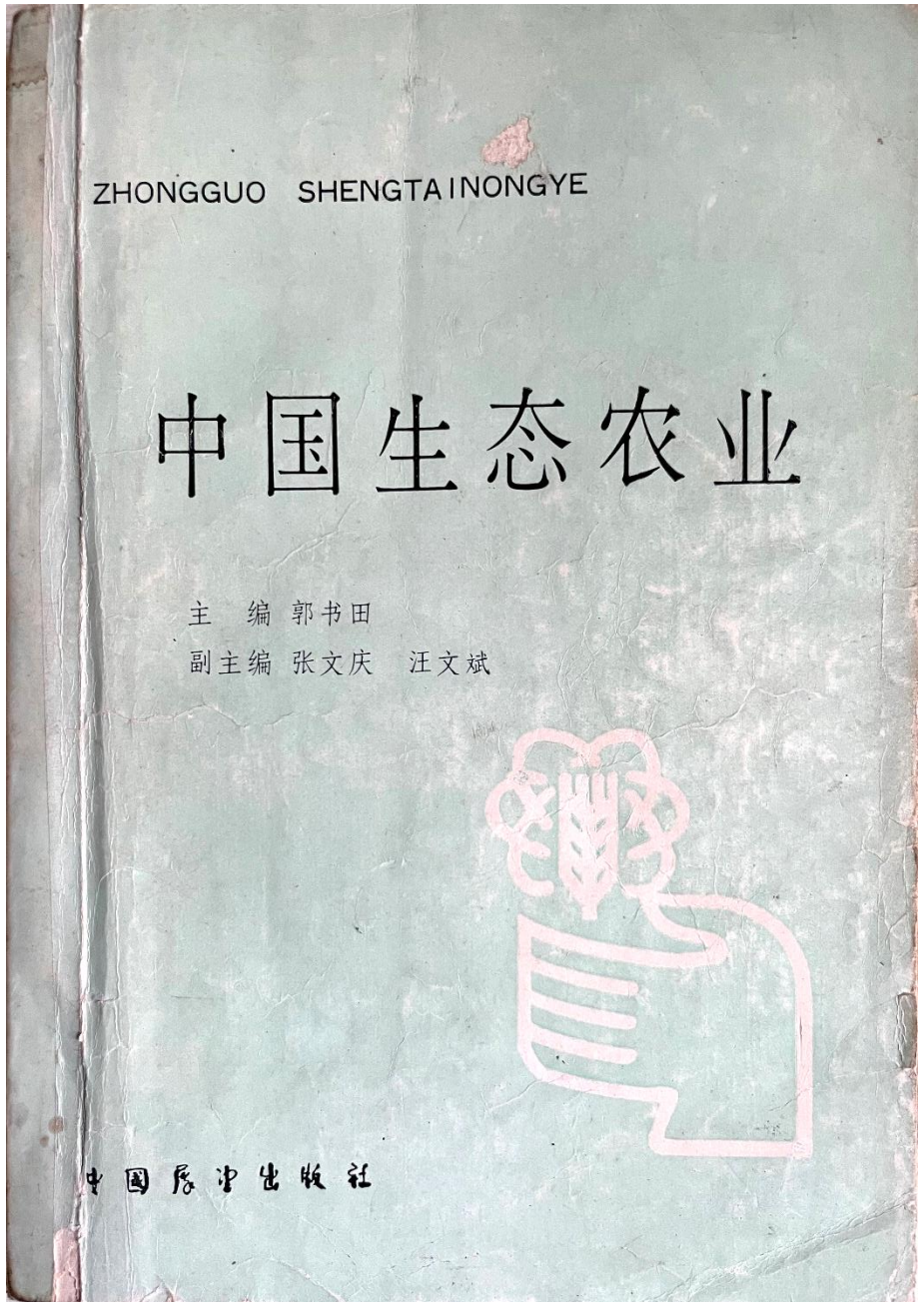


1987



2017

频繁的生态农业经验交流 Frequent experience exchanged for agroecology practices



Proceedings of the seminar for agroecology development in 1987

1987年5月农牧渔业部和有关学会一起在安徽阜阳召开“全国生态农业问题讨论会”。这是正式出版的会议论文选编。

Proceedings of the seminar for agroecology development in 1991

1991年5月农业部与林业部环保部，中国生态学会，中国生态经济学会在河北唐山召开了“全国生态农业县建设经验交流会”。这是会议交流材料汇编

深入开展典型生态农业模式研究

Intensive Research for typical agroecology systems in 1980s-1990s, like this dike-pond system research.

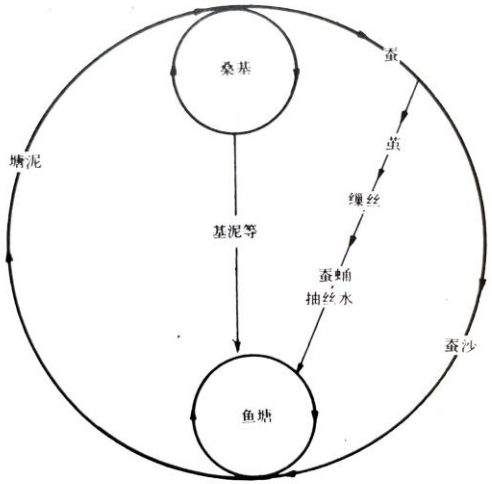


图 1.6 桑基鱼塘生态循环结构

系统结构

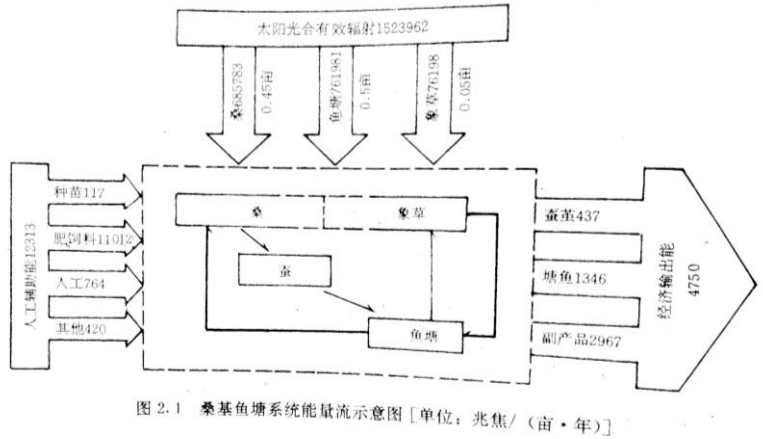


图 2.1 桑基鱼塘系统能量流示意图［单位：兆焦/（亩·年）］

能流关系

表 2.7 各种基塘类型系统的经济效益 单位：元/亩

基塘类型	产值	成本	利润	利润/产值	产值/成本	利润/成本
桑基鱼塘	898.59	510.71	387.88	0.43	1.76	0.76
蔗基鱼塘	867.07	501.39	365.68	0.42	1.73	0.73
花基鱼塘	1 3348.70	2 975.90	10 372.80	0.77	4.49	3.49

经济效益

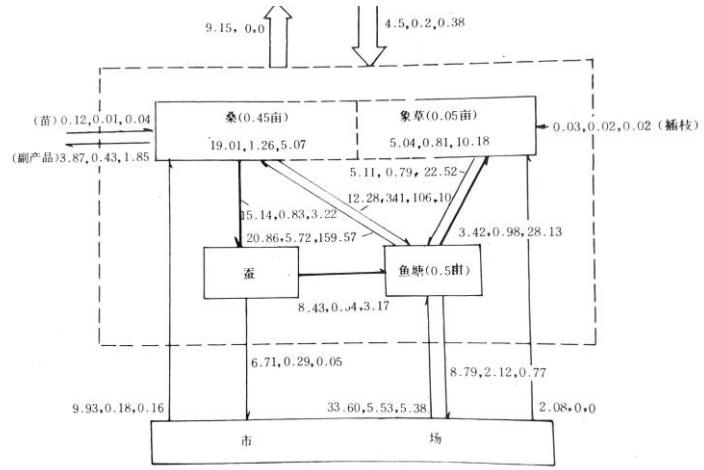


图 2.4 桑基鱼塘系统物质流示意图 (N,P,K 单位:公斤)

物流关系

钟功甫等，基塘系统的水陆相互作用，1993，科学出版社

4. 需求驱动的生态农业阶段
Agroecology Development Driven by Social Demand (2001-)

Since the beginning of this century , the social demand for better environment and saver food became very strong. Green, eco-friendly, safety and low carbon agriculture development became a common view.

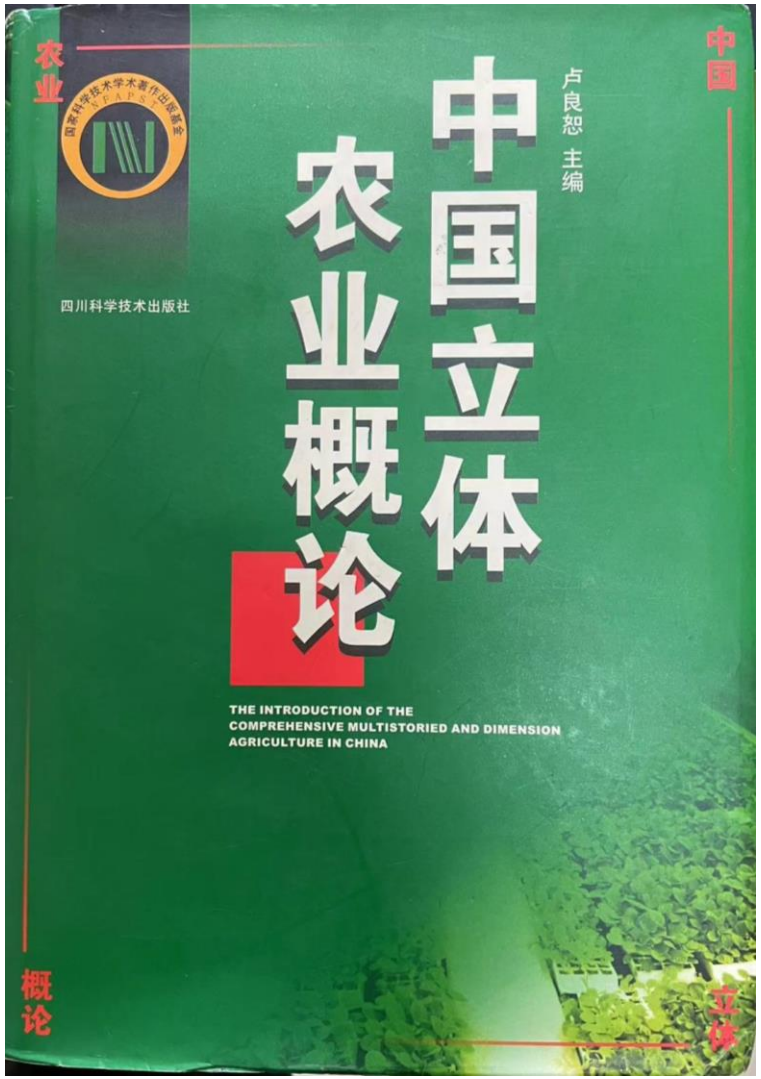
- Agricultural Scientists and Technicians systematically studied and summarized Agroecological Practices.
- Government Administration push forward a series of actions and policy to improve the use of resources , to protect environment and to build eco-farms.
- Civil society engaged mor on agroecological actions such as Community Supported Agriculture (CSA) etc.

进入新世纪以后，由于社会经济和农业工业化同步快速发展，农业生产产生的环境污染问题和食品安全问题也变得越来越突出。民众生活水平提高，对环境生态需求上升，对食品质量要求更加敏感，农业的绿色、生态、低碳、安全，日益成为社会共识。

- 科技工作者在这个阶段把中国生态农业的实践经验进行了全面总结提升
- 农业管理部门出台一系列控制资源消耗，保护生态环境，推动生态农场建设等一系列配套措施
- 民间也自觉行动起来，开展社区支持生态农业运动，以及生态农业建设

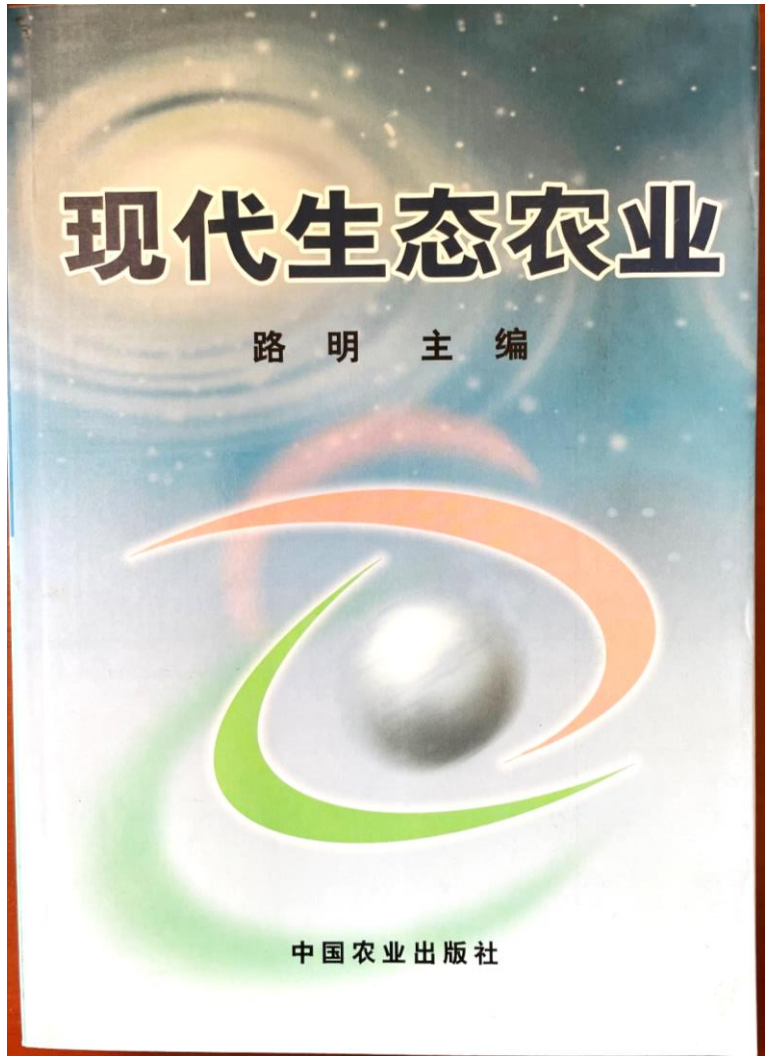
对生态农业经验
的总结和提升

Systematically studied
and summarized
Agroecological Practices



Introduction to Vertical
Agriculture Systems in China

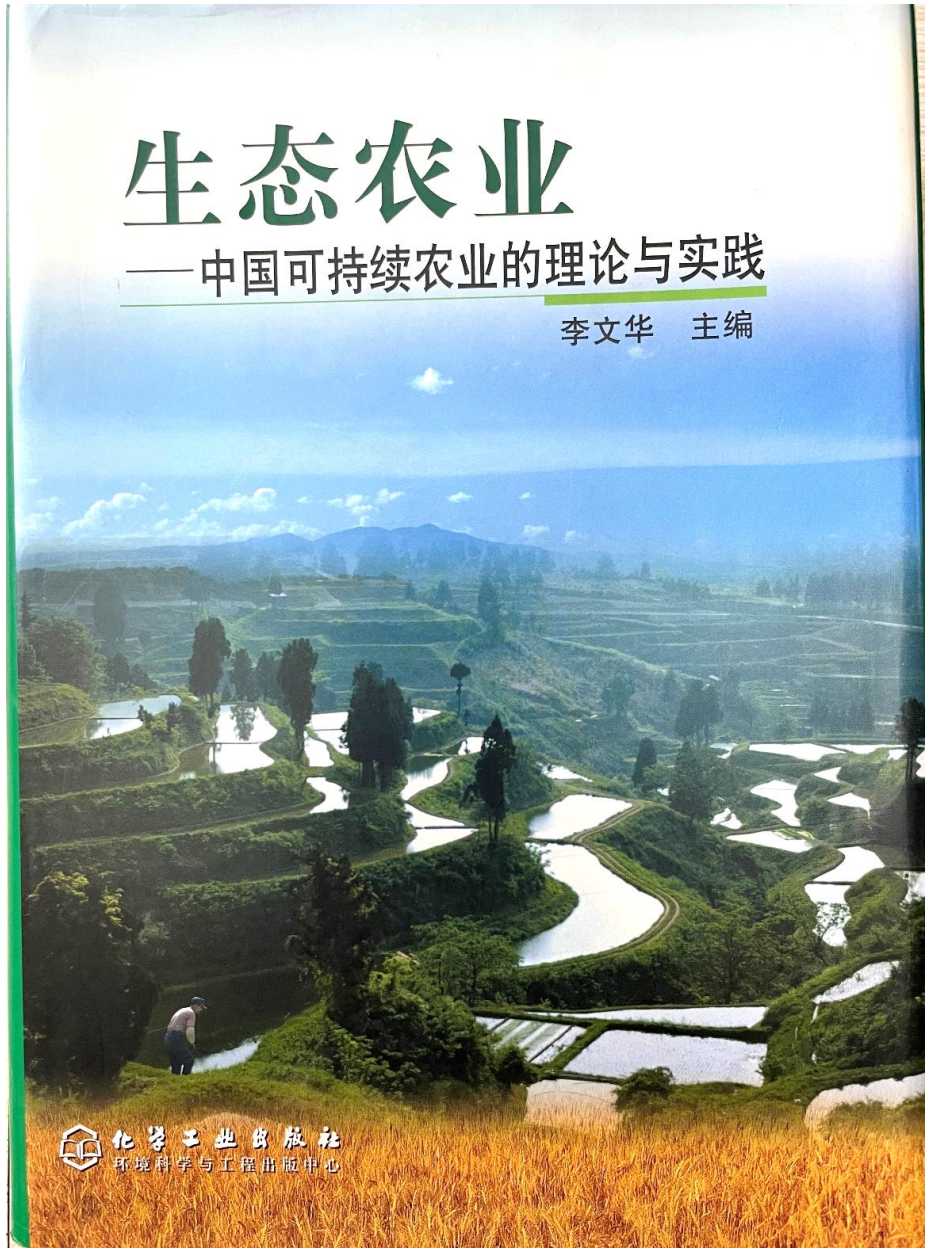
1999　　卢良恕院士 主编



Modern Agroecology

2002　路明副部长 主编

Agroecology - Theory and Practices for Sustainable Agriculture in China



《生态农业——中国可持续农业的理论与实践》

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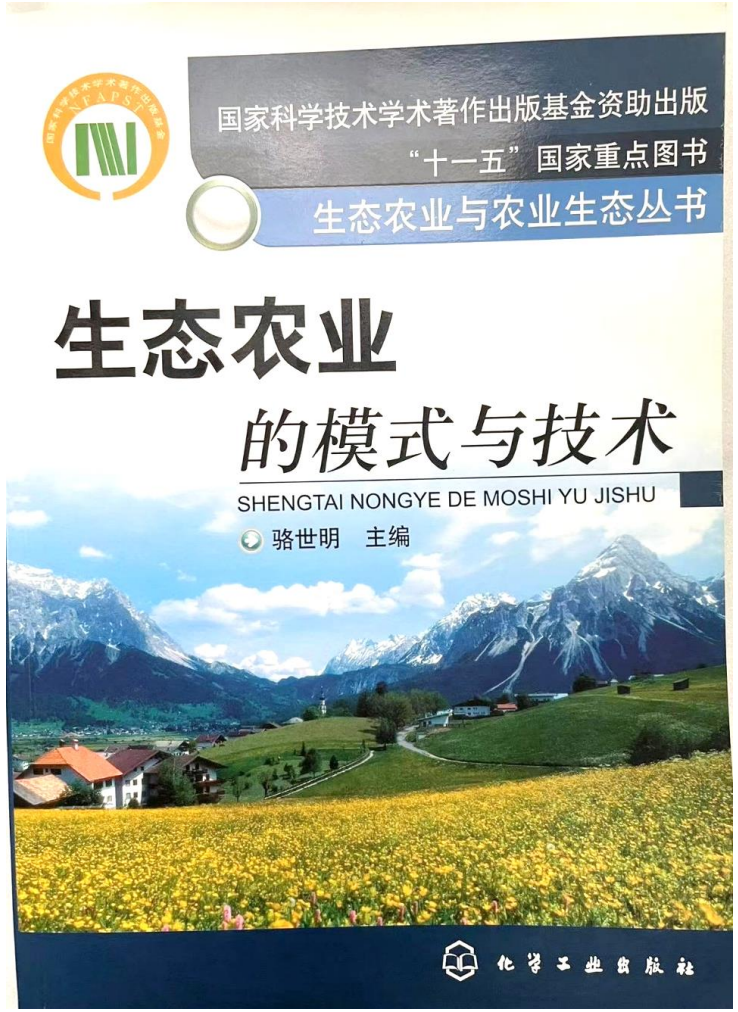
卢宗凡	卢剑波	包维楷	成升魁	乔玉辉	伍光和
刘子刚	刘凤芝	刘玉海	刘建康	刘高焕	许中旗
许再富	孙　辉	孙铁珩	孙彩霞	孙鸿良	孙振钧
孙新章	杨　修	苏守德	李　军	李　周	李文华
李玉春	李江华	李国学	李彦明	严力蛟	严茂超
吴文良	吴国庆	何丙辉	邹冬生	闵庆文	汪诗平
沈亨理	张壬午	张远东	张岁歧	张建平	张恩林
张象枢	张福绥	张福锁	陆庆光	陈佐忠	陈怀顺
陈惠萍	武志杰	林位夫	周钟毓	胡春胜	赵春江
赵晓英	赵魁义	钟功甫	侯向阳	段华平	闻大中
宣维健	骆世明	秦伯强	高怀友	郭书田	黄卫东
黄守锋	曹志平	盛承发	章家恩	梁文举	彭世奖
彭廷柏	程　序	黎华寿	颜京松	潘晓玲	

学术秘书：许中旗

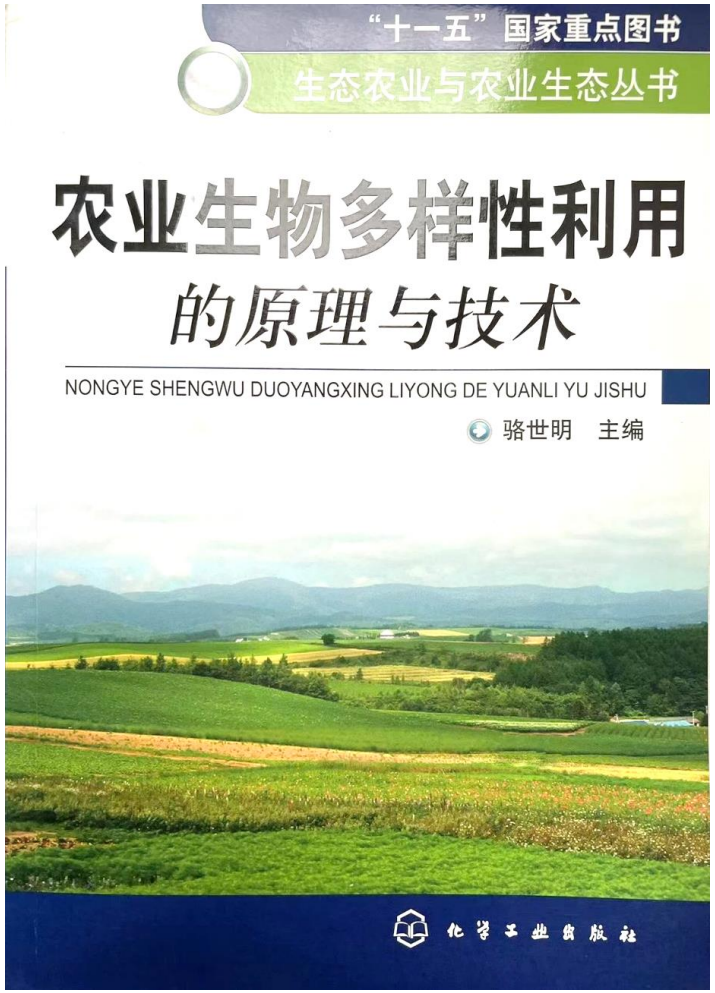
2003年
李文华院士主编

System Patterns and Technology for Agroecology



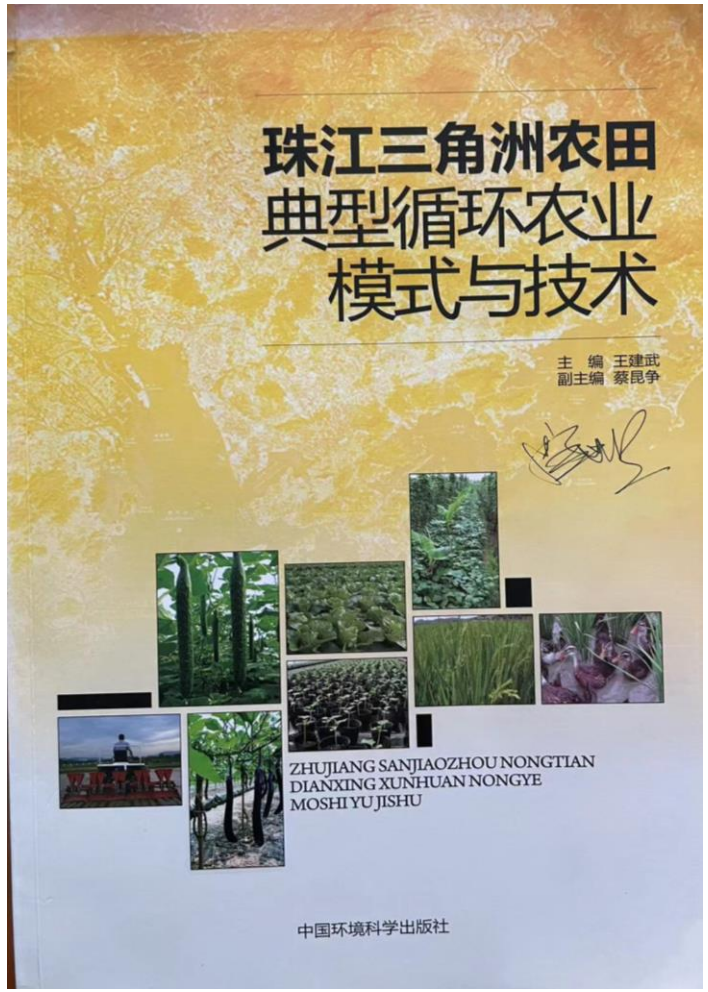
2010

Theory and Technology for the Use of Biodiversity in Agriculture



2010

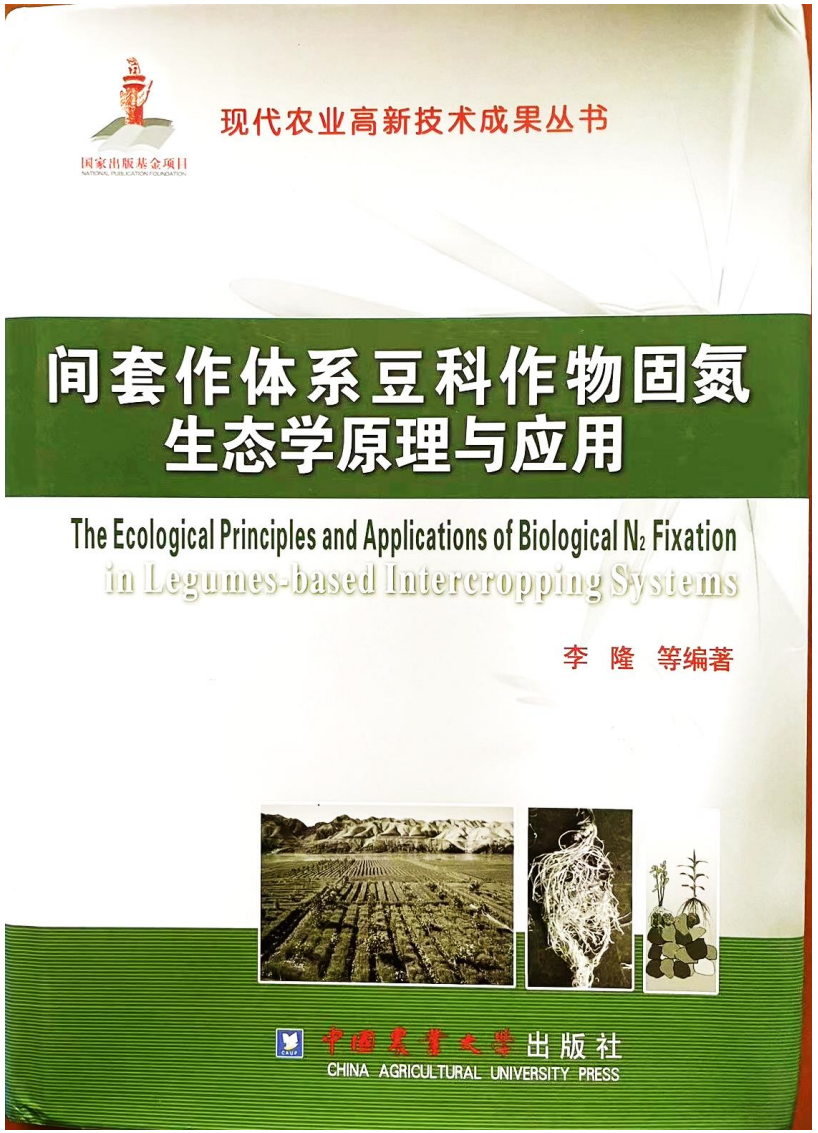
Typical circulation agricultural systems and their technology used in the Pearl River Delta.



2010

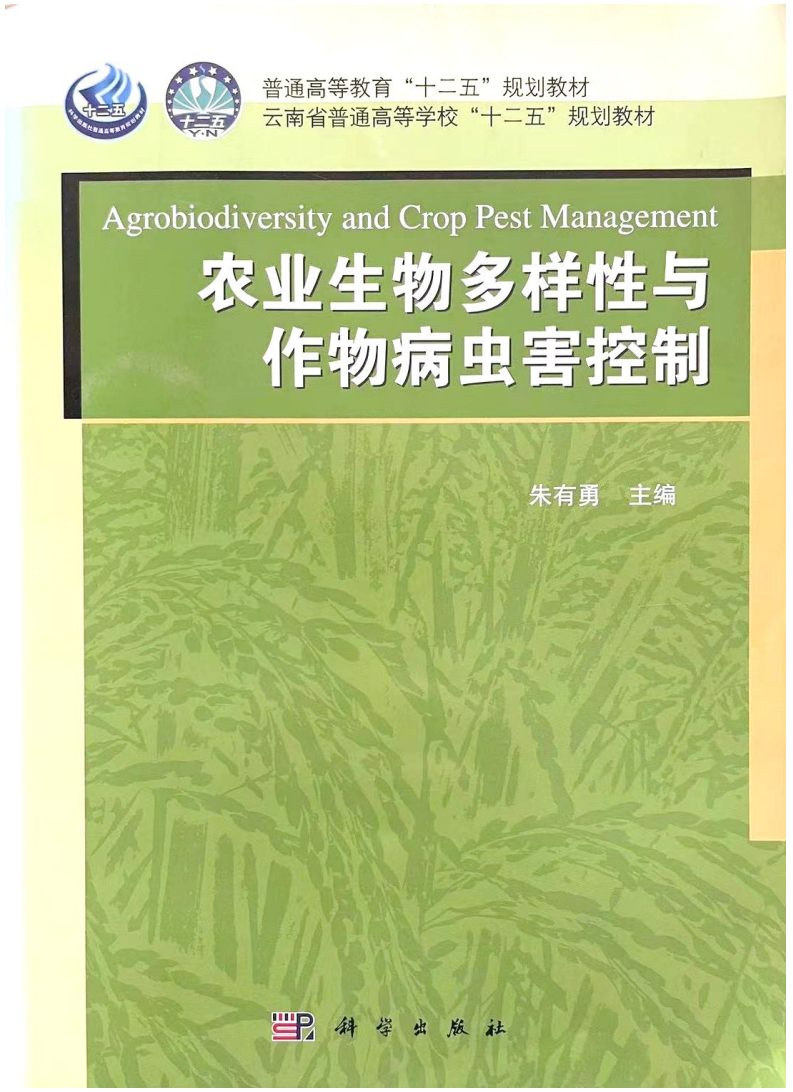
华南农业大学团队成员主编

The Ecological Principles and Applications of Biological N_2 Fixation in Legumes-based Intercropping Systems



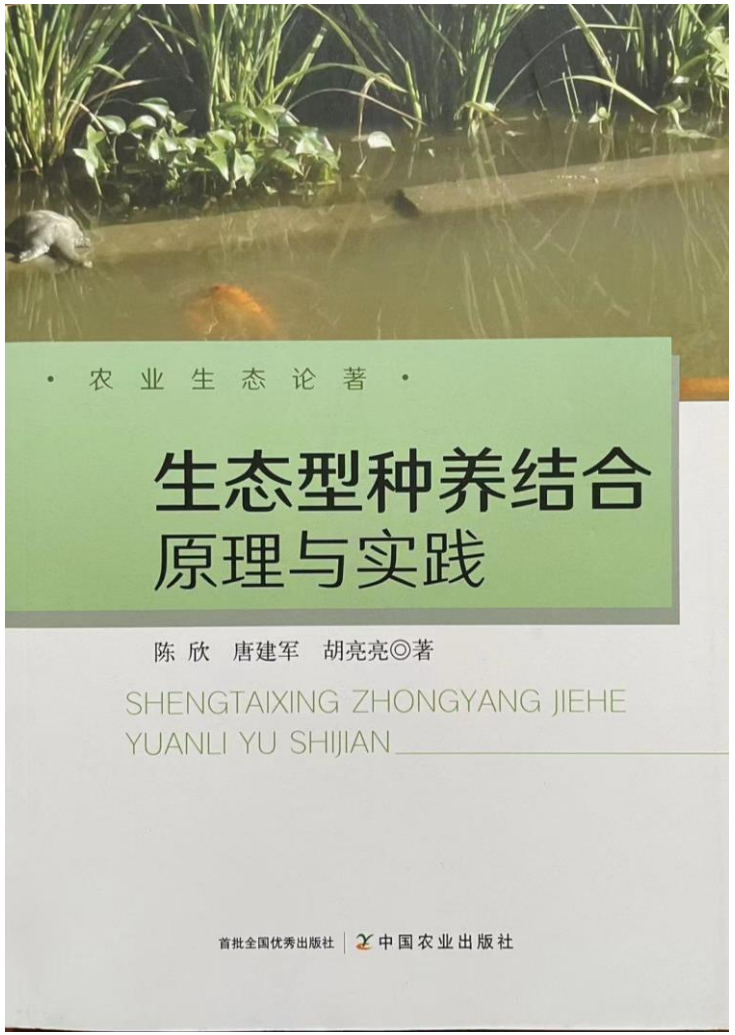
2013 李隆等编著

Agrobiodiversity and Crop Pest Management



2013 朱有勇院士主编

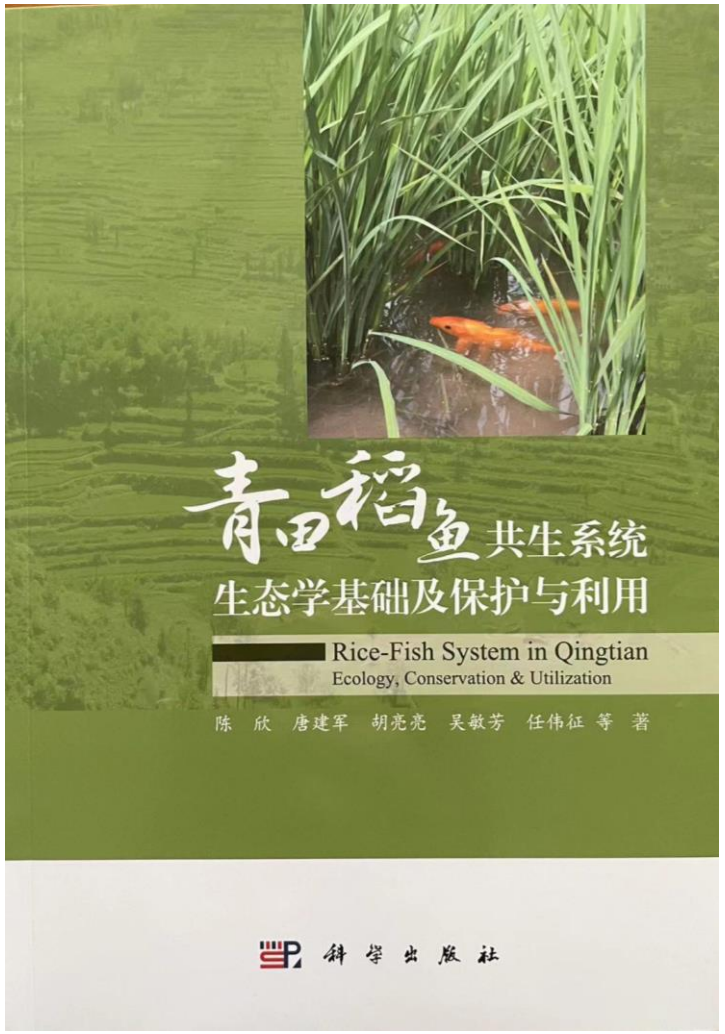
Principles and Practices of Eco-types of Mixed Crop and Animal Production



2019

浙江大学团队 陈欣团队 著

Rice-Fish System in Qingtian - Ecology, Conservation and Utilization



2021

Research on high quality development of green Rice-Shrimp production

2022

华中农业大学曹凑贵团队编著

政府陆续出台的有关促进农业生态转型的政策措施

Many policies and measures for Agroecology development have been proposed by government

- 退耕还林：2002年4月11日，国务院发出《关于进一步完善退耕还林政策措施的若干意见》。二十年年来总共退耕还林还草5.15亿亩。
- 草畜平衡：农业部于2005年1月19日发布《草畜平衡管理办法》，全国禁牧休牧和草畜平衡实施面积已达到38亿亩，占全国草原面积的63%，惠及1200多万户牧民。

- Retreating farmland for returning to forestry and grassland: more than 34 billion ha of land have been returned to forestry or grassland in the last 20 years.
- Balancing animal number and grass supply: This measure has been applied to 667 billion ha of grassland which is about 60% of total grassland in China. It benefited more than 12 million household of herdsmen.

- 主体功能区： 2010年国务院发布通知要求进行《全国主体功能区规划》
- 面源污染控制：2015年《农业部关于打好农业面源污染防治攻坚战的实施意见》，提出控制农业用水量、减少化肥农药用量、普遍实施作物秸秆和禽畜排泄物循环利用，开展农用薄膜回收再加工利用等措施。
- 生态农场建设： 2020年农业农村部发布了《生态农场评价技术规范》，2022 年2月农业农村部《推进生态农场建设的指导意见》。

- The State Department: main functional zoning has been finished since 2010s to set up ecological, agricultural, industrial and urban zones all over China .
- The Ministry of Agriculture: : to push forward measures to control non-point pollution control from agriculture include the control of water usage and the amount of chemical fertilizer and pesticide application, the use of crop residue and animal waste by circulation system and the reuse of agricultural plastic film.
- The Ministry of Agriculture: “The standard for eco-farm assessment” was published in 2020. “Guide for Accelerating Eco-Farm Construction” was published in 2022.

- 生态补偿：2016年国务院办公厅《关于健全生态保护补偿机制的意见》

建立以绿色生态为导向的农业生态治理补贴制度，对在地下水漏斗区、重金属污染区、生态严重退化地区实施耕地轮作休耕的农民给予资金补助。扩大新一轮退耕还林还草规模，逐步将25度以上陡坡地退出基本农田，纳入退耕还林还草补助范围。研究制定鼓励引导农民施用有机肥料和低毒生物农药的补助政策。

- Ecological compensation: “Measures to well establish compensation mechanisms for ecological protection” was published by the State Department in 2016. Compensation will be available for those who implement the action of returning farmland back to forestry and grassland. Compensation for farmers who use organic fertilizer and low toxic bio-pesticides will also be arranged.

- 绿色发展：2017年中共中央办公厅 国务院办公厅《关于创新体制机制推进农业绿色发展的意见》

坚持以空间优化、资源节约、环境友好、生态稳定为基本路径，坚持以农民主体、市场主导、政府依法监管为基本遵循。实现资源有偿使用、环境保护有责、生态功能改善激励、产品优质优价。

- 碳交易制度：2021年中共中央、国务院《关于完整准确全面贯彻新发展理念做好碳达峰碳中和工作的意见》

将碳汇交易纳入全国碳排放权交易市场，建立健全能够体现碳汇价值的生态保护补偿机制。健全企业、金融机构等碳排放报告和信息披露制度

Mechanism for green development was published in 2017 by the State Council. Measures proposed included payment for resources use and environment pollution, reward for improvement of multiple eco-functions, and higher price for high quality eco-produce.

A nationwide carbon trade market system began to be established in China since 2017.

农业的生态转型趋势
The Trend of Agriculture Eco-Transition

- 2021年国家首批认证生态农场132家，2022年国家认证生态农场300家，计划到2025年国家认证生态农场1,000家，地方认证10,000家。
- 2023年7月16日，全国碳排放权交易市场运行满两周年，累计成交碳交易额超过110亿元人民币。

- In 2021, there were 132 national certified eco-farms, and in 2022, there were 300 national certified eco-farms. It is planned to have 1,000 national certified eco-farms and 10,000 local certified eco-farms by 2025.
- On July 16, 2023, the national carbon emission trading market completed its second anniversary of operation, with a cumulative transaction volume of over 11 billion yuan in carbon trading.

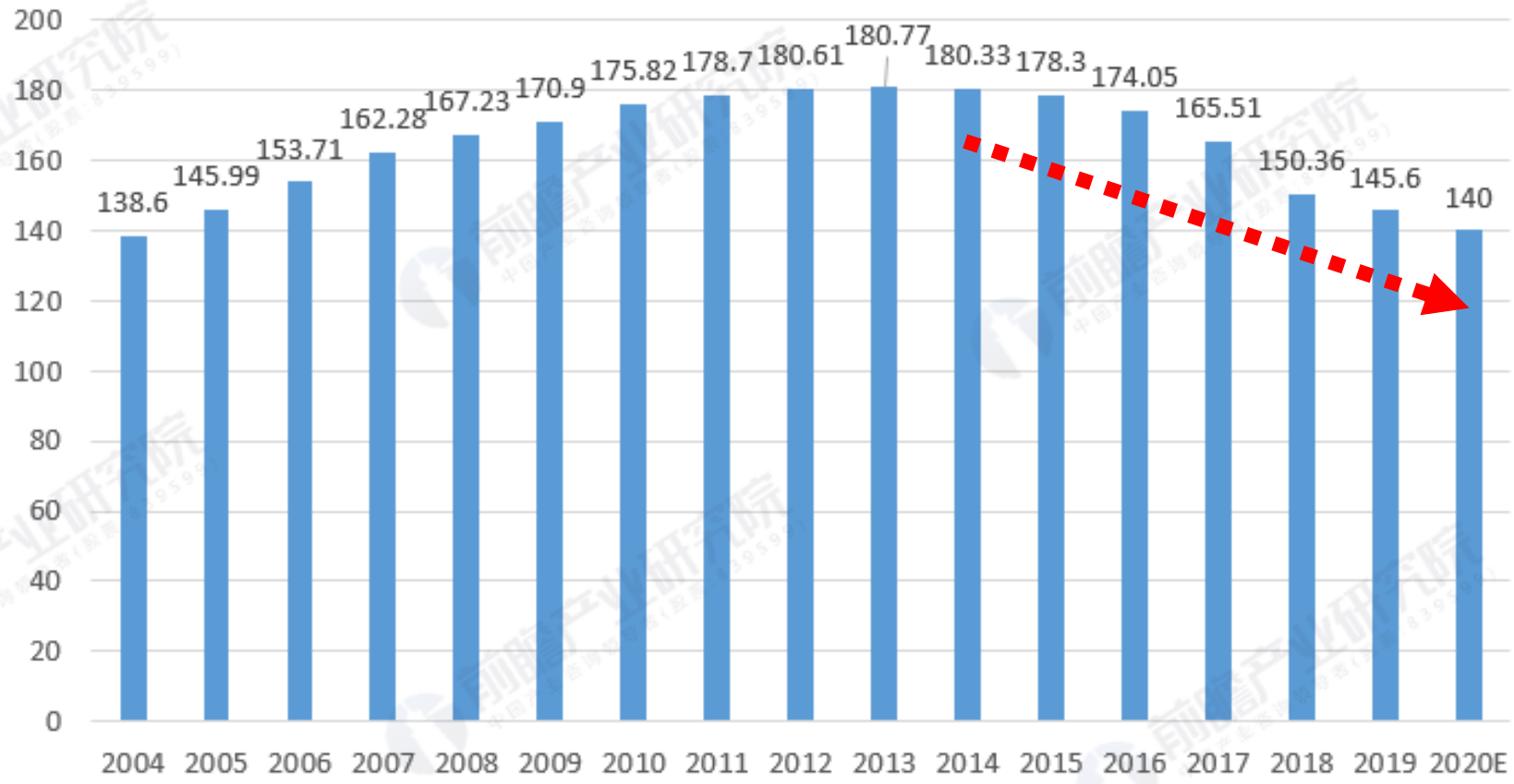
- 2022年我国农用化肥施用折吨量为5079.2万吨，较2021年下降112.06万吨，同比下降2.16%，连续7年下降从2015年6023万吨，下降了15.7%。

- In 2022, the agricultural fertilizer application in China was 50.792 million tons, a decrease of 1.1206 million tons, -2.16% compared to 2021, and a decrease of 15.7% from 60.23 million tons in 2015 for 7 consecutive years.

2022年为止，我国连续7年农药用量保持负增长，同时低毒微毒农药占比达85%

Pesticide used in agriculture has decreased continuously for 7 years from 2015.

图表 12：2004-2020年我国农药使用商品量变化情况(单位：万吨)

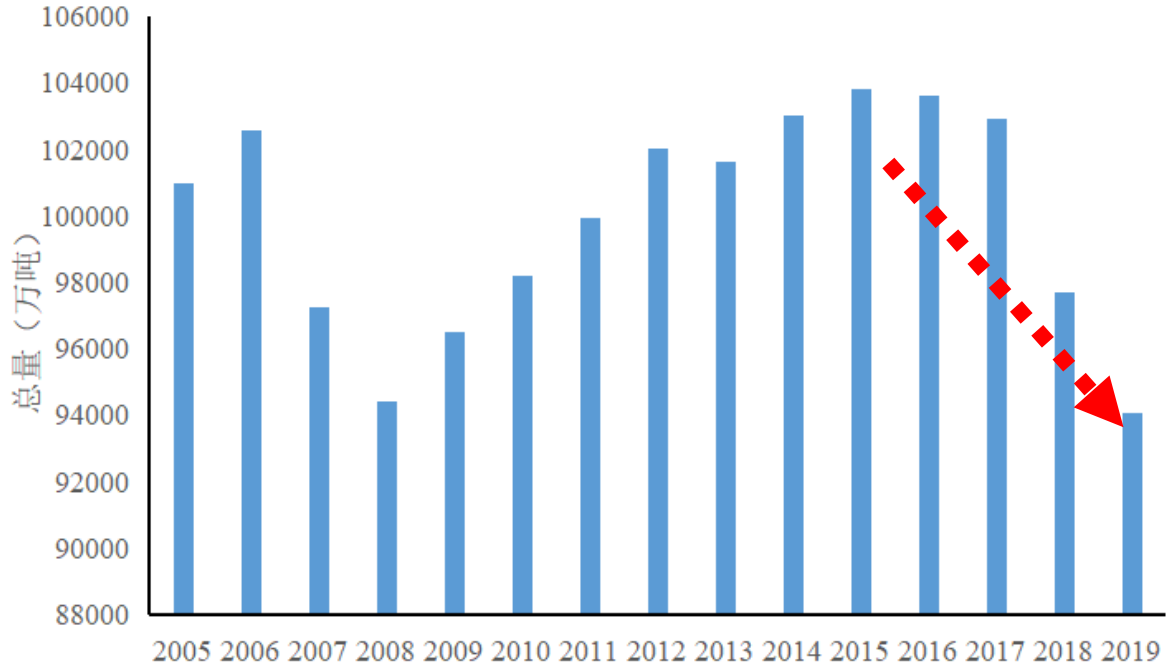


资料来源：全国农技中心 前瞻产业研究院整理

@前瞻经济学人APP

- 到2021年全国农作物秸秆综合利用率达88.1%，全国畜禽粪污资源化利用率达到78%，全国农膜回收利用率稳定在80%以上。
- 农业碳排放从2015年起持续下降。
- 2022年食品抽检安全合格率达到97.14%。

- Recycling and reuse rate reached 88.1% for crop residue, 78% for animal waste, and more than 80% for agricultural plastic film from 2021.
- Carbon emission by agriculture has decreased since 2015.
- The passing rate of food safety check reached 97.14% in 2022.



Agriculture carbon emission amount ($\times 10^5$ ton)

连续7年来在农产品明显增产的情况下，农业用水量基本维持不变

Water used in agriculture remain stable in the last 7 years, although agriculture production has increased a lot.

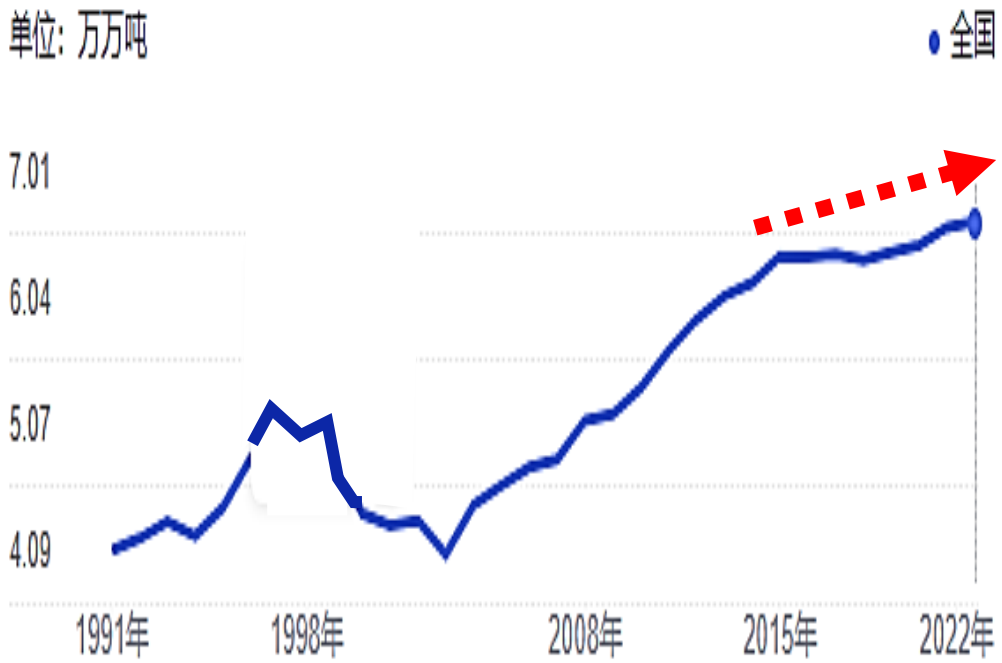
2015-2022年的农业用水分析Water Use

年份	全年水资源总量/亿 m^3	全国用水总量/亿 m^3	农业用水量/亿 m^3	农业用水占用水总量比例/%
2015	27 962.6	6 103.2	3 851.1	63.10
2016	32 466.4	6 040.2	3 768.0	62.38
2017	28 761.2	6 043.4	3 766.4	62.32
2018	27 462.5	6 015.5	3 693.1	61.39
2019	29 041.0	6 021.2	3 682.3	61.16
2020	31 605.2	5 812.9	3 612.4	62.14
2022	**27 088.1**	**5 998.2**	**3 781.3**	**63.0**

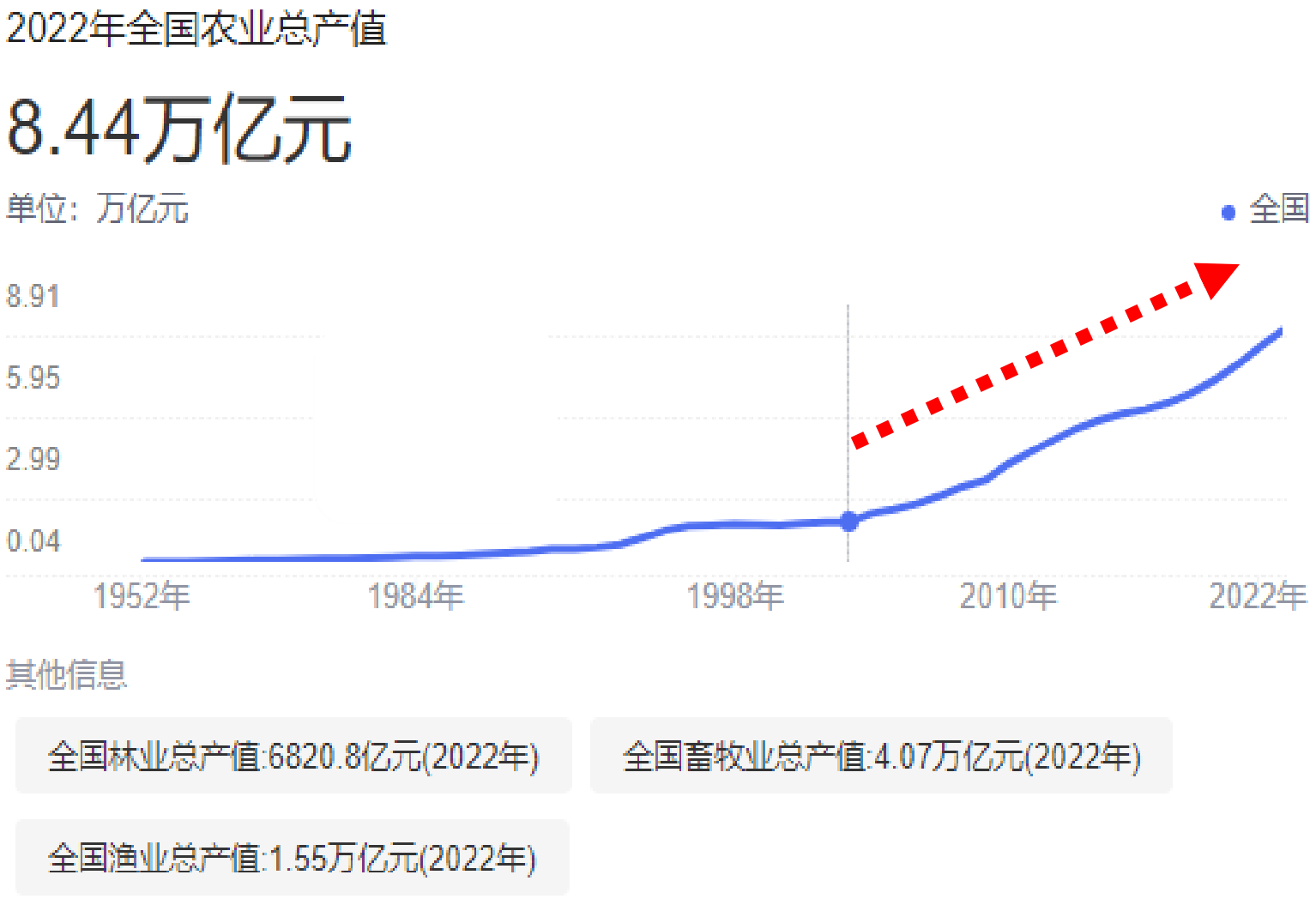
Water used

1991-2022全国粮食产量变化

Grain Production



Total agriculture production continuously increased in the past 20 years.



民间行动 以社区支持生态农业为例（Community Support Agriculture, CSA）

石嫣，女，中国人民大学农业与农村发展学院博士，清华大学人文与社会科学学院博士后，毕业于河北农业大学。2009年开创“小毛驴市民农园”，现为分享收获和CSA项目创始人与负责人。中国社区支持农业和可持续农业的重要推动者。

Very Active CSA movement led by Prof. Wen Tiejun and Dr. Shi Yan.

温铁军，三农问题专家。中国人民大学二级岗位教授，曾在中国人民大学农业与农村发展学院院长等机构当负责人。在国家机关、联合国机构以及美国等有丰富的经验

International and National Conference of CSA in 2018 in Sichuan Province

2018-12-16
四川郫都召开第10届中国社会生态农业CSA大会


社会生态农业
CSA
CSA大会


CDTFY
天府源
买
玖农生活

National Conference of CSA in 2019 in Guangdong Province

2019年12月12-14日肇庆召开的全国第11届社会支持生态农业CSA大会

5. 生态农业的实践案例
模式与技术体系

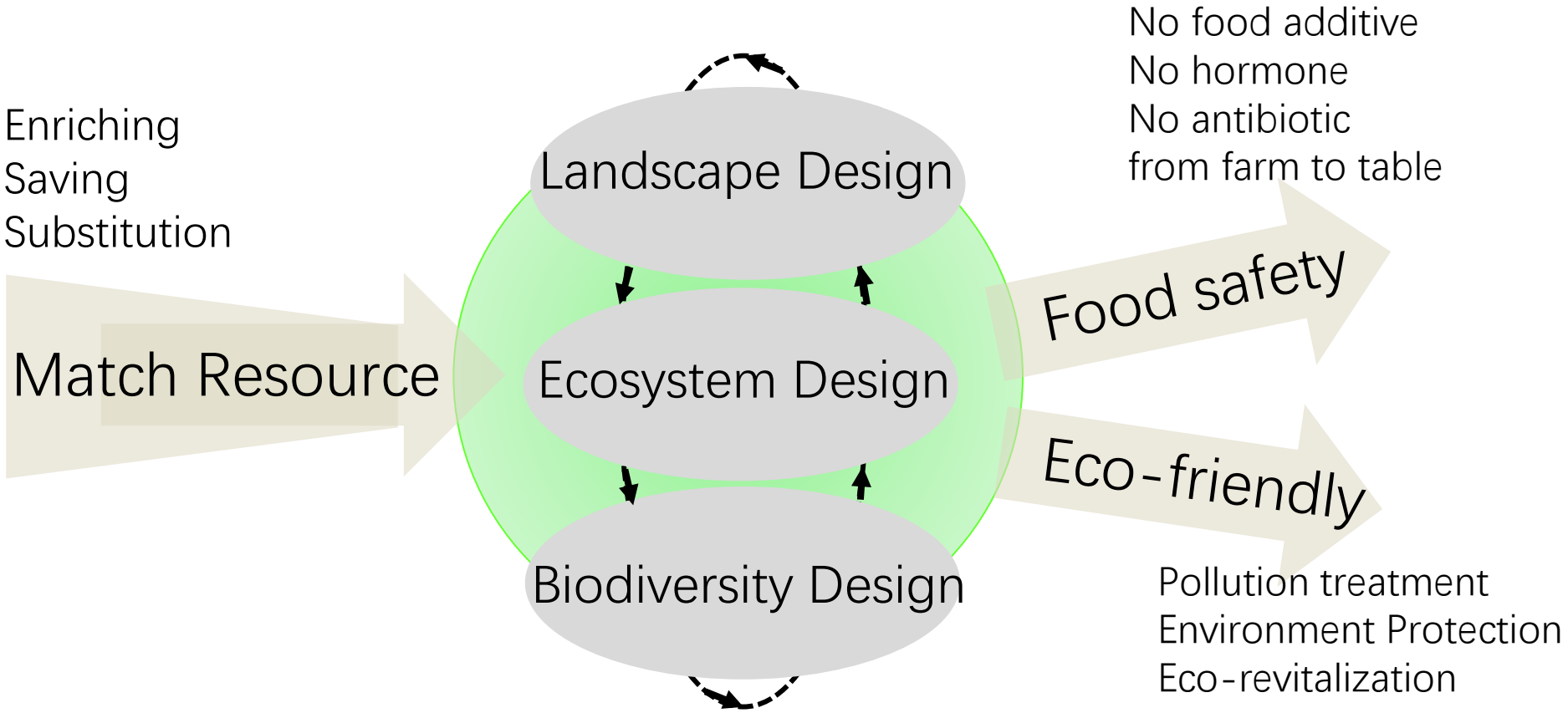
Examples of Agroecology Practices
System Design and Technology Package

(1) 实施生态农业要根据实际明确划定红线

Bottom Red line for agroecology (Basic requirement)

(2) 生态农业建设的绿色行动指南

Recommended Green Actions for Agroecology



绿色行动指南选择要有利于解决当地农业与资源、生态、环境的主要矛盾，行动容易落地，让农业生产者能根据自身情况进行选择

(3) 生态农业实践的一些例子 Examples

A. 轮间套作 Intercropping and rotation

Corn intercropping with broad bean

玉米与蚕豆间作

Intercropping soybean within tea plantation in Fujian Province

福建安溪举源
金龙铁观音生态茶场

小茶绿叶蝉
Green leaf hopper

椿象
stinkbug

尺蠖　inchworm

Besides N fixation, soybean is also a trap crop for many tea pests.

“牺牲自己，
成就别人”

aphid
蚜虫

Spider and bird in eco-tea plantation

安溪生态茶园
的
蜘蛛网与鸟巢

B. 稻田养鸭　　Rice Duck Co-culture System

C. 稻田养鱼 Rice Fish Co-culture System

D. 多层次农林体系　　Agroforestry Systems

杨树间小麦

Wheat production under poplar forestry in North China.

泡桐间小麦

Because the characteristics of deciduous tree, crops in winter and early spring are more adaptive to the agroforestry system. Here it is wheat under *Paulownia* trees in North China.

Harvesting wheat under *Paulownia* trees

Cabbage production under young forestry in winter.

胶茶间作

Robber plantation intercropping with tea

E. 利用生物多样性防治害虫 Biodiversity for pest control

Pushing Effect

害虫的驱赶植物

Perilla frutescens (L.) Britton in greenhouse for repelling purpose

害虫的
陷阱植物

Pulling
Effect

田埂种植香根草（吸引水稻螟虫）

Vetiver grass to trap rice stem borer

农田林网

Shelter belt network in plain region

D. 利用生物多样性防治杂草　Biodiversity use for weed control

Hairy vetch (*Vicia villosa Roth*.) is a leguminous plant which can fix nitrogen and can also suppress weed growth.

柔毛野豌豆
（毛苕子）

做绿肥
可控制杂草

茶园间种广金钱草
控制茶园杂草

Weed control in tea plantation

Desmodium *styracifolium (Osbeck.) Merr.* covers in tea plantation not only can suppress weed grow, but it can also be harvested as a Chinese medicinal herb.

广金钱草 又名落地金钱、马蹄草、铜钱草，为豆科山蚂蝗属多年生半灌木状草本植物，是岭南特色中药草，其干燥植物全株均可入药，为《中华人民共和国药典》2020 版收录中药品种，具清湿热，利尿通淋，可治肾炎浮肿、尿路感染、尿路结石、胆囊结石等功效。

稻田温室气体减排综合技术体系

Integrative package of technology for reducing green house gas emission from paddy rice

■ 技术架构

	灌溉用水	能源消耗	投入品
问题	长期淹水会显著增加稻田CH4的排放量。间歇性节水灌溉技术可以通过提高甲烷氧化菌丰度，减少稻田甲烷排放 。	• 农机工作消耗汽油和柴油，燃烧时产生大量二氧化碳 • 灌溉提水泵站用电消耗	农资等投入品导致的温室气体排放占总排放量的 14.95% 左右
解决方案	精准灌排	无人农机	绿色防控
	稻田数字孪生系统+算法模型		
建设成效	Occasionally dry the field could reduce CH_4 by 10-15%	Reducing machine operational energy consumption by 7%	Reducing chemical fertilizer and pesticide use through IPM by8%

减少稻田甲烷排放 10%~15%

减少间接碳排放在8%-15%

数字赋能，低碳循环

6. 推进生态产品市场化的途径

To expand Eco-friendly products in market

方法1. 生态标签

The 1st Approach:. Eco-label for agroecology products

绿色、有机、生态、地理标志性产品认定

Green Food

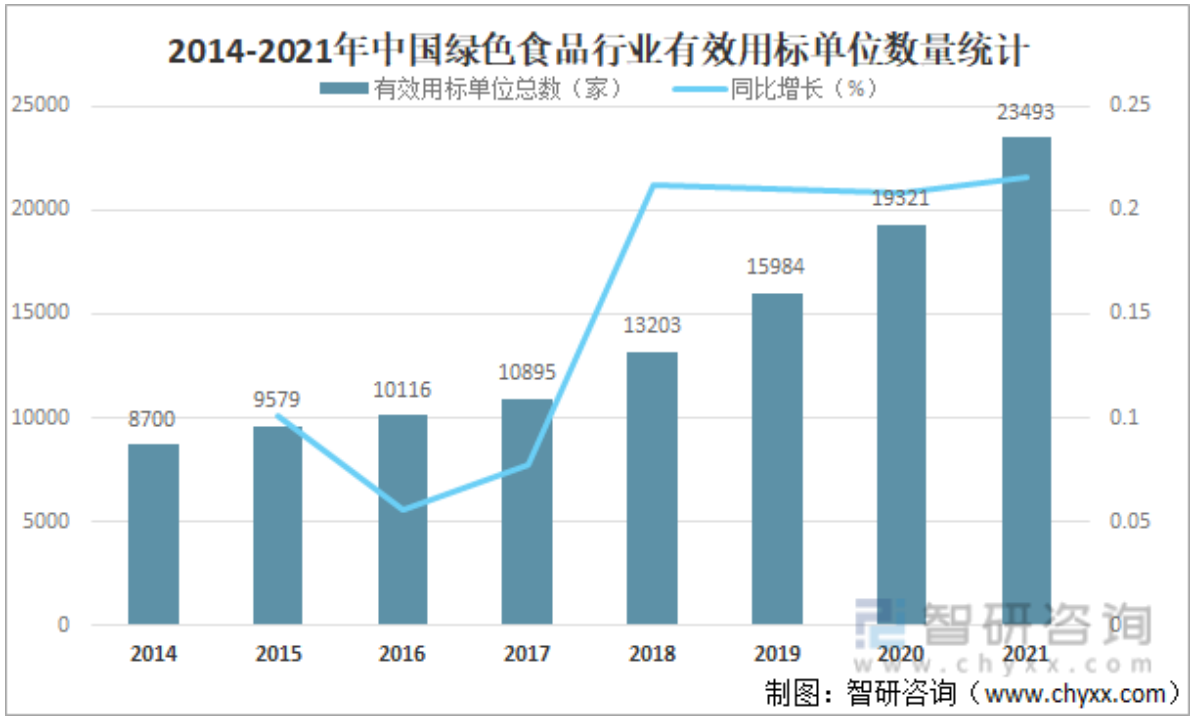
Organic Food

Geographical Indication Product

绿色食品在中国的发展趋势

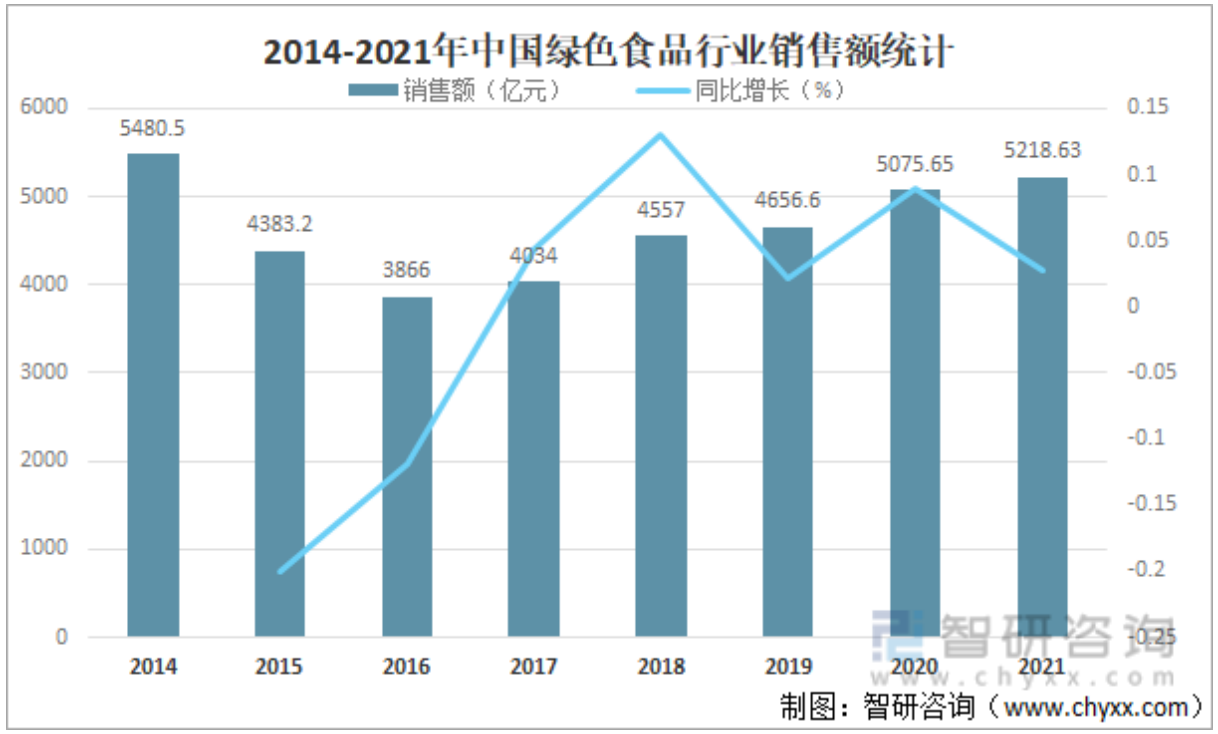
Green Food Development in China

绿色食品标识使用单位数量



Numbers of individual business using green label

绿色食品销售额



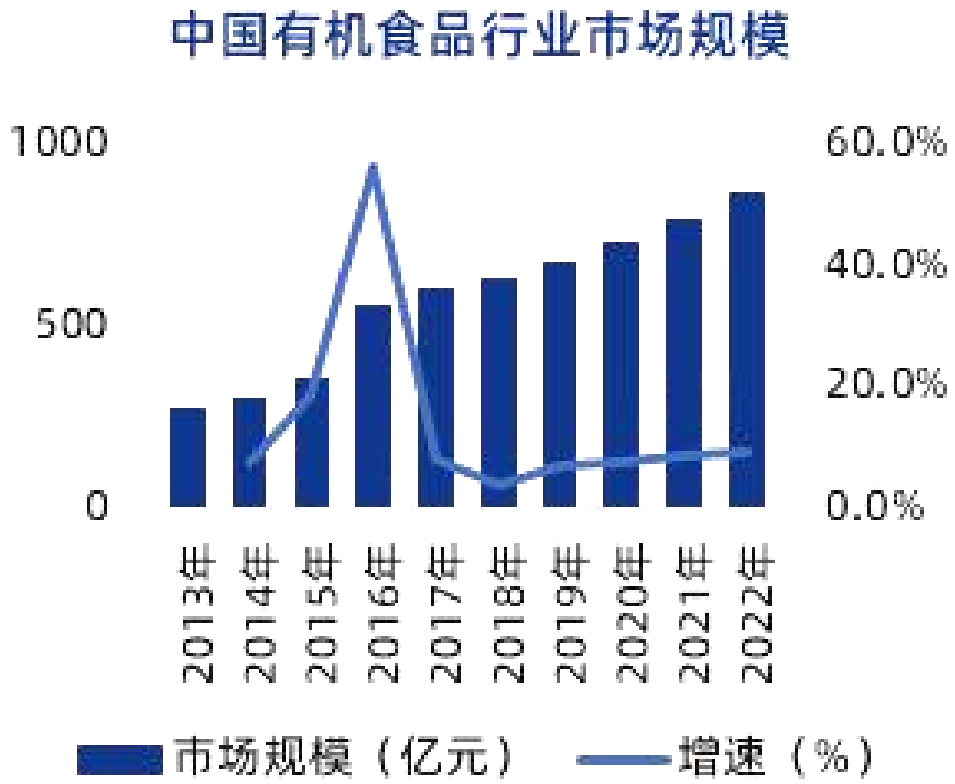
Total sale volume of green food in China

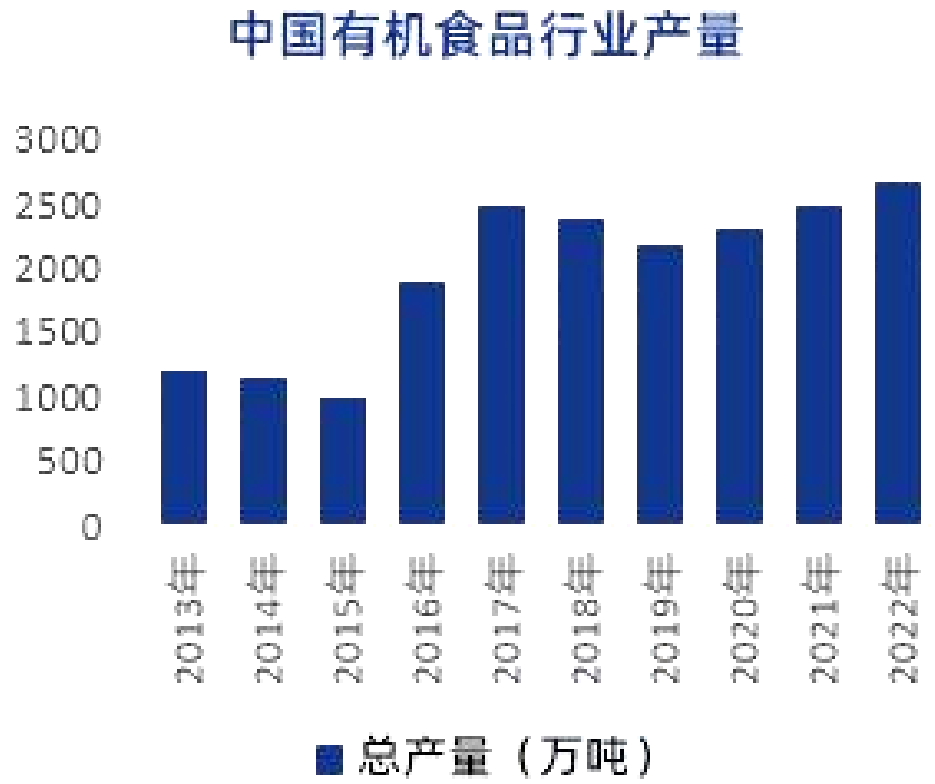
有机食品在中国的发展趋势

Organic Food Development in China

总体呈现上升趋势，2022年销售额达到869.4亿元，总产量为2674.1万吨

It is increasing in general. Total sale reached 86.84 $\times 10^{10}$ RMB Yuan, and total production was 26.74 million ton in 2022 .





方法2. 乡村生态旅游业

The 2nd Approach: Eco-tourism in rural region

由于实施生态农业后获得的良好乡村生态环境和安全农产品，有利于进一步发展第三产业，如

- 乡村旅游
- 休闲养生
- 劳动锻炼
- 教学实习

广州市从化区香蜜山生态果庄有限公司生态农场

8. 前瞻　　Prospect

问题与解决途径

Difficulties and Solutions

- 时间：重新建立生态平衡和土壤改善需要的时间比较长，生态农业取得经济效益的时间长，但是资金周转着眼的时间短，如何建立绿色金融，完善生态补偿制度还需进一步努力
- Time: To recover and to re-establish biological balance in agricultural ecosystem, it needs much longer time than many investment expected. So, it is needed to develop green finance and better eco-subsidy policy.

- 尺度：鉴于病虫害扩散，污染扩散，以及有益生物对于自然环境的依赖，生态农场建设有赖于周边大环境的改善和连片实施。有赖于农民协会、农业合作者或者有一定规模的农业企业连片实施，依赖于政府对改善生态环境的投入（生态廊道建设、缓冲区建设等）
- Scale: The pest expansion, pollution diffusion, and the stable environment needed for beneficial organisms decide that small scale eco-farm surrounded by many chemical farms is hard to get success. Through the effort of Farmers' Association / Cooperation for large scale implementation of agroecology approach is needed. Government coordination and investment for public green environment is also essential.

- 市场：目前生态产品的消费者认可以及去伪存真还存在挑战，生态产品的市场建设还需要进一步拓展
- Market: The fake eco-product still could be found in the market. The consumer education and more effective inspection for eco-labeled products is essential for future market expansion.
- 科研：目前最大挑战在于农作物病虫害以及养殖业病害的生态管控办法，绿色措施有待进一步完善
- Research: The most difficult challenge for agroecology development lies on crop pest control and animal disease control without chemicals or antibiotic/hormone.


谢谢！ Thank you!