

A study of the new synthetic index to reveal the forest value

----- A development of the forest value index -----

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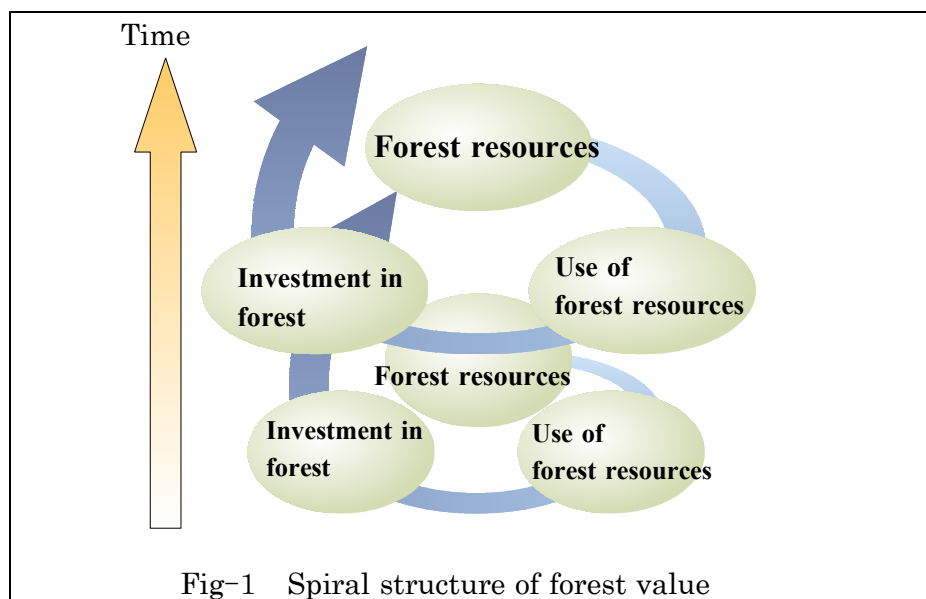
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The objective of this study is to develop the new synthetic index to evaluate the forest conservation and growing at a region in Japan. The forest value has been studied by many diverse ideas. The traditional forest value was a physical property of forest, for example, the function of water cultivation etc. So, it was required to develop the new synthetic measure of forest value from a point of view of relationship with forest, human society and economy.

<The concept of new forest value>

Fig-1 is the concept of new forest value. Forest resources are limited and regenerative resources. For that reason, it is the greatest value that forest resources make the most of sustainability. The forest resources have to make the most of use for the possibilities of society and economy. It is required to invest in forest for the regeneration.



The total forest value is a balance of 3 values, forest resources, use of forest resources and investment in forest. These 3 values are classified by 5 indexes(1st index). Therefore, total index of forest value is taken an average of 5 1st indexes.

〈Forest value index〉

The forest value was evaluated with 47 prefectures and 1700 cities in Japan. The indexes of forest value is different with prefecture index and city index. Because, statistics is different between prefecture and city. The prefecture index of forest value is made up of 82 indexes and the city index is 47. Table-1 is a forest value index for prefecture.

〈Expression of forest value index〉

Expression of forest value index is the followings.

FV_{ijk}m:forest value index

i,j,k,m:subscript of categorized index

i:1st index subscript

j:2nd index subscript

k:3rd index subscript

m:detailed indicator subscript

FV:total index

$$FV = \text{Average}(\overline{FVi})$$

$$\overline{FVi} = FVi / (\max FVi) \times 100$$

$$FVi = \text{Average}(\overline{FVij})$$

$$\overline{FVij} = FVij / (\max FVij) \times 100$$

$$FVij = \text{Average}(\overline{FVijk})$$

$$\overline{FVijk} = FVijk / (\max FVijk) \times 100$$

$$FVijk = \text{Average}(\overline{FVijkm})$$

$$\overline{FVijkm} = FVijkm / (\max FVijkm) \times 100$$

〈An assignment〉

An assignment hereafter is to develop the world forest value index. The world forest value index will be made up of different factors in Japan because of usable statistics. Measuring each country forest value is significant to forest policy evaluation and sustainable forest management.

Table-1 A prefecture forest value index(1)

番号	Categorized index of forest value (FV)			Detailed indicator(FVijk)	Expression of detailed indicator
	1st index(FVi)	2nd index(FVij)	3rd index(FVijk)		
1	Natural power FV1	Resources	Natural forest area	Natural forest area per head	Natural forest area / population m ² per head
2		FV11	Plantation area	Plantation area per head	Plantation forest area / population m ² per head
3		Production of forest FV12	Production of natural forest	Hardwood production per natural forest area(ha)	Hardwood production / natural forest area m ³ /ha
4				Share of hardwood production	Regional hardwood production / national hardwood production %
5			Production of plantation	Softwood production per plantation area(ha)	Softwood production / plantation area m ³ /ha
6				Share of softwood production	Regional softwood production / national softwood production %
7		The environment FV13	Water cultivation	Annual average water reserved in forest	(annual rainfall * forest area *0.5)/(population/1000)
8			Prevention of landslide	Not landslide forest area	Forest resource monitoring data
9			Absorption of carbon dioxide	Annual average absorption of carbon dioxide in natural forest	Natural forest annual growth(forest volume/average forest age) × 0.8 × 1.6/(population/1000) CO ₂ t per 1000heads
10		Landscape and preservation FV14	Landscape	Forest park area	Forest park area/forest area %
11				Share of forest park area	Regional forest park area/the whole country forest park
12			Preservation	Preservation forest area	Preservation forest area/forest area %
13				Share of preservation forest area	Regional preservation forest area/the whole country preservation forest area
14		Biodiversity FV15	Diversity of cover	Index of diversity	Forest resource monitoring data
15			Diversity of natural forest	High tree	Forest resource monitoring data
16				Middle tree	Forest resource monitoring data
17				Low tree	Forest resource monitoring data
18	Social power FV2	Social fundamentals	Fundamentals	Number of forestry family	Forestry family/family %
19				Share of forestry family	Regional forestry family/the whole country family
20				Variations of population	2005 population/2000 population
21		Living vitality	Green action	Green endowment per head	Green endowment/population
22				Share of green endowment	Regional green endowment/national green endowment
23			Floor space	Floor space of wooden house	Floor space/house
24			Income	Prefecture income distributed	Income distributed/family
25				Forestry production income	Forestry production income/forestry family
26				Share of forestry production income	Sum of prefecture forestry income/sum of the whole country forestry income
27		Financial standing	Financial standing	Revenue	(Revenue - grant-in-aid)/population
28				Ratio of bond	1 - public bond/(revenue - grant-in-aid)
29		Culture	Forest workshop and recreation	Workshop and sports facility	Number of facility/(forest area/1000)
30				Share of facility	Number of regional facility/the whole country
31				Forest recreation area	Forest recreation area/forest area
32				Share of forest recreation area	Regional forest recreation area/the whole country
33			Historic site and scenic beauty	Number of structure	Number of structure/(forest area/1000)
34				Number of historic site and natural monument	Number of historic site and natural monument/(forest area/1000)
35				Share of historic site and natural monument	Number of regional historic site and natural monument/the whole country
36				Forest area of temple and shrine	Forest area of temple and shrine/forest area
37				Share of forest area of temple and shrine	Regional forest area of temple and shrine/the whole country

Table-1 A prefecture forest value index(2)

番号	Categorized index of forest value (FV)			Detailed indicator(FVijkm)	Expression of detailed indicator
	1st index(FVi)	2nd index(FVij)	3rd index(FVijk)		
38	Industry power FV3	Forestry	Forest product	Forest product	Forest product/forest area ven/ha
39			Share of forest product	Share of forest product	Regional forest product/the whole country
40			Minor forest products	Minor forest products	Minor forest products/forestryhouse 10000ven/hous
41				Share of minor forest products	Regional minor forest product/the whole country
42			Sapling product	Seed bed area	seed bed area/plantation area
43		Wood industry (sawing,paper etc.)	Wood products	Wood products	(Wood + furniture+paper)products/gross products %
44				Share of wood products	Regional wood products/the whole country %
45			Forest public work and housing products	Forest public work budget	Forest public work budget/gross products %
46				Ratio of newly-built house	newly-built houses/total living units
47			Biomass use	Disused wood	used woods/total disused woods %
48				Utilizing ratio for the energy source	used woods/total energy sources %
49		Forest tourism	The number of forest recreation use	The number of use at culture and recreation facility in forest	The number of use/recreation forest area
50				Share of recreation use	Regional forest recreation use/the whole country %
51			The number of forest park use	The number of use in forest park	The number of use/forest park area
52				Share of forest park use	Regional forest park use/the whole country
53		Local production and consumption	Wood production	Wood products per annual plantation growth	Annual wood products/annual plantation growth
54				Share of Wood products	Regional wood products/the whole country %
55			Self-sufficiency ratio of wood	Self-sufficiency ratio of wood consumption	Self-sufficient wood consumption/total consumption
56	Sustainable forest management FV4	Forest organization	Forestry organization	Forestry cooperative earnings	Annual forestry cooperative earnings/cooperative members
57				Forestry cooperative forest area	Forest cooperative owner's area/total private forest area
58				Resident forest owners	Resident forest owners area/total private forest area
59			Forestry Volunteer, labor force, business organization	The number of forestry volunteer	The number of forestry volunteer/plantation area
60				Forestry labor force	Forestry labors/plantation area
61				Share of forestry labor	Regional forest labors/the whole country
62				Share of forestry business organization without forestryhouse	Regional forestry organizations/the whole country
63		Technology and system of forest	Forestry technology	The leader of study and technology	Forestry leaders/plantation area
64				Forestry induction participants	Total forestry induction participants/total forestryhouses
65			Forestry system	Afforestation	Afforestation area/plantation area
66				Forestry road	Newly forestry road extension/total forestry road extension
67				Erosion and flood control	Erosion and flood control budget/total landslide points
68				Forestry budget of prefecture	Forestry budget/plantation area
69		Forest management	Plantation resources	Yield plantation area	Plantation area more than 10 age-class/population
70				Plantation stock	Plantation stock/population
71			Network of forest roads	Efficiency of forestry roads	Plantation area within 200m from forestry road/total plantation area
72				Extension of forest road	Extension of forest road/plantation area m/ha
73			Forest reserve	Forest reserve area	Forest reserve area/forest area %
74				Water cultivation forest reserve area	Water cultivation forest reserve area/forest area %
75	Management of plantation FV5	The environment of plantation	Plantation health	Groundcover rate in plantation	plantation area more than groundcover rate 40%/plantation area
76			Absorption of carbon dioxide into plantation	Annual absorption	(annual plantation growth $\times 0.4 \times 1.6$ / population CO ₂ t
77		Biodiversity of plantation	Biodiversity of groundcover in plantation	Biodiversity index of groundcover in plantation	Forest resource monitoring data
78				High tree	Forest resource monitoring data
79			Biodiversity of plantation	Middle tree	Forest resource monitoring data
80				Low tree	Forest resource monitoring data
81		SATOYAMA(Forest at countryside)	Population of village	Resident rate in village	Resident families in village/total families %
82			SATOYAMA area	SATOYAMA area rate	Forest area within 300m from village/total forest area %

