上海交通大學
SHANGHAI JIAO TONG UNIVERSITY

设计学院
SCHOOL OF DESIGN
ARCHITECTURE 建筑 / DESIGN 设计
LANDSCAPE ARCHITECTURE 风景园林

Sustainable Ecology Research Center

School of Design, Shanghai Jiao Tong University

CONTENTS

1. Introduction

Founded in 2018, the Sustainable Ecology Research Center is one of the interdisciplinary research platforms established by the School of Design at Shanghai Jiao Tong University. Adhering to the concept of ecological civilization, the Center takes the deep integration of ecological science and ecological humanities as its methodological foundation, and the sustainable development of human settlements and ecosystem health as its strategic objectives. It is committed to building a comprehensive research platform that integrates academic innovation, talent cultivation, and industrial practice. The Center focuses on cutting-edge fields such as integrated governance of the Yangtze River Delta ecosystem, maintenance of coastal ecosystem health, enhancement of urban climate resilience, synergy between urban green space ecology and human settlement health, optimization of ecological service functions in waterfront spaces, and sustainable development of rural ecological health and leisure industries. It has produced a series of innovative achievements of significant academic value and practical significance, making positive contributions to regional and national ecological civilization development.

2. Research Areas

1. Sustainable Landscape Ecological Design

This research direction integrates ecological principles with landscape planning and design practice, dedicated to exploring comprehensive landscape solutions to address climate change and urban environmental challenges. The team has systematically constructed a methodological framework for ecological planning and design, achieving important breakthroughs in the theoretical framework and key technological innovations for urban climate resilience development. Building upon this foundation, the team applies ecological aesthetics theory to provide systematic theoretical guidance for enhancing the public well-being value of urban ecological green spaces. Furthermore, in response to the characteristics of high-density urban environments, the team conducts in-depth explorations of naturalistic green space construction strategies such as urban rewilding, providing innovative paradigms and model pathways for biodiversity-oriented ecological design.

2. Landscape Perception and Health Design

This research direction focuses on the health effects of human settlements, approaching from the perspective of perception science to deeply investigate the mechanisms through which landscape environments influence public physical and mental health and their corresponding planning and design strategies. For high-density urban environments, based on landscape spatial perception theory and neuroscience experimental methods, the team systematically explores the deep mechanisms through which landscape perception affects public health. Meanwhile, utilizing big data analysis technology, the team scientifically evaluates the potential benefits of urban green space quality in reducing medical expenditures and improving cognitive health. The team comprehensively employs various technical methods including questionnaire surveys, behavioral trajectory tracking, physiological indicator monitoring, psychological scale assessments, and structural equation modeling, providing a solid scientific basis for creating biophilic and restorative healthy human settlement environments.

3. Territorial Spatial Ecological Planning and Restoration Design

Addressing major national strategic needs, this direction comprehensively applies multidisciplinary and interdisciplinary technical methods to systematically carry out multi-scale territorial spatial ecological planning and restoration research ranging from watersheds and coastal zones to rural settlements. The team integrates multi-objective collaborative mechanisms with deep learning technology, conducting systematic research in the field of urban-rural ecological spatial pattern optimization. At the same time, targeting urban aquatic ecosystems, the team comprehensively applies multi-scenario simulation and engineering technologies to deeply explore planning response strategies for stormwater risk management and non-point source pollution control, constructing a watershed management system oriented toward aquatic ecological health and climate change.

4. Ecosystem Services and Management

This research direction takes quantitative assessment and spatial planning as its core, focusing on the service functions of urban and regional ecosystems, their spatial trade-offs and synergies, and their deep impacts on human well-being. The team has long been committed to multi-scale modeling and analysis of urban social-ecological systems, exploring technical models for optimizing ecological spatial patterns to enhance integrated service functions including provisioning, regulating, and cultural services during the urbanization process. In addition, the team has conducted frontier explorations in community biodiversity conservation, socio-ecological value assessment of urban green infrastructure, and other fields, with its achievements providing important technical support for intelligent ecosystem management based on multi-source data.

III. Research Team

1. Key Research Personnel

Che Shengquan

Tenured Professor, Doctoral Supervisor, Director of the Sustainable Ecology Research Center, Deputy Director of the Key Laboratory of Urban Agriculture, Ministry of Agriculture, Principal Investigator of the Shanghai International Joint Laboratory of the Belt and Road Initiative—China-Bulgaria Climate Change Rural Ecosystem Governance Project, Principal Investigator of the Shanghai Municipal Education Commission Think Tank Construction Project—Climate Change and Urban Adaptive Governance, Research Fellow of the China Institute for Urban Governance; Member of the Second and Third National Steering Committee for Professional Master's Education in Landscape Architecture, Vice Chairman of the Shanghai Botanical Society, Executive Director of the Shanghai Landscape Architecture Society, and Member of the Shanghai Sponge City Expert Committee.

Research Fields: Climate Change Risk and Adaptive Governance, Ecosystem Services and Human Health & Recreation, Sustainable Ecological Planning and Design.

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Li Junxiang

Ph.D., Tenured Professor of the School of Design, Doctoral Supervisor. He has led and participated in over 20 national and provincial-level research projects, including the National Key R&D Program of the Ministry of Science and Technology, the National Natural Science Foundation of China, the Sino-German Science Center, the EU Erasmus+ Program, the German Federal Agency for Nature Conservation (BfN), the Key Science and Technology Projects of the Ministry of Education, and the Key Projects of the Zhejiang Provincial Department of Science and Technology. He has published over 60 monographs and papers. He also serves as Executive Committee Member of the International Society of Urban Ecology (SURE), Vice Chairman and Secretary-General of SURE China Chapter, Council Member of the International Association for Landscape Ecology (IALE) China Chapter, Council Member of the Ecological Society of China, Vice Chairman of the Sustainable Resource Utilization and Disaster Reduction Professional Committee of the China Society of Natural Resources, Member of the Territorial Spatial Planning Professional Committee of the China Society of Natural Resources, Member of the Landscape Architecture and Beautiful China Construction Professional Committee of the China Urban Science Research Society, and Member of the Urban Agglomeration Green Development Professional Committee of the China Urban Science Research Society.

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Wang Ling

Ph.D., Department Head and Associate Professor, Department of Landscape Architecture, School of Design, SJTU; Visiting Scholar at Cornell University; She served at the Shanghai Municipal Agriculture and Rural Affairs Commission from 2016 to 2017. She is a National Certified Urban and Rural Planner and concurrently serves as Deputy Secretary-General of the Climate Change Response Working Committee of the Chinese Society of Landscape Architecture, Member of the Education Committee and Youth Committee of the Chinese Society of Landscape Architecture, Council Member of the Shanghai Landscape Architecture Society, Member of the Ecology and Landscape Architecture Professional Committee of the Shanghai Urban Planning Society, and Expert Advisor of the Shanghai Baoshan District Rural Governance Institute.

Her research focuses on high-density urban areas, dedicated to cutting-edge research in sustainable planning, design, and construction management of rural human settlements, climate change adaptive planning and design, and landscape spatial perception.

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Xie Changkun

Associate Department Head, Tenured Track Associate Professor, Doctoral Supervisor, Department of Landscape Architecture, School of Design, SJTU; Deputy Director of the Sustainable Ecological Design Center. He received his Ph.D. from SJTU in 2018 and conducted postdoctoral research at SJTU and the Fraunhofer Institute for Building Physics (Fraunhofer IBP) in Germany from January 2019 to March 2023. He has led and participated in multiple projects funded by the National Natural Science Foundation of China (Youth Project), the National Key R&D Program, the National Science and Technology Support Program, the National Natural Science Foundation of China (General Project), the Shanghai Municipal Science and Technology Commission Key R&D Program, international cooperation projects, and policy consulting and planning & design research projects. He has published over 50 academic papers, obtained 15 national invention patents, serves as Youth Editorial Board Member of Acta Ecologica Sinica, Executive Editorial Board Member of Landscape Architecture Frontiers, and reviewer for over 10 international journals.

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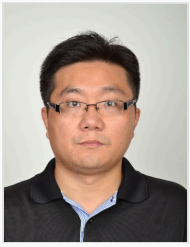

Wang Jin

Ph.D. in Environmental Engineering, Registered Environmental Engineer. He is currently an Associate Professor at the Department of Landscape Architecture, School of Design, SJTU.

Research Directions: Carbon sequestration of forest-water complexes, carbon sequestration of urban constructed wetlands, pollution reduction and carbon emission reduction water treatment technologies, and sponge city research. He has led and participated in one National Natural Science Foundation project each, led two provincial/ministerial-level projects, participated in two National Key R&D Program projects and two international cooperation projects. He has published nearly 20 papers in SCI-indexed journals as the first or corresponding author (including co-corresponding author), and obtained 13 national invention patents as the first inventor.

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Gu Xiaokun

Professor, School of International and Public Affairs, SJTU; Director of the Land Governance Center, China Institute for Urban Governance. He concurrently serves as Council Member and Youth Working Committee Member of the China Society of Territorial Economics, Secretary-General of the Population and Resources Professional Committee of the China Society of Natural Resources, and Member or Youth Member of multiple sub-committees of the China Land Society, the China Urban Planning Society, and the China Urban Science Research Society.

Main Research Directions: Land consolidation, rural transformation and rural gentrification, urban renewal and innovation districts.

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Wang Lu

Director of the Low-Carbon Ecology Research Center, SJTU Design Research Institute; Ecological Tourism Development Consultant.

Research Directions: Ecological tourism, strategic positioning, tourism product development, and tourism planning and design.

Qin Yifeng

Ph.D. in Ecology. He completed his B.S., M.S., and Ph.D. at Central South University, Monash University (Australia), and SJTU, respectively. He is currently an Assistant Professor at the School of Design, SJTU. He has participated in and completed multiple research projects, including the National Key R&D Program, the National Natural Science Foundation of China, and the National Water Special Project of the 12th Five-Year Plan. He has contributed to the formulation of one agricultural industry standard, co-authored one academic monograph, published over 20 academic papers, and obtained 5 national invention patents. He serves as Guest Editor of Discover Cities and reviewer for multiple international journals, including Sustainable Cities and Society and Innovative Infrastructure Solutions.

Main Research Fields: Urban Pluvial Flood Resilience and Watershed Management in the Context of Climate Change.

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Jin Yiding

Ph.D. Candidate (Class of 2023), B.S. and M.S. from Central Saint Martins, University of the Arts London.

Her research focuses on landscape and public space design and its health benefits in the context of high-density cities. She emphasizes the impact of the built environment on public mental health, attention restoration, and stress relief. Adopting an interdisciplinary approach integrating environmental design, environmental psychology, and cognitive neuroscience, she employs multi-dimensional physiological measurement techniques including functional near-infrared spectroscopy (fNIRS), electroencephalography (EEG), and electrodermal activity (EDA), combined with behavioral observation and psychological scales. Through quantitative and qualitative methods, she systematically reveals the interactions between landscape environments and psycho-physiological health, providing empirical evidence and design strategies for promoting public health and constructing supportive urban environments.

Zhao Yangling

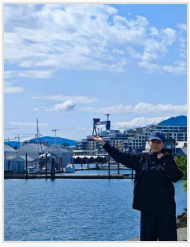
B.S. and M.S. from Minzu University of China, Ph.D. Candidate (Class of 2024).

Research Directions: Urban Resilience Planning. With an interdisciplinary background in environmental engineering and ecology, she focuses on how spatial planning and design can enhance urban adaptive capacity, recovery capacity, and sustainability in response to climate risks and disaster disturbances. She is committed to integrating multi-source data and ecological wisdom to provide scientific support for building more resilient future cities.

Li Mingqian

B.S. and M.S. from Sichuan Agricultural University and Shenzhen University, Ph.D. Candidate (Class of 2025).

Research Directions: Urban Planning, Climate Change, Urban Heat Island, Health and Healing. With an interdisciplinary background in landscape architecture and urban planning, she focuses on how landscape environments influence users' physical and mental health through perceptual experience, spatial characteristics, and psychological response mechanisms. Combining multi-modal research methods such as environmental behavior studies, eye-tracking, and physiological feedback, she explores the healing potential of urban green spaces and therapeutic landscapes, providing evidence-based health-oriented design strategies for high-density urban environments.



Li Xiaotong

B.S. and M.S. from Huaqiao University and SJTU, Ph.D. Candidate (Class of 2026).

Research Directions: Environmental Design, Landscape Health Effects, and Environmental Psychology. She investigates the effects of natural and built environments on mental health, stress recovery, cognitive performance, and physiological responses. By comprehensively employing spatial quantification, psychological measurement, physiological signal acquisition, and virtual reality experiments, she explores the design mechanisms and evaluation methods of health-promoting environments.

Jiang Ruiyuan

Ph.D. Candidate (Class of 2019). Research Directions: Ecological Benefits of Urban Blue-Green Infrastructure, Climate Adaptive Urban Design. He is currently a Lecturer at the College of Landscape Architecture, Nanjing Forestry University.

Man Zihao

Ph.D. Candidate (Class of 2020). Research Directions: Ecological Protection and Restoration of Gardens, Climate Adaptive Cities, and Ecological Planning and Design of Gardens. He is currently a Lecturer at the College of Forestry and Landscape Architecture, Anhui Agricultural University.

Wu Hao

Ph.D. Candidate (Class of 2021). Research Directions: Urban Climate Resilience and Climate Simulation. He is currently a Lecturer at the School of Civil and Architectural Engineering, Zhejiang University of Science and Technology.

2. Visiting Researcher

Yang Fei

Ph.D., Associate Professor from the Institute of Geographic Sciences and Natural Resources Research, CAS;Master's Supervisor; Council Member of the Agricultural Information Branch of the China Association of Agricultural Science Societies, Council Member of the Beijing Agricultural Information Society, Visiting Scholar at George Mason University, and High-Level Flexible Talent Introduced by Yunnan Province.

His research focuses on Remote Sensing (RS) and Geographic Information System (GIS) technologies and methodologies, geospatial big data analytics, and their applications in intelligent monitoring of land and resources, agriculture, ecological environment, and natural disasters.

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IV. External Cooperation

1. International Cooperation

(1) Fraunhofer Institute for Building Physics (Fraunhofer IBP), Germany

The two sides have maintained long-term cooperation and jointly developed the GIS-LCZ optimized classification technology. By integrating three-dimensional building morphological parameters to improve the traditional Local Climate Zone (LCZ) classification method, this technology has significantly enhanced the classification accuracy and precision of urban climate zones, addressing the limitations of traditional land cover classification methods in considering three-dimensional attributes. The technology has been successfully applied to urban heat island research in Berlin, Germany and Shanghai, China, providing refined technical support for the formulation of differentiated heat island mitigation strategies in both cities.

(2) University of New South Wales, RMIT University, and Queensland University of Technology, Australia

Long-term close cooperation has been maintained, focusing on the quantitative assessment and synergistic optimization of urban green infrastructure and ecosystem services. Addressing the trade-offs and synergies among ecosystem services, the collaborative team developed a Bayesian network and SHAP model-based threshold determination method for ecosystem service clusters, capable of identifying key influencing factors and spatial thresholds from nonlinear driving factors, providing scientific evidence and decision-making support for refined planning and design to enhance urban ecosystem service functions.

(3) Bulgarian Academy of Agricultural Sciences, Bulgarian Academy of Sciences, Plovdiv University of Agriculture, and University of National and World Economy

A strategic partnership has been established, with approval for the construction of the Shanghai Belt and Road China-Bulgaria Rural Ecosystem Climate Change Adaptive Governance International Joint Laboratory and the China-Bulgaria Climate Change Ecotourism Sustainable Development Research Center (Guilin), conducting long-term research on urban-rural climate risk assessment and climate resilience construction. The collaborative team developed a CMIP6-based downscaling multi-scenario climate simulation method, constructed a rural climate change vulnerability assessment system covering exposure, sensitivity, and adaptability, and established a Pressure-State-Response-Prediction (PSRP) climate resilience assessment model applicable to urban-rural gradients, forming a "Rural Climate Risk Assessment and Adaptive Design" technical system. The team also published the Bulgaria Rural Climate Risk Assessment (the first climate risk assessment report targeting rural areas in Bulgaria). This technical system has been successfully applied by the Sofia Institute of Agricultural Economics and Plovdiv University of Agriculture to sustainable agriculture and rural climate risk assessment in the Sofia and Plovdiv regions, and has been incorporated into Bulgaria's rural sustainable development assessment technical system. Building upon this, two technical reports—Bulgaria Rural Ecological and Cultural Resource Assessment and Sustainable Development Strategies and Agricultural

Environmental Sustainable Management Assessment and Technology Application—have been adopted by the Bulgarian Ministry of Agriculture and Food and incorporated into the Bulgaria Agriculture 2030 Development Plan.

(4) University of Bucharest, Romania

A long-term and stable academic partnership has been established under the framework of the EU Erasmus+ Program. The two sides conduct in-depth academic exchanges in the fields of ecological planning theory, spatial design methodology, responses of landscape ecosystems to climate change, and landscape adaptive planning, regularly sending scholars for keynote presentations and joint investigations. The cooperation covers cutting-edge directions such as ecological design innovation, territorial spatial planning practice, Nature-based Solutions (NbS), and resilient urban ecological construction, and promotes international talent cultivation through various forms including faculty and student exchanges and joint training programs, providing cross-regional academic wisdom and a cooperation platform for addressing new challenges in global human settlement construction.

2. Partner Organizations

The Center actively establishes in-depth cooperative relationships with government management departments, industry benchmark enterprises, and medical institutions to promote the translation of research achievements into practical applications. Major partner organizations include:

- Shanghai Huangpu District Landscaping and City Appearance Bureau
- Shanghai Fengxian District Landscaping and City Appearance Bureau
- Shanghai Botanical Garden
- Shanghai Landscaping Management and Guidance Station
- Shanghai Public Green Space Construction Affairs Center
- Shanghai Shendi Eco-Group Co., Ltd.
- Shanghai Xiandai Architectural Decoration and Environmental Design Research Institute Co., Ltd.
- Shanghai West Bund Development (Group) Co., Ltd.
- Beijing Feidu Technology Co., Ltd.

Collaborative Achievements with Domestic Local Governments:

Lingbi County, Anhui Province: Rural climate adaptive planning and design technology was applied to the Practical Village Plan for Lizhai Village, Lingbi County. Lizhai Village received special funding for beautiful villages in Anhui Province in 2023, with a total investment of approximately RMB 16.85 million.

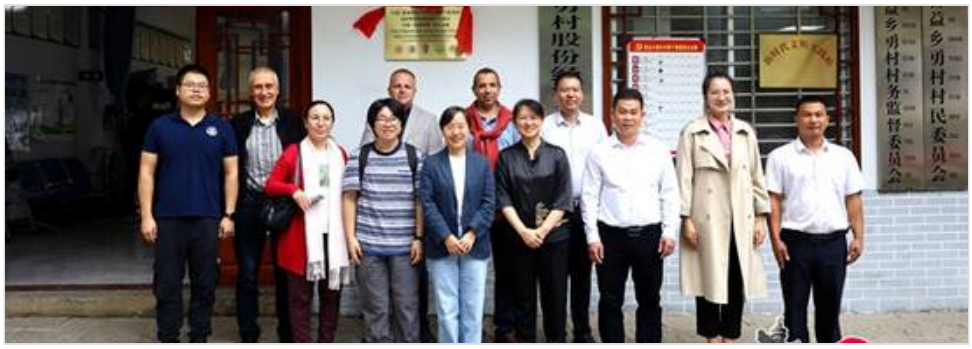
Fengxian District, Shanghai: The consulting report Climate Risk Assessment and Biodiversity Conservation Strategies for Fengxian Park City Demonstration Zone was produced and has been adopted and applied by Fengxian District.

Guilin City, Guangxi: The consulting report Countermeasures and Suggestions for Promoting the Construction of Guilin National Sustainable Development Agenda Innovation Demonstration Zone was

produced, and its core content has been adopted by the Guilin Municipal Science and Technology Bureau.

3. Research Bases

Relying on the international joint laboratory, the Center has established 17 long-term observation and research bases in the Yangtze River Delta and Southwest China, as well as in Bulgaria, forming a rural ecological climate monitoring network covering different geographic and climate types.



Yangshuo Research Base

Bulgaria Erato Sik-Ivanov Stancheva & Co. Farm Research Base

List of Research Bases:

1. Yangshuo Research Base (National Sustainable Development Agenda Innovation Demonstration Zone)
2. Shanghai Chongming District Zhongxing Town Research Base
3. Shanghai Jinshan District Langxia Town Research Base
4. Shanghai Outer Ring Green Belt
5. Shanghai Botanical Garden
6. Shanghai Fengxian District South Shanghai Central Park
7. Shanghai Xuhui District West Bund Natural Art Park
8. 8 Pocket Parks in Risk Areas of Shanghai
9. 11 Pocket Parks in Qingpu District, Shanghai
10. Anhui Suzhou City Huaigou Town Research Base
11. Jiangsu Suzhou City Zhouzhuang Town Research Base
12. Zhejiang Shaoxing City Shihuang Town Research Base
13. Bulgaria Erato Sik-Ivanov Stancheva & Co. Farm
14. Bulgaria Tsalapitsa Town Research Base
15. Bulgaria Brestovitsa Vineyard Research Base
16. Bulgaria Stamboliiski City Research Base
17. Bulgaria Spherica Biodynamic Farm Research Base

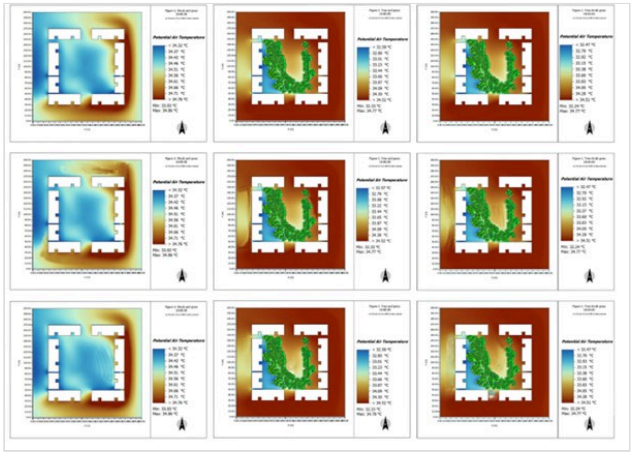
5. Representative Achievements

Technical Achievements

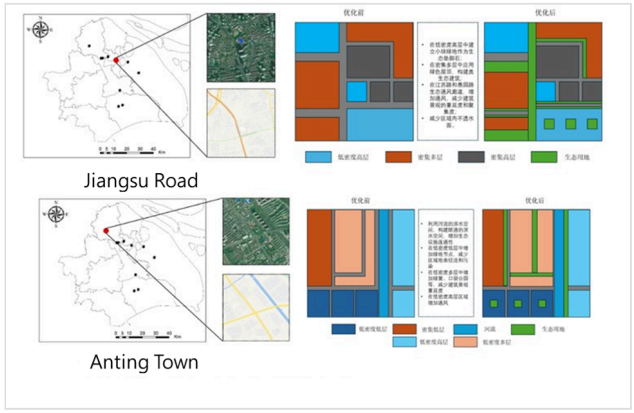
1. Urban and Rural Climate Adaptive Planning and Design Technology System

In response to the dual stressors of extreme heatwaves and pluvial flooding, the Center has developed differentiated "gray-green synergistic" adaptation strategies. High-risk areas prioritize the reinforcement of gray infrastructure and the reduction of impervious surfaces; medium- and low-risk areas promote green facilities such as permeable pavements, rain gardens, and ecological grassed swales. Additionally, optimization thresholds for landscape patterns and integrated solutions for building facades and vegetation structures have been proposed.

The system has been applied to practical projects including Shanghai Huaxin Town Beautiful Block, Shangda Central Park, and Xuhui West Bund Natural Art Park, as well as climate adaptive planning in rural Bulgaria, providing directly implementable design tools for urban and rural thermal environment improvement.



Climate Resilience Assessment

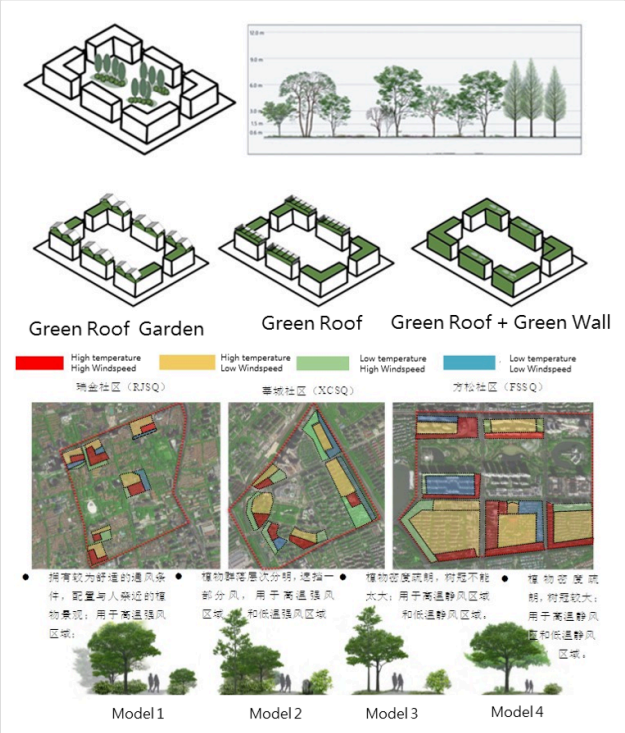


Climate Resilience Optimization Solution

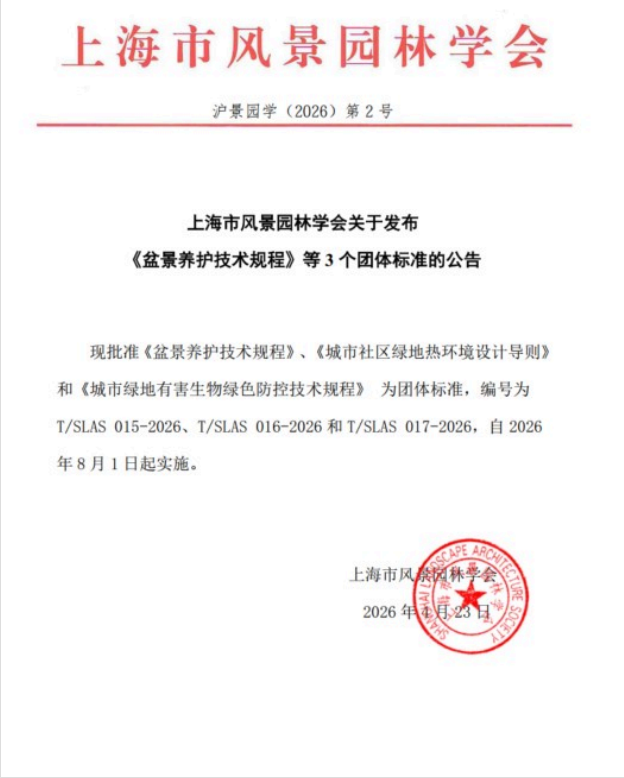
2. Green Space Landscape Planning and Management Technology for Urban Thermal Environments

The Center has constructed a comprehensive urban thermal environment regulation technology system for green spaces covering the entire process of "planning-design-management." A three-level spatial framework of "cool-source green space-cool-corridor green belt-cool-island network" has been proposed, along with a complete set of technical specifications ranging from cool-source layout, corridor width, plant configuration, and shading design to maintenance management.

This provides urban planners and landscape designers with systematic and operable thermal environment regulation tools. Based on this technology, the "Design Guidelines for Thermal Environment of Urban Community Green Spaces" has been released as a Shanghai group standard (T/SLAS 016-2026), providing scientific support for thermal environment adaptive design in the Yangtze River Delta region.



Green Space Landscape Planning and Management Technology for Urban Thermal Environments



上海市风景园林学会

沪景园学（2026）第 2 号

上海市风景园林学会关于发布
《盆景养护技术规程》等 3 个团体标准的公告

现批准《盆景养护技术规程》、《城市社区绿地热环境设计导则》和《城市绿地有害生物绿色防控技术规程》 为团体标准，编号为 T/SLAS 015-2026、T/SLAS 016-2026 和 T/SLAS 017-2026，自 2026 年 8 月 1 日起实施。

上海市风景园林学会

2026 年 6 月 23 日

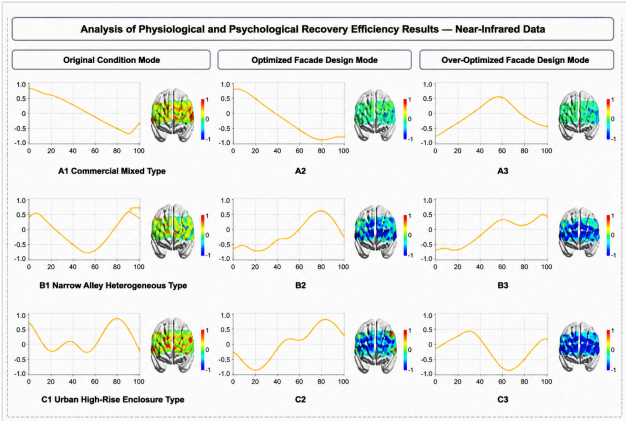
Group Standard Release Notice

3. Rehabilitative Landscape Design Technology System for Stroke Patients

In collaboration with the Stroke Rehabilitation Department of Zhongshan Hospital, Fudan University, the Center utilizes functional near-infrared spectroscopy (fNIRS) to monitor hemodynamic responses in the prefrontal cortex, establishing quantitative correlations between landscape morphology and neural signals, and constructing a three-level progressive rehabilitative landscape design model.

This enables visualized and quantified evaluation of design effects, clarifying the promoting effects of landscapes on cognitive-emotional recovery of stroke patients, and providing evidence-based optimization pathways for community rehabilitation trails, healing gardens, and other scenarios.

Rehabilitative Landscape Design Model

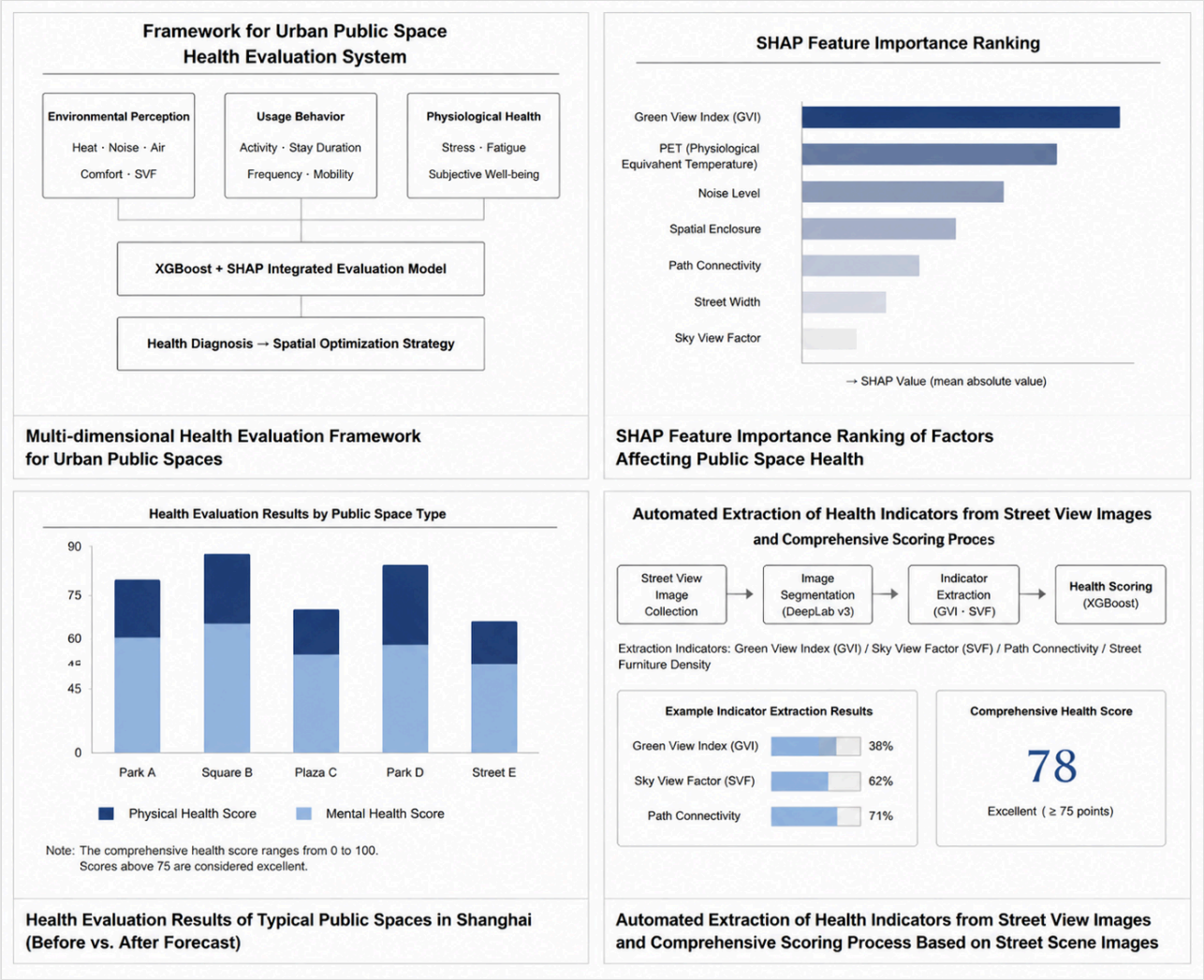


Rehabilitative Landscape Design Model Effects

4. Urban Public Space Health Indicator Assessment Model

The Center has constructed a multi-dimensional assessment system integrating environmental perception, usage behavior, and physiological health, incorporating streetscape imagery, sensor measurements, and resident questionnaire data. Quantitative models have been established for core indicators including air quality, thermal comfort, soundscape, green visibility rate, and accessibility, identifying key factors and thresholds affecting the health benefits of public spaces.

A replicable technical guide for health diagnosis and enhancement of urban public spaces has been developed, applied to empirical assessments of typical community parks, streets, and plazas in Shanghai, supporting space quality improvement oriented toward healthy cities.

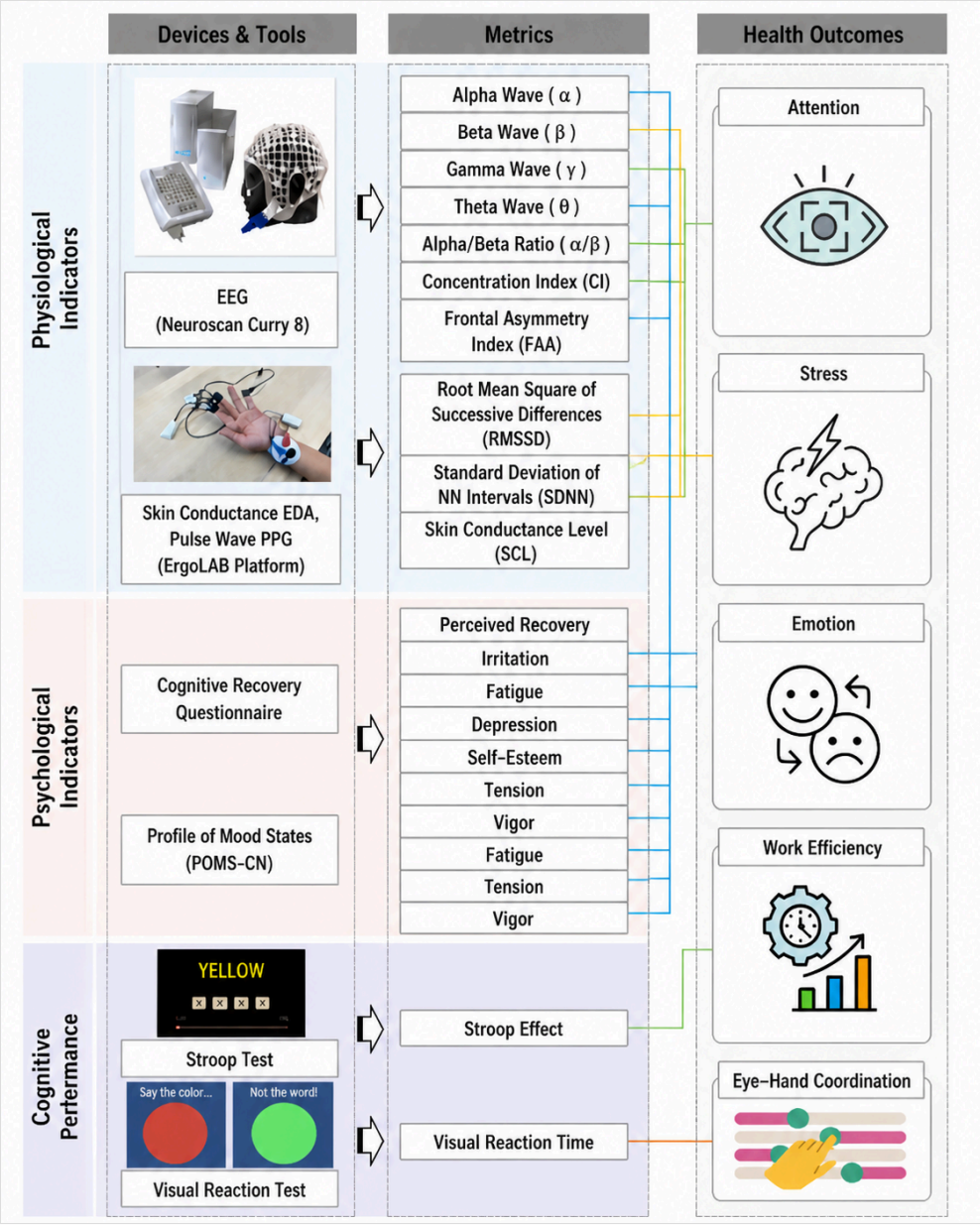


Urban Public Space Health Indicator Assessment Model

5. Mental Health Assessment and Design Generation for School Campuses

Combining standardized assessments (PHQ-9, GAD-7, Perceived Restorativeness Scale) with physiological sensors (skin conductance, heart rate variability), the Center evaluates the impact of campus spaces including playgrounds, corridors, classrooms, and courtyards on students' mental health. Integrating parametric design and generative AI, a mental health-oriented campus space design assistance generation framework has been constructed.

This provides a digital technology pathway for evidence-based design and precise intervention of primary and secondary school campus environments, from assessment and diagnosis to scheme output, supporting the construction of healthy campuses.

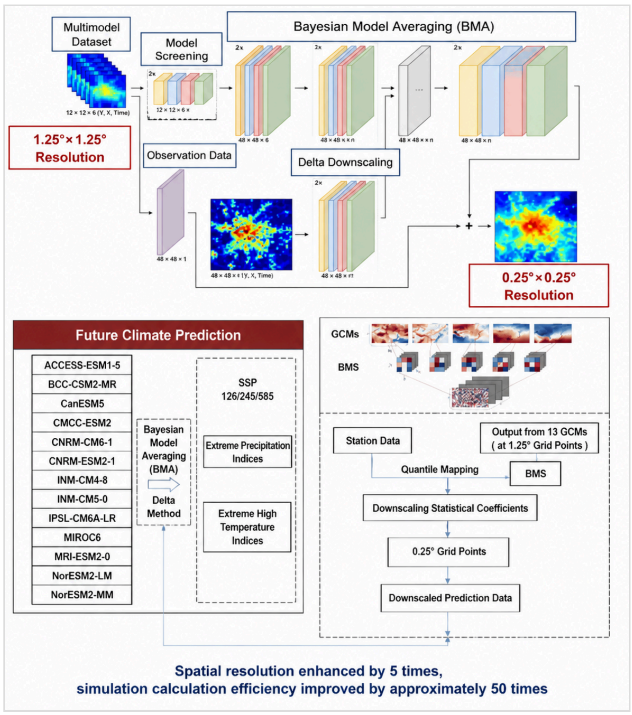


Mental Health Assessment and Design Generation for School Campuses

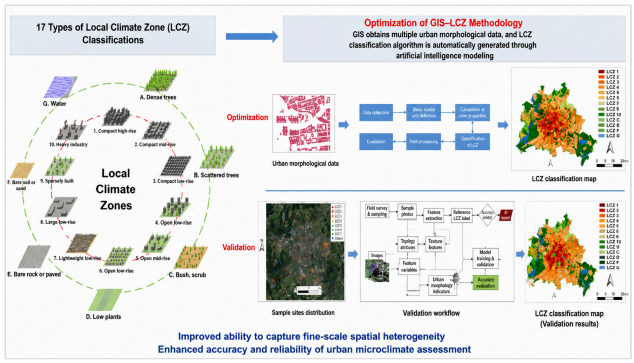
6. High-Precision Urban Climate Zoning and Multi-Scenario Land Use Simulation Technology

In collaboration with the Fraunhofer Institute for Building Physics, Germany, the Center has introduced three-dimensional building morphology parameters to optimize LCZ classification, improving classification accuracy from 61%-84% to over 92%. Simultaneously, using the BMA-Delta downscaling method and CA-Markov model, multi-scenario climate and land use change simulations at 0.25-degree resolution have been achieved.

This has been applied to urban heat island studies in Berlin and Shanghai, supporting urban ventilation corridor planning, heat island risk mapping, and territorial spatial planning decision-making, providing key technical support for high-precision climate-adaptive urban layouts.



BMA-Delta Downscaling Method

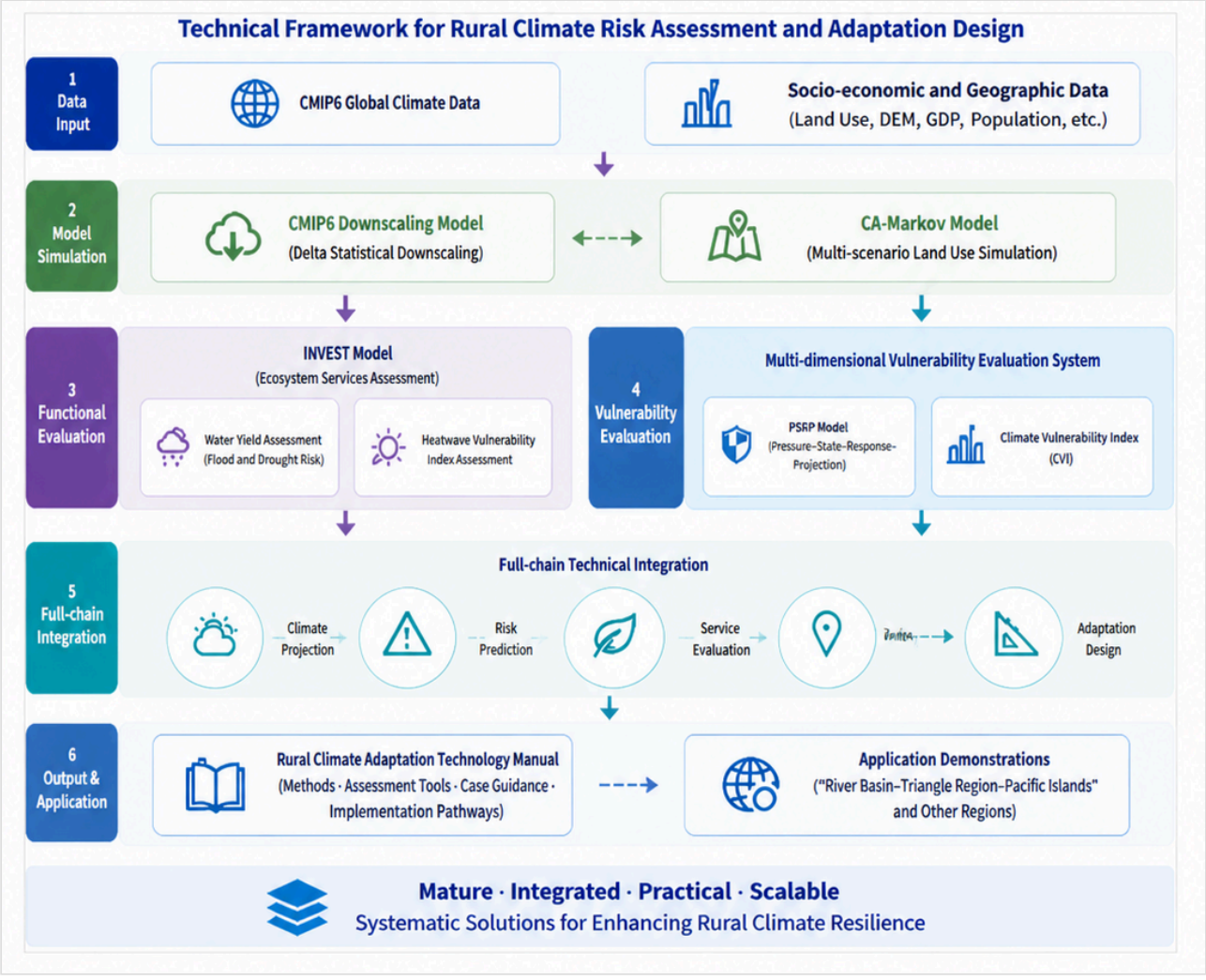


GIS-LCZ Method

7. Integrated Technical System for Rural Climate Risk Assessment and Adaptive Design

The Center has integrated CMIP6 downscaling, CA-Markov land use simulation, InVEST service assessment, multi-dimensional vulnerability evaluation, and the PSRP (Pressure-State-Response-Prediction) model to form a complete-chain technical system covering "climate prediction-risk prediction-service assessment-vulnerability zoning-adaptive design," accompanied by the compilation of the "Technical Manual for Rural Climate Adaptive Governance."

This has supported rural climate risk assessment and adaptive planning design in Guilin (Guangxi), Fengxian (Shanghai), the Sofia region, and the Plovdiv region in Bulgaria. It has been incorporated into Bulgaria's agricultural development planning and provides systematic tools for domestic rural construction.

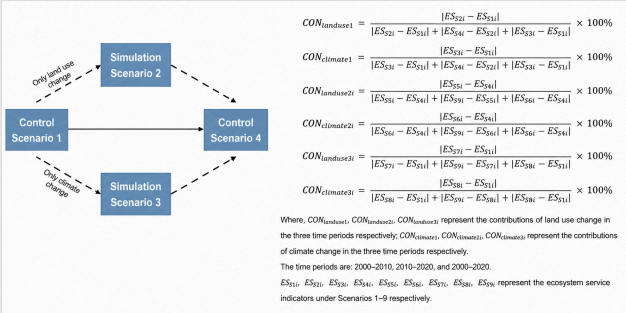


Integrated Technical System for Rural Climate Risk Assessment and Adaptive Design

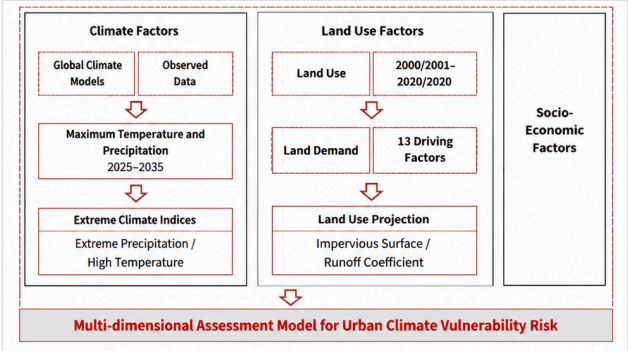
8. Integrated Assessment Technology for Ecosystem Services and Climate Vulnerability

Based on the InVEST model coupled with future climate and land use scenarios, the Center quantitatively assesses urban water yield (pluvial flood risk) and heatwave mitigation index (heat resistance capacity), quantifying the independent contributions of climate change and land use change. Simultaneously, a three-dimensional vulnerability evaluation model encompassing climatic factors, land use factors, and socio-economic factors has been constructed, employing the entropy weight method to classify five-level climate vulnerability risk zones.

This serves pluvial flood management and heat island mitigation strategy formulation for projects such as Shanghai Fengxian Park City Demonstration Zone and Guilin Sustainable Development Agenda Innovation Demonstration Zone, and supports climate vulnerability zoning at the township scale in Shanghai and in rural Bulgaria, providing risk level bases for differentiated adaptation strategies.



Quantitative Assessment Method for Urban and Rural Ecosystem Services



Multi-Dimensional Climate Vulnerability Risk Assessment Model

Software Tools

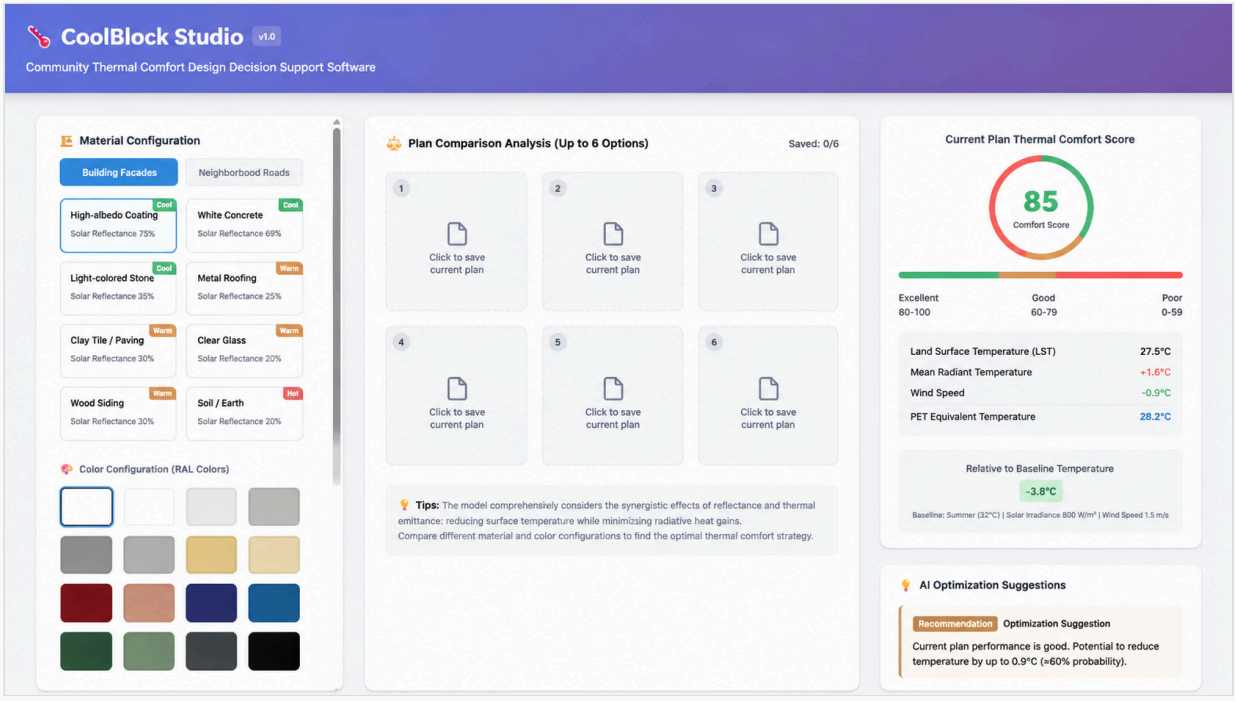
1. Community Carbon Emission Accounting and Analysis System

This system addresses community-scale carbon accounting and emission reduction decision-making needs. It incorporates multi-source data models for building energy consumption, transportation emissions, green space carbon sinks, and waste treatment, supporting rapid generation and visualized analysis of community-level carbon emission inventories. Designers and managers only need to input conventional planning parameters such as community land use type, building density, energy structure, and green coverage rate; the system automatically calculates total annual carbon emissions, sub-item compositions, and carbon sink balance status, and intelligently identifies major emission sources and emission reduction potential points. The system can be used for low-carbon community applications, planning scheme comparison, carbon reduction target tracking, and other scenarios, providing quantified decision-making tools for community low-carbon construction.

Community Carbon Emission Accounting and Analysis System Interface

2. Urban Community Thermal Environment Optimization Design Decision Software (CoolBlock Studio)

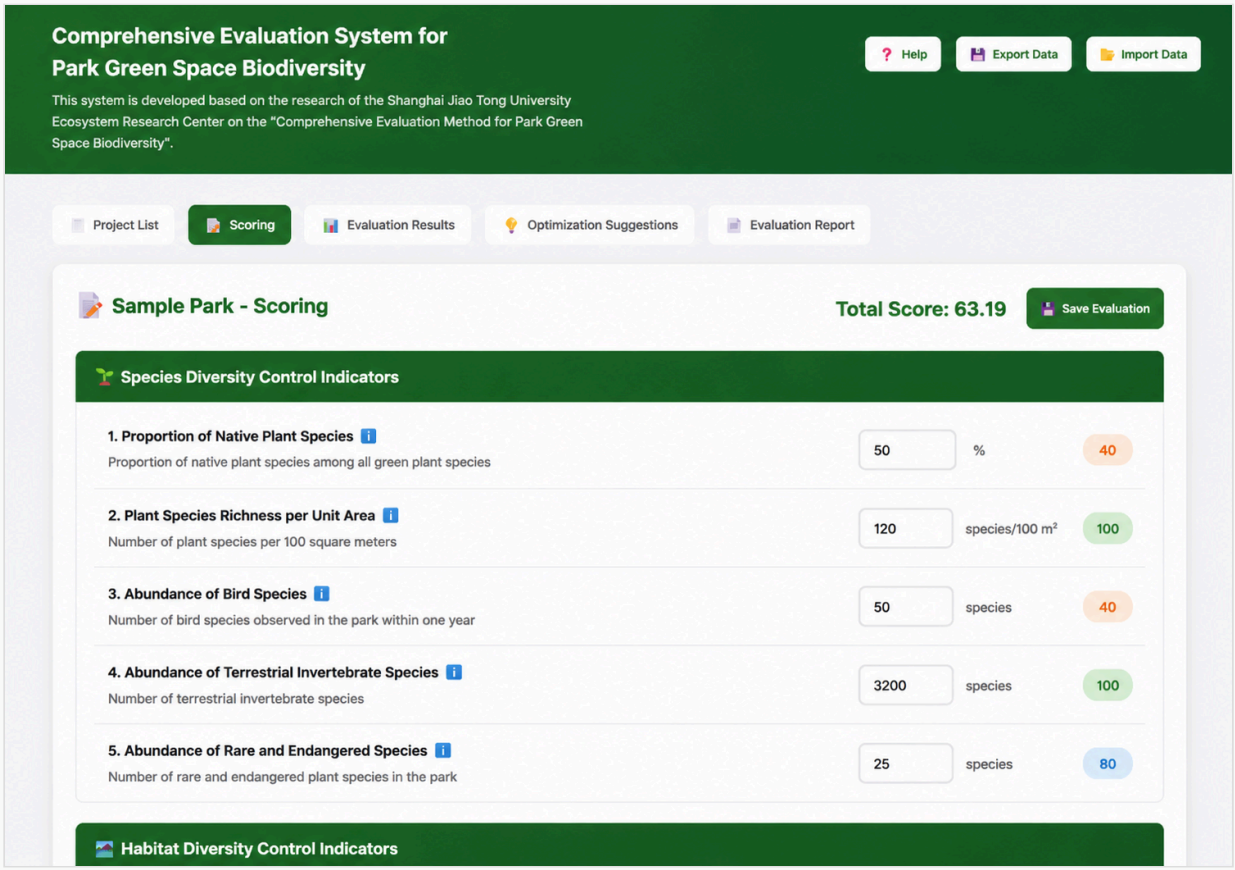
Addressing the issue that current thermal environment simulation tools have overly specialized parameters disconnected from designers' thinking, this software adopts a design semantics translation architecture. Based on the Center's long-term research measurement data, a multiple regression model is constructed; the frontend uses designers' daily vocabulary: facade materials, RAL color cards, shading coverage ratio, tree-shrub-grass ratios, etc. Users do not need to understand physical parameters such as albedo and leaf area index; they only need to select material colors and set greening structures according to their design habits, and the system provides real-time feedback on thermal comfort scores (PET index), thermal risk levels, and optimization suggestions. It supports comparison of up to six schemes and intervenes at the conceptual design stage to improve design efficiency.



CoolBlock Studio Interface

3. Park Green Space Biodiversity Integrated Assessment System

Based on the 12 core indicator system constructed by the Center (covering three dimensions: species diversity, habitat diversity, and management control), the system enables rapid quantitative assessment of park green space biodiversity levels. After users input raw data such as native plant ratio, bird species count, natural space proportion, habitat type, permeable pavement ratio, and management operation systems, the system automatically calculates comprehensive scores and grades based on multi-group decision-making weights, and visually displays scores for each dimension through radar charts and bar charts. The system also includes an intelligent optimization suggestion module that automatically generates prioritized improvement strategies and implementation difficulty prompts for indicators with low scores, and supports the generation of PDF assessment reports. It is applicable to park management departments' status assessments, design scheme comparisons, long-term monitoring, and scientific research data collection.



Park Green Space Biodiversity Integrated Assessment System Interface

6. Courses

The Center has established a curriculum system centered on three graduate courses taught in English---"Ecology and Design," "Climate Adaptive Design," and "Spatial Data Statistics and Analysis"---and two undergraduate courses---"Intelligent Perception of Landscape Environments and Health" and "Urban Climate Resilience Design"---systematically integrating research outcomes into teaching practice. Graduate courses emphasize theoretical methods and technical tools through all-English instruction, dedicated to cultivating professionals with international perspectives; undergraduate courses emphasize design practice and frontier exploration, consolidating professional foundations.

Graduate Courses (Taught in English)

Ecology and Design

This course focuses on ecosystem service assessment and sustainable landscape design, combining tools such as the InVEST model and ecological sensitivity analysis to guide students in understanding the structure and function of urban and rural ecological spaces from multiple dimensions including ecological processes, spatial patterns, and design expression, and mastering planning and design methods based on ecosystem services. The course emphasizes the deep integration of theoretical instruction and design practice, enabling students to systematically master the theoretical framework and technical approach of ecological design, providing scientific support for solving practical ecological problems.

Climate Adaptive Design

This course integrates the Center's research outcomes in CMIP6 multi-scenario climate simulation, multi-dimensional vulnerability evaluation, and adaptive planning and design technology, focusing on urban and rural responses to typical climate risks such as extreme heatwaves and pluvial flooding. It teaches the complete-chain methodology from climate risk assessment to spatial design strategies. The course covers key technologies including statistical downscaling methods, CA-Markov land use simulation, and ecosystem service assessment, with emphasis on cultivating students' comprehensive capabilities in conducting resilient design under uncertain climate scenarios.

Spatial Data Statistics and Analysis

This course combines the Center's research foundation in GIS-LCZ local climate zone optimization, spatial analysis, landscape pattern dynamics, and ecosystem service assessment, systematically teaching methods for spatial data acquisition, processing, analysis, and visualization. The course covers spatial autocorrelation analysis, spatial regression modeling, and time series prediction techniques, and conducts skill training using tools such as R language. Students will master core capabilities including spatial data mining, spatial statistical modeling, and spatial presentation of computational results, laying the foundation for participating in ecological planning and GIS-related research and practice.

Undergraduate Courses

Intelligent Perception of Landscape Environments and Health

This course focuses on the deep impact of landscape environmental quality on human physical and mental health, combining cutting-edge technologies such as microclimate monitoring and EEG/skin conductance physiological index testing with traditional landscape evaluation methods, guiding students to analyze health-driving factors of landscape perception from multiple dimensions. The course integrates multi-dimensional data including EEG monitoring, behavioral trajectory analysis, and population profiling, exploring the correlation mechanisms between environmental exposure and health benefits, cultivating students' abilities to use scientific methods to optimize health-oriented landscape design.

Urban Climate Resilience Design

This course takes landscape strategies for responding to climate risks such as extreme heat and urban waterlogging as its core content, combining the Center's research outcomes in pluvial flood resilient green spaces and cooling plant communities, guiding students to apply targeted surface cooling, interception and infiltration promotion, and microclimate improvement measures at community and neighborhood scales to conduct resilient optimization scheme design. The course emphasizes the deep integration of theory and practice, aiming to enhance students' systematic thinking and practical capabilities in implementing sustainable landscape design in the context of climate change.

7. International Conferences and Forums

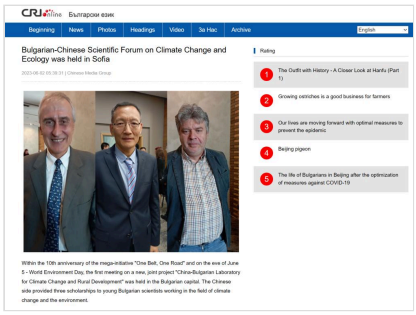
Based on the major strategic needs of global climate governance and ecological civilization construction, the Center regularly conducts high-level international academic exchange activities, focusing on core issues such as climate change adaptive design, low-carbon cities, rural revitalization, and ecosystem governance. Through continuously hosting series of international forums and academic seminars, the Center continuously expands its international cooperation network, gathers global academic wisdom, and promotes transnational sharing and transformative application of research outcomes.

Overview of Major International Conferences Held in Recent Years

No.	Date	Conference Name	Location
1	2022.09	Launch Ceremony of the China-Bulgaria Joint International Laboratory for Climate Change Adaptive Governance of Rural Ecosystems and China-Bulgaria Academic Seminar on Climate Change and Rural Ecosystem Governance	Shanghai, China
2	2023.05	2023 China-Bulgaria Climate Change and Rural Revitalization Forum and Annual Seminar and Training Conference of the China-Bulgaria Joint International Laboratory for Climate Change Adaptive Governance of Rural Ecosystems	Sofia, Bulgaria
3	2023.08	"Future Eco-City Forum---Climate Change and Low-Carbon Cities" Forum	Shanghai, China
4	2023.10	China-Bulgaria Climate Change and Rural Revitalization Forum (2023 Shanghai) and Shanghai "Belt and Road" Joint International Laboratory Research Base Accreditation Ceremony	Shanghai, China
5	2024.08	2024 China-Bulgaria Climate Change and Rural Revitalization Forum and Global Challenges Program---China-Bulgaria Climate Change Assessment and Adaptive Planning Achievements Exhibition	Sofia, Bulgaria
6	2024.10	2024 China-Germany "Addressing Climate Challenges---Digital Analysis of Urban Built Environment Thermal and Moisture Conditions" Academic Seminar	Shanghai, China
7	2024.11	"2024 Climate Change and Adaptive Design" International Academic Seminar	Shanghai, China
8	2024.11	"Belt and Road" Climate Change and Regional Sustainable Development Forum and Guilin National Sustainable Development Agenda Innovation Demonstration Zone Capacity Building Training Conference	Guilin, China
9	2025.04	2025 Shanghai International Flower Show "Dancing with Nature, Resonating with Life" Themed Salon	Shanghai, China
10	2025.06	2025 China-Bulgaria Climate Change and Rural Revitalization Forum (Sofia) and Shanghai "Belt and Road" Joint International Laboratory Annual Conference	Sofia, Bulgaria

Through continuously hosting international conferences, the Center has expanded its cooperation network and formed a complete exchange chain of "academic seminars-achievements exhibition-joint base establishment-capacity building training." The series of conferences have repeatedly received support from official institutions such as the Chinese Embassy abroad, Shanghai Municipal Science and Technology Commission, and the Bulgarian Academy of Agricultural Sciences, and have been widely reported by mainstream domestic and

international media including Xinhua News Agency, People's Daily Online, China Media Group, and Bulgarian National Television.



China Media Group International Online (Bulgarian Channel) Report

Bulgarian News Agency Report

Xinhua News Agency (English Edition) Report