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首届联合国地信周



Land and Resources Survey, Dual Assessment and Spatial Planning

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1. Ministry of Natural Resources and the New Territorial Spatial Planning

2. How the “Dual Assessment” Supports Planning Decisions?

3. In What Way Can Land and Resources Survey Improve “Dual Assessment” ?



Part 1

1. Ministry of Natural Resources and the New Territorial Spatial Planning

1.1 Establishment of the Ministry of Natural Resources



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The ministry is the result of national institutional reform, which aims at promoting the capacity for territorial and spatial governance. It will execute duties as:

- Unified survey, registration and management of all natural resources;
- Unified land use control for zoning and conversion;
- Unified ecological restoration;
- Unified territorial spatial planning.

深化国务院机构改革

国土资源部

职责

国家发改委

组织编制
主体功能区规划职责

住建部

城乡规划管理职责

水利部

水资源调查和
确权登记管理职责

农业部

草原资源调查
和确权登记管理职责

国家林业局

森林、湿地等资源调查
和确权登记管理职责

国家海洋局

职责

国家测绘
地理信息局

职责

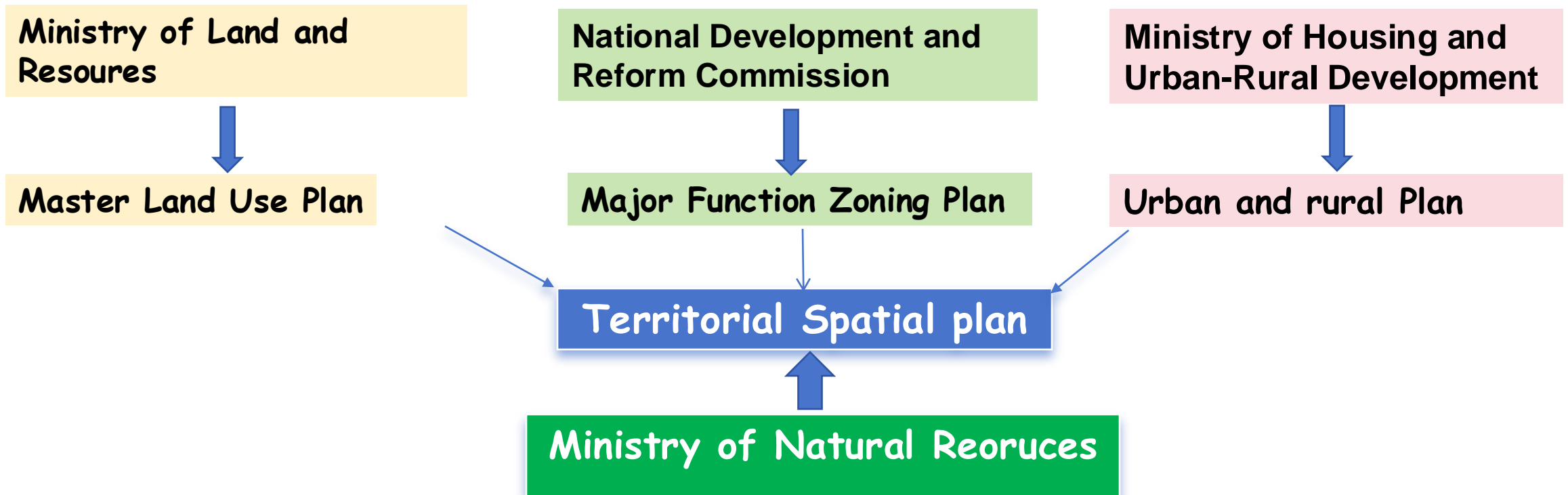
自然资源部

对外保留
国家海洋
局牌子

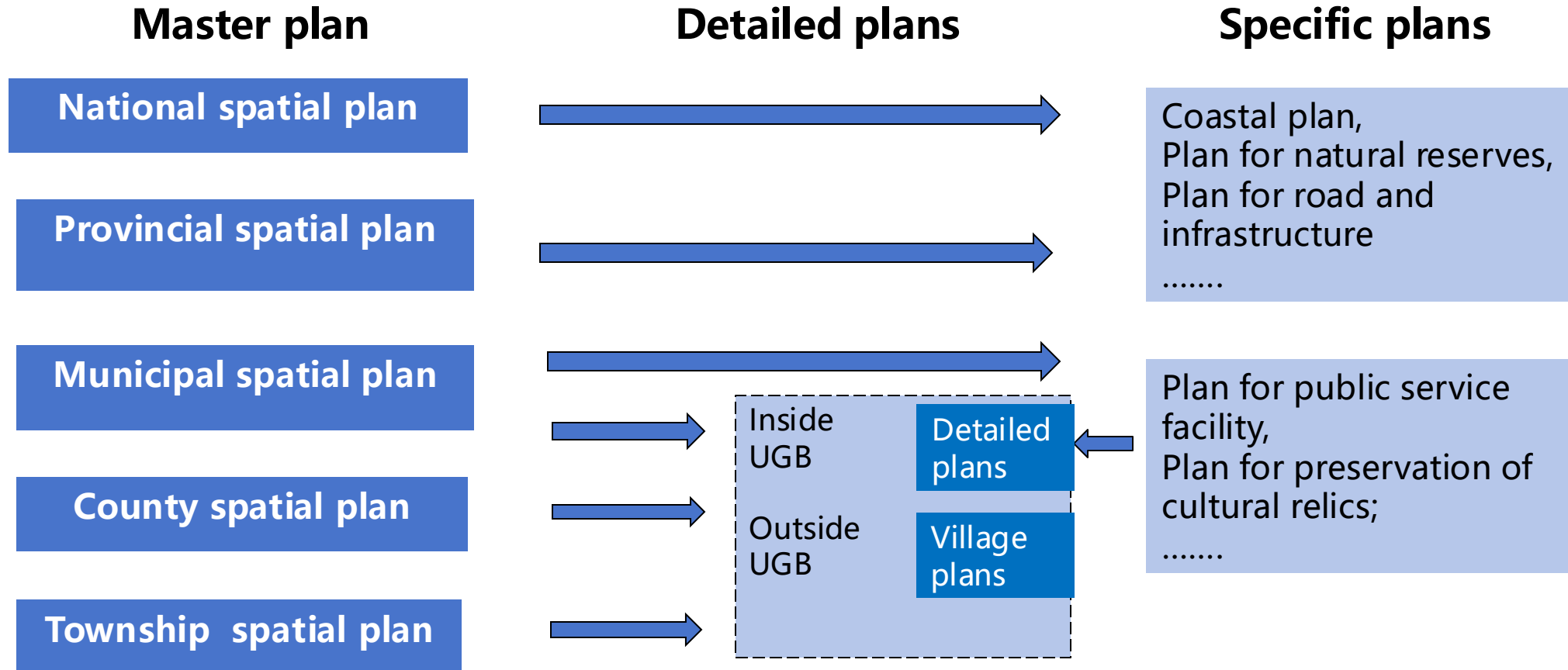
1.2 An integrated new planning



The plan is intended to solve problems as overlapping, repetition and contradictions between previous spatial plans by different governmental sectors.



1.3 Hierarchy of spatial plan: “five levels and three types”



1.4 Major tasks of the planning



- The plan is the guide for national spatial development, the spatial blueprint for sustainable development, and the basis for various development, protection and construction activities.
- The plan takes into account factors such as population distribution, economic layout, land use, ecological and environmental protection, and scientifically distributes production, living, and ecological space, and makes overall plans for the development and protection of China's territorial space.
- The following critical red lines must be drawn: **ecological red lines, permanent basic farmland, urban development boundary, as well as flood control line, historical and cultural protection line.**





Part 2

2. How the “Dual Assessment” Support Planning Decisions?

2.1 Definition and role



- “Dual Assessment” refers to the carrying capacity **assessment** of resources and environment, and suitability **assessment** of territorial space development.
- It is the fundamental tool for decision making in regard to protection and development of territorial space.



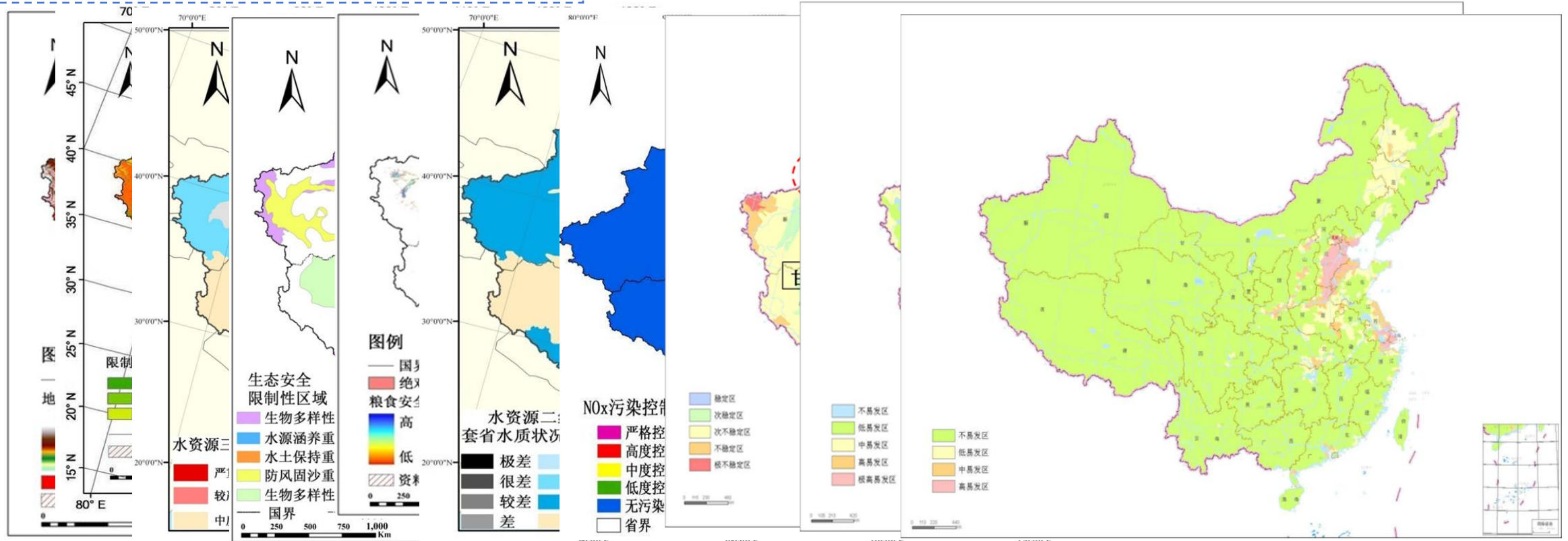
- ◆ **Describe** the background of resource, ecological and environmental conditions;
- ◆ **Identify** the main types of resource and environmental risks faced by development, and their spatial differentiations;
- ◆ **Seek** the causes of resource and environmental risks;
- ◆ **Suggest** suitable space for development;
- ◆ **Provide** multi-scenario for optimization of spatial pattern;
- ◆ **Propose** planning solutions and strategies;
- ◆

2.2 A useful tool for problem diagnosis



It can identify key areas suitable or not suitable for urbanization and industrialization from perspective of sustainable development.

Resource and environmental factors influencing regional development include topography, climate, ecology, cultivated land, water resource, environmental carrying capacity, geological disasters, etc.



2.3 Contribute to delineating three red lines--- permanent prime farmland



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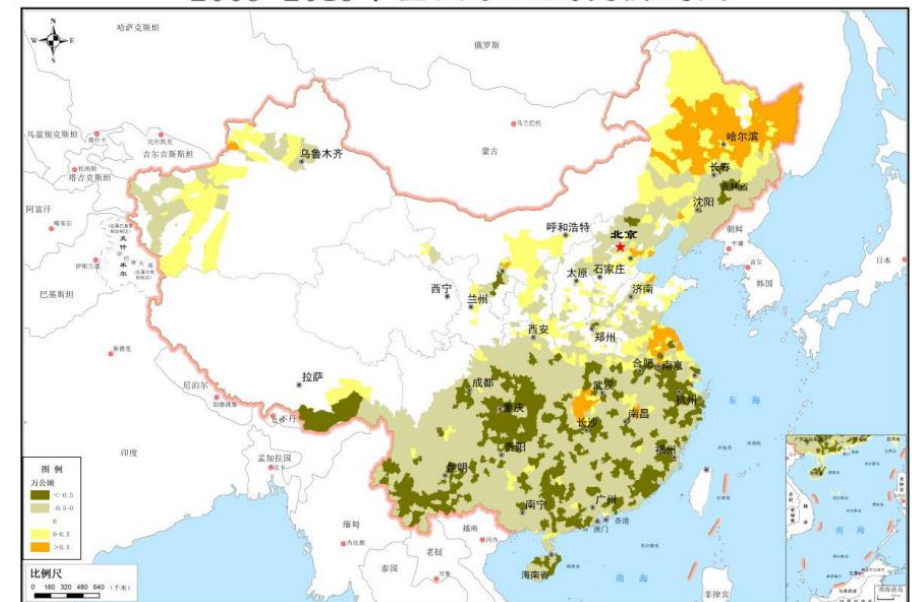
Cultivated land protection is the basic national policy of China

Indicators for suitability assessment for agricultural production include:

- topographic factors: slope, elevation, etc.
- agro-meteorological conditions: photoperiod and temperature, etc.
- soil conditions: organic matters, texture, soil acidity and alkalinity, etc.
- irrigation and drainage conditions;
-



2009-2019年全国水田变化情况图



Paddy land change from 2009-2019

2.3 Contribute to delineating three red lines-- urban development boundary



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To use land more efficiently and more economically is also a basic national policy. Curbing urban sprawl is crucial!

Indicators for suitability assessment for urban and town development include:

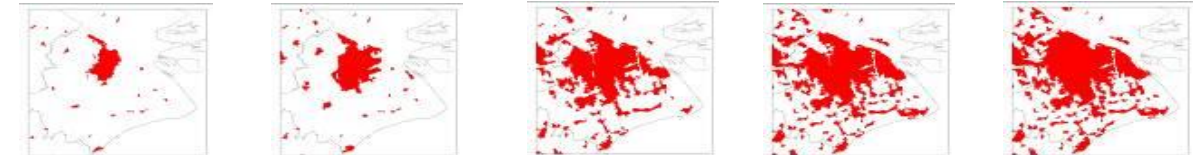
- topographic factors: slope, elevation, etc.
- disasters factors: geological disasters, earthquake risk, etc.
- resource supply: water, land;
- environmental capacity: air, water, soil, etc.
- social economic advantage: transportation, population, economy, etc.



北京市1990年-2012年城市建设规模扩展示意图



天津市1990年-2012年城市建设规模扩展示意图



上海市1990年-2012年城市建设规模扩展示意图



珠江三角洲城市群1990年-2012年城市建设规模扩展示意图

Mega City Expansion in China from 1990-2012

2.3 Contribute to delineating three red lines-- ecological red lines



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- ◆ **Ecological Red Lines** refers to areas where ecological functions are extremely important, or fragile, or with potentially important ecological values, and must be forcibly and strictly protected.
- ◆ It is the bottom-line and lifeline for ensuring and safeguarding the national ecological security .



2.3 Contribute to delineating three red lines-- ecological red lines



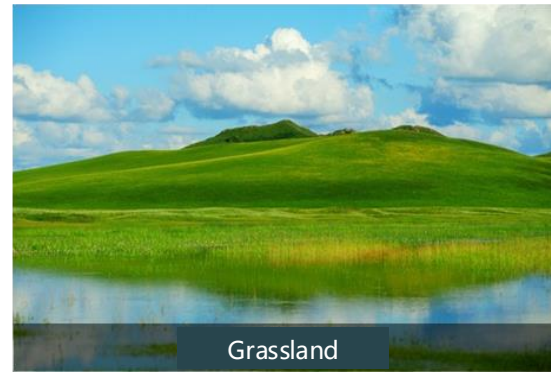
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It includes 99% of China's mangroves, 96% of first-class national public welfare forests, 92% of glaciers and permanent snow, 91% of coral reefs, 89% of seagrass beds, and 94% of undeveloped and uninhabited islands.



Natural forests



Grassland



Wetlands



Mangroves



Coral reefs



Seagrass beds

2.3 Contribute to delineating three red lines-- ecological red lines

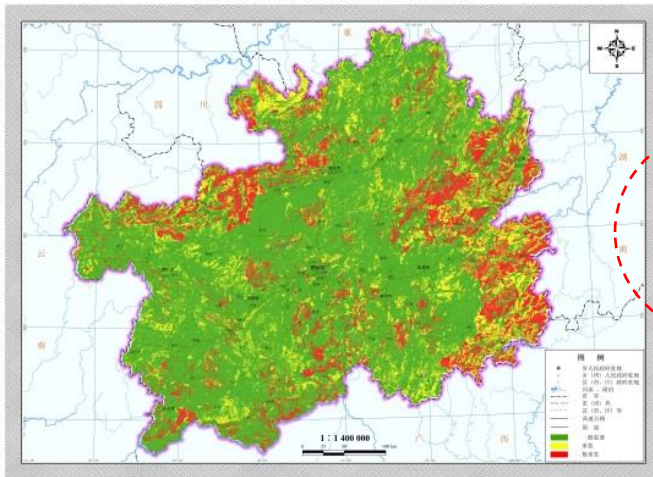


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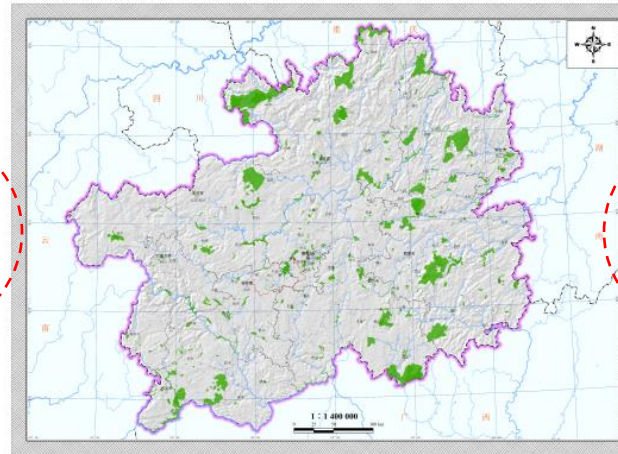


Precedure of delineating ecological red lines

贵州省水源涵养功能重要性评价



自然保护区+风景名胜区+地质公园+湿地公园+森林公园+水产种质+水源地+自然遗产地



Step 1: Assessment
Identify areas with extremely important ecological functions, and extremely vulnerable.

Step 2: Integration
Integrate with natural protected areas.

Step 3: Coordination
Solve conflicts with other land uses as mining, infrastructure, urban and rural development, etc.

Ecosystem Service Functions Assessment

生态系统服务	主要影响因素	模型评价方法	定量指标法
水源涵养	降水量、蒸散量、下垫面	$TQ = \sum_{i=1}^j (P_i - R_i - ET_i \cdot A_i)$	$WR = NPP_{mean} \times F_{sic} \times F_{pre} \times (1 - F_{sio})$
土壤保持	土壤侵蚀量、植被、土壤、地形	$A_c = A_p - A_r = R \times K \times L \times S \times (1 - C)$	$S_{pro} = NPP_{mean} \times (1 - K) \times (1 - F_{sio})$
防风固沙	风速、降雨、温度、土壤质地、地形以及植被	$SR = S_{L潜} - S_L$	$S_{ws} = NPP_{mean} \times K \times F_q \times D$
生物多样性维护	关键物种分布	物种分布模型(Species distribution models)	$S_{bio} = NPP_{mean} \times F_{pre} \times F_{tem} \times (1 - F_{alt})$

Ecological Vulnerability Assessment--soil and water erosion

水土流失敏感性评估

- 将反映各因素对水土流失敏感性的单因子分布图，用地理信息系统进行乘积运算，公式如下：

$$SS_i = \sqrt[4]{R_i \times K_i \times LS_i \times C_i}$$

式中： SS_i 为*i*空间单元水土流失敏感性指数，评价因子包括降雨侵蚀力（ R_i ）、土壤可蚀性（ K_i ）、坡长坡度（ LS_i ）、地表植被覆盖（ C_i ）。

指标	降雨侵蚀力 R	土壤可蚀性K	地形起伏度 LS	植被覆盖C	分级赋值 (S)
一般敏感	<100	石砾、沙、粗砂土、细砂土、粘土	0-50	≥ 0.6	1
敏感	100-600	面砂土、壤土、砂壤土、粉粘土、壤粘土	50-300	0.2~0.6	3
极敏感	>600	砂粉土、粉土	>300	≤ 0.2	5

Ecological Vulnerability Assessment--Desertification

土地沙化敏感性评估

- 将反映各因素对土地沙化敏感性的单因子分布图，用地理信息系统进行乘积运算，公式如下：

$$D_i = \sqrt[4]{I_i \times W_i \times K_i \times C_i}$$

式中： D_i 为*i*评价区域土地沙化敏感性指数； I_i 、 W_i 、 K_i 、 C_i 分别为评价区域干燥度指数、起沙风天数、土壤质地和植被覆盖的敏感性等级值。

指标	干燥度指数	≥6m/s起沙风天数	土壤质地	植被覆盖度	分级赋值 (S)
一般敏感	≤1.5	≤10	基岩、粘质	≥0.6	1
敏感	1.5~16.0	10~30	砾质、壤质	0.2~0.6	3
极敏感	≥16.0	≥30	沙质	≤0.2	5

Ecological Vulnerability Assessment--Stony desertification

石漠化敏感性评估

- 将反映各因素对石漠化敏感性的单因子分布图，用地理信息系统进行乘积运算，公式如下：

$$S_i = \sqrt[3]{D_i \times P_i \times C_i}$$

式中： S_i 为*i*评价区域石漠化敏感性指数； D_i 、 P_i 、 C_i 分别为*i*评价区域碳酸岩出露面积百分比、地形坡度和植被覆盖度。

指 标	碳酸岩出露面积百分比 (%)	地形坡度	植被覆盖度	分级赋值
一般敏感	≤30	≤8°	≥0.6	1
敏感	30~70	8° ~25°	0.2~0.6	3
极敏感	≥70	≥25°	≤0.2	5



Part 3

3. In What Way Can Land and Resources Survey Improve “Dual Assessment” ?



数据类型	数据名称	数据精度要求		数据来源
		省级（区域）	市县级	
Land resource	第三次全国国土调查成果及年度变更数据（三调成果形成之前使用全国第二次土地利用现状更新调查数据）	优于或等于1:1万	优于或等于1:1万	自然资源部门
	DEM数据	1:10万	1:5万	
	省/市土壤数据库（含不同土壤粒径百分比%，土壤有机质含量%）	1:25万	1:5万	农业部门
Water resource	第二、三次全国水资源调查评价成果	-	-	水利部门
	省（市）近五年水资源公报	-	-	
	省（市）水资源综合规划	-	-	
	水资源流域分区图	三级或四级流域	四级流域	
	水资源控制单元（现状供水结构中过境水源超过50%的省区收集）	县（市、区）	可使用省级评价结果	
	用水总量控制指标数据（现状供水结构中过境水源超过50%的省区收集）	县（市、区）		
	农垦各农场用水调度指标分配数据（现状供水结构中过境水源超过50%的省区收集）	县（市、区）		



数据类型	数据名称	数据精度要求		数据来源
		省级 (区域)	市县级	
Environment	大气环境容量标准数据及其分级结果	5km×5km	5km×5km (采用方法二时网格大小与DEM一致)	生态环境部门
	各控制单元或流域分区水质目标数据	与控制单元或流域分区一致		
	各控制单元地表水资源量	-	-	
	各控制单元可利用的过境水资源量	若考虑过境水资源量影响时, 需收集		
	各控制单元过境水资源量	若考虑过境水资源量影响, 计算过境水环境容量时需收集		
	过境河长与流速			
	土壤污染状况普查数据	-	-	
	海水水质监测数据 (包括pH、COD、溶解氧、石油类、重金属 (汞、铜、铅、镉、锌、砷、总铬)) (涉海地区)	涉及空间插值的数据精度, 建议与所使用的DEM一致		生态环境部门
	可能最大潮流流速 (滨海地区)	2°网格	优于1km×1km	自然资源部门

Big data of Multi-source and multi-precision



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数据类型	数据名称	数据精度要求		数据来源
		省级（区域）	市县级	
Ecology	NDVI数据集	优于50m	-	
	地下水矿化度、地下水埋深	-	-	
	雪盖产品数据集	0.05度	/	中科院寒区旱区科学数据中心
	森林、灌丛、草地、园地（乔木、灌木）、湿地等生态类型空间分布数据	-	/	自然资源部门
	沙漠化、石漠化、盐渍化、海岸侵蚀（涉海地区）等生态退化区域和强度分级数据	-	/	自然资源部门、生态环境部门
	一级、二级水源涵养区分布图	-	-	生态环境部门
	生态廊道数据	-	-	专家判读
	遥感影像数据	2m	优于2m	商业卫星
	珍稀濒危物种分布图及物种数量监测调查数据（含滨海地区）	-	/	自然资源部门
	滨海湿地及河口、红树林、珊瑚礁、海草床、海岛等生态类型空间分布图及相关监测调查数据（滨海地区）	-	/	
	水生生物自然保护区、海洋特别保护区、沙源保护地分布图（滨海地区）	-	/	
	渔业种质资源保护区、重要鱼类产卵场、索饵场、越冬场及洄游通道（滨海地区）	-	/	

Big data of Multi-source and multi-precision



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数据类型	数据名称	数据精度要求		数据来源
		省级（区域）	市县级	
Disaster	地震动峰值加速度	-	-	地震部门
	活动断层分布图	-	-	自然资源部门
	地质灾害易发区数据（包括崩塌、滑坡、泥石流和地面沉降、矿 山地面塌陷和岩溶塌陷等）	不低于1:10万	不低于1:5万	
	风暴潮、海啸、海浪、海冰灾害危险性（滨海地区）	-	-	自然资源部门
Climate and meteorology	评价范围及其周边各气象台站站点坐标数据	-	-	气象 部门
	多年平均风速	涉及空间插值的数据精度，建议与 所使用的DEM一致		
	静风日数			
	多年平均降水量数据			
	多年平均≥10°C活动积温数据			
	蒸散发			
	干燥度指数			
	月均气温（华氏温度）	涉及空间插值的数据	/	
	月均空气相对湿度（%）	精度，建议与所使用	/	
	起沙风天数	的DEM一致	/	
	气象灾害数据（干旱、洪涝、低温寒潮等）	-	-	

3.1 Land and resources survey can improve the accuracy and reliability of assessment results

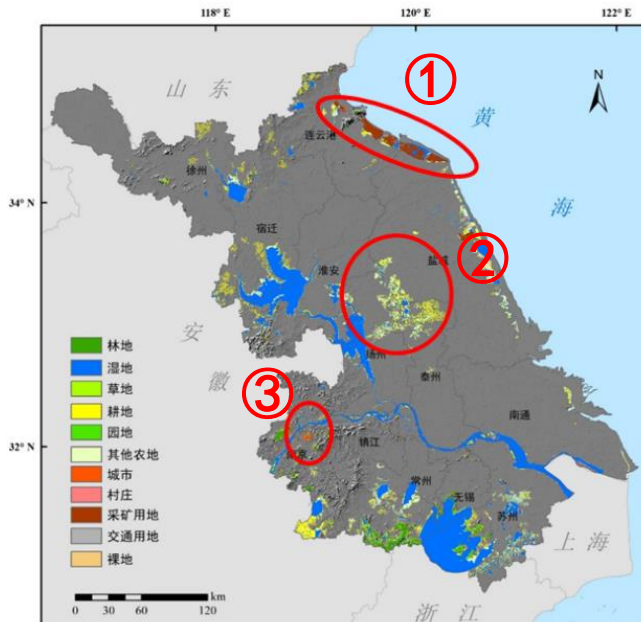


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Although big data is applied in dual assessments, the results need to be corrected by land and resources survey.

Example: the following areas were assessed as ecologically important areas.



In fact, they are

- ① salt evaporating field
- ② large area of farmland
- ③ tourist attractions

3.2 Land and resources survey can be used to coordinate conflicts

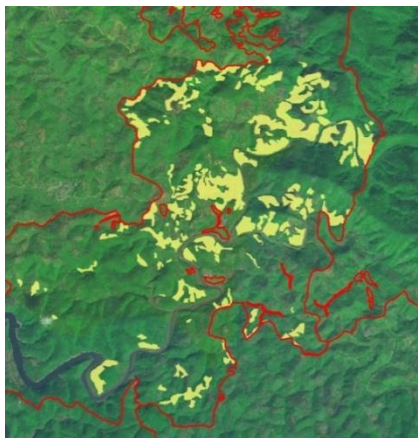


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Since there existed already many human activities in target areas, the coordination between different land uses thus become critical, and the survey can make the assessment results more scientific and workable .

Example: The actual land use has to be analyzed to identify areas not suitable for eco-red lines such as: farmland, artificial economic forest, prime grassland, contracted grassland, towns and villages, infrastructure, legal mining right, strategic mining area, facilities for the livelihoods of indigenous people



farmland in eco-red lines



contracted grassland



artificial economic forest

3.3 Land and resources survey can help to correct the results of assessment by models.



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Example: All models have their limitations, and scientific results come from correction by more detailed field survey.

The assessments below on Ecosystem Service Functions and Ecological Vulnerability were corrected and optimized by land and resources survey data.

Ecosystem Service Functions

Biodiversity

Water and land conservation

Wind prevention
Sand fixation

Coastal protection

Ecological Vulnerability

Water and soil loss

Stony desertification

Desertification

Coastal erosion and sand loss



Distribution of ecologically important areas



Distribution of ecologically vulnerable areas



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**A more detailed and more specific
land and resources survey in the
future will contribute more to a better
territorial spatial governance !**

THANK YOU!