## **Development of Natural Capital Valuation** for Decision-Making Process



### Seong-Woo Jeon









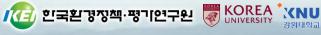


# Introduction

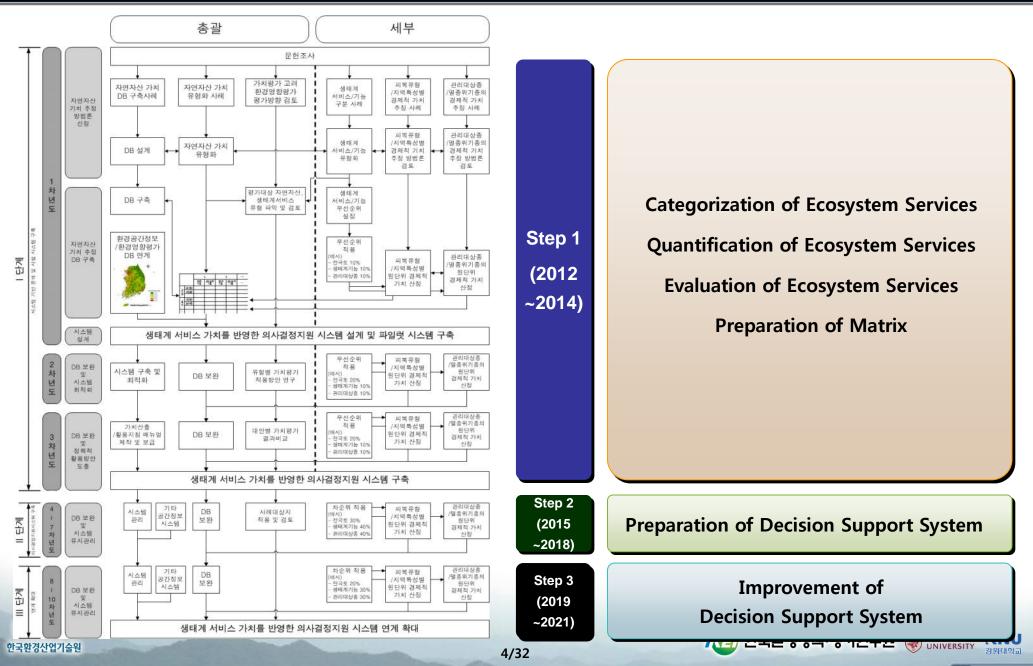
#### Building a decision support system based on the value of ecosystem services

				-			
			Relevant strative agency	Researchers		General users	
			System support to enhance information accessibility		Maximize the acquisition and utilization of information		
	Finding resolution for the social conflict	s	The needs to of analysis for na		Lack of the decision support systems		
	Environmental problem caused by large-scale national projects and so conflicts caused channe Natural environmental damage, pollution caus the social cost	ocial eled	Systematic fac	tor assessment of location was	<ul> <li>The informed informed informed informed information development in the second se</li></ul>	ntegration, analysis mation system(for lopment values, natural es) was required sion support m(considering the wide e and type of mation) was required	





### 2. Roadmap of project



# **Results**

#### Difference between qualitative characteristics

Ecosystem	Ecological feature		Forest type		Stand age			Reference	
Functions	Natural Forest	Artificial Forest	Coniferous forest	Deciduous forest	Mixed forest	1~20	21~40	41 <	
	***	*	*	***	**				Murai and Iwasaki(1975)
Water				***	*				Kim(1993)
Storage						*		***	Kim et al.(2003)
and			*	***	**				Kim(2003)
Conservation						*		***	Lee(2009)
			*	***	**				KFS(2011)
Air			*	***					Jo et al.(2001)
Purification			***	**	*	*		***	Choi et al.(2012)
Climate			*	***	**	*		***	Jo and Ahn(2000)
Regulation						*		***	Lee(2009)
			*	*					Lee(1997)
			***	*					Park(1998)
			***	*					Park et al.(1999)
Water Purification	*	*	*	*					Goo et al.(2001)
Furnication			*	*					Lee et al.(2007)
			***	*					Choi et al.(2009)
_			***	**	*				Ma et al.(2011)





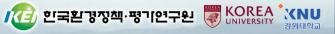
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#### Difference between qualitative characteristics

Ecosystem	Ecological m feature		Forest type		Stand age			Reference	
Functions	Natural Forest	Artificial Forest	Coniferous forest	Deciduous forest	Mixed forest	1~20	21~40	41 <	
	***	*				*		***	Kang et al.(1998)
	***	*				*	***		沼本晋也 <b>(2000)</b>
			*	**	***	*	***		Jeong and Ma(2006)
Prevention				***	*				Ma and Jeong(2007)
of			*	***	***	*		***	Song(2009)
Landslide			*	***	**	*		***	Lee(2009)
			*	***	**	*	***	**	Chun et al.(2009)
	***	*	*	***	**				Park et al.(2010)
			*	***	**				Kim et al.(2011)
Reduction			***		*				Park(2003)
of						*		***	Youn et al.(2007)
Soil Erosion						*		***	Lee(2009)
	***	*	*	**	***	*	**	***	Chung et al.(1999)
	***	*	*	**	***	*	**	***	Sung et al.(2004)
Recreation			*	*	*				KFS(2004)
						*	*	*	KFS(2008)
			*	***	***				Kim et al.(2010)





#### Forest types for ecosystem valuation

1st level	2nd level	3rd level (age class )	Area (ha)	Ratio (%)
		More than 41 (1111)	104,929	1.9
	Coniferous forest	21~40 (1112)	1,018,523	18.0
	()	1~20 (1113)	211,993	3.7
Natural		More than 41 (1121)	291,994	5.2
Forests	Deciduous forest (1120)	12~40 (1122)	1,008,729	17.8
(1100)	(1100)	1~20 (1123)	109,803	1.9
	Mixed forest (1130)	More than 41 (1131)	132,804	2.3
		21~40 (1132)	1,391,334	24.6
		1~20 (1133)	207,004	3.7
	Coniferous forest	More than 41 (1211)	22,553	0.4
		21~40 (1212)	57,0811	10.1
Artificial	(1210)	1~20 (1213)	492,366	8.7
Forests (1200)		More than 41 (1221)	53	0.0
	Deciduous forest	21~40 (1222)	38,463	0.7
	(1220)	1~20 (1223)	56,227	1.0
	Total		5,657,585	100 - 8'8억''' 이민구란 🥑 UNIVER
	Natural Forests (1100) Artificial Forests	Natural Forests (1100)Coniferous forest (1110)Natural Forests (1100)Deciduous forest (1120)Mixed forest (1130)Mixed forest (1130)Artificial Forests (1200)Coniferous forest (1210)Deciduous forest (1220)Deciduous forest (1220)	Ist level         2nd level         (age class )           Ist level         (age class )         More than 41 (1111)           Coniferous forest (1110)         21~40 (1112)         21~20 (1113)           Natural Forests (1100)         Deciduous forest (1120)         More than 41 (1121)           Deciduous forest (1120)         1~20 (1123)         1~20 (1123)           Mixed forest (1130)         More than 41 (1131)         21~40 (1132)           Mixed forest (1130)         1~20 (1133)         1~20 (1133)           Artificial Forests (1200)         Coniferous forest (1210)         21~40 (1212)           Deciduous forest (120)         1~20 (1213)         1~20 (1213)           Deciduous forest (1220)         More than 41 (1221)         21~40 (1222)           Deciduous forest (1220)         21~40 (1222)         1~20 (1223)	Ist level         2nd level         (age class )         Area (ha)           Image: line state sta

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#### Grassland types for ecosystem valuation

1st level	2nd level	3rd level	Area (ha)	Ratio (%)
	Alpine grassland	Alpine & subalpine grassland (2111)	9	0.0
	(2110)	Sasa quelpaertenisis Nakai community (2112)	489	0.3
Natural Grasslands (2100)	Mountainous grassland (2120)	Miscanthus sinensis var. purpurascens community (2121)	11,534	7.8
	Low-lying grassland (2130)	Riparian grassland (2131)	8,416	5.7
	Other (2140)	Unclassified grassland (2141)	12,743	8.6
	Pasture (2210)	Pasture (2211)	17,722	12.0
		Living area park (2221)	4,890	3.3
Artificial	Park	Urban nature park (2222)	2,421	1.6
Grasslands	grassland (2220)	Cemetery park (2223)	36,917	24.9
(2200)	()	Theme park (2224)	15,821	10.7
		Transport facilities (2231)	18,649	12.6
	Other	Sports facilities (2232)	7,604	5.1
	(2230)	Unclassified grassland (2233)	10,913	7.4
<u>دا</u>	Total	0/22	14820年2	김경정책·평기연구원 🐺 🕅 Real

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#### Sample area of grasslands



Sasa quelpaertenisis Nakai community (2112)



Miscanthus sinensis var. purpurascens community (2121)



**Riparian grassland (2131)** 



Living area park (2221)



Cemetery park (2223)



Transport facilities (2231)

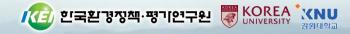




#### • Wetland types for ecosystem valuation

1st level	2nd level	3rd level	Area (ha)	Ratio (%)
		Seashore wetlands (3111)	-	-
	Marine/Coastal Wetlands	Estuary wetlands (3112)	4,768	2.2
	(3110)	Lake/Marsh wetlands (3113)	481	0.2
Natural		Unclassified wetlands (3114)	30,094	14.1
Wetlands (3100)		River wetlands (3121)	85,155	39.9
	Inland	Lake wetlands (3122)	29,775	13.9
	Wetlands (3120)	Palustrine wetlands (3123)	46,925	22.0
		Unclassified wetlands (3124)	3,703	1.7
Artificial	Artificial	Agricultural land (3211)	1,361	0.6
Wetlands (3200)	Wetlands (3210)	Urban and industry (3212) 11,384		5.3
	Total		213,646	100





#### Results

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#### Sample area of wetlands



Estuary wetlands (3112)



Lake/Marsh wetlands (3113)



River wetlands (3121)



Lake wetlands (3122)



Palustrine wetlands (3123)



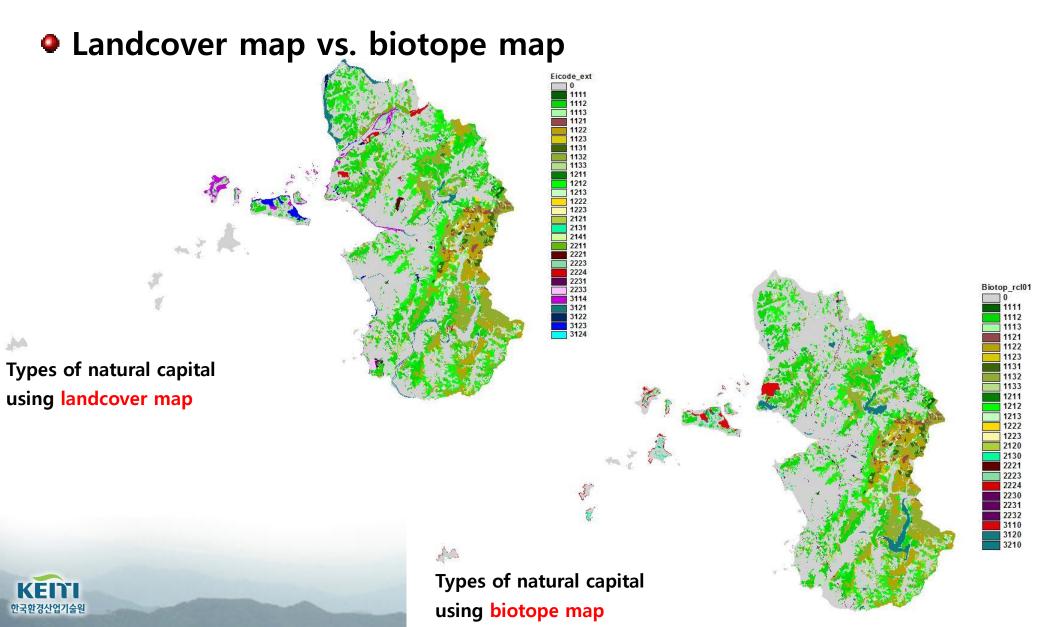
Urban and industry (3212)







## 4. Pilot testing for enhancement of types



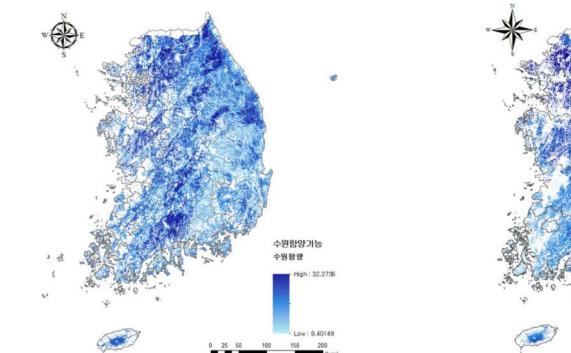
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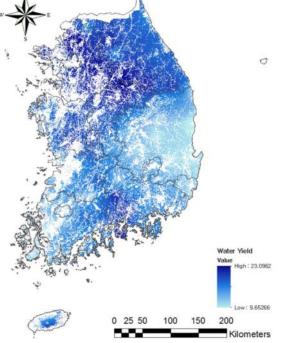
#### • Landcover map vs. biotope map

Categories	Landcover map	Biotope map	notes
Total	61,001.95m <sup>2</sup>	61,001.95m <sup>2</sup>	
Forest types	27,847.16m <sup>2</sup>	25,192.60m <sup>2</sup>	
Grassland types	1,566.57m <sup>2</sup> (include pasture)	2,549.75m <sup>2</sup> (exclude pasture)	Biotope map classified detailedly than landcover map
Wetland types	2,263.99m <sup>2</sup>	1,990.73m <sup>2</sup>	
Other types	29,324.23m <sup>2</sup>	31,268.87m <sup>2</sup>	



#### Provisioning services

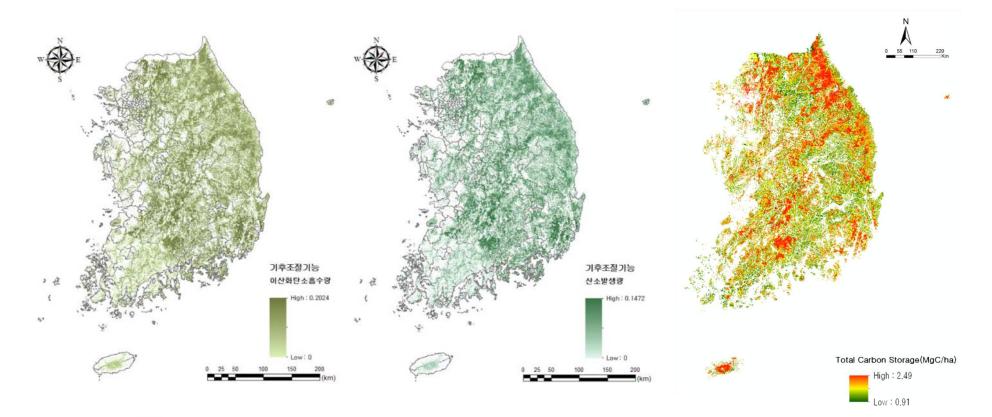






Water availability (KFRI statistic model) Water yield (InVEST model) (InVEST model) (InVEST model)

#### Regulating services



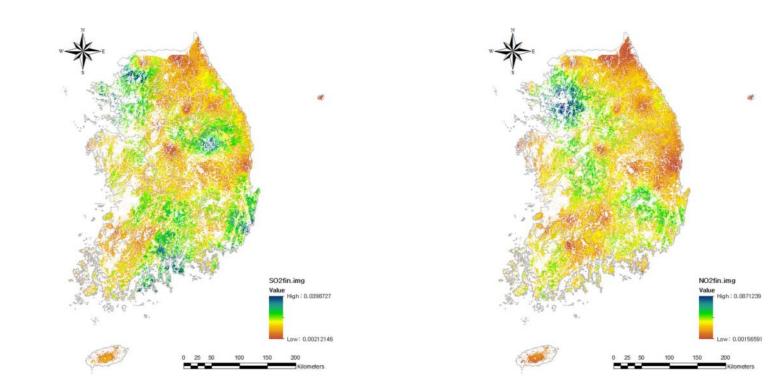
CO<sub>2</sub> sequestration (KFRI statistic model)

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O<sub>2</sub> production (KFRI statistic model)

#### Carbon storage (InVEST model) বিরুষ্টার্থ্র জ্বাণ্ডন্থ 🐺 KOREA মেনের্বা

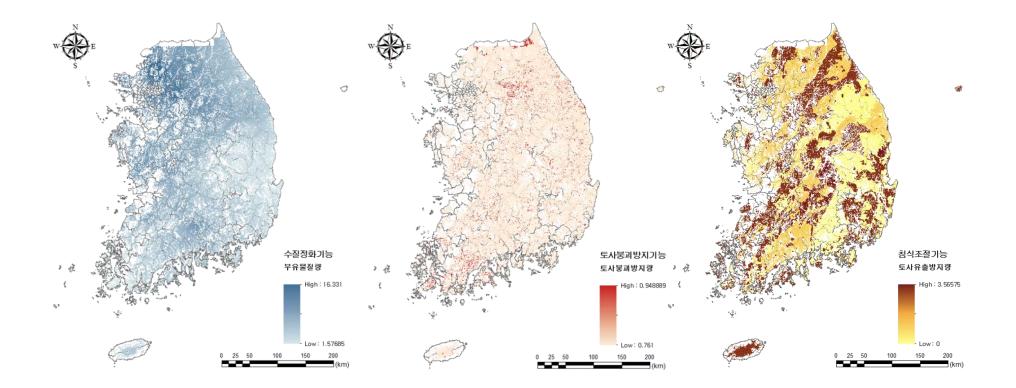
#### Regulating services





SO<sub>2</sub> absorption (KFRI statistic model) NO<sub>2</sub> absorption (KFRI statistic model ক্রি গ্রন্থস্বগ্র্পান্স্র্র্যাণ্ডন্থ 🐺 KOREA

#### Regulating services



Water purification (KFRI statistic model)

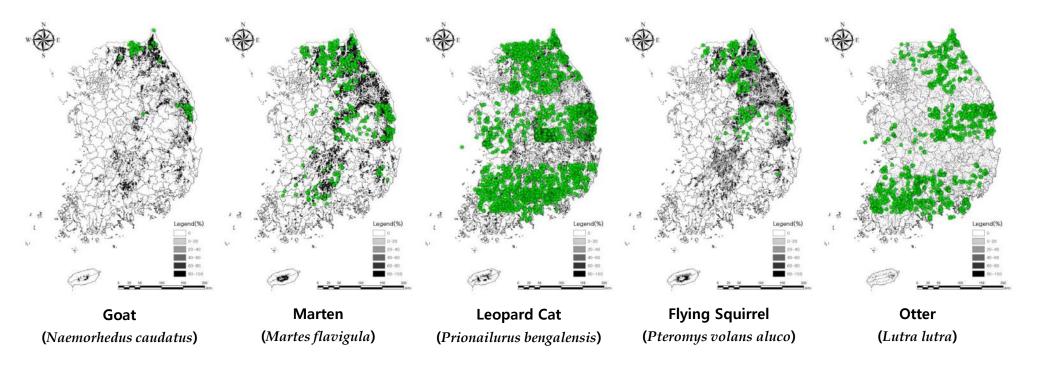
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Prevention of landslide (KFRI statistic model) Reduction of soil erosion (InVEST model) তি গ্রহায়স্য জ্বাণ্ডিন্থ 🐺 জেল্লের্কা জ্বোলের্বার্থানের্বার্থানের্বার্থানের্বার্থানের্বার্থানের্বার্থানের্বার্

Results

### Supporting services

- Spatial distribution probabilities of endangered mammals



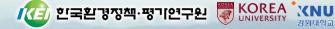


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#### Provisioning services - water availability

Level I	Level II (Stand)	Level III (Tree age)	Area (ha)	Amount (ton/yr)	Economic Value (\$/yr)	Unit area (\$/ha/yr)	Ratio (%)
		Over 5 <sup>th</sup> age-class	104,849	231,925,988	103,292,261	986	1.9
	Coniferous	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,016,215	2,065,965,095	920,130,231	905	17.1
	Forest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	211,143	382,379,973	170,253,745	806	3.2
	Ducallast	Over 5 <sup>th</sup> age-class	291,958	822,445,686	366,301,766	1,255	6.8
Natural Forest	Broadleaf Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,007,548	2,621,639,896	1,167,651,654	1,159	21.7
rorest	Forest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	109,624	264,961,208	117,974,272	1,076	2.2
	Mixed Forest	Over 5 <sup>th</sup> age-class	132,728	303,548,936	135,189,649	1,019	2.5
		3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,388,433	2,599,146,576	1,157,633,341	834	21.5
	rolest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	206,405	291,031,050	129,604,728	628	2.4
	Coniform	Over 5 <sup>th</sup> age-class	22,543	54,531,517	24,239,711	1,075	0.5
	Coniferous Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	570,061	1,237,032,370	550,949,639	967	10.2
Artificial	Forest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	491,716	989,824,308	440,805,773	897	8.2
Forest	Dreadlasf	Over 5 <sup>th</sup> age-class	53	136,952	57,577	1,086	0.0
	Broadleaf Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	38,402	100,344,426	44,679,373	1,163	0.8
	roiest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	56,156	133,033,564	59,246,231	1,055	1.1
	Tota	I	5,647,834	12,097,947,545	5,388,355,410	954	100.0

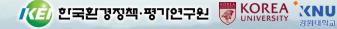




#### • Regulating services - CO<sub>2</sub> sequestration

Level I	Level II (Stand)	Level III (Tree age)	Area (ha)	Amount (ton/yr)	Economic Value (\$/yr)	Unit area (\$/ha/yr)	Ratio (%)
	с. · с	Over 5 <sup>th</sup> age-class	(ha)(ton/yr)104,849904,481,016,2158,983,37211,1431,863,413291,9584,511,301,007,54816,058,96109,6241,671,203132,7281,587,0031,388,43317,349,933206,4052,523,37322,543210,193570,0615,085,924491,7164,239,27338,402593,48356,156881,639,39	29,340,991	280	1.4	
	Coniferous	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,016,215	8,983,372	291,423,513	287	13.5
Forest     1 <sup>st</sup> ~2 <sup>nd</sup> age-class       Natural     Broadleaf     Over 5 <sup>th</sup> age-class       Forest     3 <sup>rd</sup> ~4 <sup>th</sup> age-class	211,143	1,863,418	60,449,579	286	2.8		
	Dreadlaaf	Over 5 <sup>th</sup> age-class	291,958	4,511,307	146,347,977	501	6.8
		3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,007,548	16,058,965	520,963,792	517	24.2
lorest	rorest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	109,624	1,671,201	54,214,044	494	2.5
	Mixed Forest	Over 5 <sup>th</sup> age-class	132,728	1,587,007	51,479,159	388	2.4
		3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,388,433	17,349,934	562,844,946	406	26.1
	FOIESL	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	206,405	2,523,378	81,856,526	396	3.8
	Coniform	Over 5 <sup>th</sup> age-class	22,543	210,193	6,817,059	302	0.3
	Coniferous Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	570,061	5,085,926	164,991,251	(\$/ha/yr) 280 287 286 501 501 517 494 388 406 396	7.7
Artificial	Forest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	491,716	4,239,271	137,521,498	279	6.4
Forest	Dreadlaaf	Over 5 <sup>th</sup> age-class	53	895	28,788	544	0.0
	Broadleaf Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	38,402	593,484	19,247,827	501	0.9
	ruiesi	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	56,156	881,639.36	28,598,253	280         287         287         286         501         501         517         494         388         406         396         302         290         279         544         501         509	1.3
	Tota	I	5,647,834	66,464,477.36	2,156,165,508	382	100.0





#### • Regulating services - O<sub>2</sub> production

Level I	Level II (Stand)	Level III (Tree age)	Area (ha)	Amount (ton/yr)	Economic Value (\$/yr)	Unit area (\$/ha/yr)	Ratio (%)
	с. · с	Over 5 <sup>th</sup> age-class	104,849	657,904	142,847,325	1,362	1.4
	Coniferous	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,016,215	6,528,732	1,417,821,597	1,395	13.6
	Forest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	211,143	1,352,515	293,697,785	1,391	2.8
	Dreadlasf	Over 5 <sup>th</sup> age-class	291,958	3,279,092	712,106,295	2,439	6.8
Natural   Broadleaf	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,007,548	11,681,081	2,536,821,099	2,518	24.3	
lorest	Forest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	109,624	1,214,421	263,700,422	2,405	2.5
	Mixed Forest	Over 5 <sup>th</sup> age-class	132,728	1,144,770	248,557,800	1,873	2.4
		3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,388,433	12,438,525	2,701,317,192	1,946	25.8
	rorest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	206,405	1,819,565	395,147,599	1,914	3.8
	Coniform	Over 5 <sup>th</sup> age-class	22,543	152,909	33,164,071	1,362 1,395 1,391 2,439 2,518 2,405 1,873 1,946	0.3
	Coniferous Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	570,061	374,563	804,516,596	1,411	7.7
Artificial	rorest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	491,716	3,082,211	669,326,947	1,361	6.4
Forest	Dreadlasf	Over 5 <sup>th</sup> age-class	53	650	115,153	2,173	0.0
	Broadleaf Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	38,402	431,554	93,676,984	2,439	0.9
	roiest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	56,156	28       1,144,770       248,557,800       1,873       2         33       12,438,525       2,701,317,192       1,946       25         05       1,819,565       395,147,599       1,914       3         43       152,909       33,164,071       1,472       0         61       374,563       804,516,596       1,411       7         16       3,082,211       669,326,947       1,361       6         53       650       115,153       2,173       0         02       431,554       93,676,984       2,439       0         56       640,987       139,162,428       2,478       1	1.3		
	Tota		5,647,834	48,129,479	10,452,497,484	1,851	100.0





#### Regulating services - carbon storage

Level I	Level II (Stand)	Level III (Tree age)	Area (ha)	Amount (ton/yr)	Economic Value (\$/yr)	Unit area (\$/ha/yr)	Ratio (%)
		Over 5 <sup>th</sup> age-class	104,849	35,181,995	1,141,339,189	10,886	2.0
	Coniferous	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,016,215	265,816,815	8,623,349,288	8,486	15.3
	Forest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	211,143	40,571,663	1,316,199,054	6,234	2.3
	Durallast	Over 5 <sup>th</sup> age-class	291,958	166,472,781	5,400,504,054	18,497	9.6
Natural Forest	Broadleaf	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,007,548	418,622,182	13,580,456,626	13,479	24.1
TOTESt	Forest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	109,624	18,551,200	601,789,699	5,490	1.1
	Mixed Forest	Over 5 <sup>th</sup> age-class	132,728	59,596,383	1,933,361,681	14,566	3.4
		3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,388,433	437,835,899	14,203,779,941	10,230	25.2
	rolest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	206,405	32,780,486	1,063,438,169	5,152	1.9
	Coniform	Over 5 <sup>th</sup> age-class	22,543	7,561,895	245,333,515	38       8,486         54       6,234         54       18,497         26       13,479         29       5,490         31       14,566         41       10,230         59       5,152         15       10,883         50       8,129         92       5,861         91       18,468         93       11,717         94       4,753	0.4
	Coniferous Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	570,061	142,837,710	4,633,757,650	8,129	8.2
Artificial	FOIESL	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	491,716	88,845,293	2,882,222,592	5,861	5.1
Forest	Dreadlaaf	Over 5 <sup>th</sup> age-class	53	30,028	978,801	18,468	0.0
	Broadleaf Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	38,402	13,869,928	449,960,438	11,717	0.8
	roiest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	56,156	8,227,948	266,924,707	4,753	0.5
	Tota	I	5,647,834	1,736,802,208	56,343,452,979	9,976	100.0

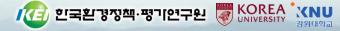


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#### Regulating services - water purification

Level I	Level II (Stand)	Level III (Tree age)	Area (ha)	Amount (ton/yr)	Economic Value (\$/yr)	Unit area (\$/ha/yr)	Ratio (%)
		Over 5 <sup>th</sup> age-class	104,849	57,920,808	33,446,196	319	1.7
	Coniferous	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,016,215	531,669,006	307,055,536	302	15.5
	Forest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	211,143	94,124,892	54,357,985	257	2.7
	Durallast	Over 5 <sup>th</sup> age-class	291,958	182,496,250	105,393,804	361	5.3
		3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,007,548	678,874,617	392,073,013	389	19.7
TOTESt	Forest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	109,624	72,799,389	42,042,369	384	2.1
	Mixed	Over 5 <sup>th</sup> age-class	132,728	77,557,536	44,788,768	338	2.3
		3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,388,433	812,539,056	469,271,599	338	23.6
	rorest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	206,405	113,645,196	65,631,466	318	3.3
	Coniform	Over 5 <sup>th</sup> age-class	22,543	20,117,276	11,613,183	515	0.6
		3 <sup>rd</sup> ~4 <sup>th</sup> age-class	570,061	420,687,707	242,961,363	426	12.2
Artificial	rorest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	491,716	314,129,508	181,417,830	369	9.1
Forest	Dreadlasf	Over 5 <sup>th</sup> age-class	53	19,610	5,757	108	0.0
		3 <sup>rd</sup> ~4 <sup>th</sup> age-class	38,402	25,924,062	14,969,893	389	0.8
	roiest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	56,156	37,222,274	21,493,312	383	1.1
	Natural Forest1st ~2nd age-classBroadleaf ForestOver 5th age-classForest1st ~2nd age-classMixed ForestOver 5th age-classMixed Forest3rd ~4th age-classMixed Forest3rd ~4th age-classMixed Forest0ver 5th age-classMixed Forest3rd ~4th age-classSt ~2nd age-class3rd ~4th age-class1st ~2nd age-class3rd ~4th age-class1st ~2nd age-class3rd ~4th age-classSt ~2nd age-class3rd ~4th age-class <t< td=""><td>5,647,834</td><td>3,439,727,187</td><td>1,986,573,893</td><td>351</td><td>100.0</td></t<>		5,647,834	3,439,727,187	1,986,573,893	351	100.0

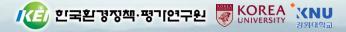




#### • Regulating services - prevention of landslide

Level I	Level II (Stand)	Level III (Tree age)	Area (ha)	Amount (ton/yr)	Economic Value (\$/yr)	Unit area (\$/ha/yr)	Ratio (%)
		Over 5 <sup>th</sup> age-class	104,849	7,913,196	43,838,756	418	1.8
	Coniferous	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,016,215	76,691,372	424,908,898	418	(%)4181.841817.84253.84215.142117.74362.04202.342024.44253.74190.441810.04519.33260.04231.1
	Forest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	211,143	16,194,640	89,721,478	425	3.8
Natural Forest	Broadleaf Forest	Over 5 <sup>th</sup> age-class	291,958	22,169,580	122,827,972	421	5.1
		3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,007,548	76,452,808	423,584,638	421	17.7
		1 <sup>st</sup> ~2 <sup>nd</sup> age-class	109,624	8,632,251	47,823,051	436	2.0
		Over 5 <sup>th</sup> age-class	132,728	10,070,304	55,791,640	420	2.3
	Mixed Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,388,433	105,174,804	582,720,358	420	24.4
	rolest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	206,405	15,822,114	87,660,239	425	3.7
	Coniformer	Over 5 <sup>th</sup> age-class	22,543	1,705,820	9,448,306	419	0.4
	Coniferous Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	570,061	43,068,592	238,620,095	418	3       1.8         3       17.8         5       3.8         1       5.1         1       17.7         5       2.0         0       2.3         0       24.4         5       3.7         0       0.4         3       10.0         1       9.3         5       0.0         4       0.7         3       1.1
Artificial	rolest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	491,716	40,076,844	222,043,817	451	9.3
Forest	Dreadlasf	Over 5 <sup>th</sup> age-class	53	3,952	17,273	326	6       2.0         0       2.3         0       24.4         5       3.7         9       0.4         8       10.0         1       9.3         6       0.0
	Broadleaf Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	38,402	2,938,705	16,276,880	424	0.7
	rolest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	56,156	4,800,004	26,588,833	473	473 1.1
	Tota		5,647,834	431,714,986	2,391,918,292	423	100.0

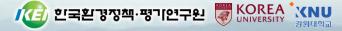




#### Regulating services - reduction of soil erosion

Level I	Level II (Stand)	Level III (Tree age)	Area (ha)	Amount (ton/yr)	Economic Value (\$/yr)	Unit area (\$/ha/yr)	Ratio (%)
		Over 5 <sup>th</sup> age-class	104,849	30,324,192	131,159,293	1,251	(%)         51       1.9         15       18.1         20       3.6         29       5.1         13       18.0         18       2.0         51       2.4         36       24.6         15       3.6         06       0.4         26       10.0         14       8.8         36       0.0         79       0.6
	Coniferous	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,016,215	292,314,379	1,264,783,229	1,245	
	Forest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	211,143	58,085,534	251,321,473	1,190	3.6
	Broadleaf Forest	Over 5 <sup>th</sup> age-class	291,958	82,926,296	358,759,243	1,229	5.1
Natural Forest		3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,007,548	289,504,936	1,252,634,586	1,243	18.0
		1 <sup>st</sup> ~2 <sup>nd</sup> age-class	109,624	31,623,264	136,801,792	1,248	2.0
	Mined	Over 5 <sup>th</sup> age-class	132,728	38,380,356	166,050,660	1,251	2.4
	Mixed Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	1,388,433	396,529,905	1,715,722,468	1,236	24.6
	rolest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	206,405	57,960,840	250,745,707	1,215	3.6
	Coniform	Over 5 <sup>th</sup> age-class	22,543	6,292,287	27,176,114	1,206	0.4
	Coniferous Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	570,061	161,539,513	698,921,273	1,226	5       18.1         0       3.6         9       5.1         3       18.0         8       2.0         1       2.4         6       24.6         5       3.6         6       0.4         6       10.0         4       8.8         6       0.0         9       0.6         1       1.0
Artificial	Forest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	491,716	141,308,755	611,404,976	1,244	8.8
Forest	Dreadlasf	Over 5 <sup>th</sup> age-class	53	17,119	57,577	1,086	0.0
	Broadleaf Forest	3 <sup>rd</sup> ~4 <sup>th</sup> age-class	38,402	10,461,664	45,255,138	1,179	0.6
	roiest	1 <sup>st</sup> ~2 <sup>nd</sup> age-class	56,156	15,462,425	66,903,907	1,191	1.0
Total			5,647,834	1,612,731,465	6,978,042,894	1,235	100.0





## 7. Construction of Decision Support System

## • Natural Capital Valuation Support System

#### NCVSS

- Supporting to decide for the place expected development by NCVSS
- Supporting select easy the target area and use query result
- Supporting the result of valuation of forest types, CO<sub>2</sub> absorption, O<sub>2</sub> supply, preventing soil erosion, water recharge.

Business planning and examine the development place



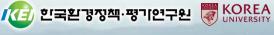
클 주요 A	배부 분석 공	불과					
四门的首之3	45.0008.0728%	7유 기능은 101,628	BER LENGS				
8¥#	426	C02 84	산土발생	도시유물 방지	우차원 명류	(H.N. (Ha)	면적의 (%)
	5월급이상 (1111)	Б	0	e.	8	0.00	B.00
신입 수당	3-422 2 (11125	0	0		.0	0.00	6.00
	0-2212 (1113)	0	0	0		0.00	0.00
	823010f (1121)	0	0	6	0	0.00	8.00
발언 수험	₽~4명급 (11225	0	0	.0	0	6.00	6.00
	0~200 (1120	0	0	.0	0	0.00	0.00
	9월급01월 (1130)	Ð	0	0	0	0.00	8.00
829	3-40 0 (1132)	3.03.094	6, 295, 220	2145.890	101,629	1.54	100.00
	8-283 (1120	0	0	0	0	0.00	0.00
	922-014r (1211)	8	6	0	0	0.00	0.00
913 913	2-42 B (1212)	0	0	0	0	0.00	8.00
	0~283 (1215)	0	0	0	-0	0.00	0.00
	5분급이상 (1221)	0	9	0	p	0.00	6.00
활압 수렴	3~48日 (1222)	0	9	0	0	0.00	8.00
	8-223	0	0	0	0	0.00	0.00
	10 80% 30 80% 30 15 5 36 17 5 36 18 5 18 5 19 5 19 5 19 5 19 5 19 5 19 5 19 5 19	Korress La 2011 Link 한 한 해 Korress La 2011 Link 한 한 한 한 한 한 한 한 한 한 한 한 한 한 한 한 한 한 한	Karlon entry Kreekere, anomany L entry Kreekere Anoma Carlos entry Kreekere Anoma Carlos entry Anoma C	ND AP258 1247.1258 12 18 12 19 22 12 12 12 10 12 12 12 12 12 12 12 12 12 12 12 12 12		ND APER UATA 1228, 연광현 08124 LENALL APORES COIRA 0.185 13045945 04240 위가 182 146.000, 4789193 1788 108.189124 LENAL 02881 02881 02881 0288 위가 182 446.048, 4789193 1788 108 189124 LENAL 02881 02881 0288 788 028 192 11111111111111111111111111111111111	

NCVSS Provides En a decision support system

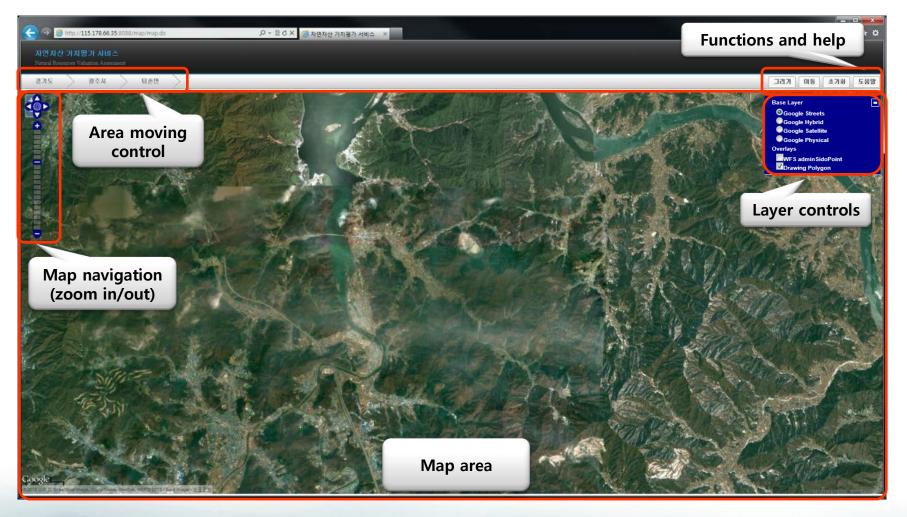
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Environmental Impact Assessment And Development

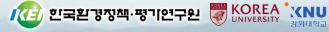




## • Main screen of NCVSS







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## • Reports of NCVSS

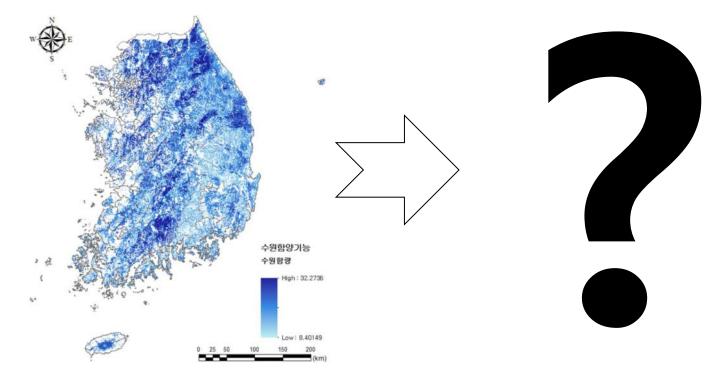
자연자산 가지평가 결과보고서 - Windows Internet Explorer 대한 1115.178.66.35:8088/map/report.do		<ul> <li>자연자산 가치평가:</li> <li>http://115.178.66</li> <li>방지 기능은 38, 스</li> </ul>		classification by forest				classification by functions			
생태계 서비스 유형별								-			
자연자산 가치 분석 결과		대분류	중분류	세분류	면적 (ha)	면적비 (%)	C02 흡수	산소발생	토사유출 수자원 방지 함유	합계	
본 자료는 해당 영역의 자연자산(산림)의 가치를 분석한 결과입니다.			합계	501 J.O.L.U.	1,44	100.00	7, 964, 528	13, 283, 504	5, 684, 272 405, 488	27, 337, 79;	
				5영급이상 (1111)	0.00	0.00	0	0	0	5	
일반현황 General Information			침엽 수림	3~4영급 (1112)	0.00	0.00	0	result of the		1	
분석 마상지 면적은 1.44ba로 자연림의 구성은 100.01%, 인공림의 구성은 0.00%				0~2영급 (1113)	0.00	0.00	0		uation by		
총평	5			5영급이상 (1121)	1.36	94.45	7, 248, 936	u	nit area	25,087,240	
분 대상 지역의 자연자산 및 상태계 서비스 가치평가 분석~~···································	-	자 연 림	활엽 수림	3~4영급 (1122)	0,08	5,56	715, 592	1, 194, 056	320, 024 20, 890	2, 250, 552	
of analysis results				0~2영급 (1123)	0.00	0.00	0	0	0 0		
유형별 주요 세부 분석 결과				5영급이상 (1131)	0.00	0.00	0	0	0 0		
산림부문		2	혼효림	3~4영급 (1132)	0.00	0.00	0	0	0 0		
산림의 가치는 자연림 27,337,792원, 인공립 0원으로 IFIT ALE I COL				0~2영급 (1133)	0.00	0.00	0	0	0 0		
유출방지 기능은 5,684,272원, 수자원합유 기능은 405,483원으로 나타났다. 안 type analysis results				5영급이상	0.00	0.00	0	0	0 0		
···· 토사용 <u>축 소개</u> 였			침엽	(1211) 3~4영급			-				
대분류 중분류 세분류 면적 면적비 (%) CO2 흡수 산소발생 통사유출 수자원 합계 합계 1.44 100.00 7.964,528 13.283,504 5.684,272 405,488 27.337,792			침엽 수림	(1212)	0.00	0.00	0	0	0 0		
월개 1,44 100.00 7,394,528 15,255,504 5,694,272 405,468 27,357,732 5영급이상 0.00 0.00 0 0 0 0 0 0 0 0		이 사 디		0~2영급 (1213)	0.00	0.00	0	0	0 0		
		림		5영급이상 (1221)	0.00	0,00	0	0	0 0	1	
수렴 (1112) 0.00 lable of each type			활엽 수림	3~4영급 (1222)	0.00	0.00	0	0	0 0		
0~2留計 (1113)         0.00         0         analysis results				0~2영급 (1223)	0.00	0.00	0	0	0 0	1.1.1.1.2	
5명급이상 1.36 94,45 7,248,936 12,083,448 5,364,248 384,608 25,087,240 (1121)		-		J. Immert.							



## Next step

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#### • Ecosystem Services of forest to considering Climate change



Water availability (KFRI statistic model, InVest Model)





