

Green Belt Abolition and Strategic Environmental Assessment: The Case Study of Chongju City

Lee, Jong-Ho

Department of Urban and Regional Planning, Chongju University

(Manuscript received 24 June 2003; accepted 14 July 2003)

개발제한구역의 해제와 전략환경평가 : 청주시를 사례로

이 종 호

청주대학교 도시·지역계획학전공

(2003년 6월 24일 접수, 2003년 7월 14일 승인)

요 약

1999년 7월 청주권을 비롯한 7개 지방중소도시권은 친환경적 도시기본계획을 수립한 후 개발제한구역을 해제하도록 하고, 수도권을 비롯한 7개 대도시권은 보전가치가 낮은 지역을 위주로 부분적으로 해제하도록 하였다. 그리하여 표고, 경사도, 농업적성도, 식물상, 임업적성도, 수질 등 6개 항목에 대한 환경평가를 통해 개발제한구역에 용도지역이 지정되었다.

청주시의 경우 환경평가와 주민의견 반영 후 도시계획재정비에 따라 용도지역이 지정되었으나, 평지나 산림생산성이 떨어지는 곳은 낮은 환경등급을 받아 개발이 가능한 용도지역이 지정됨으로써 벨트형 녹지 유지가 어려워져, 시가지 팽창, 대전과 연담화, 도시 허파기능 상실 등의 가능성이 커지게 되었다.

따라서 청주권 개발제한구역의 시가화 영향을 토지피복, 지목, 용도지역 등의 변화를 통해 살펴보고, 6개 항목에 대한 환경평가 과정상 문제점을 고찰한 후, 개발제한구역의 해제 영향을 도시성장추진과 환경용량평가를 통해 규명하고, 전략환경평가의 적용방안을 모색하고자 한다.

전략환경평가의 시행을 위해서는 먼저 오염총량관리제, 국토의 계획 및 이용에 관한 법률에 의한 개발밀도관리구역, 수도권정비계획법에 의한 인구집중시설에 대한 개발총량규제 등이 반영되어야 할 것이다. 그리고 이미 시행중인 개발사업 및 개발계획중인 사업에 대한 누적영향평가와 함께 해당 지역에 대한 환경용량평가가 이뤄져야 하고, 아울러 개발제한구역 해제지역에 대한 사전환경성검토업무편람의 내용을 토대로 하여 환경평가항목에 대한 스코우핑, 환경평가

지표 개발이 이뤄져야 할 것이다.

주요어 : Strategic Environment Assessment, Environmental Assessment, Environmental Carrying Capacity, Green Belt

I. Introduction

In Korea, green belt was assigned to the out-skirt green zones of 14 major cities for the restriction of urban sprawl and the concentration of population and industry, for the protection of national security, and for the environmental conservation in the 1970's.

Nevertheless, there have been brought about many undesirable problems, such as infringement of private property right, leapfrog development, the abnormal rise of land price, and speculation, etc. Therefore lately most major cities with green belt have begun to readjust and release their green belt.

Complying with the policy of central government to readjust and release green belt, the city government has assigned new zoning to the green belt area according to the comprehensive environmental grade based upon six environmental indicators such as elevation, slope, agricultural suitability, vegetation, forestry suitability and water quality. Because the environmental carrying capacity of each city was not analyzed and strategic environmental assessment of such land use (zoning) change also was not done, urban sustainability could not become ensured in various aspects.

Therefore the impact of green belt on urban growth will be analyzed with the change of land cover, land use and urban planning zoning. The environmental assessment of Chongju green belt area by the six environmental indicators will be analyzed, and the environmental carrying capaci-

ty of Chongju City will be assessed. Finally the strategic environmental assessment of assigning new zoning to the previous green belt area based upon Pre-environmental Assessment of the Area under Special Act on Assignment and Management of Green Belt, will be suggested.

II. The History of Green Belt in Korea

During 1971-1973, the green belt was assigned at 14 areas for various purposes such as concentration restraint of population and industry, protection of military facilities and development control for security, restriction of urban sprawl, control of rapid urbanization resulting from heavy industrial complex, and conservation of tourist resource and natural environment (Table 1).

Especially the Chongju green belt area covering Chongju City and Chongwon County, was assigned for the restriction of urban sprawl uncontrolled in 1973.

In the green belt area, the development which is illegal under the Special act on the assignment and management of green belt, has been strictly regulated. Therefore the green belt has done much contribution to the conservation of natural ecosystem and the living environment.

But the green belt has been pointed out to have many problems such as insufficient reflection of characteristics of relevant cities, lot penetration due to the improper delineation, inefficient land use,

Table 1. The Purpose and Assignment Standard of Green Belt

Area	Year	Area		Purpose of Green Belt
		km ²	%	
Total	-	5,231.0	100.0	-
Seoul Metropolitan	'71.7-76.12	1,449.3	27.7	<ul style="list-style-type: none"> • concentration restraint of population and industry • protection of military facilities and development control for security
Busan	'71.12	591.5	11.3	
Daegu	'72.8	540.7	10.3	<ul style="list-style-type: none"> • restriction of urban sprawl uncontrolled
Gwangju	'73.1	571.8	10.9	
Daejeon	'73.6	438.8	8.4	
Ulsan	"	283.8	5.4	<ul style="list-style-type: none"> • control of rapid urbanization due to heavy industry etc.
Chuncheon	"	289.8	5.5	<ul style="list-style-type: none"> • conservation of tourist resource and natural environment
Chongju	"	179.3	3.4	<ul style="list-style-type: none"> • restriction of urban sprawl uncontrolled
Jeonju	"	210.2	4.0	
Yeosu	'77.4	86.6	1.7	<ul style="list-style-type: none"> • control of rapid urbanization due to heavy industry etc.
Masan	'73.6	288.8	5.5	
Jinju	"	192.0	3.7	<ul style="list-style-type: none"> • control of rapid urbanization due to heavy industry etc. • conservation of tourist resource and natural environment
Tongyoung	"	27.1	0.5	<ul style="list-style-type: none"> • conservation of tourist resource and natural environment
Jeju	'73.5	81.1	1.6	

Source: Ministry of Construction and Transportation, Korea, 1999, *Comparative Study on Urban Environmental Characteristics for Green Belt Adjustment*, 6-7.

leapfrog development, the abnormal rise of land price and real estate speculation, the infringement of private property right, the deterioration of living environment (Ministry of Construction and Transportation, Korea, 1999c, 67).

III. The Impact of Green Belt Abolition on Chongju

1. Impact of Green Belt on Urban Growth

Table 2 shows the change of land cover from the imagery of LANDSAT-TM in 1979 and 1998. During the last 20 years, the decrease in the area of forestry was 8.4 %, but the increase in the area

of field and urban was 5.0% and 9.0 % in the green belt. But out of the green belt, the increase in urban was 31.6%, and the decrease in forestry and paddy field were 14.2% and 13.5%. It may be concluded that the green belt has made the inner region high-density area and restrained the urban growth.

The population of Chongju green belt area decreased to the half. According to the land use change, the increase in the area of forestry and paddy field were nearly same with the data from the imagery of LANDSAT-TM (Table 3).

The population density in the green belt area is 131-183 person/km², very low compared with 7,091 person/km² in the inner region of green belt (Table 4).

Since the assignment of green belt in 1973, the

Table 2. Change of Land Cover in Chongju Green Belt Area (1979-1998)

(Unit : km²)

Area	Year	Land use						
		Total	Forestry	Paddy Field	Field	Water	River	Urban
Green-Belt	1979	183.5	96.1	34.4	48.5	1.5	2.2	0.7
	1998	183.5	80.7	33.3	57.7	1.5	0.5	9.7
	Change Ratio	0.0	-15.4	-1.0	9.2	0.0	-1.7	9.0
	1979-1998	(0.0%)	(-8.4%)	(-0.6%)	(5.0%)	(0.0%)	(-0.9)	(4.9%)
Non Green-Belt	1979	92.5	42.1	18.9	25.3	0.1	2.1	3.9
	1998	92.1	29.0	6.4	21.3	0.1	2.6	33.1
	Change Ratio	0.0	-13.2	-12.5	-3.9	0.0	0.4	29.2
	1979-1998	(0.0%)	(-14.2%)	(-13.5%)	(-4.3%)	(0.0%)	(0.5%)	(31.6%)

Source: Ministry of Construction and Transportation, Korea, 1999, The Adjustment of Green Belt, 185-187.

Table 3. Population and Land use of Chongju Green Belt Area (1974-1998)

Year	Household	Population	Land use(km ²)					
			Total	Forestry	Paddy Field	Field	Dwelling	Others
1974	8,807	53,936	180.10 (100.0%)	57.88 (32.1%)	33.85 (18.8%)	22.45 (12.5%)	2.25 (1.2%)	63.67 (35.4%)
1990	6,563	34,748	180.05 (100.0%)	52.78 (29.3%)	47.32 (26.3%)	31.67 (17.6%)	29.37 (16.3%)	18.91 (10.5%)
1999	8,104	27,063	180.10 (100.0%)	80.13 (44.5%)	43.73 (24.3%)	22.22 (12.3%)	3.99 (2.2%)	30.03 (16.7%)

Source: Ministry of Government Administration and Home Affairs, 1975, 1991, 2000, Municipal Yearbook of Korea.

Table 4. Chongju Green Belt Area

Category	Area (km ²)	Population	Population Density (person/km ²)	Household	Buildings
Chongju City (A+B)	153.30	587,069	3,830	179,809	
Non GB Area(A)	80.93	573,838	7,091	175,982	
GB Area in Chongju (B)	72.37	13,231	183	3,827	14,825
GB Area in Chongwon-County(C)	104.73	13,723	131	4,207	12,023
Chongju GB Area(B+C)	180.10	26,954	150	8,034	26,848

Source: 1) Chongju City, Korea, 2001, Chongju Statistical Yearbook.

2) Chongwon County, Korea, 1999, Chongwon County Statistical Yearbook.

population has increased from 178,000 to 583,000, the population density from 2,734 person/km² to 3,830 person/km². The residential area has increased from 18.4km² to 23.5km², the industrial

area from 3.6km² to 6.4km². The green zone occupies 90% of the urban planning area and its composition was largely changed as the green zone was assigned to the previous green belt area, The

Table 5. Change of Urban Planning in Chongju City (1974-2000)

Year	Population	Area of Administrative District (km ²)	Population Density (km ²)	Urban Planning Area (km ²)	Urban Planning Area(km ²)						
					Residential	Commercial	Industrial	Green Zone			
								Total	Conservation	Nature	Production
1974	177,630	64.96	2,734	264.1	18.4 (7.0%)	2.1 (0.8%)	3.6 (1.4%)	240.0 (90.9%)			
1980	237,348	64.91	3,057	264.1	14.5 (5.5%)	1.3 (0.5%)	4.6 (1.7%)	243.8 (92.3%)	-	232.2	11.6
1990	497,429	153.59	3,238	264.1	21.3 (8.1%)	2.0 (0.8%)	5.5 (2.1%)	235.3 (89.1%)	-	224.4	10.9
2000	582,758	153.30	3,830	274.3	23.5 (8.6%)	2.4 (0.9%)	6.4 (2.3%)	241.9 (88.2%)	0.9	233.2	7.8
2000								241.9	89.2	115.4	37.4

Source: Ministry of Government Administration and Home Affairs, 1975, 1991, 2000, Municipal Yearbook of Korea.

area of conservation green zone was changed from 0.9km² to 89.2km², the area of production green zone changed from 7.8km² to 37.4km², but the area of natural green zone was changed from 233.2km² to the half, 115.4km² (Table 5).

2. Environmental Assessment of Green Belt Region

Environmental assessment is defined as the comprehensive grading on elevation, slope, agricultural suitability, vegetation, forestry suitability and water quality (Ministry of Construction and Transportation, Korea, 1999b). The result of environmental assessment is as follows (Chongju City, 2001a).

1) Environmental Assessment

(1) Elevation

The 1st and 2nd grade area higher than EL.171m occupies 20.5% of Chongju green belt area, which covers mostly Uam Mountain located

in the eastern part of Chongju City, and the 4th and 5th grade area lower than EL.130m does 72.3%.

(2) Slope

The 1st and 2nd grade area with steeper slope than 26° occupies only 5.4 %, but 4th and 5th grade area with gentler slope less than 15° does 71.5%.

(3) Agricultural Suitability Grade

The assessment of agricultural suitability was implemented based upon the location map of agricultural promotion region, the map of agricultural land readjustment, the map of water resource development and the map of agricultural land productivity produced from soil distribution map. The occupancy ratios of 1st, 2nd, 3rd, 4th, 5th grade area are 8.9%, 11.7%, 14.1%, 18.8%, and 46.6% of the green belt area.

(4) Vegetation Grade

The vegetation grade was decided by the

Table 6. Grade Criteria of Six Environmental Constituents

Grade	1st	2nd	3rd	4th	5th
Elevation	higher than 211m	171~210m	131~170m	91~130m	lower than 90m
Slope	larger than 36°	26°~35°	16°~25°	6°~15°	smaller than 5°
Agricultural Suitability	· Agricultural Promotion Region	· Agricultural Land Adjustment Region/ Water Resource Development Region	· Agricultural Land Adjustment Region/ Water Resource Development Region · 1st & 2nd Agricultural Land Productivity	· 3rd & 4th Agricultural Land Productivity	· 5th Agricultural Land Productivity · Forestry and others
Vegetation	· natural monument, out-of-the-way plant community · natural trees over 41 years of age	· natural trees 21~40 years of age · artificial trees over 41 years of age	· natural trees less than 20 years of age · artificial trees 21-40 years of age	· artificial trees less than 20 years of age	· land without trees, open Space among forests · agricultural Land and others
Forestry Suitability	1st Grade Forest Land Productivity	2nd Grade Forest Land Productivity	3rd Grade Forest Land Productivity	4th Grade Forest Land Productivity	5th Grade Forest Land Productivity
Quality	more than 18 point	14~17 point	10~13 point	6~9 point	smaller than 5 point

Source: Chongju City, 2001, Environmental Assessment of Chongju Area Green Belt.

kinds, density and age of tree. The 1st and 2nd grade area, which should be conserved, occupy 9.6%; but 4th and 5th grade area available for development do 72.8%.

(5) Forestry Suitability Grade

The 1st and 2nd grade area, based on the map

of forestry soil level, occupy 5.2%, but 4th and 5th grade area do 77.5%.

(6) Water Quality

The water quality grade was decided by the water pollution potentiality, the impact on water supply source, the water quality standard and

Table 7. Criteria for Water Quality Grade

Score	8	7	6	5	4	3	2	1	0
Index of Water Pollutant Source	-	-	-	-	built area ratio 0.01% below	built area ratio 0.01%-0.1%	built area ratio 0.1%-1.0%	built area ratio 1.0%-5.0%	built area ratio 5.0%
Distance to Water Intake	0-2km above	2-5km above	5-10km above	10-15km above	15-20km above	20-25km above	25-30km above	30km above	down stream
Water Quality Standard					1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade
Wastewater Emission Permission Standard	-	-	-	-	Clean Region	-	A Region	-	B Region

Source: Chongju City, 2001, Environmental Assessment of Chongju Area Green Belt.

the wastewater emission permission standard (Table 7). There are not the 1st and 2nd grade area, but 4th and 5th grade area occupy 75.6%.

2) Environmental Grade

The comprehensive environmental grade is given according to the highest grade among the grades on six environmental indicators. The result of environmental assessment shows that the area of 1st grade is 44.2km²(24.2%), that of 2nd grade 38.3km²(21%), that of 3rd grade 61.2km²(33.5%), that of 4th grade 36.8km²(20.1%), and that of 5th grade 2.1km²(1.2%) (Table 8).

The area of 1st & 2nd grade, which should be conserved, is mostly located in the eastern part of Chongju green belt area. The area of 3rd grade is located in the inner part of Chongju green belt area.

3) Problems of Environmental Assessment

The six environmental indicators could not reflect the environmental condition of green belt areas. Nevertheless the three green zones were assigned to the green belt area according to the comprehensive environmental grade based upon

the six environmental indicators. Especially the problems in water quality assessment will be discussed as follows.

(1) Index of Water Pollutant Source

The built area ratio can't be the absolute standard. Even though it is high; given that the wastewater is treated completely, the water pollution problem could not be brought about. In case of livestock wastewater, its quantity and characteristics are more important than the built area ratio.

(2) Distance to Water Intake

The score is not evenly distributed in accordance with the pollutant loading level.

(3) Water Quality Standard

Only small score is given to the water quality standard, which results in lower scores than present water quality.

The index of water pollutant source and distance to water intake will become meaningless under total emission control which control strongly most point source loading. Not only the distance to water intake but also the slope

Table 8. Environmental Grade of Chongju Area Green Belt

Grade	Total		Elevation		Gradient		Agricultural Suitability		Vegetation		Forestry Suitability		Water Quality	
	Area(km ²)	%	Area(km ²)	%	Area(km ²)	%	Area(km ²)	%	Area(km ²)	%	Area(km ²)	%	Area(km ²)	%
1st	44.2	24.2	28.8	15.8	1.0	0.6	16.2	8.9	0.2	0.1	0.0	0.0	0.0	0.0
2nd	38.3	21.0	8.6	4.7	8.7	4.8	21.3	11.7	17.4	9.5	9.5	5.2	0.0	0.0
3rd	61.2	33.5	13.3	7.3	42.3	23.2	25.7	14.1	32.2	17.6	31.5	17.3	44.6	24.4
4th	36.8	20.1	28.4	15.6	56.3	30.9	34.3	18.8	22.0	12.1	18.8	10.3	49.8	27.3
5th	2.1	1.2	103.4	56.7	74.1	40.6	85.1	46.6	110.8	60.7	122.7	67.2	88.2	48.3
Total	182.5	100.0	182.5	100.0	182.5	100.0	182.5	100.0	182.5	100.0	182.5	100.0	182.5	100.0

Source: Chongju City, Korea, 2001, Environmental Assessment of Chongju Area Green Belt (Data Book), 33.

between pollutant sources and water intake could influence especially non-point source loading.

3. The Impact of Green Belt Abolition on Urban Environment

1) The Impact on Urban Growth

As new town plans such as Osong health & medical science Complex and Ochang Science & Industrial Complex are being carried out near Chongju City, so the development pressure on the previous green belt area could not become large for the time being (Ministry of Construction and Transportation Korea, 1999a, 89-91). But the possibility of location of restaurant, hotel, motel and rest area commanding a fine view still remains.

The more development will be done in the

nature green zone, the higher will be the possibility of conurbation with Daejeon Metropolitan City located in the southeast of Chongju City, Jochiwon in the west, and Jeongpyoung in the north.

2) Excess of Environmental Carrying Capacity

(1) Rapid Growth of Population

The population of Chongju is predicted to increase from 583,000 in 2000 to 850,000 in 2021. The inflow of population and development in the previous green belt area will make the environmental carrying capacity exceeded by far(Table 9).

(2) Excess of Urban Public Facilities & Services Capacity

The demand for waster supply and waste-

Table 9. Population Estimation of Chongju City

(unit: thousand persons)

Category	1990	1996	2001	2006	2011	2016	2021	remarks
2016 Chongju Urban Plan(1996)	497	531	681	766	846	887		planning period: 1997-2016
2021 Chongju Urban Plan(2001)			600	670	740	800	850	· including 13 thousand people at Green Belt in Chongwon County · planning period: 2002-2021

Source: Chungbuk Development Institute, Korea, 2001, 2020 Chongju Metropolitan Urban Plan (Draft), 75.

Table 10. Estimation of Urban Public Facilities in Chongju City & Chongwon County

(unit: m³/day)

Category		2005	2010	2015	2020	
Chongju City	Water Supply	Demand	229,190	354,000	411,136	448,250
		Capacity	468,000			
		Shortage	196,809	72,000	14,864	-22,250
	Wastewater	Quantity Planned	157,803	240,075	284,743	326,000
		Capacity	280,000			
		Shortage	122,196	39,925	-4,743	-46,000
Solid Wastes	Generation	1,444,185	1,845,000	1,975,380	2,004,900	
Chongwon County	Solid Wastes	Generation	109,350	153,900	186,300	204,120

Source: Chungbuk Development Institute, Korea, 2001, 2020 Chongju Metropolitan Urban Plan (Draft), 131-141.

water treatment will increase and exceed the capacity in the years 2015-2020. The landfill capacity of Chongju City and Chongwon County will be full in 2006. Therefore the development in the previous green belt area will expedite the shortage of urban public facilities.

IV. Strategic Environmental Assessment of the Previous Green Belt Area

1. Methodology and System for the Application of Strategic Environmental Assessment

Strategic environmental assessment(SEA) is environmental assessment of the PPP: policies, plans, and programs. This is a mechanism for integrating environmental awareness into the decision-making process at the early stages of planning, policy formulation, and the like, before a project is materialized. This process has been called the greening of the decision-making process.(Ministry of Environment, Japan, 2000, 1).

Environmental carrying capacity assessment (ECCA) is necessary for SEA. The systems directly related with ECCA under enforcement are Total Pollutants Management System, Development Density Regulation Zoning, and Total Development Quota Regulation of Population Concentration Facilities.

1) Environmental Carrying Capacity Assessment

For the environmentally sound and sustainable urban development, the ECCA of natural ecosystem, river and reservoir used for water supply, airshed, the landfill capacity for solid

waste, and the capacity of water supply and wastewater treatment should be done above all. Without ECCA, EIA, the pre-environmental assessment and SEA become nearly impossible. The ECCA is also the basis for cumulative impact assessment.

2) Total Pollutants Management Systems

These systems has been reflected in the Act on Water Supply Source Water Quality Improvement of Han River Watershed and Its Residents Support, the Act on Water Resources Management of Kum River Watershed and Its Residents Support, the Act on Water Resources Management of Youngsan River & Sumjin River Watershed and their Residents Support, and the Act on Water Resources Management of Nakdong River Watershed and Its Residents Support.

The systems specify that local government can establish total pollutants management plan including the detailed regional development plan, total pollutants generated and annual pollutants reduction plan, pollutants loadings due to regional development and its reduction plan.

The guidance of total pollutants management plan should include the kinds of pollutants, the establishment of total pollutants management objectives, the planning periods, the estimation method of pollutants loading, and the reduction method of pollutants loadings.

3) Development Density Regulation Zoning

Development Density Regulation Zoning is the zone where infrastructures construction is predicted to be insufficient and difficult, so built ratio or volume ratio is restricted according to the

Act on National Land Plan and Use.

Minister of Construction and Transportation assigns Development Density Regulation Zoning to the places where it is difficult to construct road, water supply facilities, sewerage system, and education facilities among the places above infrastructures are insufficient.

4) Total Development Quota Regulation of Population Concentration Facilities

The Minister of Construction and Transportation can restrict the construction and expansion of education facilities, factories, public facilities, business/sales facilities, training institute and so forth, which pull population concentration and exceed certain standards, in the Seoul Metropolitan Area under the total permissible capacity.

Especially the Seoul Metropolitan Adjustment Committee should decide the total development quota regulation of factories and the Minister of Construction and Transportation should announce it.

2. Strategic Environmental Assessment of the Previous Green Belt Area in Chongju

1) Pre-environmental Assessment of the Area under Special Act on Assignment and Management of Green Belt

The Act applies to the project whose area is more than 5,000m². The important issues are the obedience of the act, the satisfaction of the regulation applied in the Special Management Region for Water Quality Conservation, the connection of urban region and suburban area by green axis and

nature ecosystem, the exclusion or conservation in the Production and Conservation Green Zone, the 7th and the higher grade area of the degree of Green and Nature, the area with steeper slope than 20°, the landscape, environmentally friendly land use planning, the environmental conservation area such as landscape and buffer zone.

2) Strategic Environmental Assessment of the Previous Green Belt Area in Chongju

(1) Environmental Carrying Capacity(ECC) on the Urban Environment

All resources could be converted to the area of land necessary for producing the resources for economic activities. EF (ecological footprint) of resources is defined as the area of land which is necessary for producing the resources. EF is applied to the assessment of ECC of Chongju City. Because the land area per capita is 0.026 ha/capita and EF per capita is 1.731 ha/capita, one citizen of Chongju City consumes 1.704 ha more than the area of land given. The excessive consumption of land means the excessive consumption of ECC (Lim and Lee, 2002).

Ecological deficit means EF minus EPL. EPL (ecologically productive land) is the sum of area of field, paddy field, pasture land, orchard and forestry etc. Ecological Deficit could also assess the impact of human development upon nature. The area of land which Chongju City need in order to keep the level of consumption, is 69.6 times as many as EPL in 1989, 107.8 times as many as EPL in 1999. This means that Chongju City consumes much more than EPL, and it supplements the deficits from the outside.

The area of land, which Chongju City needs for self-sufficiency, is 51 times as many as the

Table 11. Ecological Footprint and Ecological Deficit

(unit: thousand persons)

		Popula- tion	Area	EPL	EPL per capita	EF	Excess Consumption	Ecological Deficit		No. of multiple
unit			ha	ha	ha/capita	ha/capita	ha/capita	ha/capita	%	multiple
equation		P	A	EPL	$\frac{epl=}{EPL/P}$	ef	$ef-A/P$	$ef-epl$	$\frac{100(ef-epl)}{epl}$	$(P \times ef)/A$
Chongju	1989	453,470	11,901	8,406	0.0185	1.731	1.704	1.29	6,960	51
	1999	570,622	15,332	9,975	0.0175	1.901	1.874	1.88	10,775	71
Seoul	1987	9,991,089	60,540	22,887	0.0023	3.66	3.65	3.66	159,768	604
	1997	10,389,057	60,552	19,438	0.0019	4.32	4.31	4.32	230,958	742

Source: 1) Lim, Jae-Ho and Lee, Jong-Ho, 2002, A Study on the Environmental Carrying Capacity Assessment of Chongju City, Korean Society of Environmental Impact Assessment, Journal of Environmental Impact Assessment, 11(1): 30-31.

2) Lee, Chang-Woo and Oh, Yong-Soon, 1999, A Study on the Environmental Carrying Capacity of Seoul, Seoul Development Institute, Korea, 73.

* EPL(ecological productive land) = the sum of area of field, paddy field, pasture land, orchard, forestry etc.

* EF = ecological footprint.

administrative area in 1989, 71 times as many as that in 1999. This means that Chongju City needs 51 times area in 1989, 71 times area in 1999 in order to support all citizen.

As seen above, the ECC of Chongju City has been already exceeded very much. Therefore the additional development at nature green zone assigned to the previous green belt area would make it exceeded the more.

(2) Strategic Environmental Assessment of the land use planning of the Previous Green Belt Area

The urban planning zones assigned to the green belt area based upon environmental assessment are as Table 12. The 1st and 2nd grade area including small part of 3rd grade area are assigned as the conservation green zone, nearly half of 3rd grade area as the production green

Table 12. Environmental Grade of Chongju Green Belt Area and Urban Planning Zoning

Grade	Environmental Assessment		Conservation & Development			Green Zone Assigned		
	Area(km ²)	%		Area(km ²)	%	Zoning	Area(km ²)	%
1 st	44.2	24.2	Absolutely	82.5	45.2	Conservation	88.3	48.4
2 nd	38.3	21.0	Conservation					
3 rd	61.2	33.5	Conservation	61.2	33.5	Production	29.6	16.2
4 th	36.8	20.1	Development permitted	38.9	21.3	Nature	64.7	35.4
5 th	2.1	1.2						
계	182.5	100.0	-	182.5	100.0	-	182.6	100.0

Sources : 1) Chongju City, Korea, 2001, Environmental Assessment of Chongju Area Green Belt.

2) Lee, Jong-Ho, 2002, Green Belt Abolition and Urban Environmental Management, National Land and Environment, Seoul : Hanwool Academy.

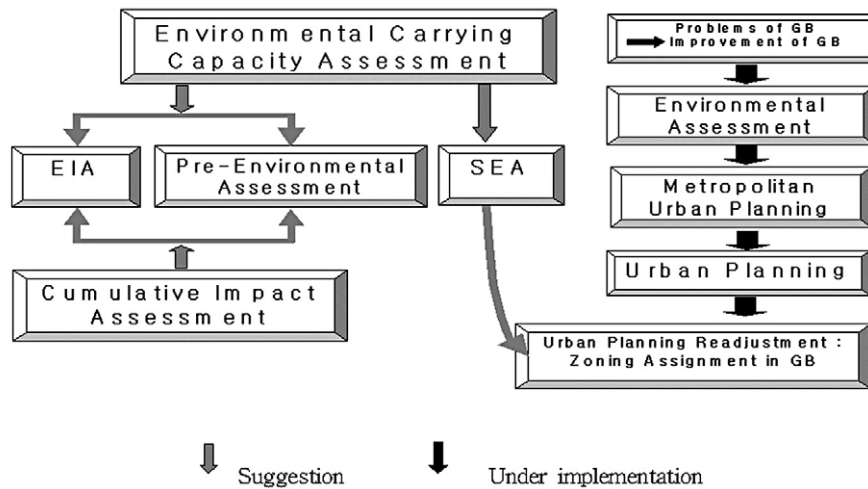


Fig. 1. SEA and Urban Planning of Green Belt Area

Source: Lee, Jong-Ho, 2002, Green Belt Abolition and Urban Environmental Management, National Land and Environment, Seoul : Hanwool Academy, 552.

zone, and the 4th and 5th grade area as the nature green zone.

Therefore keeping belt-typed conservation green zone can not become possible and uncontrolled development will destroy the function of urban lung which previous green belt has kept. As the result, the possibility of the conurbation of Daejeon and Chongju would become higher than before.

Based upon the fact mentioned above, SEA of Metropolitan Urban Planning, Urban Planning, and Urban Planning Readjustment should be implemented(Fig. 1).

As analyzed from the capacity of urban public facilities and the land use for resources, the ECC of Chongju City has already been exceeded. Therefore urban planning should be done upon the environmental carrying capacity. And when development is planned at the nature green zone in the previous green belt area, SEA of the land use plan using the result of ECCA should be

done.

The environmental constituents, objectives and indicators for SEA of the zoning assigned to the previous green belt area could be constructed based upon the environmental constituents for Pre-Environmental Assessment as Table 13.

V. Conclusion

In Korea, the environmental assessment of 14 green belt areas has already been done, and the detailed green zones were assigned to the previous green belt areas, which is being reflected in the metropolitan urban planning, urban planning, and urban planning readjustment. As the result, 7 green belt areas in Korea have been released except those of 7 metropolitan cities.

Summing up the urban planning zoning assigned to the previous green belt based upon environmental assessment, the 1st and 2nd grade

Table 13. Environmental Objectives and Indicators needed for SEA of Zoning Assigned to previous Green Belt Area

Environmental Constituents		Objectives	Indicators	
Sustain ability	Transportation Energy	Reduction of Trip Distance	Trip Distance	
		Reduction of Trip Generation	Trip Generation	
		Mass Transportation	Ratio of Mass Transportation to Total Trip	
		Walking/Bicycle	Ratio of Walking/Bicycle to Total Trip	
	Energy	Building Heat Shield	Ratio of Housing with Heat Shield	
		Reduction of Heating Energy Demand	Heating Energy Demand	
		Protection of Natural Energy Sources	Ratio of Natural Energy Sources	
		Increase of Solar Energy Use	Ratio of Housing using Solar Energy	
	Protection of Wild Animal	Increase and Conservation of Green Axis	Area of Green Tract of Land	
		Natural Ecosystem Conservation	Natural Ecosystem Conservation Area	
Wild Animal Habitat Conservation		Number of Wild Animal		
Natural Resources	Air Quality	Reduction of Air Pollutants	Concentration of Air Pollutants	
	Conservation of Water Resources & Water Quality	River & Ground Water	Concentration of Ground Water Pollutants	
		Water Quality of Water Supply Sources	Concentration of Water Pollutants	
	Conservation of Soil & Land Resources	Soil & Sand Conservation	Ratio of Area Washed away	
		Soil Pollution Abatement	Concentration of Soil Pollutants	
		Conservation of Farmland	Ratio of Area of Farmland	
	Mineral Material Conservation	Reducing Consumption of Fossil Fuel & Mineral	Ammount of f Fossil Fuel & Minera Consumption	
		Recycling & Reuse of Resources	Ratio of Waste Recycled & Reused	
	Living Enviro nment	Landscape & Open Space	Landscape Conservation & Improvement	
			Rural Landscape & Keeping Open Space	
Protection of Urban Living Environment		Environmental Planning based on Low Density or Stories	Number of Stories, Building Coverage, Volume Ratio	
		Urban Landscape Improvement		
		Safety & Comfort		
		Amenity Environment(Noise, offensive odor)	Noise Level	
Historical Heritage Conservation		Historical Architecture & Cultural Assets Preservation		
		Historical & Geological Remains Conservation		
Open Space Availability		Open Space Accessibility	Area of Open Space Per Capita	

Source: 1) Chungbuk Province, Korea, 2000, 2001-2006 Green Belt Management Plan, 36-37.

2) Lee, Jong-Ho, 2002, Green Belt Abolition and Urban Environmental Management, National Land and Environment, Seoul: Hanwool Academy, 554.

area including part of 3rd grade area are assigned as the conservation green zone, nearly half of 3rd grade area as the production green

zone, and the 4th and 5th grade area as the nature green zone. As the result, belt-typed green zone could not be kept in the future and urban

sprawl can not be avoidable. Therefore the possibility of conurbation with Daejeon Metropolitan City, which has 1,380,000 population, becomes higher than ever before. And the function that the previous green belt had before as if as a lung of the city, could not operate as before.

Because the ECC of Chongju City has already been exceeded, urban planning should be done upon the ECC. As the result of ECCA, SEA should be applied to the land use plan at nature green zone in the previous green belt based upon Pre-environmental Assessment of the Area under Special Act on Assignment and Management of Green Belt. And this paper suggests the environmental constituents, objectives and indicators for SEA of the zoning assigned to the previous green belt area based upon the environmental constituents applied in Pre-Environmental Assessment.

In order to apply SEA, first the development potential in the previous green belt area should be estimated using the data on the development cases in the nature green zone in non green belt. Secondly the Total Development Control had better be established in the previous green belt area based upon the ECC of the city. Finally the city should control the development in previous green belt area especially on the characteristics and scale (built-area ratio, density, volume etc).

References

- Chongju City, Korea, 2001a, *Environmental Assessment of Chongju Area Green Belt*.
- Chongju City, Korea, 2000b, *Chongju Urban Plan Readjustment*.
- Chongju City, Korea, 2001c, *2021 Chongju Urban Plan (Draft)*.
- Chongju City, Korea, 2001d, *Chongju Statistical Yearbook*.
- Chungbuk Development Institute, Korea, 2001, *2020 Chongju Metropolitan Urban Plan (Draft)*.
- Chungbuk Province, Korea, 2000, *2001-2006 Green Belt Management Plan*.
- Department of Environmental Affairs and Tourism, South Africa, 2000, *Strategic Environmental Assessment in South Africa*.
- Hong Kong Government, 1991, *Environmental Guidelines for Planning in Hong Kong*.
- Kyonggi Development Institute, 2000, *A Study on the Boundary Regions' Actual Conditions and the Re-adjustment of the Natural Preservation Regions in Kyonggi Province*, 114-117.
- Lee, Chang-Woo and Oh, Yong-Soon, 1999, *A Study on the Environmental Carrying Capacity of Seoul*, Seoul Development Institute, Korea.
- Lee, Jong-Ho, 2002, *Green Belt Abolition and Urban Environmental Management, National Land and Environment*, Seoul : Hanwool Academy.
- Lim, Jae-Ho and Lee, Jong-Ho, 2002, *A Study on the Environmental Carrying Capacity Assessment of Chongju City*, Korean Society of Environmental Impact Assessment, *Journal of Environmental Impact Assessment*, 11(1), 25-36.
- Ministry of Construction and Transportation, Korea, 1999a, *Comparative Study on Urban Environmental Characteristics for Green Belt Adjustment*.
- Ministry of Construction and Transportation, Korea, 1999b, *Environmental Assessment Standard for Green Belt Adjustment*.
- Ministry of Construction and Transportation, Korea, 1999c, *The Adjustment of Green Belt*.
- Ministry of Environment, Japan, 2000, *A Study to Introduce SEA System in Japan*.

- Ministry of Environment, Korea, 2000, *Pre-Environmental Assessment Manual*.
- Ministry of Environment, Korea, 2001, *Cases of Pre-Environmental Assessment*.
- Ministry of Environment, Korea, 2001, *Environmental Assessment for Environmentally Sound Urban Planning*.
- Ministry of Environment, Korea, 2002, *Environmental Yearbook*.
- Ministry of Government Administration and Home Affairs, Korea, 1975, 1980, 1991, 2001, *Municipal Yearbook of Korea*.
- Onishi, Takashi, 1994, A Capacity Approach for Sustainable Development: An Empirical Study, *Regional Studies*, 28(1).
- Ortolano, Leonardo, 1997, *Environmental Regulation and Impact Assessment*, John Wiley & Sons.
- Therivel, Riki *et al.*, 1992, *Strategic Environmental Assessment*, Earthscan.
- Therivel, Riki and Minas, Phillips, 2002, Ensuring effective sustainability appraisal. International Association for Impact Assessment. *Impact Assessment and Project Appraisal*, 20(2), 81-91.