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# Study on the setting-up priority area for protecting the ecological environment of the basin

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**Abstract:** For the purpose of protecting ecological environment of the basin and improving its ecological function, we proposed 4 principles of setting up priority area. Along with this, we analyzed the characteristics of the both sides of the Taedong River in its area ratio, topography, precipitation distribution and the flood, thereby set up a priority area (area of priority protection) in the basin. The results will provide scientific basis for protecting ecological environment, managing ecological safety in this area ensuring sustainable economic development of the area.

**Key words:** ecological environment protection; priority area; ecological function

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## 流域生态环境保护中优先领域的设定研究

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**摘要:** 以流域生态环境保护与生态功能提升为目的,提出了优先领域设定的 4 个原则,以大同江流域为例分析了其左岸与右岸的面积比率、地形特征、降水量分布特征以及对应的洪水特征,设定了该流域的优先领域(优先保护领域),研究结果可为区域生态环境保护与生态安全管理以及区域经济的可持续发展等问题的研究提供参考。

**关键词:** 生态环境保护; 优先领域; 生态功能

### 1 Principles for the setting-up priority area

Priority area for protecting the ecological environment of the basin is an ecologically functional area, which is selected inside the basin for various purposes and effects, i. e., to weaken flood process, increase water storage capacity, block the erosion and movement of earth and sand, increase the ecological function of the basin, etc<sup>[1]</sup>.

Priority area, as functional one, selected the riparian protection forest, windshield forest and water conservation forests. These forests and other functional areas inside priority area must be planned through an ecological design.

The principles of setting up priority area are as follows. First is the principle of unity. Pay attention to improving the ecological function of the area as a whole, in the long run, must be resulted in the rational control of water flow.

Second is the principle of sustainable development. Ensure the prospective improvement of the whole area beginning from some selected areas, while laying stress on the ecological interest. Third is the principle of protection from disasters. Deal with main damages on the basis of analysis on the existing or possible accidents. Fourth is the principle of suiting to the specific condition of the area. Consider the area's various natural conditions and different land-use method there<sup>[2]</sup>.

2 Setting up priority area for protecting ecological environment of the basin

The Taedong River adjoins the Chongchon River and many other rivers and valley, their watershed is high in the east and the north east

and gets low gradually westwards and south-westwards. The Taedong River's upstream constitutes a steep slope of 1/17 and its downstream is a very gentle slope of 1/2500 – 1/10000.

The floods in the Taedong River basin vary according to the characteristics and position of the precipitation. Therefore, the previous research classified the floods into 4 categories and defined their features after analyzing the 40-odd floods of in this area<sup>[3-5]</sup>.

The Table 1-4 show the area ratio with the heights above sea level and sloping degrees in Maengsan County on the upstream of the Taedong River and Yangdok County, Sinyang County on its midstream<sup>[6]</sup>.

Table 1 Area ratio with heights above sea level in Maengsan County

Hight above sea level/m	100-200	200-400	400-800	800-1 000	1 000-1 500	1 500≤
Area / %	0.4	27.3	50.2	8.4	13.6	0.1

Table 2 Area ratio with sloping degrees in Maengsan County

Sloping degree / (°)	<5	5-15	15-25	25≤
Area / %	4.8	12.2	12.4	70.6

Table 3 Area ratio with hights above sea level in Sinyang County

Hight above sea level/m	100-200	200-400	400-800	800-1 000	1 000-1 500
Area/ %	3.9	27.7	46.1	13.3	9.6

Table 4 Area ratio with sloping degrees in Yangdok County

Sloping degree / (°)	<5	5-15	15-25	25≤
Area/ %	5.6	17.5	29.4	47.5

As seen in Table 1-4, slope of above 15° covers 83% of the area in Maengsan County situated in the upstream of the Taedong River and 76.9% in Sinyang County situated in the mid-stream. It connected with the Sinyang County, which is situated in the west slope of the ridge of Pukdaebong Mountain Range.

Sinyang County occupies the upstream area of the Piryu River, a tributary stream of the

Taedong River and most of its area is comparatively steep slopes. Therefore a flood can occur easily if the upstreams of the Taedong River and the Piryu River overflow. This fact shows that maximizing the ecological environmental stability of these areas is the primary solution to the decrease of flood process, the increase of water storage capacity and the prevention of the movement of earth and sand in the whole of the

Taedong River basin.

On this basis, this paper presented the reasons why priority area should be set up in the Taedong River basin.

First: Priority area should be marked out the left, considering the area distribution on the both sides of the Taedong River (left: 76.2%, right: 23.8%).

Second: Upstream areas of the Taedong River, Piryu and Nam Rivers, their tributary streams should be selected as priority areas, considering their topographical features, precipitation distribution and the flood characteristics thereof.

Third: The selection of above-mentioned upstream area is based on the priority-area-selecting principles for solving the ecological and

disaster problems existing in these areas.

Therefore the areas selected as priority areas are upstream area of the Taedong River and both the upstream areas of the Piryu and Nam Rivers.

The ecological environmental stability state of the counties situated in the upstream of the Taedong River and the Nam and Piryu Rivers, their tributary streams is also studied. The stability state of these areas was defined through calculation with ecology-environment stability index, as a result, their position was decided in the rating range.

Table 5 shows that the changes in their stability ratings of the counties situated in the upstream areas of the Taedong River, Nam and Piryu Rivers.

Table 5 Ecological-environment stability index in the upstream and midstream area of the Taedong Rier in 1991-2010

Area	Rating				
	I (0.021-0.060 6)	II (0.060 7-0.100 2)	III (0.100 3-0.139 9)	IV (0.140 0-0.179 5)	V (0.179 6-0.219 0)
Upstream				2002(0.160) 2010(0.148)	1991(0.183)
Midstream			2010(0.138)	1991(0.174) 2002(0.152)	

As seen in the Table 5, upstream area is stable state (V-class of stability ratings) at first, but it became low gradually with time and midstream is comparatively stable state (IV-class of stability rating), but it also became low with time. This is attributable to the many changes in the land-use structure affected by different socio-

economic activities during this period.

This paper suggests recovery area results of the damaged forests land to update the present ecological environment stability from class IV to class V in the 4 Counties situated in the Taedong River upstream areas since 2010 (Table 6).

Table 6 Recovery area results of cities and counties (Jongbo)

City, County	Types of land	Needle-leaf forest	Broad-leaf forest	Mixed forest
Tokchon City	bare land	6 677.19	7 744.46	8 436.94
	Sparse tree land	21 166.73	17 540.83	15 188.21
Maengsan County	bare land	18 260.3	18 260.3	18 260.3
	Sparse tree land	7 015.08	4 692.47	3 185.47
Nyongbyon County	bare land	23 111.25	23 111.25	23 111.25
	Sparse tree land	6 165.09	3 474.83	1 729.2
Taechung County	bare land	33 220.11	33 220.11	33 220.11
	Sparse tree land	11 957.34	7 805.90	5 112.28

As explained above, recovery and conservation area results of the forests land of Sinyang County, the upstream area of the Piryu River and Yangdok County, the upstream area of the Nam River were obtained to update their stability

state onto class IV since 2010. On this basis, this paper decided the recovery area results of forests and land to update their stability state into class V as priority area (Table 7).

Table 7 Areas of Sinyang County in the upstream of the Piryu River and Yangdok County in the upstream of the Nam River (Jongbo)

Name of County	Type of forest		
	Needle-leaf forest	Broad-leaf forest	mixed forest
Sinyang County	32 158. 20	29 203. 11	27 285. 73
Yangdok County	32 298. 93	29 330. 92	27 405. 15

(1 Jongbo=2. 45 1acres)

In the upstream and midstream areas of the Taedong River forest land should be recovered in accordance with their actual conditions and the results investigation of the changed land-use realities in 1991-2010. Priority area should be set up to ensure the ecology-environment protection of the whole basin of the Taedong River, ensure the sustainable development of the ecological function displayed by the basin.

3 Conclusion

On the basis of topographical features of the Taedong River basin and its flood process, this paper suggested priority area, where the damaged forest land should be recovered according to its ecology-environment stability ratings.

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