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## Urban-Rural Environmental Master Planning An Instrument for Sustainable Spatial Management

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# Forword >>

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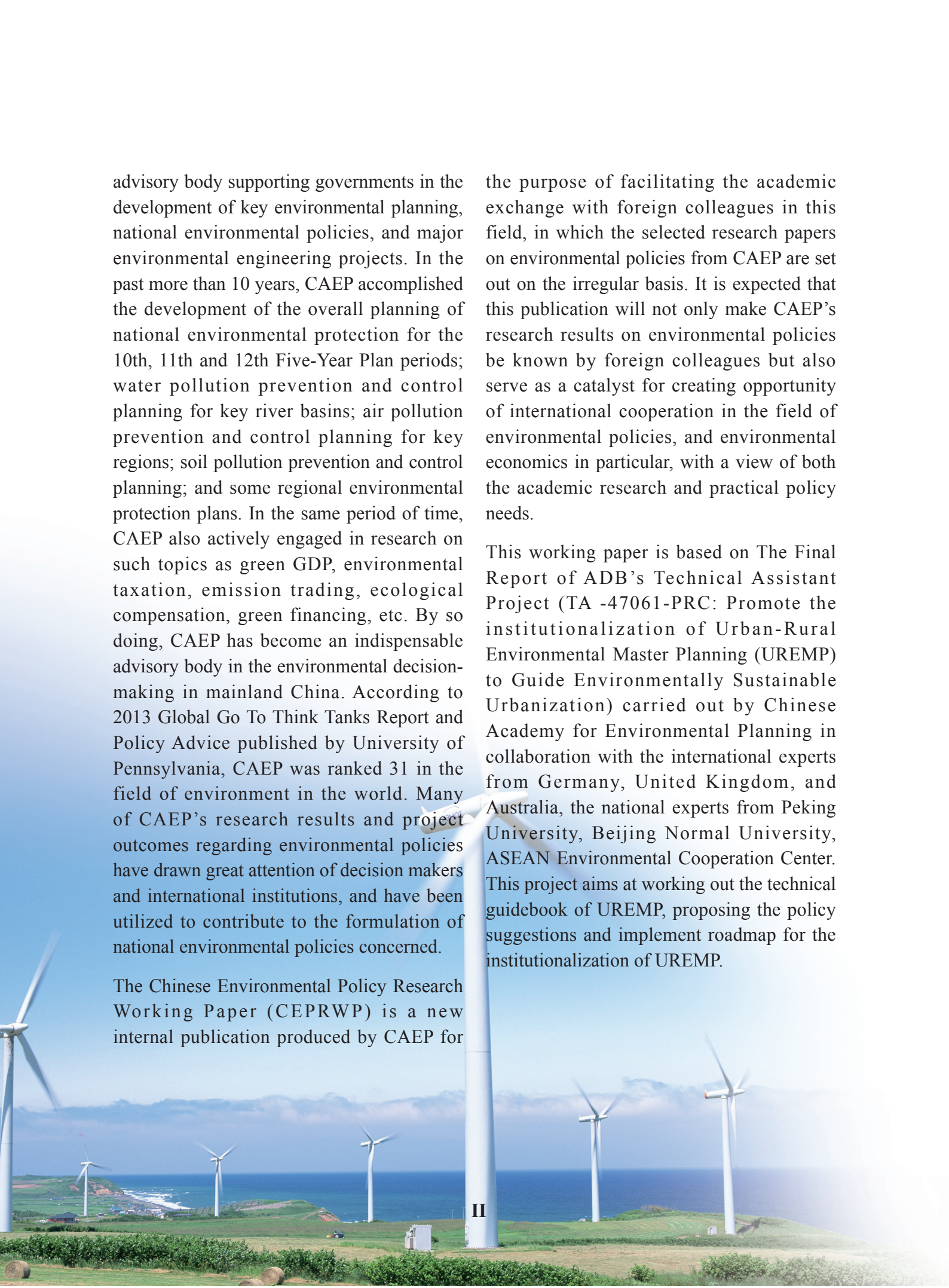


Since its opening-up and reform, China has been in the process of rapid economic development with its people enjoying an increasingly improved standard of life. Meanwhile accompanying this dramatic economic growth is the degradation of environment which has, to some extent, damaged the gains of the opening-up and reform and prevented the economy from a healthy and sustainable development. The Chinese government is increasingly aware of that without addressing the environmental issues it is facing now will jeopardize its long term goal of the great rejuvenation of the Chinese nation. Given the magnitude and complexity of the environmental issues in China, there is no easy way in addressing them and the solution to them entails an equal priority being given to environmental protection, ecological conservation and economic development or even higher than the latter by mainstreaming the former into the overall socio-economic decision-making process. As a matter of fact, China has

been in the struggle against environmental pollution since the very beginning of its economic take-off and trying to explore a pathway that could help address China's environmental issues in the way most suitable to China's specific circumstances.

In recent years, especially since the 12th Five-Year Plan period, the enhanced measures including legislation, policy, regulatory and economic means have been taken by the Chinese government in dealing with environmental problems, of which environmental policies have played an important role in this regard. Corresponding to this situation and in meeting the demand of governments at different levels for environmental policy tools, the environmental policy research projects on topics of a wide range have been conducted by some Chinese environmental research institutions including the Chinese Academy for Environmental Planning (CAEP).

CAEP founded in 2001 is a research



advisory body supporting governments in the development of key environmental planning, national environmental policies, and major environmental engineering projects. In the past more than 10 years, CAEP accomplished the development of the overall planning of national environmental protection for the 10th, 11th and 12th Five-Year Plan periods; water pollution prevention and control planning for key river basins; air pollution prevention and control planning for key regions; soil pollution prevention and control planning; and some regional environmental protection plans. In the same period of time, CAEP also actively engaged in research on such topics as green GDP, environmental taxation, emission trading, ecological compensation, green financing, etc. By so doing, CAEP has become an indispensable advisory body in the environmental decision-making in mainland China. According to 2013 Global Go To Think Tanks Report and Policy Advice published by University of Pennsylvania, CAEP was ranked 31 in the field of environment in the world. Many of CAEP's research results and project outcomes regarding environmental policies have drawn great attention of decision makers and international institutions, and have been utilized to contribute to the formulation of national environmental policies concerned.

The Chinese Environmental Policy Research Working Paper (CEPRWP) is a new internal publication produced by CAEP for

the purpose of facilitating the academic exchange with foreign colleagues in this field, in which the selected research papers on environmental policies from CAEP are set out on the irregular basis. It is expected that this publication will not only make CAEP's research results on environmental policies be known by foreign colleagues but also serve as a catalyst for creating opportunity of international cooperation in the field of environmental policies, and environmental economics in particular, with a view of both the academic research and practical policy needs.

This working paper is based on The Final Report of ADB's Technical Assistant Project (TA -47061-PRC: Promote the institutionalization of Urban-Rural Environmental Master Planning (UREMP) to Guide Environmentally Sustainable Urbanization) carried out by Chinese Academy for Environmental Planning in collaboration with the international experts from Germany, United Kingdom, and Australia, the national experts from Peking University, Beijing Normal University, ASEAN Environmental Cooperation Center. This project aims at working out the technical guidebook of UREMP, proposing the policy suggestions and implement roadmap for the institutionalization of UREMP.



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## EXECUTIVE SUMMARY

- 1. Institutionalization and mainstreaming of Environmental Protection from Urban development, city sprawl and over-development

China's urbanization, an important strategy to achieve modernization, has entered a crucial period. Though great achievements have been made, it still faces severe environmental challenges. The challenges are: urbanization failing to respect natural ecological pattern, increasingly severe conflicts appear between urban development pattern and natural ecological pattern, important ecosystem is encroached, invaded and even removed. Resources are excessively exploited. Water and land are deficient. The utilization of resources was wasting and inefficiency. Problems of degrading urban-rural ecological function and worsening environment quality are prevalent. China has both rapid urbanization and worsening urban environmental function.

Planning is the basic rule of guiding and controlling reasonable urban development. But the present urban environmental protection planning is congenitally deficient, of which four are distinctive. Resource and Environment carrying capacity is weakly constrained, and lacking connection with industrial development of urbanization; Environmental space management is difficult to carry out due to lack of related platform, policies, and controlling means; Ecological

and environmental service function is worsening together with environment quality. It lacks effective measurement and evaluation mechanism. The environment priority is difficult to implement because of lacking mechanism and technology platform. In addition, urban environment needs systematically management, but related contents of environmental protection are dispersed to many concerned administrative departments due to the influence of administration system which contain the contents of ecological environmental protection in their own. By this planning and management are fragmented.

Improving urban-rural environmental planning system is necessary means and only road to solve our environmental issues during urbanization and the key is establishing UREMP. In China, master planning includes Urban Master Planning, Land Use Master Planning, Main Functional Area Planning, National Economic and Social Development Planning. 'Master' means: firstly, from the perspective of legal status, related planning laws and regulations are promulgated to make clear the legal effectiveness of planning and this is a basic planning that governments and the whole society should follow. Secondly, in the aspect of planning system, planning content, technological methods, planning system and technological regulations are established systematically, strict functional layout, space control and constraint control index are designed to strengthen the guidance and constraint of planning. Thirdly, in



the aspect of planning implementation, sound mechanism of planning, approval, implementation, evaluation, revision are established to guarantee regulatory management of planning, which provide important reference for UREMP.

Many countries in worldwide have come across a series of environmental issues in the process of rapid urbanization, but they have gradually realized that environmental stability and recovery should attained by consolidating planning, perfecting laws and strengthening protection for permanent ecological land. They have provided typical cases for UREMP: permanent protection of ecological green land in Berlin and London, protection and controlling of air passage and air field in Stuttgart, and controlling intensity of land exploration in Singapore and Hong Kong.

- 2. Establish a UREMP system in the P.R.C.

It is recommended to develop a legal framework for UREMP to become a legally binding Urban Sprawl and Over-development instrument providing upstream input for the development of regional land-use plans and urban-rural master plans downstream. Cities and their surroundings in the P.R.C. will be required to prepare an urban-rural environmental master plan with environmental zoning categories, plotting urban-rural environmental red-lines (no-build zones, growth boundaries) guiding land-use and urban master plans.

Key reforms that will effectively promote a more environmentally sustainable urbanization in the P.R.C. include:

- i. Institutionalize and mainstream UREMP as a new, mandatory planning instrument to protect environment and ecosystems through “urban-rural environmental red lines” guiding urban growth and limiting sprawl.
- ii. Institutionalize inter-departmental and cross-jurisdictional coordination and partnerships.
- iii. Provide technical guidelines, capacity development for planning, implementation, monitoring, evaluation and enforcement of UREMP and develop and fund an institution and research that provide technical support.
- iv. Develop environmental management, monitoring, governance and enforcement systems, and incentives and eco-compensation mechanisms promoting urban-rural environmental protection partnerships.
- v. Integrate UREMP with regional planning and downstream urban-rural good practices planning for green, inclusive and competitive development.
- vi. Engage in public outreach, conduct awareness campaigns, and stakeholder consultations and participation during planning, operation and monitoring.





**To establish UREMP system, the priority is to make breakthrough in technology.** China faces three problems in urbanization and city construction including environmental resources overloading, environmental space disorder and environmental function worsening. To demonstrate the master, the first thing is to have scientific arrangement for urban-rural natural environmental system. Environmental function is the basis of urban development, as well as the main content and organic part of environmental competency. Extensity is distinctive feature of environmental system. Spatial difference, rule of territorial differentiation are the basic rules we should follow in UREMP. Therefore, the core thought is improving urban-rural environmental function by controlling environmental space, and the technological conundrum is correct recognition, conservation, improvement of environmental function and scientific analysis, zoning and management of environmental space. After that, mature planning scheme is constructed.

Combining practical experience in pilot cities and international experience, research team put forward monitoring and evaluation methods on resource and environment carrying capacity focusing on spatial differentiation and guaranteed rate of time period, and deepen the concept of total controlling into it, thus lay foundation for optimizing urban-rural development pattern, resource utilization and environmental resource management. Atmospheric flow region model is developed with high time resolution (hourly) and high spatial resolution

(1 km vertical ground, 28 layer the smallest scale of 10 meters). High precision pollution source sensitivity traceability evaluation method and gathering vulnerability assessment method are developed. Analytical technology of water environment system in an area of 10 square kilometres is explored. Environmental system analysis is precisely implemented in GIS system, thus achieving precise integration of water and atmospheric environment system. Urban ecological protection red-line planning technology of identification, evaluation, cohesion, landing towards ecosystem is developed to ensure the ecological red-line can be implemented. On the basis of traditional ecological land protection and ecological planning of landscape, the research team put forward the maintenance, promotion and planning ideas of ecological function, achieving optimal efficiency of ecological function protection and ecological factors input. Breakthrough in planning method is an important prerequisite and basis of the planning system breakthrough.

**To establish UREMP system, more important is to break through the system obstacles.** The property of master comes from the fact that environment is scarce resource and environmental resources are the bottleneck of healthy and sustainable development of China's urbanization. Environment quality is a public product and service. The fact that environmental quality lies in the responsibility of governments lacks legally binding. Pilot cities of UREMP promoted by the MEP and multi-planning integration promoted by National



Development and Reform Commission, Ministry of Housing and Urban-Rural Development, MEP, Ministry of Land and Resources has begun to admit the master and basic position of UREMP.

**Two ways are required to make breakthroughs in UREMP system. Firstly, establish legal status and effect of UREMP through legislation.** The newly revised Environmental Protection Law of China is to be implemented. There are a number of pollution prevention and control law to be revised during the period of 13<sup>th</sup> Five-Year Plan. We are struggling to bring the UREMP to the related laws in the process of revising other planning laws. In addition, practical experience from Guangdong province suggests that submitting the UREMP to the NPC for deliberation and implementation will also significantly improve the legal effect of planning. **Secondly, make decision-makers and other planners gradually realize**

**the master effect of UREMP.** Carrying capacity of resources, ecological protection red line and bottom line of environment quality are reflections of the objective law of the environmental system and have basic, pioneering, and mandatory effect on other planning. Integrate the core requirements of UREMP into other planning through full planning cohesion.

- 3. Prepare a Technical Guidebook of UREMP in Cities and their Rural Hinterlands in the P.R.C.

The specific objectives and methods of preparing a UREMP are described in 8 Steps in this report, which provide step-by-step technical guides to implement UREMP. Within these 8 Steps, there are 36 technical modules describing methods of analysis and synthesis on specific aspects of environmental protection and planning.

Table 1 9 Steps and 42 Modules for UREMP Zoning

8 Steps	36 Modules
<b>Step 1: Establish UREMP Area and Partnership</b>	<b>Module 1A: Analyse and map urbanized areas and areas exposed to risk from urban and suburban development and sprawl due to proximity and/or planning</b>
	<b>Module 1B: Analyse the boundaries of bioregions and subregions</b>
	<b>Module 1C: Agree on jurisdictions and UREMP partnership</b>
	<b>Module 1D: Agree on UREMP boundary</b>
<b>Step 2: Prepare agreed standards for the UREMP Atlas</b>	<b>Module 2A: Adopt data standards</b>
	<b>Module 2B: Adopt GIS standards</b>
	<b>Module 2C: Adopt mapping standards and base maps</b>

**NOTE**

Steps/Modules in **bold** are essential and very relevant areas for action, others are desirable.





8 Steps	36 Modules
<b>Step 3: Prepare an Ecosystem Map and Ecosystem Services Values Zoning and Protection Map</b>	<b>Module 3A: Map ecosystems and analyse ecosystems services (initial valuation)</b>
	<b>Module 3B: Analyse and map ecosystems health and biodiversity</b>
	<b>Module 3C: Analyse and map landscape integrity</b>
	Module 3D: Assess the roles of ecosystems in the carbon cycle
	<b>Module 3E: Indicative regional ecosystems protection zoning and mapping</b>
<b>Step 4: Prepare an Indicative Zoning Map for ‘Green’ Land Protection</b>	<b>Module 4A: Identify and map forest areas</b>
	<b>Module 4B: Identify and map agricultural and pasture areas</b>
	Module 4C: Identify and map mineral resource areas
	<b>Module 4D: Identify and map soil conservation areas</b>
	<b>Module 4E: Identify and map priority hazardous areas</b>
	<b>Module 4F: Indicative ‘green’ land protection zoning and mapping</b>
<b>Step 5: Prepare an Indicative Zoning Map for Water Quality Protection</b>	<b>Module 5A: Determine scope of water environment and spatial control units</b>
	<b>Module 5B: Adopt stream and groundwater hydrology and water quality models</b>
	<b>Module 5C: Assess priorities for protecting rivers, lakes, wetlands, reservoirs</b>
	<b>Module 5D: Assess priorities for flood risk management</b>
	<b>Module 5E: Assess priorities for water source protection</b>
	<b>Module 5F: Assess priorities for the protection of coastal areas</b>
	<b>Module 5G: Indicative water quality protection zoning and mapping</b>
<b>Step 6: Prepare an Indicative Zoning Map for Air Quality Protection</b>	<b>Module 6A: Assess priorities for urban-rural microclimate protection areas</b>
	<b>Module 6B: Develop a regional atmospheric flow model</b>
	<b>Module 6C: Develop a regional pollution source model</b>
	<b>Module 6D: Develop a regional atmospheric absorptive model</b>
	<b>Module 6E: Indicative airshed pollution protection zoning and mapping</b>
<b>Step 7: Prepare an Indicative Zoning Map for Ecosystems Restoration</b>	Module 7A: Identify and map potential for habitat and biodiversity regeneration
	Module 7B: Identify and map potential for waterbodies and riparian restoration
	Module 7C: Identify and map potential for urban greening and open space
	Module 7D: Identify and map potential for brownfield remediation
	Module 7E: Indicative environmental restoration zoning and mapping
<b>Step 8: Integrated Environmental Protection Zoning</b>	Module 8A: Identify and map potential for habitat and biodiversity regeneration
	Module 8B: Identify and map potential for waterbodies and riparian restoration
	Module 8C: Identify and map potential for urban greening and open space
	Module 8D: Identify and map potential for brownfield remediation
	Module 8E: Indicative environmental restoration zoning and mapping
<b>Step 9: Integrated Environmental Protection Zoning</b>	<b>Module 9A: Indicative comprehensive environmental protection zoning and mapping, combining, evaluating and weighting sector results</b>



It is important to acknowledge that in order to identify the UREMP boundaries and the essential environmental protection areas only a few key Steps already deliver the most critical result getting the red lines right at a very high degree. These include the key Steps 3, 4, 5, and 8, while Step 6 is also important especially in the PRC's mega-agglomerations. The methods and modules needed can be widely understood and carried out quite simply and do not require complex analysis and computation. Steps 7 are optional and should be considered in a fully sustainable environmental management and in a comprehensive way to provide and harness ecosystems services.

One of the results of UREMP is environmental zoning with a delineation of red, yellow and green lines based on comprehensive, rigorous analysis of a planning area. The first requirement is therefore to define the UREMP planning area, and to promote partnerships among the neighbouring jurisdictions.

The second requirement is to adopt an appropriate platform for the collection, integration, mapping and sharing of the data on which the analysis of the UREMP area will be carried out.

To promote clear guidance, the concluding maps of a UREMP will consist of three zones. In the red line zone environmental values are highest and human activities of development, construction, rebuilding and expansion of production are forbidden and

inappropriate land uses and buildings are removed. In the yellow line zone all forms of land use and development are strictly controlled to ensure, as far as possible, that natural ecosystems are not disturbed and green space, such as grassland, forest land, rivers, lakes and wetlands, cannot be reduced. The third zone is the green line zone. This applies to all the remaining land, subjecting it to the injunctions stated at the beginning of this section – briefly, that land use should be economical and intensive, and that development should be environmentally responsible and sustainable.

The third requirement is to analyse all aspects of the environmental value of land and water area within the UREMP area, and to assess the relative values of those areas in terms of different parameters. In this Technical Guideline, there are six parameters: ecosystems, land, water, air, remediation and energy.

The result of this comprehensive analysis is five sets of maps showing indicative protection zones resulting from the assessment and evaluation of the five main parameters. It is by overlaying these indicative zoning maps, and by integrating their ranking of the different areas, that the areas of highest environmental value can be identified. This can only be effective if the sectoral analyses are objective, quantified and rigorous. The results must be credible, and persuasive in negotiations within and between jurisdictions.



- 4. Recommendations for Policies and Institutional Arrangements, Roles and Responsibilities to anchor and link UREMP as a planning instrument within the PRC spatial planning system and implement during the 13<sup>th</sup> Five-Year Plan Period.

One of the objectives in TA is to provide recommendations to promote policy reform and pilots of Ecological Civilization mechanism, to establish administrative regulations and management rules and provide technical guidance for implementation of "UREMP" during the period of 13<sup>th</sup> Five-Year Plan. We need to make breakthroughs from the perspective of system reform, policy supporting, technology innovation and pilot practice. By summarizing as well as drawing references, the research team put forward main suggestions of promoting UREMP during the period of 13<sup>th</sup> Five-Year Plan, include: seize the opportunity of ecological civilization reform, and put the concept of ecology priority into decision making of the governments at all levels, provide scientific and systematic policy and technical support on urban-rural environmental resource base, ecological environment system structure, red line, space environment controlling, and mechanism innovation of ecological protection management. Through national legislation, departmental rules and

regulations, Party committee, government scheme, we break through the bottleneck of UREMP and gradually strengthen its legal status and legal effect.

Based on the combination of pilot city experience and the UREMP project, we improve management system of UREMP from the aspect of main body, organization, planning procedure, technology research, the NPC and CPPCC supervision and involvement. The key is to make clear of the main responsibility of local government, organization responsibility of environmental protection authorities, financial supporting mechanism and mechanism of experts guiding, technical support and public participation.

We have arduous tasks and weak foundation in building UREMP, so we need top-level design, step by step implementation, pilot test and gradual improvement. Now regulations and technology are not perfect, the key point of promoting UREMP is to advance the pilot work. In this process, we can explore new methods, test technology, summarize experience and improve the system. During the period of 13<sup>th</sup> Five-Year Plan, we should expand the pilot scale, increase and improve pilot levels, also strengthen the exchange of experience and extraction of achievements.



## 1. PROJECT OVERVIEW

Asian Development Bank (ADB) and Ministry of Environmental Protection (MEP) of P.R.C. initiated the Policy and Advisory Technical Assistance program on Promote the Institutionalization of Urban-Rural Environmental Master Planning (UREMP) to guide Environmentally Sustainable development during the urbanization in the PRC<sup>1</sup>. Managed by MEP and ADB<sup>2</sup>,

a project team<sup>3</sup> consisting of national and international experts was set up to work over the period May 2014 - October 2015. Experts from Chinese Academy for Environmental Planning, Beijing Normal University, Peking University, and Policy Research Center for Environment and Economy of Ministry of Environmental Protection P.R.C. are involved to conduct research program.

## 2. PRACTICE OF UREMP BOTH AT HOME AND ABROAD

### 2.1 Experience on Regulation of Resource and Environment Carrying Capacity in Foreign Countries

Environmental carrying capacity is proposed as a dissertation of environmental restraint planning theory. According to the standards of Europe and America, the development load has exceeded the threshold value of the resources that regional resources can supply in some cities of the third world, thus the concept of carrying capacity can be regarded as a relative standard value. Through the determination of the capacity

of urban environment, carrying capacity can be an effective policy tool. Planning idea is transformed from the target vision type to the space resource constraint type as well as the environmental benefit type.

We can draw on the experience in such aspects as planning ideas and specific planning technology at home and abroad for the management application of environmental carrying capacity in our nation; especially Hong Kong's territorial development strategy review is of a strong significance in reference to China.

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#### NOTE

<sup>1</sup> TA -47061-PRC: Promote the institutionalization of Urban-Rural Environmental Master Planning (UREMP) to Guide Environmentally Sustainable Urbanization

<sup>2</sup> The TA was managed by Jia Jinhu and Wang Xin from MEP, Stefan Rau, Urban Development Specialist, East Asia Department, ADB

<sup>3</sup> Expert team including Prof. Dr. Wu Shunze (Team leader), Dr. Wan Jun and Ge Chazhong from CAEP, Prof. Dr. Yang Zhifeng (Deputy Team leader) from Beijing Normal University, Prof. Dr. Wang Qi from Peking University, Dr. Zhou Guomei from ASEAN Center, Prof. Dr. Christina von Haaren from Leibniz University Hanover, Jeremy Dawkins from Australia, Euan Ross from United Kingdom.





Table 2 International Experience and Case Study on Environmental Carrying

Cases	Content	Status Quo	Reference
Hong Kong's territorial development strategy review	Propose each sub-regional development on capability on "urban environment that can be carried" .	The important evaluation reference for the reasonability of urban construction.	Be consistent with the management direction of current carrying capacity of resource and environment .
"Smart Growth" development pattern	By planning compact community, make full use of the effectiveness of current infrastructure and provide a variety of transportation modes and housing choices to make an effort to control urban sprawl.	Through high-density and more compact development pattern, succeed in keeping America from disorder urban sprawl.	Some cities in China are exploring. Considering special background of industrialization and urbanization, the result of China's urban sprawl is the urban-rural fringe area. The sprawl way is not necessarily the special conditions such as highways and cars abroad.
Total Maximum Daily Loads(TMDL) in the United States(US)	The distributable pollution load can be distributed to each pollution sources (including the point sources and the non-point sources), taking the safety threshold and the seasonal changes into account. The Appropriate pollution control measures shall be taken to ensure the target that waters meet the corresponding water quality standards.	Many States in the United States have implemented the TMDL plan on the quality restricted waters within their administrative areas, which has played a positive role in improving water quality.	Suggest introducing in demonstration watershed. The water ecology shall be fully inspected, not only the water quality monitoring, but also the focus on the feedback and timely adjustment after the implementation of the TMDL program. Meanwhile, the stakeholders shall be invited to participate in the whole process.



## Column 1

### Hong Kong's territorial development strategy review

Hong Kong has gone through a process on the understanding of the relationship between urban planning and environmental protection, which is closely related to the stages of economic development. Along with the comprehensive promotion of industrialization, Hong Kong Government proposed the "territorial development strategy" (depth and content are similar to China's urban master plan) in 1960's for the first time, aiming at rational land utilization, population distribution and related infrastructure construction. At that time the environmental factor was not taken into account in the planning.

By late 70s, the lasting and high intensity industrialization and urbanization brought Hong Kong the ecological environment problems such as waste water, waste gas, noise, wastes, sea garbage and oil pollution, and the public hazard caused by the pollution have attracted the great public concern. In 1987, a "Study on Urban Planning" was developed, becoming the first research report on Hong Kong environment renovation since the establishment of the district, and it did play a role in the Hong Kong environmental governance. However, to the master effect, the urban planning was not consistence to the environmental protection.

In 1989, the Hong Kong Environment and Lands Bureau made a series of modifications and review on the urban planning level to comprehensively review the "Territorial Development Strategy" (1990). In the review, the environment factors were clearly listed as main restrictive factors for urban development, and the main target of this modification is "to develop a master and long-term land use - transport - environment planning outline", in order that the government, under the "resources permitted condition, according to the recommendation in the outline, can provide necessary land and infrastructure", and seeks a "better living and work environment" for Hong Kong.

For this, firstly, a "basic" environmental study was carried out, with its main objective to appraise Hong Kong's territory environmental situation, then propose the "urban environmental carrying" capacity for the sub-regional development, thus provide the bases for policy evaluation on development programs. To one of the important bases for the assessment on whether it is reasonable or not, both the establishment of the transport system and the development scale of new urban towns take into account the master environment carrying capacity, measure the available resources and the impact on the environment, to see whether it fits Hong Kong's environment.



From the perspective of research and application, the limitations of the study on carrying capacity of single factor is more and more prominent, and it cannot meet the requirements of the ecological system for resource exploitation and development. Study on the environmental complex carrying capacity from the system point of view in the perspective of multiple elements is the future direction and trend of study on ecological carrying capacity.

From the technology perspective, carrying capacity research will also continue to be developed in the refinement and dynamic simulation direction. The complexity of urban ecosystem determines the complexity of its carrying capacity research methods and tools. In terms of quantitative analysis method, in addition to the system dynamics (SD), multiple factor analysis, input-output analysis, capital labour production function, population migration matrix and Markov Process will all be the main methods. Modern technology such as remote sensing (RS), geographical information system (GIS) will be applied to the refinement research area of carrying capacity.

For the evaluation technologies of the land carrying capacity, at present in China the study for "non-urban construction land" generally accepts the converse thinking mode from region to city, namely, unbuildable land use is firstly marked out, whereas you can better consider the possibility of future expansion direction for the rest of the region. Then in the remaining space, the region with complete infrastructure and located on the main development direction

of the city will be selected as "encouraging construction area" or "guiding development area". This idea combines the natural ecology, infrastructure, economic benefits, social culture and other factors and grades the whole regional space with the thought of "planning at full coverage", which has the same effect with main function oriented zoning, land suitability evaluation and control of four districts. The key question is whether we can make the three planning agreement on the similar management content through the tool of urban growth boundary.

After integration with international practice and relevant research, technology research and planning application of environmental carrying capacity inspires our country as follows:

Firstly, focus on the basic position of the environmental carrying capacity in environmental protection and planning. Environmental carrying capacity could be important and directional for the rationality assessment of urban construction and development.

Secondly, strengthen the exploration on refinement. Analysis method combining the mature model analysis and remote sensing, and GIS technology as well as the research method of combining various models will provide more accurate, even deeper and more comprehensive quantitative research results to the study on carrying capacity.

Thirdly, enhance dynamical simulation. In order to improve the scientific and practicability of study on carrying capacity, we must be strengthen study on dynamical



simulation of carrying capacity, realize the potential carrying capacity estimation and prediction of dynamic variation process to reflect the diversity, nonlinearity, dynamism, and multi feedback of carrying capacity. And also we need to enhance the basic theoretical research of carrying capacity, and identify the largest carrying capacity to provide the scientific basis for urban planning and decision-making.

## 2.2 International Reference on Environment Spatial Hierarchical Control

The core of space control is to implement strategic divisions of urban-rural space, make planning control and development guidance, fulfil effective disposition of urban-rural land resource, coordinate and solve the contradiction between urban infrastructure construction and ecological environment protection, thereby promoting the healthy and sustainable development of urban-rural areas.

Generally speaking, there are mainly three types about ecological space control in foreign countries. The first one is the classification control planning, which makes classified recognition and integration of ecological space elements and proposes non-construction land planning content and control requirements on the basis of the ecological spatial structure planning. The second one is the boundary control planning which restricts the scale of urban development and definitudes the scope of protection of urban non-construction by marking a clear buffer. The last one is the

forbidden and limited construction region planning which comes from the stratification and superposition analysis method of ecological elements. It determines the level of protection and utilization through the assessment of the importance of ecological factors. Space control in foreign countries often adopts meticulous management means for permanent protection on the function and scale of environment space. Here we focus on the cases of the Green Belt in UK and the Urban Growth Boundary of US.

We have analysed the applicability of the items below in China and the result is shown in Table 3, including the Green Belt in the UK, the Urban Growth Boundary of the US, the Green Core in Holland, the IBA Emscher Park in Germany, the Urban air duct in Stuttgart, the Green Way System in Tokyo, Japan and the EPA Freshwater Eco-region in the US. They can be successfully implemented due to the three common points. Firstly, they are all in the interests of majority. Secondly, they all establish procedures to coordinate each stakeholders and become legalized eventually. Thirdly, they all have a set of strict adjustment procedure.

The Green Belt in the UK, the Green Core in Holland and the Green Way System in Tokyo, Japan are the practices internationally recognized for successful protection of urban green space and ecological land and have certain functions to limit the urban growth boundary, while the Urban Growth Boundary of the US only limits urban growth boundary and has less guidance to the concrete practice of environmental protection. The EPA Freshwater Eco-region in the US focuses on





the protection of aquatic ecological health, preserve function of aquatic conservation and biodiversity. It can be referred to, in UREMP, consider more of the climate, vegetation and aquatic biodiversity. However, the operation is difficult due to data problems. The Urban air duct in Stuttgart is the current hot spot, especially as the solution of smog problem in Beijing is relatively controversial, and however, experts generally acknowledge there is certain influence on urban micro-climate and thermal island effect. The key question is how to implement and conserve the urban air ducts under the current background of rapid urbanization.

It has the following inspirations to our country after comprehensive consideration of international practices of space control and related research of ecological environment.

Firstly, implement rigid protection of ecological red line. The focus of the construction of ecological environment system is not merely on establishing the concept of sustainable development. Delineating the red line and rigid protection is equally important.

Secondly, establishing the classification and grading protection mechanisms and implementing guidance and policy support are more in line with local condition of China.

Thirdly, explore the priority for implementation of environmental management. Red line regional is the priority in management by empowering the administrative departments "management priority" of land, capital, and cooperative approaches in order to control and manage urban growth boundary by means of buffer

area.

Fourthly, the red line management should adopt comprehensive tool of multiple measures and methods. It is difficult to completely solve the problem of urban sprawl by merely relying on singular control on planning policy, and therefore we should strengthen the research on the background, make comprehensive consideration of the space strategies that correspond with the green belt, realize the complementariness of a number of policies with combination of control and guidance, punishment and compensation.

Fifthly, red line delineation is required to balance interests from different stakeholders. It is more difficult to implement the red line management policy at the stage of rapid development of urbanization than in the mature stage of urbanization. The red line area in downtown should be kept at moderate scale, and also we should balance the conflict between the master urban development and the interests of surrounding users.





Table 3 Case Analysis and Experience Learning of Management and Control of Ecological Environment Space

Case study	Key features	Status Quo	Reference
The United Kingdom 'Green Belt' (London and nationwide)	National zoning and land-use policy tools. It was considered as the contemporary concerns of environmental protection. It promoted the development for sustainable cities and the increasingly important climate-change agenda.	It's under the threat concerning its impact on cost of housing land in the capital and impinging on the laissez-faire principle of the free-market economy during the economic recession. However, the green belt receives such wide support. It is likely to steer the UK through short-term political pressures.	China supports zoning according to environmental standards in the Environmental Law that is going to issue. UK: It is applicable in the situation without specific ecology and landscape according to the spatial management and planning standard tools.
The US 'Urban Growth Boundary' (Portland)	Limited location and specific initiative, have been continually modified under development pressure, but remains valuable on reducing urban scatter and sporadic development.	Under the threat concerning impact on cost of housing land in Portland and impinging on the laissez-faire principles of the free-market economy enshrined in the 5 <sup>th</sup> Amendment.	Applicable to China, but essentially adds nothing new in terms of the philosophy and tools available to address environmental issues associated with rapid urbanization.
The Netherlands 'Randstad' ('Groene Hart'/'Deltametropolis')	More a description of an urban development pattern than a planned or achieved concept. Nevertheless, the urban structure and urban environmental quality thus created have been influential in the planning profession and have demonstrated the values inherent in specific urban rural land use mixes.	Has not been sufficiently robust to resist the pressure of suburbanization. However, the new regional development 'concept' is also a reproducible model with low density suburbs and integral 'green lungs'. The more explicit integration of water elements in delta planning is timely.	The current system is not especially compatible with the objectives of the forthcoming environmental master planning. Thus there may be limited application in China, but it demonstrates the value of identifying 'desirable' development patterns and protecting them to the extent possible to develop a robust green structure.



Case study	Key features	Status Quo	Reference
Germany 'Regional Park' (Emscher)	The proposal on specific location aims at solving widespread industrial derelict land.	The level of importance is increasing as the example of integrating eliminating urban economies and urban patterns.	Applicable to China where similar proposals are implemented to support urban regeneration and industrial restructuring in the urbanized 'rust belt' of the northeast.
Stuttgart, Germany -- Urban air duct	Based on the influence of wind environment on cities, Stuttgart left ventilation corridors and the wind crossing for built-up urban area. Besides, it improved the urban atmospheric environment by using urban natural weather conditions and relieved thermal island effect and smog.	Urban air duct is widely favoured and questioned simultaneously, and has a certain effect on alleviating the urban thermal island effect. Urban air duct research and planning have been carried out in many cities in China such as Hong Kong, Shanghai, Hangzhou, Wuhan, Nanjing, Zhuzhou, Guiyang, Shaoxing, and Fuzhou.	Applies to China, applicability to China at the macroscopic scale needs to be implemented by planning in advance, promotion of legal status and other guarantees, meanwhile its effects may be more easily reflected in middle and small scale.
Green Space System Planning in Tokyo, Japan	It focuses on construction of public green space and protection of green space system, requires compulsory greening of private land, and respectively enact laws for protection of the "historic spot" and "ecological green land", "agricultural land", and "forest land".	Implementation techniques add the payment of compensation, tax deductions and other institutions which gradually turn the green space protection from tough and outrageous policy to guiding policy. Green space policy is maturing, and it mainly enacts the laws and regulations to guide and encourage green space construction, and promote the utilization and effective management of green space.	China's relevant laws and regulations of urban green space are in its infancy, and the green space system is mainly developed by the greening ratio requirement and the park construction. Urban green space protection laws and regulations should be enacted as soon as possible to inhibit the trend of "more great parks and fewer small parks" and form a scientific and reasonable structure of green space.



Case study	Key features	Status Quo	Reference
The EPA Freshwater Eco-zoning in the US	Provide a basis for the regional multi-scale analysis and evaluation of forest by means of optimization analysis of the forests, rangelands and land use in the US. The water eco-functional zoning with the aim of ecological integration solves quality problems involving water resources evaluation, assessment and management of water environment, assessment of river restoration and surface water.	It has certain effects on the water ecological protection. The greatest challenge of water eco-functional zoning is how to become the tough and effective environmental management tool for decision makers. However, the reliability and accuracy of zoning cannot be verified due to the discrepancy between concept and index system, thus it must rely on the legal techniques to guarantee the implementation.	Existing eco-hydrological zoning is similar with that in China, but the zoning indexes are mainly water quality, hydrology and ecological water volume requirement. It can refer to the forest and land use in the US, adding the zoning indicators such as climate on the macro scale, vegetation forms on the middle scale and aquatic biodiversity on the micro scale for the purpose of further improving eco-hydrological zoning. However, it is difficult to obtain the data and takes a lot of labour force and material resources in the earlier stage.

### 2.3 International Reference of Improvement on Environmental Function and Ecological Service

In order to improve environmental function and ecological service, some foreign countries plan and construct eco-facilities (green belt, green way, and green infrastructure.) with the clear function of improving ecological service. Green belt control, green corridor, green land, buffer zone and green center and so on are included.







Table 4 Green control belt plays a role in improving the ecosystem service in urban-rural planning

Concept	Space structure	Denifition	Ecosystem services
Green belt	Ribbon pattern	According to policies and legislation, green belt is the green open space, which has its own scale and also is continuous or almost continuous and permanent, in urban peripheral areas. It also separates the urban built-up area and countryside.	<ul style="list-style-type: none"> <li>• Prevent the unrestricted sprawl of the city</li> <li>• Control city structure form</li> <li>• Protect certain functions, such as urban agricultural development, environment protection, entertainment, and so on.</li> </ul>
Green way	Line pattern	It is a linear open space combined with natural ecological environment for visitors and cyclists to enjoy themselves. Green way is constructed along natural corridor (river bank, trench, and crest line) or manual corridor (railway, scenic road).	<ul style="list-style-type: none"> <li>• convey information, energy, and martials.</li> <li>• promote valid internal cycle of landscape ecosystem.</li> <li>• leisure, culture, and esthetics.</li> </ul>
Green infrastructure	Net pattern	It is a life supportive system consisting of interconnected green space nets including all kinds of open space and natural areas, such as rivers, green ways, wet lands, forests and native vegetation, etc.	<ul style="list-style-type: none"> <li>• protect biological diversity and species habitats.</li> <li>• protect local landscape.</li> <li>• reduce the dependence on the grey infrastructure of the city.</li> <li>• decrease susceptibility to the natural disasters in cities.</li> <li>• shape the framework of urban growth.</li> </ul>

Taking those approaches of urban-rural ecological service improvement into comprehensive analysis, we can figure out three common urban containment policy tools of ecosystem service including green belt, urban service boundary and urban growth boundary(UGB), which aims at restricting

urban sprawl within a certain boundary by using an infill development way. Among these three political tools of improving ecosystem services, green belt has the greatest influence on restricting urban sprawl. Because of the effectiveness of improving urban ecological services and international



approval, many countries build green belt that surrounds cities to prevent the sprawl.

Foreign countries have following features in practice: Green control belt mainly surrounds the urban built-up areas with the aim of controlling city disordered extension and guaranteeing the formation of reasonable pattern. Mostly, the width of green control

belt is between 5-15km. For some big cities, its length can be over 100km. The area of green control belt is huge. For example, like Paris, London, and Moscow, green control belt in those metropolises are over 800km<sup>2</sup>. And some medium-sized cities have the area of green control belt more than 100km<sup>2</sup>.

Table 5 Space structure and land category of green belt in part of abroad cities

City	scale(km <sup>2</sup> )	space structure	Land category
Moscow	4630	circular green-belt & wedged green-belt	Forest park, camping base, cemetery, orchard, and woodland, etc.
London	5780	circular green-belt	Woodland, ranch, village, park, orchard, farmland, outdoor entertainment field, education field, science and research field, nature park
Ottawa	200	circular green-belt	Farmland, forest, nature reservation zone, park, golf course, equestrian field
Paris	1187	Satellite green zone around the city	National public forest, woods, park, garden, private forestland, great outdoor entertainment park, farmland, racetrack, golf course, camping base, public cemetery
Seoul	1557	circular green-belt	Agriculture, fishery, and parts of public buildings
Berlin	2866	Satellite green zone around the city	regional park

It's noteworthy that after green belt policy was implemented, it has brought both positive and negative effects to cities. The positive effects include: ① It can significantly curb the spreading speed of urban built-up areas; ② It can protect the agriculture around cities and ensure a reasonable transition between urban and rural areas; ③ It can provide leisure space for cities and surrounding areas; ④ It

can reduce the impacts of extreme climatic changes such as heat island effect, storm and flood on urban centers and maintain the urban ecological security pattern. The negative effects include: ① Improper restrictions are liable to result in a "leapfrogging" land use structure and the increase of urban commutes and infrastructure construction; ② It can push up the price of housing in central area



and exacerbate the social injustice; ③ The land of green belts is owned by different units of property right. The state-owned land and collectively-owned land have unequal access to the market, which has given rise to rampant land enclosure.

According to the international practices and related research, foreign policies of improving ecosystem services and the experience reference to our country are indicated as below:

Firstly, the fundamental status of ecological priority should be consolidated in our planning.

Secondly, the ecological pattern should be based on the quantification of ecological functions. Developing techniques for accurate qualification, quantification and assessment of ecological service functions is the key step for enhancing the ecological functions. The spatial heterogeneity of the ecosystem structure results in spatial heterogeneity with respect to functions or ecological characteristics, so the accurate qualification, quantification and assessment of ecosystem service functions appear very important in urban planning and are an inexorable trend in the research of ecosystem service functions. It provides an approach to understand the ecosystem and the relationship between “system structure, system functions, and system services”.

Thirdly, in the process of policy design, we should avoid the “benefiting errors” due to the spatial transference of ecological service functions, which will separate the ownership and use of ecosystem resources. The separation might make local residents unable to benefit from the ecosystem and cause the

“so-called benefiting errors”. Only when local residents are able to benefit economically from the ecosystem conservation will the ecosystem really be conserved. Therefore, related policy measures are also very necessary for the urban ecological planning.

## 2.4 Planning Institution Comparison between China and World-wide

Though there are no relevant plans abroad, some similar plans have referential values for the UREMP of China. In the first part of this paper, we have summed up plans and institutions of countries such as the UK, Netherlands, the US and Germany. For comparison, we will analyse the UREMP of China, green belt of the UK, space planning of Netherlands, spatial plan of Denmark and UGB of the US from different perspective, such as legal basis, management system, coordination mechanism and supervision on implementation.

In the perspective of legal basis, similar plans abroad have an excellent legal basis. For example, Netherlands has enacted the law concerning spatial planning, and Denmark has enacted the law of planning and the special spatial plan 2007. Since China only put forward UREMP in recent years, its legal basis is not solid. To further bring it into play, we need to strengthen the legal basis work.

In the perspective of management system, foreign plans have confirmed the subject to implement the plan, such as the green belt plan in the UK is implemented by the planning bureau, while the spatial planning of Netherland is implemented by the municipal administration. Among the pilot cities of



UREMP in China, currently it's implemented by local environmental protection bureau.

In the perspective of coordination mechanism, currently, there are many spatial plans and general plans in China, which are compiled and implemented by different departments. Though in the course of compilation, it has requested comments from the departments and the public, different plans do not coordinate with each other and even conflict with each other in spatial arrangement. Similar plans abroad stress the involvement of departments and the public in the course of compilation. For example, in the urban planning of Netherlands, the public that are devoted to public welfare will closely participate in the decision-making process. Though the process is relatively long, it's

smoother for implementation.

In the perspective of implementation supervision, similar plans in foreign countries are supervised by related institutions. For example, the Environment Assessment Agency of Netherland is responsible for assessing the spatial planning of Netherland while the land use regulatory system of Oregon State of the US is supervising and controlling the UGB of the state. The UREMP of China is still in the demonstration phase, so there's still no supervision on implementation at present. China can learn from similar plans abroad and improve the supervision and management on the implementation of UREMP.

Table 6 Comparison of Domestic and Foreign Planning Institutions

	Legislation	Connection	Implementation	Supervision
UREMP in China	No legislation and mature technical guidebook	A pilot exploration of "integration of several plans" is in progress, but there's still no mechanism for connection.	The mechanism for compilation, implementation and management of plans has been established basically.	There's still no mechanism for supervision.
Green belt of the UK	National Planning Policy Framework, Law of Planning	The coordination between planning department and environmental department is a compulsory provision in the regulation. The UK has no UREMP, but should include the strategies of solving environmental issues into urban planning.	The green belt is implemented by local planning authority with active means of planning.	A dedicated Planning Inspectorate is established in England and Welsh to be responsible for checking the local planning and dealing with appeals.





	Legislation	Connection	Implementation	Supervision
Spatial planning of Netherlands	Law concerning Spatial Planning	The planning department and environmental department are combined together (Housing, Spatial Planning and Environmental Department).	The municipal administration is responsible for implementation. The urban land use and construction scale will be subject to the control of an annual plan while the urban planning will be reviewed and approved based on an environmental assessment.	Environmental Assessment Bureau of Netherland is required to monitor the infrastructure and spatial planning with Mobility Expertise Center.
Spatial planning of Denmark	Law of Planning, Spatial Planning 2007 (the national planning directive of the Greater Copenhagen region)	The environmental bureau is responsible for natural planning of Denmark, including the spatial planning law that ensures the urban-rural quality. The plan balances and integrates the interests of each party involved in land use. The spatial planning of Copenhagen is under the charge of municipal administration. The regional urban development must coordinate with the master infrastructure of Copenhagen, especially the public transport service.	Three out of the seven environmental centers under the environmental department will coordinate with each city on spatial planning, so as to integrate the interest of the whole country. The implementation of Copenhagen spatial planning is based on the assessment of development of the whole region, which must be consistent with the principle of the whole urban structure.	The planning system of Denmark is decentralized in authority. The municipal council is responsible for city level and local comprehensive land use regulations, while the regional council formulates the spatial development strategic plan for each region, and the environmental department ensures the national interests by establishing the national plan. The environmental department head ensures that the municipal planning meets the national requirements.



	Legislation	Connection	Implementation	Supervision
UGB of Oregon State, the US	Decree concerning the Land Use Planning of Oregon State	UGB is the growing areas around the cities. The land might belong to the jurisdiction of adjacent town, which needs to be coordinated by the land protection and development committee of the state.	Metro is a regional institution that formulates and manages UGB, namely, the regional government and metropolis planning organization. Metro is a regional governmental body, covering the urban areas of three counties.	The land use supervision system of the state. The local government will submit the UGB proposal and the land protection and development committee will approve it.

## 2.5 Summary and Inspiration

China is now in the rapid process of urbanization, and the urbanization rate has been increased by about 1.35% since 2000. The long process of urbanization of Western countries accompanied with industrialization has been much shortened in China. After a long period of exploration and practice in the urbanization process, developed countries in Europe and America have accumulated a lot of beneficial experience in achieving a win-win situation on urbanization and environmental protection, which can provide references for the formulation of UREMP.

**Firstly, highlight the priority of planning and strengthen its legal status.** The planning of spatial control and environmental protection in the national level should have a relatively long planning period (20-30 years) and related laws and regulations should be enacted to enhance the compulsory legal status of the plan. Additionally, national level should ensure that the implementation of the plan is subject to a relatively strong binding

effect. Japan has enacted a lot of complex policies and regulations for urban green land. This is because the earliest laws did not take into account, which lacked in foresight and integrity. the diversity of land nature and land use right, it had to enact remedial laws and regulations later.

**Secondly, strengthen spatial control and realize the fine spatial management on specific plots.** Spatial control is an effective technique for resource regulation and control. As a feasible path for enhancing the use efficiency of resources, compact development has gradually become an important part of urbanization and urban planning. Practice at home and abroad, such as green way, green belt, UGB and ecological zoning, all indicate that if the plan cannot have the space where related policies are implemented, they will become empty words and the implementation effect greatly reduced.

**Thirdly, coordinate the urban development pattern and the resource environmental carrying capacity.** We should follow the



resource environmental capacity, confirm the urban atmosphere and water environmental carrying capacity, put forward the control indicators for environmental carrying capacity, thereby providing scientific guidance for optimizing the industrial pattern, pollution discharge pattern and urbanization development direction. In the course of urbanization, developed countries such as Europe, America and Japan have formulated some management measures, planning strategies and economic policies to control the urban sprawl and introduced the coordinated development between smart growth and environmental carrying capacity.

**Fourthly, pay attention to enhancing the ecosystem service functions.** The key to enhance ecosystem service functions lies in enhancing the quality of original ecological land, retaining and increasing the existing ecological land. We should refine the management of ecological resources consumption, provide the channels for the public to benefit from ecosystem and perfect the mechanism for ecological compensation.

**Fifthly, strengthen the institutional improvement and achieve an integration**

**of several plans.** We should strengthen the coordination between space control department and environmental protection department at the institutional level, reduce the cost for the interaction between administration departments, and enhance the efficiency of compilation and implementation of UREMP. In the early period of plan compilation, we should pay attention to the coordination and consistence between various plans, fully reflect the philosophy of ecology priority, and avoid the dilemma in the implementation stage of plans.

**Sixthly, strengthen the social impact assessment and stress public involvement.**

UREMP should stress not only the ecology, but also its economy and humanistic care. The environmental plans that obviously limit economic growth and lack of analysis of social impacts cannot be implemented smoothly. The international experience indicates that the plans can only be implemented smoothly when we respect the interests of each involved party, strengthen the public involvement and promote the implementation of UREMP with the aid of regulatory system and the power of public.



### 3. TECHNICAL GUIDEBOOK OF UREMP

The steps are generally carried out in the order presented, which keep consistent with table 1. However it is important to note that the UREMP process is not entirely linear. Hence it is important to reflect and adapt former steps when next steps were completed to ensure findings from one step will inform other steps. When decisions are made, however, the sequence is generally in the order of the steps as presented.

#### 3.1. Step 1: Establish UREMP Area and Partnership for City Cluster or Urban Region

Six of the pilot cities have shown the way towards urban-rural environmental protection zoning by creating red line and yellow line zones within the boundaries of their city. These pilot projects have successfully tested and generated techniques and procedures, but they are not a final model for the institutionalization of UREMP. For environmental protection to be effective, a UREMP area will need to be much larger than a single urban jurisdiction. There are five main reasons for this.

- It is intended that for all 18 city clusters planned in the New Type

Urbanization Plan for the PRC (2014-2020) UREMP will be produced as priority, and further cities and their rural hinterlands will be required to prepare UREMP.

- More importantly, urbanization is taking place in large and small cities and in other jurisdictions across the PRC, typically in the form of city clusters, comprehensive urban regions, within which cities are competing for investment and resources. In one extensive urban system, housing, transit, infrastructure, physical and human services, etc., need to be planned across jurisdictions. The largest of these urban systems are the twenty city clusters<sup>4</sup>. In the initial stages of UREMP, these city clusters are most likely where the highest priorities are for environmental protection, and where institutionalization of UREMP is most likely to be successful.

- Municipal and other boundaries divide farmland and other green areas, and fragment river basins, forest areas,

#### NOTE

<sup>4</sup> The initial 10 city clusters were Beijing-Tianjin-Hebei, Yangtze River Delta, Pearl River Delta, Central and South of Liaoning, Shangdong Peninsula, West Coast of Taiwan Straits, Central Plains, Middle Reaches of Yangtze River, Guanzhong and Chengdu-Chongqing.

These ten city clusters have been followed by ten more: Harbin-Daqing-Qiqihar-Changchun-Jilin cluster, a Hohhot-Baotou-Erdos-Yulin cluster, a Taiyuan cluster, a Ningxia cluster along the Yellow River, a Yangtze and Huaihe Rivers cluster, a Beibu Gulf cluster, a Central Guizhou cluster, a Central Yunnan cluster, a Lanzhou-Xining cluster and a Urumqi-Changji-Shihezi cluster.





wetlands and other environmentally significant systems, making protection more difficult and less likely. Individual cities are likely to avoid responsibility for protecting such an area, since they can only manage a part of the area.

- To be efficient and effective, environmental protection plans must be based on environmental regions – bioregions, watersheds, catchments, climate zones, etc. – that should be managed in an integrated way. In the landscape, geophysical patterns – that determine plant and animal communities and processes at the ecosystem scale – are unrelated to administrative boundaries, but must be the basis for effective measures for environmental protection.

- Understanding and then recovering biodiversity can only be effective at the scale of bioregions and subregions. Bioregions are defined using data about climate, geology, landform, drainage, vegetation, wildlife and land use. Subregions, which are based on finer differences in biophysical attributes including geology and vegetation, can provide more detailed information about the landscape and are used for planning and conservation<sup>5</sup>.

Therefore, the environmental protection plans will normally relate to a number of jurisdictions. The first critical step is to reach agreement, based on the scientific evidence, on the boundaries of the relevant environmental regions and, at the same time, on the composition of the UREMP partnership made up of jurisdictions within a city cluster or urban region.

The formation of the UREMP partnership will require collaboration and cooperation between jurisdictions, and between agencies within jurisdictions. In short, the Peoples Governments and agencies within the proposed environmental region(s) must form active partnerships to deliver effective environmental protection.

It will be necessary for governments and agencies to invest significant resources in building cooperation and coordination, and they will need to set up specific mechanisms such as steering committees and working groups to deliver these outcomes.

There must also be community awareness across the region, and interactions between the stakeholders of the partner jurisdictions.

Agreement on a boundary for the preparation and adoption of environmental protection zones follows naturally from agreement on bioregions boundaries and agreement on the composition of the UREMP partnership. However, compromises will need to be negotiated, balancing the effectiveness of environmental protection against the

**NOTE**

<sup>5</sup> To give an indication of the scale of bioregions and subregions, the nine Australian national and state governments have formally recognised 85 bioregions across the entire continent. These are subdivided into a total of 419 subregions. On this basis, it could be expected that a large UREMP area in the PRC would extend over parts of a number of bioregions and include multiple subregions.





feasibility of the coordinated implementation of local and municipal development control. In the end, boundaries for the proposed environmental protection plan must be agreed and adhered to.

The resulting UREMP protection zones will cover the whole UREMP area. These environmental protection zones will need to be translated from the environmental protection plans into the urban and regional master plans and development plans of the individual jurisdictions.

Step 1 (Establish UREMP Area and Partnership for city cluster or urban region), Step 2 (Prepare agreed standards for the UREMP Atlas) and Step 3 (Prepare an Indicative Zoning Map for Ecosystem Services at the scale of the UREMP area) are mutually dependent and must be carried out iteratively and in parallel. The finalization of Steps 1, 2 and 3 enables all subsequent Steps to be finalized. The other Steps, Steps 4, 5, 6 and 7, focus on different aspects of environmental services and values, namely non-urban 'green' land, water, air, energy and remediation. Each of these Steps generates several analytical maps and a consolidated map, called an *indicative zoning map* that delineates the land that has the highest need for environmental protection in terms of values derived from ecosystems, land, water, air, energy and remediation. It is from these five indicative zoning maps that it is possible, based on holistic analysis and assessment, to define the areas that should be within the red line environmental protection zone and the yellow line environmental protection zone.

### 3.2. Step 2: Prepare Agreed Standards for the UREMP GIS Atlas

Step 2 is concerned with process and format rather than content: shared standards for collecting and managing data, agreed ways to manage GIS, and a common format for maps. These standards are essential if the data collected by many agencies is to be accessible, comparable, integrated and kept up to date. It is also essential if all the data and spatial information for the UREMP area is to be integrated in the UREMP Atlas.

The UREMP Atlas is not a document or a publication. It is an emerging network of internet databases, owned and maintained by the agencies which collect and update the data and maps, with rights of contribution, editing, analysis and access assigned to various entities according to the protocols and procedures agreed by the UREMP partnership.

### 3.3. Step 3: Prepare an Ecosystem Map and Ecosystems Services Values Zoning and Protection Map

The effectiveness of urban-rural environmental protection depends on (i) the quality of measurement and mapping of land and ecosystems, and (ii) whether the value of ecosystems services to society and economy and the environment can be demonstrated convincingly.

Five technical Modules that are primarily related to ecosystem analysis are listed in table 1. The modules provide guidelines and toolkits for improving the information available to decision makers about the value of different aspects of the natural environment. The integration of the findings from ecosystem analysis allows a holistic assessment to be made of the value of



ecosystems and environmental services in the UREMP area.

It is important to note that the analysis and mapping undertaken for these and other Modules should not be confined to the proposed/agreed UREMP area. It is not possible to make an objective, quantified and rigorous assessment of these values within relatively arbitrary boundaries. The assessment must be based on the real bioregions, whether or not they extend well beyond the UREMP area. This then allows the proper assessment of environmental values within that area, so that effective controls can be designed and implemented.

Ecosystem analysis results in a series of maps (supported with evidence, GIS data, and assessment procedures) that details the relative values of land across the UREMP area, for a number of different factors including aspects of biodiversity, diverse ecological communities, diverse environmental services, and considerations of carbon substitution and sequestration.

When these maps are overlaid, areas of highest ecosystem value can be defined based on evidence and clear criteria.

### 3.4. Step 4: Prepare an Indicative Zoning Map for 'Green' Land

Non-urban land ('green' land) in the UREMP area may be in a relatively natural state, in which case its value to the economy and society is measured in Step 3: Prepare an Ecosystem Map and an Ecosystem Services Values Zoning and Protection Map. It may also be used as a natural resource for agriculture, pasture land, aquaculture

and mining, and still have high values for the protection of plant communities and wildlife, for maintaining visual amenity and recreational opportunities, for producing oxygen, for improving the urban-rural micro-climate, for filtration of water and groundwater recharge, for reducing atmospheric carbon dioxide, and for other environmental benefits. Step 4 measures the values of 'green' land in the UREMP area, so that there can be realistic estimates of the values that would be lost if the land is converted to urban uses (city expansion, industrial production, infrastructure, tourism, recreation, etc.).

Estimates also need to be made of the losses of land through over use, erosion, salinization, desertification and pollution; and potential losses from natural hazards such as landslide, floods, bushfire and storms, and from rising sea levels.

Notwithstanding the value of green land to the environment, the economy and society, all land in the UREMP area may also have a commercial value as a site for development. Land with high environmental values may, as a result, have very high value for urban development, because of its proximity to water and to natural areas, because of its clean air and views over the landscape, because of its access to resources and industrial inputs, etc. These values of land as a site for development need to be compared with the existing or potential value of land as a natural resource. Step 4 estimates those values and therefore allows a holistic assessment to be made of the real value of land in the UREMP area.

As in Step 3, this assessment cannot be



effective if it is based on the analysis only of land within the UREMP area. Factors outside the UREMP area, such as the size of populations nearby, or the shortage of agricultural land in the region, or alternatively the abundance of agricultural land beyond the boundaries of the UREMP area, must be systematically taken into consideration.

The result is a series of maps (supported with evidence, GIS data, and assessment procedures) that document the relative values of non-urban land across the UREMP area, whether used for farming, forestry, extractive industries or other purposes, and/or which show the potential for reversing the loss of productive land through over-use, and/or which show the constraints on land for both productive and urban uses. These maps allow potential protection areas to be identified, according to industry and potential benefit.

By overlaying and integrating this information, it is possible to prepare maps showing land with the highest value as a natural resource, and thus indicative areas for environmental protection. This Technical Guideline details the aims and methods for the preparation of indicative non-urban green land zoning.

### 3.5. Step 5: Prepare an Indicative Zoning Map for Water Quality Protection

Water as an environmental service – whether as aquifer, waterbody or watercourse, whether in a relatively natural or altered state – is crucial for the conservation of biodiversity, for the protection of plant communities and wildlife, for maintaining visual amenity, for reducing atmospheric carbon dioxide, as

a sink for nutrients and emissions, and for other benefits to the economy and society. These environmental services are measured in Step 3, Ecosystem analysis. Step 5, Water quality protection, measures the value of water as a resource, for urban water supplies, food production and processing, irrigation, industrial and other urban processes, waste removal, landscaping and other economic and social purposes.

Rainwater may be an undervalued resource which can be collected in urban areas and used in all the ways that existing water resources can be used, thus conserving those resources and facilitating their rehabilitation where desirable. In relevant places, the potential for collecting and using rainwater in urban areas needs to be considered, assessed and mapped.

Water and water environments are at risk from most forms of urban development, and from direct pollution, run-off pollution, air pollution, land clearing, earthworks, erosion, siltation, and, in the longer term, from climate change. Water also poses risks, through carrying pollution and disease, and through flooding and sea level rise. All of these aspects need to be considered in a holistic assessment of the value of water to the UREMP area, and the relative values of protecting water-related areas compared to their use for urban development (city expansion, industrial production, infrastructure, tourism, recreation, etc.).

The result is a series of maps (supported with evidence, GIS data, and assessment procedures) that document the relative values of land for water resources. These maps allow potential protection areas to be identified,



according to risk and benefit.

By overlaying and integrating this information, it is possible to prepare maps showing land with the highest value for water resources, and thus indicative areas for environmental protection. This Technical Guideline details the aims and methods for the preparation of indicative watershed management zoning.

### **3.6. Step 6: Prepare an Indicative Zoning Map for Air Quality Protection**

The analysis of air quality across the UREMP area will enable maps to be prepared showing capacity for further urban development, areas where air pollution must be prevented and/or reduced, and the contribution that natural areas can make to improving air quality in cities. These areas are represented as various zones on the indicative airshed zoning maps, to be overlaid on the other indicative zoning maps to allow the identification of land with the greatest need for environmental protection.

### **3.7. Step 7: Prepare an Indicative Zoning Map for Ecosystems Restoration**

Potential renewable energy resources are distributed unevenly across the landscape. Biomass, as an energy resource, can be a by-product or primary output of very different natural, farmed and created environments. Hydro power potential is confined to specific combinations of rainfall and topography. Wind energy is the result of climatic and topographical factors at both the macro and

micro scales. Solar radiation is affected by microclimate, slope and aspect. Geothermal energy is determined by variations in local geology. Where these factors combine with forests, farmland, coastlines and other non-urban land, they become significant components in a holistic assessment of environmental values.

Where there is good evidence, maps of renewable energy resources that show areas of high potential provide important input to the assessment of environmental values. The relative value of sites for renewable energy generation is not likely to be so great that they justify the protection of those sites for these reasons alone, but combined with other values – for instance, forests and biomass, or coastlines and wind power, or farmland and solar power stations – considerations of renewable energy may determine which areas are zoned for environmental protection.

In Step 7, maps for renewable energy potential are overlaid and integrated, to arrive at indicative energy zoning map(s), to be overlaid with maps from the other steps. This Technical Guideline details the methods and procedures to analyse renewable energy potential and to prepare the indicative energy zoning map.

### **3.8. Step 8: Integrate all Outputs in an Environmental Protection Zoning Instrument**

The two operative UREMP environmental protection zones, red line and yellow line (the green line is the remainder and requires responsible development) are compiled on layers of comprehensive analyses, each leading to many more than just two protection



zones.

Any one Step – for instance, Step 4: Prepare an Indicative Zoning Map for Non-Urban ‘Green’ Land – generates many layers of analysis – in this case, forests, agriculture, mineral resources etc. – which might distinguish between different kinds of forest lands, or different environmental impacts of agriculture, or different environmental sensitivities. The resulting indicative zones for non-urban ‘green’ land will show a range of assessments concerning the environmental value of distinct areas of land, and a range of potential policy responses (no development of any kind, certain kinds of positive development, encouragement of rehabilitation, long term protection for future purposes, etc.).

Each of Steps 3, 4, 5, 6 and 7 will generate an indicative zoning map of this kind, with a range of assessments and policy responses depending on a number of spatial and non-spatial factors.

To give another example, Step 5: Prepare an Indicative Zoning Map for Water Quality Protection. There will be layers of analysis – rivers, lakes, wetlands, coasts, water source protection, etc. – identifying the attributes and values of specific land or water according to its condition and its potential role as a protected area. These will be merged into indicative zones for water quality protection, zoning land in a variety of ways according to its value for particular purposes.

This is a complex but essential process. It results in six indicative zoning maps generated by Steps 3, 4, 5, 6 and 7. By overlaying the six maps, areas with exceptional value, and areas with high values

for a number of sectors, and areas with potential to provide essential environmental services, become candidates for the red line environmental protection zone. The analysis leading to this result must be interpreted alongside the red line, since the reasons for including each specific land and water area might be quite different. In short, land and water areas in the red line zone are not all the same. They are all to be given the highest level of protection from development, but for possibly diverse reasons.

The logic of the yellow line is different. While areas of land and water in the yellow line zone do not justify the blanket ban on development provided by the red line environmental protection zone, they are protected in specific ways depending on their attributes and the impact that various kinds of development would have on their environmental values and functions.

Accordingly, the yellow line zone is differentiated, with different policy implications in different areas. In some parts of the yellow line zone, low-impact urban development is compatible with environmental protection; in other parts, forms of green development such as farming or recreation is compatible; in yet other parts, the construction of certain kinds of infrastructure may have little impact, or may be beneficial.

This Technical Guideline details the aims, methods and procedures for the preparation of a UREMP environmental protection instrument with a red line zone and a yellow line zone.





## 4. POLICY SUGGESTIONS ON PROMOTING THE INSTITUTIONALIZATION OF UREMP

### 4.1 Accelerating UREMP Legalization

#### 4.1.1 Compiling UREMP on Legal Basis

The current laws related to urban planning and land use include the *Urban Planning Law of the People's Republic of China* and *Land Administration Law of the People's Republic of China*. Between them, the former stipulated the scope of urban development, development-controlled area, development intensity and urban construction land, etc.; the latter implements the systems, such as land use administration, protection of fundamental farmland and compensation to taking, which emphasizes on the long-term control of fundamental farmland and define a red line of 1.8 billion mu of arable land.

Although there are no explicit regulations on UREMP establishment in existing laws, the newly revised environmental protection law provides that compiling environmental planning is required, which can be the fundamental basis for compiling UREMP and regulations as well as management measures to further advance the legal ground for general plan. Article 13 of New Environment Protection Law stipulates: “Competent environmental protection departments of the State Council, in conjunction with relevant departments, formulate national environmental protection plan according to national economic and social development plan, apply for approval from the State Council, publish and then

carry out the plan. Competent environmental protection departments of Local People's Governments at or above the county level, in conjunction with relevant departments, shall work out environmental protection plan of their own administrative regions according to requirements of national environmental protection plan, apply for approval of People's Government at the same level, publish and then carry out the plan.” UREMP is a fundamental one in systematic environmental protection planning and this clause provides a basic legal ground for UREMP and other environmental protection plan.

Furthermore, Article 18 of New Environment Protection Law stipulates: “People's Governments at or above the provincial level should organize relevant departments or entrust professional agencies to investigate and evaluate environmental conditions and establish resources and environmental carrying capacity monitoring and warning mechanism.”, which provides a legal ground for making UREMP including urban-rural environmental carrying capacity.

Article 29 of New Environment Protection Law stipulates: “Ecological protection red lines should be defined in key ecological function areas, ecological and environmental sensitive and fragile areas, etc. and strict protection should be implemented. People's Governments at all levels should take measures to preserve different representative natural ecosystem zones, natural distribution areas with rare and endangered wildlife,



important water conservation areas, natural relics with enormous scientific and cultural value, cultural relics, ancient and precious trees. Any damage is forbidden, which provides a legal basis for confirming urban-rural ecological protection red lines and strengthening urban-rural ecological function protection.

In addition, in Article 30 of New Environmental Protection: “Develop and utilize natural resources in a reasonable way, conserve biodiversity, safeguard ecological safety, and formulate and carry out ecological protection, restoration and management schemes in accordance with laws.”, supplying a legal basis for speeding up the improvement of urban-rural ecological function services.

#### 4.1.2 Legislative Proposal to Further Strengthen UREMP Institutionalization

To clarify the legal status of UREMP can better impel UREMP work in China. Considering the situation that there is no clear rule in planning and environmental protection laws at present, but some general and indirect regulations, especially macroscopic regulations in New Environment Protecting Law, diversified legislation ways can be adopted to strengthen UREMP legalization in China.

Scheme 1: Include content about UREMP in relevant national legal regulation revision. Firstly, since provincial environmental protection regulations generally must be revised and promulgated after the issue of environment protection laws, then UREMP by prefecture-level cities is explicated in these ordinances. Secondly, clear and define requirements for key cities to formulate

UREMP in the revision of *Atmospheric Pollution Prevention Law of the People's Republic of China* and other laws. Thirdly, in revision process of *Urban-rural Planning Law* and other laws, clearly put forward urban-rural planning and other related planning as well as corresponding content in relation to UREMP.

Scheme 2: Declare legal status of UREMP by relevant plan. Firstly, study how to bring requirements of general plan into the process of making *Thirteenth Five-year Plan of National Environmental Protection* and require People's Governments at all levels to organize and work out UREMP; Secondly, explore how to make regulations about UREMP ecological protection red lines when formulating *National Ecological Red Line Protection Planning*, including schemes of protecting ecological red lines, hierarchical classification control measures, ecological red line supervision, related policies, performance evaluation, etc., which can embody UREMP legalization content in the form of planning.

Scheme 3: Determine legal status of UREMP through formulating and issuing departmental rules. Firstly, formulate *National Environmental Protection Program Regulations* and other related guidance documents. Meanwhile, bring master plan content into them. Secondly, summarize pilot experience of UREMP, then formulate and issue “Instructions for Further Promoting UREMP”.

#### 4.1.3 Promote UREMP Legalization through Local Legislation

Embody relevant regulations of UREMP in provincial and municipal laws and



regulations. For example, issuing relevant guidance documents by MEP of the P.R.C. to suggest People's Governments at all levels formulating UREMP, then the documents should be deliberated by People's Congresses at corresponding level, then published and implemented by People's Government at the same level; People's Governments at all levels should bring requirements of UREMP into "Thirteenth Five-year" Planning, encompassing the *Thirteenth Five-year Planning of National Economic and Social Development*, *Thirteenth Five-year Planning of Environmental Protection*, etc., as well as guidance documents like *Formulation Guidance of UREMP* issued by all provinces. UREMP operated by cities can be passed and issued by People's Congress at the same level, so as to make the planning more restrictive and instructional.

## Column 2

### UREMP of Yichang in Hubei Province Has Been Passed, Issued and Implemented by Municipal People's Congress

Yichang city in Hubei province is one of the first 12 UREMP pilot cities confirmed by MEP of the P.R.C. Municipal government of Yichang attached great importance to UREMP and all departments of it as well as district and county governments cooperated with each other actively to complete the work. Since its launch in January, 2013, the plan has been completed in two years. In January, 2015, Standing Committee of National People's

Congress of Yichang approved, issued and implemented the plan. In Yichang, UREMP has achieved stronger constraining force and higher decision-making position as well.

## 4.2 Establish and Improve UREMP Coordination Mechanism

The traditional UREMP implemented in China are mainly based on the administrative divisions. Such demarcation can't fully cover the urban natural ecology boundary, such as the UREMP of Guangzhou. However, if the urban master plan covers the natural ecological boundary, it is bound to involve some across-city, even across-provincial agencies and sectors, so it is indispensable for cross-region and inter-sector coordination mechanism.

The cities implementing UREMP shall establish the comprehensive coordination system to coordinate relationship with surrounding areas. When preparing and implementing UREMP within city, due to the administrative limits during coordinating the superior sector and surrounding cities, it is necessary to establish a coordination and advisory committee led by the mayor, communicating and coordinating the provincial departments and surrounding cities and counties by the form of consultation and comment, communicating and consulting the development and implementation of UREMP. A steering team led by the competent deputy mayor shall be formed to guide the formulation and implementation of



such planning as a whole. The steering team consists of the leaders from the departments of environment, construction, development & reform, and agriculture, etc. as well as County and District leadership under the jurisdiction of the city. The responsibilities of steering team cover the decision-making of UREMP, internal coordination, division and implementation, etc. General office of steering team is set under the local environmental protection bureau.

### 4.3 Establish and Improve Institutional Mechanism of UREMP Formulation and Implementation

UREMP formulation aims to build a complete system under unified leadership of governments, comprehensive coordination of environmental-protection departments, positive cooperation of all departments, areas and countries, supervision and suggestion of National People's Congress and Chinese People's Political Consultative, guidance of experts, and support from technical units and public participation. Competent environmental-protection departments of superior People's Governments should guide and support the formulation and implementation of UREMP. At present, regulatory framework promoting institutionalization of UREMP is still deficient. Firstly, organization mechanism which is led by government, negotiated by all departments and required by UREMP is slightly weak. Secondly, relevant regulations on planning approval and record are not complete. Thirdly, there is no scientific supervision and evaluation system, thus it's difficult to ensure effective implementation of UREMP. Therefore, in order to establish a

management mechanism for the formulation and implementation of UREMP, several suggestions are listed as following.

**Explicate subjects of UREMP formulation.** Municipal People's Governments should be the main body to compile UREMP. UREMP formulation should be under the unified leadership of Municipal People's Governments, comprehensive coordination of municipal environmental-protection departments and cooperation of departments and country governments in corresponding jurisdiction. A work steering group should be established by Municipal People's government to comprehensively guide planning formulation. Entrusted by Municipal People's Government, competent municipal environmental-protection departments can assume organization and coordination work of planning formulation. All departments should actively participate in and support plan study and formulation according to their own functions. Besides competent municipal financial departments should classify planning study and formulation fees into annual financial budget of government at the same level.

**Improve organization mechanism of planning formulation.** According to requirements of Municipal People's Government, planning formulation task should be proposed by Municipal Environmental-protection Bureau and organize public bidding domestically. Technical support academy with relevant qualifications can be entrusted to take technical work of planning formulation. Agencies which take planning formulation work should have relevant qualifications in environmental consultant field and the



academy should have senior technical personnel with reasonable professional team. Project leaders and technical teams should possess experience that is related to urban-rural environmental-protection plan and is capable to provide technical support for environmental planning and management. Implementation outline, research report and other planning documents need to be discussed and proved by experts without exception. In addition, MEP of the P.R.C. sets up expert think tank of UREMP, so that pilot cities can choose experts from the think tank to participate in planning and plan outline discussion.

**Complete working mechanism of planning formulation which contains two stages--- planning outline and formulation.** Outline confirms primary scheme in relation to basic thoughts, general goals, technical routes and spatial layout of UREMP. Formulation planning text in accordance with planning outline should be discussed and proved by experts. As for major problems related to urban development, such as environmental carrying capacity, ecological protection red lines, etc., competent municipal environmental-protection administrative departments should organize experts to carry out mono graphic study and argumentation. Furthermore, they should ask for opinions of relevant departments and the public and hold hearings in terms of planning content directly related to legal interests of citizens, legal persons and other organizations. At the hearing, public opinions should be fully concentrated and public opinion solicitation should run through the whole planning formulation process.

**Establish planning approval mechanism.**

Municipal People's Government organizes planning investigation on the basis of discussed planning outline, then planning formulation units make modification and revision of UREMP in light of investigation suggestions to form the plan for approval. After the final plan submitted by Municipal People's Government has been discussed and passed by Standing Committee of People's Congress at the same level, it can be issued and carried out by Municipal People's Government. UREMP of municipalities directly under the central government, cities specifically designated in state plan and provincial capitals should be investigated and discussed by competent environmental-protection departments of the State Council and finally submitted to the State Council for examination and approval.

**Build planning implementation and supervision mechanism.** Mandatory content confirmed by UREMP should be implemented throughout government's comprehensive decision-making, urban construction, resource exploitation, economic development and other activities. In terms of main planning content, Municipal People's Government can entrust competent municipal environmental-protection departments to make periodic assessment and the results should be reported to Municipal People's Government and National People's Congress.

**Establish planning implementation evaluation mechanism.** Implementation condition of UREMP and its effect on economy and society should be evaluated. Assessment of social benefits and potential negative social effect of UREMP should be based on sustainable development of urban-rural human settlement environment





evaluation as well as suitability analysis. At the same time, put forward measures to eliminate its negative impact. Assessment of social effect should run through the whole planning process. Public participation should be strengthened and relevant technical researches on it should be conducted. Carry out ecological environment benefit evaluation of UREMP to assess ecological environment benefit, protection of significant environmental functions and implementation of planning tasks since operation of planning evaluation.

**Strengthen organization and guidance of UREMP.** Competent environmental-protection departments of the State Council and all Provincial People's Governments (autonomous regions and municipalities directly under the central government) should strengthen their guidance and management of UREMP. (1) Summarize formulation experience of UREMP of all cities, (2) make and improve management regulations, rules of technical methods and planning implementation methods, (3) propose legislative suggestions for UREMP, and (4) Participate in the planning deliberation and receive UREMP.

#### 4.4 Establish UREMP Assorted Supporting System

Taking UREMP as a platform, complete current environmental-protection management policies on the basis of management differentiation and delicacy and promote planning implementation by policies. Firstly, make a comprehensive consideration of urban-rural environmental capacity, ecological environmental carrying capacity, environmental quality,

total pollutant discharge amount control, environmental risk, and environmental factors in many aspects. Secondly, rural and urban industry distribution, economic and social development, spatial layout, and structure adjustment should be provided by fundamental environmental guidance through rational confirmation of urban-rural environment function orientation. Thirdly, environmental management policies of our country, such as total amount control, ecological compensation, etc., need to be docked with related content of UREMP. Meanwhile, corresponding environmental management policies should be established to achieve the planning content when implementing UREMP.

**Formulate the policy of environmental spatial management and control.** The red line of ecological functions and the baseline of environmental quality are the basis for the regional resource exploration and the establishment of projects. The relevant planning, resource explorations, and the establishment of projects shall match the scheme of ecological functional red lines and the environmental quality baseline, and focus on proofing whether the spatial arrangement, scale, and the types of the industries meet the requirements of the planning control in the course of making policies, evaluating environmental plan as well as projects. Strengthen the connection between the assessment of red line conservation areas and policies, establishing the synthetic system of urban environmental resource, which based on the three red lines of ecosystem protection. Industries, that discharge the pollutants to the atmosphere and water system and are marked within the areas enclosed by red lines, should be eliminated gradually.



**Improve amount control policies.** Strictly carry out control policies of total emission amount of major pollutants issued by the state and all provinces and distribute requirements of total emission amount control of major pollutants to various districts, countries and key industries. Adjust measures to local conditions and optimize total amount control policies from bottom to top on the basis of sub-stream basin and unit delicacy management from environmental quality.

**Formulate the policy of environmental risk prevention.** Implement the control mechanism forbidding and warning the relevant activities in the areas enclosed by red lines and yellow lines respectively. Determine the major responsibilities of environmental risk prevention, and the new project must implement the assessment of environmental risk. The facilities of environmental risk prevention should be included in “three same time”. The existing projects should launch the assessment of environmental risk. List the sources of environmental risk and manage the pollutants with the specific classifications. Establish the mechanism about assess the environmental loss and compensations of environmental damage.

**Establish monitoring-warning system for environmental-resource carrying capacity.** Measure, calculate and evaluate resources and environmental carrying capacity on regional basis, analyse resources and environmental bearing pressure and changing trends of different areas, and establish disposition and management mechanism including monitoring, assessment, scheduling, early warning, etc. Combine resources and environmental carrying capacity monitoring and warning system with planning and

project environmental impact assessment, total amount control, emergency monitoring, etc. Optimize environmental management policies based on regional and time difference of resources and environmental carrying capacity. Evaluate the budget of carrying capacity of water, land and atmosphere in different districts and counties. Analyse the status of environmental carrying capacity and changing trend in different areas. Then, establish the processing mechanism with monitoring, assessing, dispatching, and alerting. Combine the emission control and monitoring as well as alerting of environmental resource carrying capacity. Strictly implement the policies of the emission control of major pollutants. Integrate the reduction of major pollutant emission and the structure of urban industries. Adjust the major industrial scale and structure, and put the target of reducing emission at the first place. Develop total amount control of pollution emission system for characteristic pollutants, regional and control units based on environmental resource carrying capacity in the river basins and regions.

**Establish management system of environmental quality assessment.** Set up environmental management policies focusing on environmental quality assessment. Increase index weights of environmental quality assessment in each district and county. Monitor and evaluate air and environment quality, centralized drinking water quality, water quality in transition section between districts and countries, etc. and publish monitoring results.

**Improve eco-compensation policy.** Formulate the policies about the compensation of the land use for the



ecosystem purpose, and compensate the residents who live in the areas enclosed by the red line of ecological functions and water quality. Formulate the policy of eco-compensation about the conservation areas of drinking water resource. Establish the mechanism of eco-compensation about natural protected areas; enhance the construction level of protected areas and compensate the citizens who are affected by the relevant activities. Formulate the compensation policy about the equalization of environmental public services, and compensate the areas which cannot reach the standards of basic public services about environmental monitoring and relevant environmental facilities. In order to equalize the environmental public services in the urban areas, for those areas cannot reach the standards of public services, it could imitate the government to purchase the services from the society.

**Establish ecological assets accounting system.** Build a series of ecological assets accounting system composed of ecological assets statistics, valuation, account balance and reports. Set up technical support institutions of ecological assets at the central level. Study and formulate technical specification of ecological assets assessment. Strengthen ecological assets regulation and establish talent training and follow-up training mechanism.

## 4.5 Reinforce Planning Connection and Capacity Building

### 4.5.1 Improve Planning Connection System

**Consummate connection institution of UREMP and other urban planning.** Strengthen the connection of UREMP with National Economic and Social Development Plan, Urban Master Plan, Land Use Master Plan, National Main Functional Zoning Plan, etc., from five aspects containing planning system, planning objectives, spatial layout, management policies and planning data. Insist on environment priority and forerunner and confirm ecological protection red lines, environmental quality baselines and resources and environmental limitation, especially in constraining force index, spatial layout and space control, providing fundamental environmental basis for other planning formulation.

**Improve interdepartmental connection institution of UREMP formulation and implementation.** Establish coordination and connection institution of technic, data, and schemes required by planning among MEP, Ministry of Land and Resources, Ministry of Housing and Urban-Rural Development (MOHURD), etc. For example, MOHURD designates basic ecological control lines, while Ministry of Land and Resources masters fine spatial data and develops a number of technical specifications, such as making detailed specification on figure types, drawing board, and other requirements. In order to improve planning connection system, it is necessary to establish and complete institutions linking each department and planning. It is crucial to be fully connected and integrated with planning of each department form essential data map, specification of spatial database, spatial hierarchical control technology, planning levels, planning objectives, planning schemes, and other aspects.



#### 4.5.2 Enhance Capacity Building

Build basic data platform of UREMP and integrate essential data of environmental fields, such as environmental monitoring, environmental pollution source investigation, environmental supervision, environmental functional district planning, ecological monitoring and evaluation, etc. Integrate data in relation to basic geographic information, national economic and social development, relevant resources and energy, urban planning and construction, etc. Establish and improve standard data system, classification and grading system as well as planning, application and control system of UREMP, and tightly combine achievements of the planning with decisions and management of urban development, economic construction, resource exploitation and environment protection. At the meantime, reinforce software, procurement and simulated information platform construction of planning formulation.

Enhance capacity building of UREMP preparation units. UREMP should be undertaken by provincial environmental planning agencies (autonomous regions and municipalities directly under the central government) with qualification and abilities. In addition, these units should set up an environmental planning team with complete business areas, professional skills, and reasonable personnel structure and equip with necessary instrument and equipment, service system and model tools. Meanwhile, the professional teams should receive UREMP training for the purpose of better finishing UREMP formulation tasks.

#### 4.6 Proposal to Promote UREMP for the 13<sup>th</sup> Five-Year Plan Period

**Continuously enhance planning technical level.** Firstly, it is necessary to comprehensively summarize planning formulation, implementation and management experiences as well as technical methods of 28 pilot cities. Secondly, speed up research on technical specification of UREMP., Strengthen technical summary and extract, Summarize and improve key technic and methods in UREMP researches and practices as soon as possible, so as to form technical specification of UREMP formulation.

**Promote the formulation and implementation of UREMP.** Take UREMP formulation as key task of the 13<sup>th</sup> FYP. It is suggested to firstly conduct UREMP formulation in a batch of typical cities selecting from national environmental-protection model cities, key national environmental-protection cities, and key cities involved in air and water pollution plan, and newly established cities, to expand the scope of implementation.

**Explore to establish UREMP management system.** Further perfect management policies of UREMP formulation, discussion, approval, implementation, evaluation, assessment, etc., and gradually establish legal status of the planning. It is suggested that UREMP should be discussed, approved and implemented by Municipal People's Congress at the same level and its formulation of key cities should be reported to MEP of the P.R.C. for record.

**Actively promote UREMP to participate in “multi-planning integration”.** In cities and counties, explore and promote “multilateral





integration” jointly operated by National Development and Reform Commission, Ministry of Land and Resources MEP, Ministry of Environmental Protection and MOHURD, realizing environmental priority and organic link, especially in spatial function layout, resources and environmental carrying capacity constraints and other aspects.

**Promote city clusters to formulate UREMP.** Based on the key development areas, the city clusters, regulated in the National Main Functional Zoning Plan, should formulate UREMP for the cities located in the city clusters respectively.

**Build knowledge sharing and innovation platform of UREMP.** Firstly, innovate planning formulation mechanism and compile plan in an open way by absorbing opinions completely from local pilot governments, research institutions, relevant experts and representatives of local residents, ensuring that the policies conform to actual local situation and laying a foundation for planning implementation. Secondly, share achievements of project researches and practices by relying on existing domestic and international cooperation platforms. Thirdly, expand financing channels of planning formulation. Raise fund from central government, local governments, international agencies, etc. and support the promotion of UREMP and achievement application.







## 5. INSTITUTION ARRANGEMENT OF UREMP

All municipal departments including Municipal People's Government, Development and Reform Commission, Land and Resources Bureau, Urban-rural Planning Bureau, Water Conservancy Bureau, Forestry Bureau, Road Transport Bureau, etc., play an important role in the process of formulating UREMP of pilot cities. Furthermore, country-level governments and departments also play a role to certain degree. A planning formulation kick-off meeting participated by representatives from all relevant municipal departments shall be held after determining formulation tasks of UREMP. At the conference, first of all, confirm UREMP along with Urban Master Plan, Land Use Master Plan, and other specialized department plan that are on the same level and explicate the link of UREMP with various plan in general goals and function orientation. Development directions and targets, spatial planning,

restrictive requirements, etc. related to each relevant field put forward by each department should be introduced in UREMP as important content.

The compilation of UREMP should hold symposiums with each department respectively. Ask for related information and do a better handover job in urban spatial control, basic data, base map and other aspects. The following table lists internal units and responsibilities in relation to ecological environment protection, roles in UREMP formulation, content to connect with UREMP in relevant planning, etc. of each municipal department. In addition, Municipal People's Government shall organize and set up a work steering group which is responsible for organization, guidance and approval of planning formulation.



Table 7 Institution Arrangement for Each Municipal Department to compile UREMP

Department	Program Plan	Related Internal Units	Related Function	Roles in UREMP Formulation and Implementation	Content to Connect with UREMP
Municipal People's Government	—	Financing Budget Office and Urban Development Section of Research Department	Responsible for message management, meeting arrangement and supervision of development plans, research of major problems in water affairs, environmental protection, urban management, etc. and putting forward policy suggestions.	Establish and organize work steering group responsible for organization, guidance and approval of planning formulation.	—
Municipal Development and Reform Commission	National economic and social development planning (plan) and municipal major function oriented zoning	Development Planning and Resources and Environment Department (Branch)	Compile municipal regional economic development plan. Coordinate important problems of ecological construction, environmental protection, energy conservation and emission reduction, etc. formulate and implement planning to response to climate change.	Provide national economic and social development plan, main municipal functional zoning and other documents, and giving suggestions to UREMP.	Pollutant emission reduction targets and protecting prohibited development zone.
Municipal Environmental Protection Bureau	Municipal environmental-protection plan, ecological city construction plan, environment and air quality function zoning, etc.	Financing Planning Section (Branch)	Organize the formulation and implementation of municipal environmental protection and ecological construction plan and review the environmental protection content in specialized and comprehensive plan.	Entrusted by Municipal Party Committee and Municipal Government, formulate and coordinate UREMP.	UREMP is the foundation of any other specialized environmental plan.



<p>Land and Resources Bureau at Municipal and Country Level</p>	<p>Municipal land utilization master plan and annual land utilization plan</p>	<p>Planning Section (Branch)</p>	<p>Formulate and implement municipal comprehensive planning of territory, land utilization, mineral resources, geological environment, etc. Guide and review relevant national land and resources plan. Work out annual land utilization plan, etc.</p>	<p>Provide relevant database and base map, master land utilization plan, annual land utilization plans, and other documents. Give suggestions to UREMP.</p>	<p>Land utilization index control and prohibited development area zoning.</p>
<p>Urban-rural Planning Bureau at Municipal and Country Level</p>	<p>UREMP</p>	<p>Planning Formulation Section (Branch)</p>	<p>In charge of administrative examination, approval application, and approval of urban planning formulation projects. Participate in land utilization master plan formulation.</p>	<p>Provide relevant database and base map, master urban plan documents. Give suggestions to UREMP.</p>	<p>“blue line, green line, purple line, etc.” in master urban plan, prohibited development area, pollution treatment facilities.</p>
<p>Municipal Agricultural Bureau</p>	<p>Special planning of municipal modern agricultural development, protective, cultivation project construction, mineral grassland, mineral resource, etc.</p>	<p>Financing Budget Section (Branch)</p>	<p>Organize to draft medium and long-term development planning and annual plan of agriculture and rural areas.</p>	<p>Provide relevant database and planning documents. Give suggestions to UREMP.</p>	<p>Cultivated land and prime farmland, mineral development and protection.</p>





Municipal Water Conservancy (Water and Electricity) Bureau	Water resource protection planning, urban water conservancy development planning, urban fishery industry development planning, etc.	Financing Section Planning Section (Branch)	Formulate municipal water resource development and strategy plan, and formulate comprehensive plan, professional plan and special plan of major municipal water conservancy.	Provide relevant database and planning documents. Give suggestions to UREMP.	Water resource conservation and utilization, red lines of drainage basin and water resource, flood control.
Municipal Forestry Bureau,	Plan of garden plant development, forest construction planning, afforestation and plant plan, ecological public-welfare forest management, etc.	Financing Budget Section (Branch), Resource and Forest Administrative Division	Draft relevant municipal forestry development plan; organize and guide the establishment and implementation of ecological compensation system of forestry and its ecological construction.	Provide relevant database, base map and relevant urban forestry development planning documents, give suggestions to UREMP.	Animals, plants and other biological resource system conservation.
Municipal Transportation Bureau (Commission)	Comprehensive urban transportation planning, transportation infrastructure planning, etc.	Development Planning Section (Branch)	Compile highway and waterway transportation plan, industry development plan as well as annual plans; master transportation plan.	Provide relevant database, base map and relevant urban transportation planning documents. Give suggestions to UREMP.	Green corridor and ecological transportation.





## REFERENCES

- 1 European Commission COST Action C11 Green Structure and Urban Planning, Final Report, 2005.
- 2 RISE: Region Integrated Strategies in Europe, Final Report 13 July 2012.
- 3 ESPON Targeted Analysis Based on User Demand , Identifying and exchanging best practice in developing Regional Integrated Strategies in Europe (RISE) 2010.
- 4 UK Government, Planning practice guidance, February 2014.  
<http://planningguidance.planningportal.gov.uk/blog/guidance/>
- 5 Planning Policy Framework, Department for Communities and Local Government, March 2012.
- 6 Green Belts: A Twentieth-century Planning Experiment, Marco Amati, 2008.
- 7 Urban Growth Boundaries, A Policy Brief for the Michigan Legislature, Michigan State University, Kolakowski, Machemer, Thomas, Hamlin, December 2000.
- 8 Constitutional, Political, and Philosophical Struggle: Measure 37 and the Oregon urban growth boundary controversy, Benjamin P. O'Glasser, Journal of Constitutional Law, January 2007.
- 9 The Columbia Region Association of Governments, Metro's predecessor, engaged in a complete planning process and proposed an urban growth boundary for the region in 1977. When Metro was created by voters in 1979, it inherited the boundary planning effort. A year later, the Land Conservation and Development Commission approved the boundary as consistent with state-wide planning goals. Oregon metro website.
- 10 The Effects of Portland's Urban Growth Boundary on Urban Development Patterns and Commuting, Urban Studies, Vol. 41, No. 7, 1333–1348, June 2004, Myung-Jin Jun, October 2003.
- 11 Urban-Growth Boundaries and Housing Affordability: Lessons from Portland, Samuel R. Staley and Gerard C.S. Mildner, October 1999.
- 12 RISE Regional Integrated Strategies in Europe, Annex 3 Randstad Case Study, Targeted Analysis, Marjolein Spaans, Bas Waterhout, Wil Zonneveld ESPON and University of Birmingham, 2012.
- 13 Randstad Holland towards 2040 - perspectives from national government, Arjen J. van der Burg and Bart L. Vink – Randstad Holland 2040, 44th ISOCARP Congress, 2008.



- 14 Green Heart Attack: An Environmentalist's Eulogy for the Randstad, Dutch Grand Planning, and the Compact City, Kate Keleher, 2012.
- 15 Hybrid Parks, Parks and Gardens in Spatial Development Policies North Rhine-Westphalia - A best practice case study, 2010.

# Chinese Progress on UREMP Formulation

To protect the healthy development of urbanization and environment safety, MEP has launched the system and theory research work on UREMP since 2009. UREMP was positioned as one of the two basic system constructions supporting new urbanization and environmental protection, with characteristics of basis, guiding, forward-looking and strategic. *National Environmental Protection for 12<sup>th</sup> Five-year plan period, Action Plan for Prevention and Control of Air Pollution*, and other regulations clearly require to promote the compiling of UREMP.

CAEP, as the only finance budget support institution who research on UREMP decided by MEP, in 2012, approved by MEP, established a technical work team of UREMP to support the research of theoretical approaches, management system and technical specifications research for long term. CAEP worked with MEP and compiled *Opinions of carry out the UREMP in pilot city (MEP, [2012] NO.1088)*, *Technical requirement of UREMP (MEP, [2012] NO.1088)*, and *Work rules of UREMP in pilot city (MEP, [2013] NO.449)*, etc. CAEP has built the pilot exchange platform for UREMP, which supports MEP to carry out multiple technical training on UREMP focusing on the technical method, practice and exploration, control measures, etc. CAEP issued 37 working papers on the brief



▲ TA groups and speakers from 10 cities who participates the UREMP training

introduction of UREMP, published more than 20 related articles and one monograph *Theory Method and Practice of UREMP*.

CAEP actively carry out the pilot practice and exploration of UREMP. In the three batches of 28 pilot cities, CAEP has carried out the UREMP formulation for Yichang, Fuzhou, Guangzhou, Pingtan, Weihai, Qingdao, Guiyang, Yantai, Yichun, Beihai, Urumqi, Tongling, Haikou and Sansha, totally 14 pilot cities. Among them, Yichang had successfully completed and got highly evaluation from leadership of MEP, expert evaluation group and Yichang Municipal People's government. Yichang Municipal People's Congress have approved the implementation of UREMP. Weihai, Fuzhou, Pingtan have passed expert demonstration. Guangzhou, Beihai, Urumqi, Haikou, Guiyang, Yichun have completed the planning structure design or preliminary drafts. Other cities' UREMP are also being compiled in an orderly manner.



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