MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF SPATIAL PLANNING
JL. PATTIMURA 20 KEBAYORAN BARU JAKARTA SELATAN TEL. 021 7257406
WWW.PU.GO.ID WWW.PENATAANRUANG.NET

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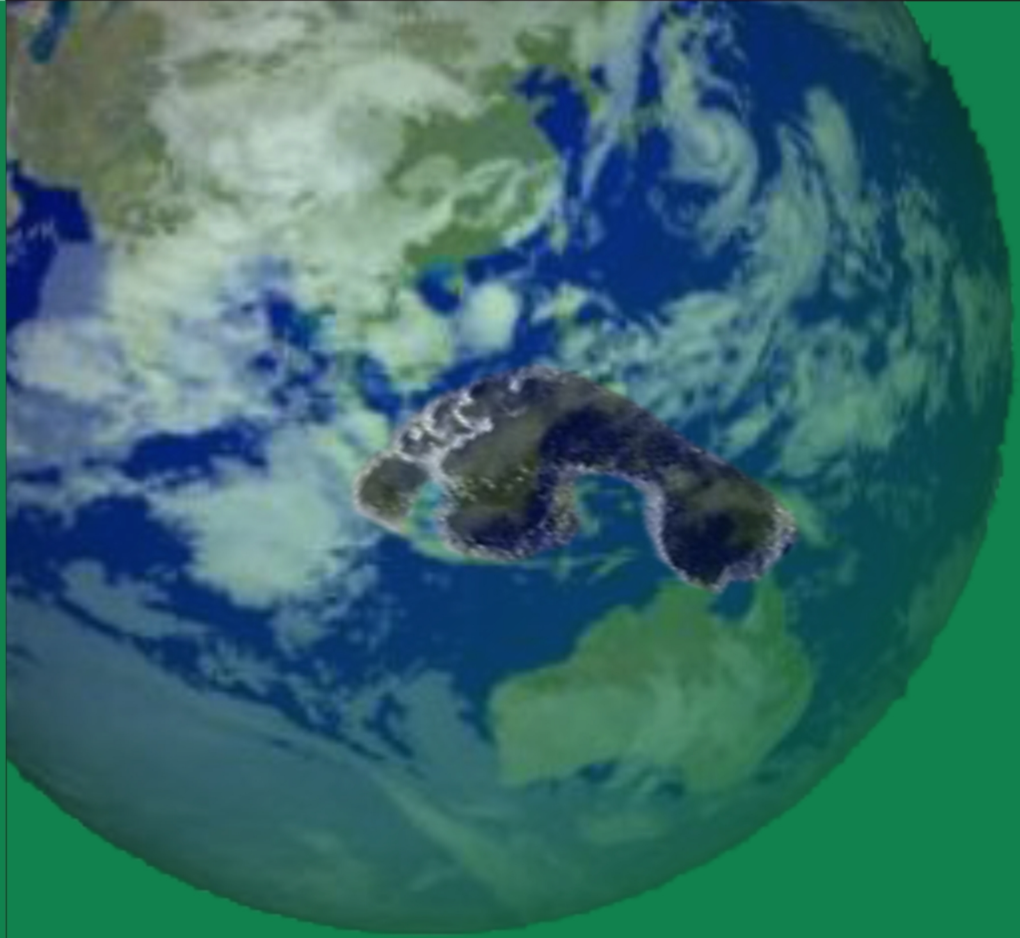

ecological footprint of Indonesia

MINISTRY OF PUBLIC WORKS

2010

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FOREWORD

Assalamu'alaikum wr. wb.

I feel blessed and thankful for the publication of this "Ecological Footprint of Indonesia". It is just in-time considering the increased of public awareness towards environmental sustainability for development, and a greater need for us to recognize interests in preparing for a future with tightening resource constraints.

As a relatively new concept, dissemination of the ecological footprint study is essential in order for the entire stakeholders to have better understanding. I hope this knowledge will be applied when composing development strategies and policies that are environmentally friendly. Hopefully, with the right strategy, we can utilize our natural resources to its potential, not only for our generation today, but also for the future generations after us.

I think the publication of "Ecological Footprint of Indonesia" is a perfect platform towards the mainstreaming of sustainable development in Indonesia. I hope, readers will gain new perspective and greater inspirations in order to bring about lasting human wellbeing in a resource-constrained world, for a better Indonesia.

Wassalamu 'alaikum wr.wb.

Jakarta, June 2010

Minister of Public Works,

DJOKO KIRMANTO

PREFACE

Advanced knowledge on sustainable development has led to various efforts by the stakeholders to raise awareness on environmental issues. Global warming phenomenon and climate change has made governments and the global population on their feet and started to take responsibility on their actions toward the environment. These actions are taken to prevent further damage to the environment.

The implementation of sustainable development has to be based on thoroughly comprehensive knowledge on existing condition and the desired state in the future. Directorate General of Spatial Management, Ministry of Public Works of Indonesia has taken the initiative to recognize the state of the art of current conditions by conducting a study of ecological footprint of Indonesia resulted by socio-economic activities of the society.

Ecological footprint is a portrait of using natural resources by the population in a region in order to fulfill their daily needs. The higher the demand of the society, the higher natural resources needed, thus resulted on higher ecological footprint. Furthermore, if the ecological footprint value is compared to its biocapacity (environmental capacity to supply natural resources) level, sustainability of a region can be identified.

The result of the ecological footprint study of Indonesia shows in general that we are still using relatively less natural resources than its potential. It's shown by the high level of biocapacity to the lower level of ecological footprint. In other words, the biocapacity of Indonesia is still in reserved condition. Nevertheless, some of the most populated regions in Indonesia, such as the Island of Java and Bali, have staggering level of deficit in biocapacity.

It is important to consider nearly deficit condition of ecological footprint of Indonesia in formulating development policies and strategies. Furthermore we must consider actions to change consumption patterns that tend to overuse resources, along with the increase of public welfare and the population growth. If not managed wisely, Indonesia will have higher ecological footprint level and is in danger for being a deficit region.

The purpose of this book is to enlighten the readers of Indonesia's current condition, and to give an inspiring view when formulating the best policy to implement appropriately sustainable development and spatial management in Indonesia. Moreover, in general, it is also intended to promote the well being and to keep our environment so it is continuously beneficial for generations to come.

Dedicated to the best planning for all and environmental sustainability.

Jakarta, June 2010

Director General of Spatial Management
Ministry of Public Works,

Ir. Imam S. Ernawi, MCM, M.Sc.

A. INTRODUCTION

In order for mankind to continue their existence, they need to begin using the natural resources wisely, for the environmental sustainability of future generation. Sustainability can be achieved if the use of natural resources and environment are still considering the carrying capacity and the capacity of the environment. By then and only then the harmony between the natural and artificial environment can be achieved.

To achieve sustainability, a tool is needed to measure the supply and demand capacity of the resources. Ecological Footprint is one of the tools that can be used to determine the sustainability of the natural resources and the environment. Ecological Footprint is a measure of how much biologically productive land and water an individual population requires to produce all the resources it consumes and to absorb generated wastes.

The Ecological Footprint approach is intended to show the dependency of human being to their environment and also to reserve the natural resources for future mankind. Ecological footprint consists of 4 (four) basic parameters, namely; population, land and sea area, productivity (product/ha) and indicator (ha/capita), and this calculation will be part of the equation for environmental carrying capacity to determine the sustainability of natural resources and the environment. If the ecological footprint level of a region is lower than its biocapacity level, it shows that in order to fulfill their needs, the population of the region are paying attention to the carrying capacity of the environment and by that they secured their sustainability of their natural resources and environment for the future.

Ecological footprint was first introduced by William Rees in 1992. The concept and method of calculation of ecological footprint was developed in Mathis Wackernagel's Phd dissertation under the supervision of William Rees in the University of British Columbia, Vancouver, Canada, from 1990 -1994. In early 1996, Wackernagel and Rees published a book "Our Ecological Footprint: Reducing Human Impact on Earth".

B. METHODOLOGY

A. Frameworks

Humanities relies on ecosystem products and services for existence. As the time goes, and the advancement of technology, some interactions between human and environment have negatively affected the environmental carrying capacity. According to Khana (1999) carrying capacity is divided into two components, namely supportive capacity and assimilative capacity.

Ecological footprint is just a tool for evaluating the land that naturally able to produce and manage waste, otherwise known as biologically productive land. The basic calculation of ecological footprint reflects on how much tools, energy, and space needed by a population to the area needed to supply it. Ecological Footprint accounting is based on six fundamental assumptions (Wackernagel et al. 2002):

- The majority of the resources people consume and the wastes they generate can be tracked.
- Most of these resource and waste flows can be measured in terms of the biologically productive area necessary to maintain flows. Resource and waste flows that cannot be measured are excluded from the assessment, leading to a systematic underestimate of humanity's true Ecological Footprint.
- By weighting each area in proportion to its bioproductivity, different types of areas can be converted into the common unit of global hectares, hectares with world average bioproductivity.
- Because a single global hectare represents a single use, and all global hectares in any single year represent the same amount of bioproductivity, they can added up to obtain an aggregate indicator of ecological footprint or biocapacity.
- Human demand, expressed as the Ecological Footprint, can be directly compared to nature's supply, biocapacity, when both are expressed in global hectares.

- Area demanded can exceed area supplied if demand on an ecosystem exceeds that ecosystems regenerative capacity (e.g., humans can temporarily demand more biocapacity from forests, or fisheries, than those ecosystems have available).

B. Ecological Footprint Calculation Components

Method used in the study of "Ecological Footprint of Indonesia" is the method developed by the Global Footprint Network (GFN, USA) written in the Guidebook to the National Footprint Accounts 2008.

Bioproductive area can be defined as all areas that contributes to the biocapcity that economically supplies concentrated biomass. Biologically productive land and water is the land and water (both marine and inland waters) area that supports significant photosynthetic activity and the accumulation of biomass used by humans. Following are the conversion factors used in the ecological footprint (EF) and biocapacity (BC) calculations:

1. Equivalent factor

   A productivity-based scaling factor that converts a specific land type_(such as cropland or forest) into a universal unit of biologically productive area, a global hectare. Global Footprint Network recognized six land categories for the equivalent factors, namely; cropland (2.64), fishing grounds (0.40), grazing land (0.50), forest land (1.33), built-up land (2.64) and carbon uptake land that is needed to absorb CO_2 from the emission of fossil fuel (1.33).

2. Yield factor

   Yield factors account for countries' differing levels of productivity for particular land use types. The yield factor provides comparability between various countries' Ecological Footprint or biocapacity calculations. In every year, each country has a yield factor for cropland, grazing land, forest land, and fishing ground.

In the method developed by GFN, demand is portrayed as the final calculation for ecological footprint of a region. Meanwhile, supply is portrayed in its biocapacity. The ideal condition is that the total demand (ecological footprint) is lower than its supply (biocapacity), so it could grant sustainability of natural resources usage.

C. Demand/Ecological Footprint (EF) Calculation

Ecological footprint gave a portrait of the goods and services needed by the population from the environment that is depicted in net consumption from categorized products such as agricultural products, farming products, forestry products, fishing products, the need of space and land, and energy consumption.

Net consumption is actual consumption that affected the trading activities (export-import). The calculation of actual consumption will add imported goods and took out exported goods displayed in this equation:

Net Consumption/Total (ton) = Local Production (ton) + Import (ton) – Export (ton)

Ecological footprint (EF) for every type of land is:

$$EF = \frac{P}{Y_N} \cdot YF \cdot EQF$$

EF = Ecological Footprint
P = amount of a product harvested or waste emitted
Y_N = national average yield for P
YF = Yield Factor
EQF = Equivalence Factor for the land use type calculated

In some cases, the result of the calculation for EF consumption = 0 eventhough the value (EF production + EF import)<EF export and does not give a negative value, this is based on the conception of the existing Ecological Footprint. For the year data, total production is total product that is produced by that year (2007), and total export is total product that is produced in that year and/or the stock/product from year before that is sold/exported on that particular year (2007).

D. Supply/Biocapacity (BC) Calculation

Biocapacity is the capacity of ecosystems to produce useful biological materials and to absorb waste materials generated by humans, using current management schemes and extraction technologies. Just like ecological footprint, biocapacity also have the same six land categories, cropland, fishing ground, grazing land, forest land, built-up land and carbon uptake land.

According to GFN-USA in the **Guidebook to the National Footprint Accounts 2008** (NFA 2008) the carbon uptake land does not have biocapacity because NFA 2008 assumes all carbon uptake is a demand on forest land biocapacity. Therefore, carbon biocapacity is accounted as addition to forest land biocapacity.

In this method, the value of ecological footprint and biocapacity of built up land is the same. The demand for built-up land and infrastructure (built-up land EF) will be directly proportional to the supply (built-up land BC), where as for every new land clearing will be accompanied by the growth of built-up land.

Biocapacity (BC) for every land use type is:

$$BC = A \times YF \times EQF$$

BC = Biocapacity
A = area available for a given land use type
YF = Yield Factor
EQF = Equivalence Factor for the calculated land use type

E. Ecological Footprint Deficit (ED) Calculation

Ecological footprint value shows whether a region has exceeded its biocapacity level or not. A region can be declared as a 'deficit region' when the Ecological Footprint value is greater than its biocapacity. A greater Ecological Footprint value shows that the population in the particular region have used more natural resources than provided by its environment.

Ecological Deficit is calculated with the equation:

$$ED = EF_{total} - BC_{total}$$

ED = Ecological Deficit
TE_{total} = Ecological Footprint Total
BC_{total} = Biocapacity Total

The standard used to determine the level of ecological deficit in this study is one that was developed by China Council for International Cooperation on Environment and Development-World Wide Fund for Nature (CCICED-WWF) in 2006, as seen in Table 1.

Table 1. Ecological Footprint Deficiency Level

Deficit Region	Reserve or Balanced Regions
Very severe deficit (ED>2.0) Severe deficit (1.0<ED≤2.0) Moderate deficit (0.5<ED≤1.0) Minor deficit (0.1<ED≤0.5)	Balanced regions (-0.1<ED≤0.1) Reserve regions (ED≤-0.1)

Source: CCICED-WWF, 2006

Bruntland Report, Our Common Future, reserved 12% for biodiversity (Bruntland Report assumed that biocapacity could only be used up to 88% and the other 12% is reserved for biodiversity).

D. ECOLOGICAL FOOTPRINT OF INDONESIA

A. Ecological Footprint of the Island of Sumatera

Generally, the carrying capacity of the Island of Sumatera as a natural resources supplier for cropland, grazing land, and forest land is still in surplus condition. But its ability as the producer of fish has suffered a deficit.

In general, the population of the Island of Sumatera is highly consuming agricultural products. This is shown by the value of ecological footprint on the cropland category, which is higher than the others (Table 2). Even though the ecological footprint value is high, it has yet to surpass the biocapacity value, in otherwise its ability to produce agricultural products has not exceeded yet. Nevertheless, we still need to use the natural resources wisely and paying attention to the environmental carrying capacity and improving the biocapacity level. This is needed to ensure that the island of Sumatera can support other regions with agricultural sector, since it is the region that has the highest productive ecological footprint value for agriculture.

The biocapacity value for forest land in the Island of Sumatera has higher value than its ecological footprint value. One of the reason behind it is the still existing National Parks that is located throughout the island such as Mount Leuser National Park (located in Nangroe Aceh Darussalam and North Sumatera) and Kerinci Seblat National Park (located in West Sumatera, Jambi, South Sumatera, and Bengkulu). This condition is shown in the diagram as the forest land in Nangroe Aceh Darussalam, Jambi, South Sumatera, and Bengkulu are higher than the other provinces of Sumatera. The biocapacity value for fishery is far below its ecological footprint value, showing that the population of Sumatera has a high consumption on fishing products.

Table 2. Ecological Footprint & Biocapacity of the Island of Sumatera

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	64,781,358	1,047,326	14,226,926	51,601,757	72,785,601	Reserve
Grazing Land	0	22,803	21	22,782	133,269	Reserve
Forest Land	4,572,656	113	6,346	4,566,423	9,833,289	Reserve
Fishing Grounds	7,766,477	14,221	553,008	7,227,691	60.140	Deficit
Carbon Uptake Land	64,728	224	3,241	61,711	0	-
Built Up Land	11,285,243	0	0	11,285,243	11,285,243	-
TOTAL	88,470,462	1,084,687	14,789,543	**74,765,606**	**94,097,541**	**Reserve**

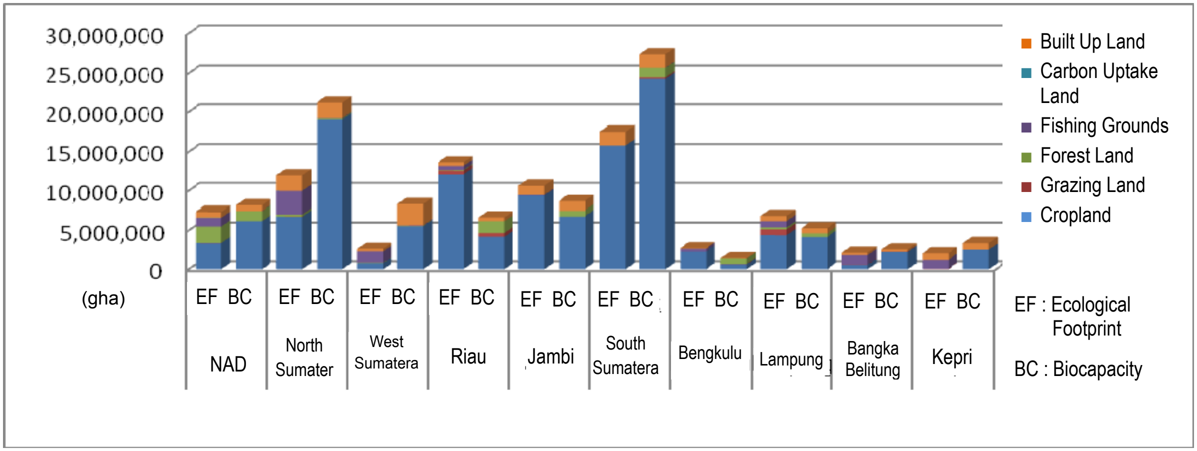

Figure 1. Ecological Footprint to Biocapacity by Province in Island of Sumatera

B. Ecological Footprint of the Island of Sulawesi (Celebes)

The calculation analys is has shown that the carrying capacity in the Island of Sulawesi (Celebes) as the supplier of natural resources of agricultural products, farming products, and forestry are still surplus, but as a supplier of fishery product the island has suffered a deficit.

In general, the population of the Island of Sulawesi (Celebes) has a high consumption of fishery product, this is shown by the value of ecological footprint is 10,152,547 gha. From Table 3 we can see, the value of ecological footprint is high above the biocapacity value, this is shown that the population of the island of Celebes has committed overfishing in the area of the island.

Furthermore, the island of Celebes has a high biocapacity level for its forest land (the highest component in the region), it shows that the island has high potential in forestry. Figure 2 shows the biocapacity level of the forestry in the island is higher than its ecological footprint. The main contributing factor is the Lore Lindu National Park, that serves as a sanctuary for the ecosystem in the Island of Sulawesi (Celebes).

The high value of ecological footprint for cropland mainly comes from the value of production ecological footprint. It shows the high level of agricultural products consumed by the people of Sulawesi (Celebes), nevertheless the biocapacity value is still higher than its ecological footprint value, guaranteeing the resources that produce cropland still a surplus.

Table 3. Ecological Footprint & Biocapacity of the Island of Sulawesi (Celebes)

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	9,356,668	5,076,817	1,995,273	12,438,212	14,446,022	Reserve
Grazing Land	0	0	0	0	2,253,687	-
Forest Land	105,061	16	677	104,400	5,840,142	Reserve
Fishing Grounds	10,152,547	32	0	10,152,579	2,897,265	Deficit
Carbon Uptake Land	8,641	0	24,249	0	0	-
Built Up Land	1,012,949	0	0	1,012,949	1,012,949	-
TOTAL	20,635,866	5,076,864	2,020,199	**23,708,139**	**26,450,065**	**Reserve**

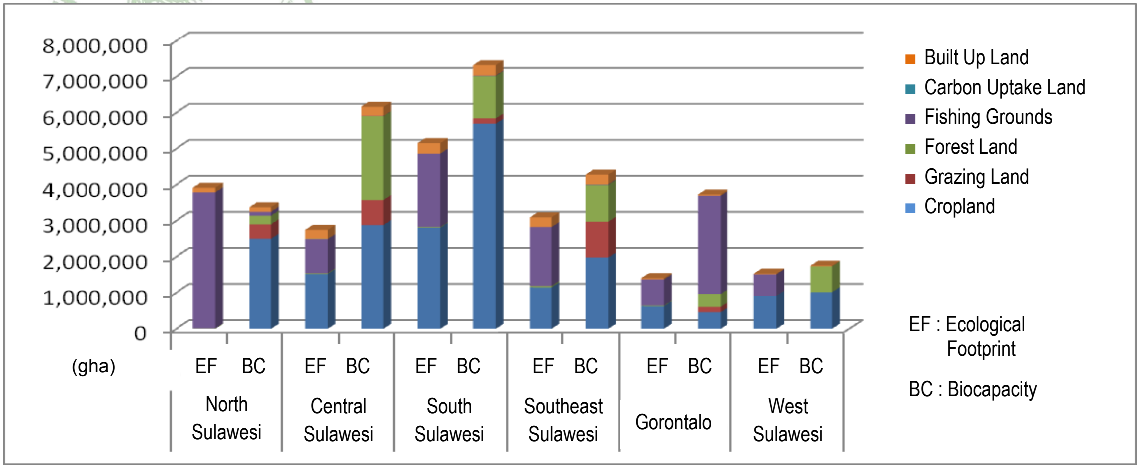

Figure 2. Ecological Footprint to Biocapacity by Province in Island of Sulawesi (Celebes)

C. Ecological Footprint of the Island of Bali

In general, the Island of Bali has suffered a deficit as the supplier of natural resources, this is shown by the value of ecological footprint that is higher than the value of its biocapacity in all land use categories. The island of Bali is a tourist destination, local and international tourists. Due to the extensive tourism activity, the island of Bali has a higher consumption level than any region in Indonesia.

The ecological footprint value for carbon production was higher than the other components (2,433,016 gha), followed by cropland (2,397,717 gha), and fishing ground (697,383 gha). The high ecological value in cropland is not balanced with its biocapacity value, this shows that the level of consumption for agricultural product in the Island of Bali is higher than its environmental carrying capacity. From each ecological footprint component in the region shows that its biocapacity value is much lower than its ecological footprint value, this means that the environmental carrying capacity condition in Bali relatively can no longer support the needs of its population.

Table 4. Ecological Footprint & Biocapacity of the Island of Bali

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	2,412,251	2,648	17,182	2,397,717	712,810	Deficit
Grazing Land	2	36	0	39	3	Deficit
Forest Land	331,559	1	14	331,545	4,869	Deficit
Fishing Grounds	733,085	2,635	38,337	697,383	394	Deficit
Carbon Uptake Land	2,432,846	215	45	2,433,016	0	-
Built Up Land	87,168	0	0	87,168	87,168	-
TOTAL	5,707,153	295,292	55,577	**5,946,868**	**805,214**	**Deficit**

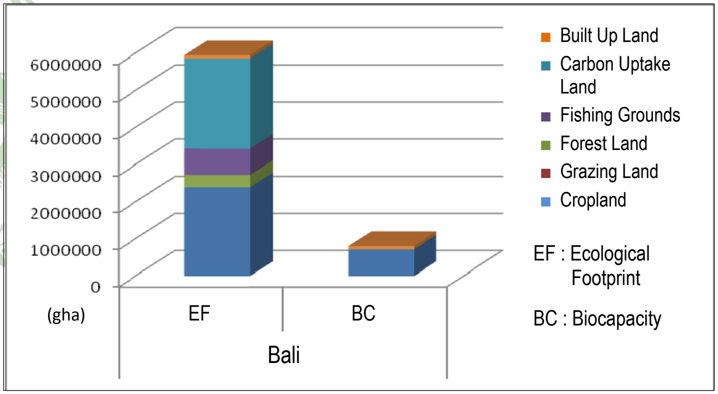

Figure 3. Ecological Footprint to Biocapacity by Province in Island of Bali

D. Ecological Footprint of the Isles of Nusa Tenggara (Lesser Sunda Isles)

The carrying capacity of the Isles of Nusa Tenggara (Lesser Sunda Isles) in agricultural products and fishery has suffered deficit. In the more optimistic note, the biocapacity for grazing land and forest land in this region are in the surplus condition. These conditions are found in both provinces of the Isles of Nusa Tenggara, the West Nusa Tenggara (NTB) and East Nusa Tenggara (NTT).

The Isles of Nusa Tenggara is one of the regions in Indonesia that has a high potential in agricultural sector. The potential can be seen from its highest production, that is agricultural sector, it is also supported by the ecological footprint production value that is higher than any other components. This high potential in agricultural sector is not balanced by the capacity of the environment (biocapacity value is lower than its ecological footprint value). Similar to the cropland, the ecological footprint value for fishery is also higher than its biocapacity. In this regard, the use of natural resources on agricultural and fishery products needed to be done wisely, so that the effort to fulfill the need of agricultural and fishery products for the people of Lesser Sunda Isles can be guaranteed for the future generation.

The highest biocapacity value in the island is on grazing land. This fact confirmed that Lesser Sunda Isles has high environmental capacity as a supplier of farming products (Tabel 5). Grazing land biocapacity value is high in both of the provinces. Nevertheless, the environmental capacity as supplier for the farming products has been used by its own population in East Nusa Tenggara (NTT), furthermore, in West Nusa Tenggara (NTB), the environmental capacity is yet to be used to its potential (Figure 4).

The forest land component in this region is also the one with high biocapacity value. This means that the Lesser Sunda Isles still has the environmental capacity to produce forestry products.

Table 5. Ecological Footprint and Biocapacity of the Nusa Tenggara (Lesser Sunda Isles)

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	2,252,807	142,337	722,737	1,672,408	701,612	Deficit
Grazing Land	1,338,498	0	161,661	1,176,837	2,385,296	Reserve
Forest Land	25,917	0	26	25,890	909,241	Reserve
Fishing Grounds	961,244	0	9	961,235	19,757	Deficit
Carbon Uptake Land	11	108	0	118	0	-
Built Up Land	97,283	0	0	97,283	97,283	-
TOTAL	4,675,760	142,445	884,433	**3,933,772**	**4,113,189**	**Reserve**

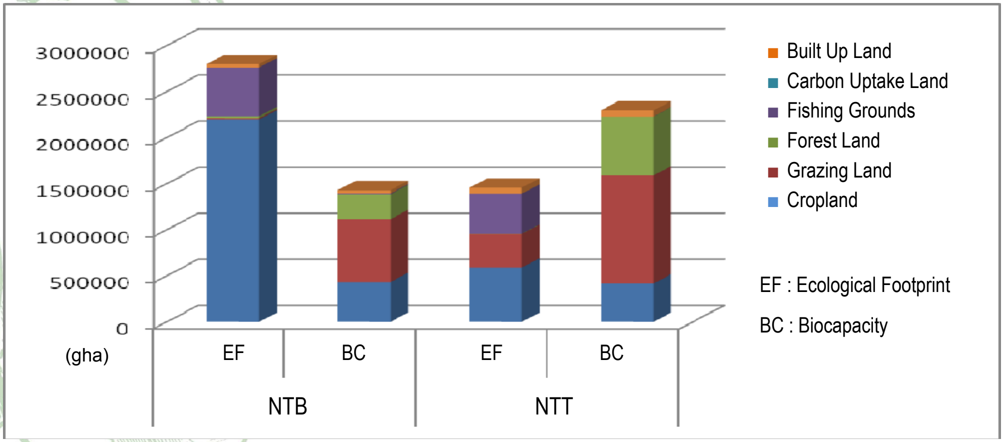

Figure 4. Ecological Footprint to Biocapacity by Province in Isles of Nusa Tenggara

E. Ecological Footprint of the Isles of Maluku (Moluccas Isles)

The analysis of the calculation reveals that the carrying capacity of the Isles of Maluku (Moluccas Isles) as the supplier for agricultural and fishery products has suffered deficit, meanwhile the carrying capacity for the forest land is still surplus. Even so, the total biocapacity value of the region (2,959,192 gha) and its ecological footprint value (2,840,801 gha) does not have significant difference.

Geographically, the Isles of Maluku is located in the Pacific that has strategic position. This geographical advantage would be a big chance for this province to develop, and action has to be taken as soon as possible, so the momentum would not be lost. The development of the Province of Maluku and the Province of North Maluku will be significant because of its great potential for the marine resources.

This great potential is shown on the ecological footprint value on fishing ground as being the highest value from all of the components, both fresh water or saltwater. Unfortunately, the ecological value for the fishing ground is greater than its biocapacity value, meaning it has exceeded the maximum exploitation for the fishery in the area.

The Isles of Moluccas also has high potential for natural resources in agricultural sector, this component highly contributes to the economy of the region. This is shown by high value of ecological footprint production on this component. Nevertheless, same as fishery, the ecological footprint value of cropland is higher than its biocapacity value, even though the figures are not far off. But still, this means that the Isles of Moluccas has passed its biocapacity for the resources for cropland.

The forest land, in the other hand, has a surplus ecological footprint value, because the biocapacity of this component is higher than other components in the region. The value of the biocapacity of this component came from the forest land in the Province of North Maluku (Figure 5). The forest land of the region might have a potential for further development, but we still have to consider the status of the forest land and its use to avoid an exploitation of resources.

Table 6. Ecological Footprint & Biocapacity of the Isles of Maluku (Moluccas Isles)

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	845,955	9,854	130,044	725,766	569,995	Deficit
Grazing Land	839,350	0	0	839,350	839,350	-
Forest Land	145,103	0	467	144,636	1,489,366	Reserve
Fishing Grounds	1,142,985	610	41,322	1,102,273	31,710	Deficit
Carbon Uptake Land	5	0	3	3	0	-
Built Up Land	28,772	0	0	28,772	28,772	-
TOTAL	3,002,171	10,464	171,834	**2,840,801**	**2,959,192**	**Reserve**

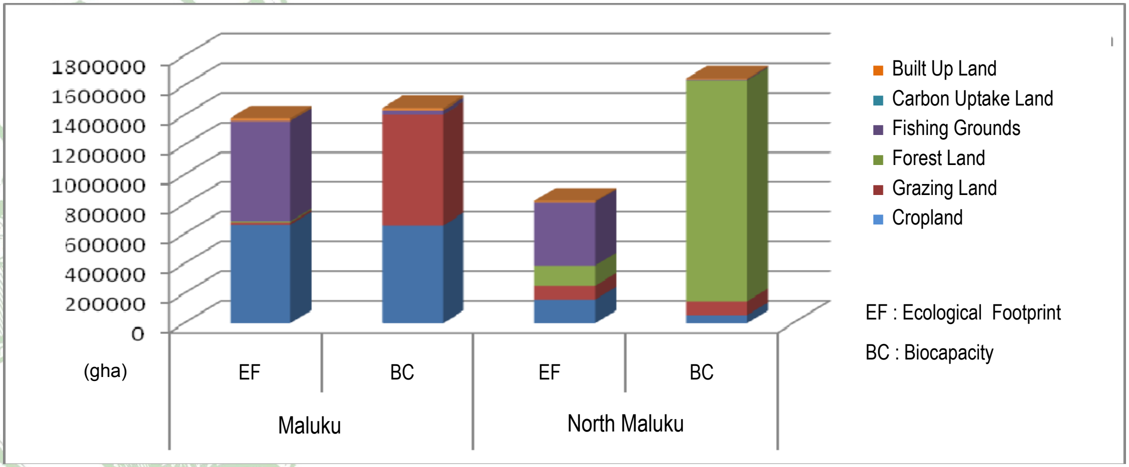

Figure 5. Ecological Footprint to Biocapacity by Province in Isles of Maluku

F. Ecological Footprint of the Island of Papua

From Table 7, we could know that all the carrying capacity resources for the Island of Papua as supplier of agricultural, farming, forestry and fishery products are still surplus. Overall, the carrying capacity of the Island of Papua is still surplus 20,357,741 gha. Nevertheless, we still need to manage this potential so it will not end up as a disaster that is overexploiting the land. From the total biocapacity calculation of the Island of Papua, we can tell that Papua can support the life of its population, especially in the agricultural resources and forestry.

The island of Papua is a self-sufficient island shown by the high ecological footprint production compared to its imported ecological footprint. Especially the ecological footprint value for the use of cropland showed particularly that Papua supported its own agricultural needs.

Most of the island of Papua is covered with forest land, this is shown that the Island of Papua has high potential on forest natural resources. The biocapacity value of forest land is the highest value out of every other component in the region. The overall calculation of the biocapacity shown that the environmental carrying capacity and the natural resources of the island is high, and the region is highly potential for further developments. This also means development in agriculture with various technology, so that the exploitation is not solely on the forest land, for it would take a long time to regenerate.

Table 7. Ecological Footprint & Biocapacity of the Island of Papua

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	861,436	380	88,068	773,748	9,898,051	Reserve
Grazing Land	357,190	0	113,888	243,302	357,190	Reserve
Forest Land	383,003	0	53,810	329,193	9,165,747	Reserve
Fishing Grounds	282,055	214	262	282,007	401,566	Reserve
Carbon Uptake Land	19	0	0	19	0	-
Built Up Land	535,186	0	0	535,186	535,186	-
TOTAL	2,418,889	594	256,029	**2,163,454**	**20,357,741**	Reserve

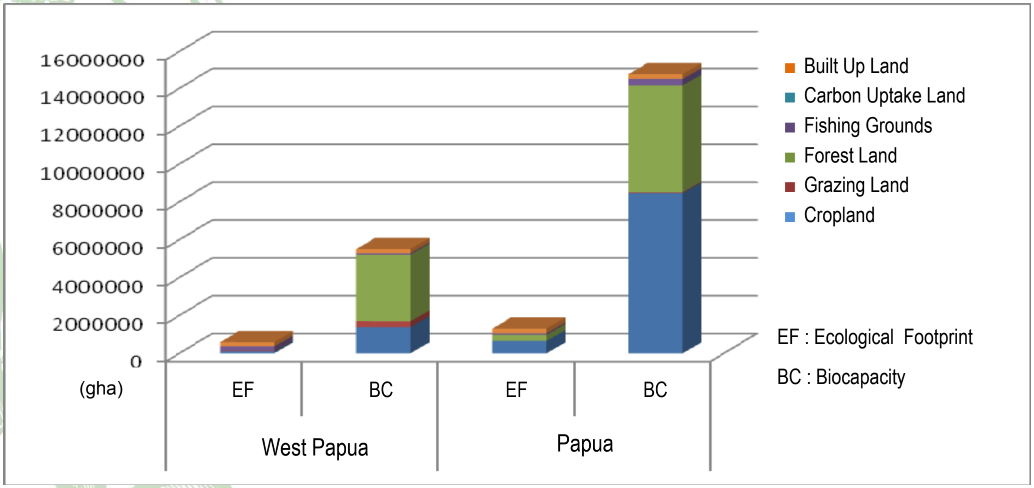

Figure 6. Ecological Footprint to Biocapacity by Province in Island of Papua

G. Ecological Footprint of the Island of Java

In general the biocapacity of the island of Java is deficit (its biocapacity value is lower than its ecological footprint value). The biggest sector in the island, agricultural has become the highest ecological footprint value out of the other components. Nevertheless it is still the main sector for income in the Province of Central Java, and it could supply the demand of its own population as well as others.

The carrying capacity of the Island of Java as the supplier of natural resources for forestry is only located in the Province of Banten, West Java and Central Java. Meanwhile for the fishing grounds components in all provinces has suffered deficit. The Province of DKI Jakarta has the highest ecological footprint in the carbon uptake land, followed by the Province of East Java. The ecological footprint data for the Island of Java are shown in the provincial level.

Table 8. Ecological Footprint & Biocapacity of the Province of DKI Jakarta

Land Use	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	4,343,805	437	Deficit
Grazing Land	1,715	10,045	Reserve
Forest Land	12,616	457	Deficit
Fishing Grounds	2,047015	133	Deficit
Carbon Uptake Land	7,016,882	0	-
Built Up Land	130,933	130,933	-
TOTAL	**13,552,967**	**142,005**	**Deficit**

The highest ecological deficit would come from the Province of DKI Jakarta, shown by the high ecological footprint value compared to its modest biocapacity value. This region is highly dependent on the surrounding regions for its supply on agriculture, livestock, and fishery. From all ecological footprint values in this province, the highest value comes from the carbon uptake component. This is caused by the higher use of energy by the population of DKI Jakarta rather than any other region, mainly for transportation and industrial purposes.

Table 9. Ecological Footprint & Biocapacity of the Province of Banten

Land Use	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	1,799,662	2,246,468	Reserve
Grazing Land	61,268	61,268	-
Forest Land	32,503	39,150	Reserve
Fishing Grounds	388,577	0	-
Carbon Uptake Land	303,604	0	-
Built Up Land	287,760	287,760	-
TOTAL	**2,873,374**	**2,634,645**	**Deficit**

Different from other provinces, the biocapacity value for cropland in the Province of Banten is still higher than its ecological footprint value. The same pattern can be seen also on its forest land, even though the difference is not significant, but the biocapacity of forest land is still higher than its ecological footprint. These figures reveal that the people of Banten is more efficient in using their resources than other provinces in the Island of Java. Furthermore, the Province of Banten also has high potential in agricultural sector, but it is yet to be utilized to its potential.

Table 10. Ecological Footprint & Biocapacity of the Province West Java

Land Use	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	11,628,485	8,497,350	Deficit
Grazing Land	251,029	251,029	-
Forest Land	137,651	211,545	Reserve
Fishing Grounds	2,010,487	22,126	Deficit
Carbon Uptake Land	2,249,759	0	-
Built Up Land	1,040,251	1,040,251	-
TOTAL	**17,317,662**	**10,022,301**	**Deficit**

Table 10 shows that the carrying capacity of the Province of West Java is still surplus, but only in the forest land components. The existence of several forest land in few of the highlands in West Java contributes to this condition. This condition has to sustain, and needs a special attention from the stakeholders, because the location of the province is at the upstream of national strategic area of Jabodetabekpunjur (Jakarta, Bogor, Depok, Tangerang, Bekasi, Puncak, Cianjur). As it is located in the upstream, its function as a catchment area to prevent or lessen the negative impact of potential flood and landslide.

As for the cropland and fishing ground components both are deficit. The carrying capacity of the Province of West Java as the supplier of both agricultural and fishery product are suffering deficit. Ecological footprint value for the Province of West Java is the second highest for the Island of Java.

Table 11. Ecological Footprint & Biocapacity of the Province of Central Java

Land Use	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	16,224,856	756,603	Deficit
Grazing Land	0	12.737	-
Forest Land	194,075	356,272	Reserve
Fishing Grounds	60,313	17,049	Deficit
Carbon Uptake Land	1,555,363	0	-
Built Up Land	237,227	237,227	-
TOTAL	**18,271,834**	**1,379,888**	**Deficit**

Like the province of West Java, the carrying capacity of the Province of Central Java has already deficit for cropland and fishing ground components. The components that is still surplus are grazing land and forest land.

From the overall calculation, the ecological footprint value of cropland is the biggest contributor. This is caused by the consumptive behavior of the population in the Province of Central Java or any other provinces towards the use of agricultural products, and also the negligence to acknowledge the environmental capacity in supplying it. Even though the significance is low, the capacity of forest land is still surplus, it is shown by the difference between the biocapacity value that is higher than the ecological footprint value.

Table 12. Ecological Footprint & Biocapacity of the Province of East Java

Land Use	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	4,079,377	217,107	Deficit
Grazing Land	117,030	117,030	-
Forest Land	3.691,916	2,277,175	Deficit
Fishing Grounds	378,308	33,102	Deficit
Carbon Uptake Land	4,687,132	0	-
Built Up Land	48,277	48,277	-
TOTAL	**13,002,039**	**2,692,692**	**Deficit**

It is shown in Table 12 that all components in the Province of East Java have suffered deficit. This is shown by higher ecological footprint value than its biocapacity. Different from other provinces in the Island of Java, where the highest component of ecological footprint came from cropland, in East Java, the highest component of ecological footprint came from carbon uptake land. This means that the population of East Java is more consumptive than of other provinces.

Other components have also suffered deficit in East Java, namely the cropland, forest land, and fishing grounds. This shows that the population of East Java consumed the product of these components more than the environmental capacity.

Table 13. Ecological Footprint & Biocapacity of the Province of DI Yogyakarta

Land Use	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	1,192,044	393,575	Deficit
Grazing Land	55,889	55,889	-
Forest Land	12,265	2,114	Deficit
Fishing Grounds	26,630	15,326	Deficit
Carbon Uptake Land	976,024	0	-
Built Up Land	225,896	225,896	-
TOTAL	**2,488,750**	**692,801**	**Deficit**

Similar with East Java, the Province of DI Yogyakarta has suffered deficit in almost all components. Higher ecological footprint value than its biocapacity in cropland, fishing ground, and forest land depicted that the consumption pattern is higher at those components than its capacity.

H. Ecological Footprint of the Island of Kalimantan (Borneo)

In general the biocapacity of each province in the island of Kalimantan (Borneo) is still greater than its ecological footprint. The highest value for biocapacity comes from its forest land. Both provinces of Central Kalimantan and South Kalimantan have the highest biocapacity value. The Island of Borneo is one of the biggest islands in Indonesia that has a vast forest land area. One of the contributing factors of high biocapacity value is that the reforestation of production forest that is still in progress, so it has yet to produce resources to its maximum.

For the agriculture component, Central Kalimantan has the highest value on biocapacity, this reveals that Central Kalimantan has a great potential for natural resources in agricultural sector. In spite of that, the ecological footprint of agriculture component has a low value. This means the natural resources of agriculture sector has not been explored to its potential. The calculations of ecological footprint of the Island of Kalimantan is shown in provincial level.

Table 14. Ecological Footprint & Biocapacity of the Province of West Kalimantan

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	1,296,658	10,404	21,143	1,285,920	0	-
Grazing Land	0	0	0	0	7,218,801	-
Forest Land	0	941	16,342	0	3,506,811	-
Fishing Grounds	0	3,737	866	2,871	133,103	Reserve
Carbon Uptake Land	361,693	103	2,609	359,187	0	-
Built Up Land	207,222	0	0	207,222	207,222	-
TOTAL	1,865,573	15,186	40,960	**1,855,200**	**11,065,937**	**Reserve**

Generally, carrying capacity for the Province of West Kalimantan as the supplier of resources in farming, forestry, and fishery products are still on the surplus side. From all components, the highest biocapacity value is the grazing land. This shows that the environmental capacity as a supplier for farming product is still relatively high. For the ecological footprint value, the highest came from cropland, with the highest contribution from its ecological footprint production.

Table 15. Ecological Footprint & Biocapacity of the Province of Central Kalimantan

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	229,936	0	0	229,936	5,631,332	Reserve
Grazing Land	27,356	0	0	27,356	957.572	Reserve
Forest Land	0	0	0	0	8,636,220	-
Fishing Grounds	411,021	0	0	411,021	3,019	Deficit
Carbon Uptake Land	727	123	1.161	0	0	-
Built Up Land	0	0	0	0	0	-
TOTAL	669,040	123	1.161	**668,314**	**15,228,143**	Reserve

On the whole, carrying capacity in the Province of Central Kalimantan as the supplier of resources is still surplus. Meanwhile, for the condition per land use components the cropland, grazing land, and forest land are all surplus. Highest biocapacity value for the forest land rather than any other land use components is because the preservation of forest as supplier for forestry products. The second highest biocapacity value came from cropland, this shows the high potential of developing agricultural sector in this region. Albeit the high potential in agricultural sector, the people of Central Kalimantan have yet to utilize the resources, or the demand for the agricultural product is not high in this region. This is shown by the ecological footprint value that is much lower than the environmental capacity (Table 15). The highest ecological footprint value is on fishing ground, as the result of high consumption of fishery product in the region.

Table 16. Ecological Footprint & Biocapacity of the Province of South Kalimantan

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	1,984,681	1,507,983	734,479	2,758,185	298,634	Deficit
Grazing Land	1,243,020	0	0	1,243,020	1,243,020	-
Forest Land	0	0	156,313	0	7,954,283	-
Fishing Grounds	808,004	0	1,271,624	0	24,548	-
Carbon Uptake Land	7,506	2,452,876	4,328	2,456,054	0	-
Built Up Land	18,474	0	0	18,474	18,474	-
TOTAL	4,061,685	3,960,859	2,166,745	**6,475,733**	**9,538,958**	**Reserve**

Different from the Province of Central Kalimantan, the high ecological footprint value for cropland on the Province of South Kalimantan is not balanced with its biocapacity value. This shows that the demand from the population towards cropland products and its consumption pattern is relatively high. Generally, from Table 16 we could tell that the carrying capacity of South Kalimantan is still surplus. Similar with the Province of Central Kalimantan, the highest biocapacity level is on the forest land component, compared to any other components. South Kalimantan has a high level of ecological footprint in carbon (2,456,054 gha) which is occurred due to its high ecological footprint import. The high consumption of energy is in order to fulfill its need for transportation of agricultural goods (import). This is also indicated by the high ecological footprint import value for cropland in South Kalimantan.

Table 17. Ecological Footprint & Biocapacity of the Province of East Kalimantan

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	3,332,856	3	0	3,332,860	1,284,869	Deficit
Grazing Land	3,081,693	2	0	3,081,694	3,081,693	-
Forest Land	53,227	0	0	53,227	5,713,033	Reserve
Fishing Grounds	650,948	0	0	650,948	0	-
Carbon Uptake Land	5,005	2,407	10,743	0	0	-
Built Up Land	2,184	0	0	2,184	2,184	-
TOTAL	7,125,912	2,413	10,743	**7,120,913**	**10,081,779**	**Reserve**

Just like the other provinces in the Island of Borneo, the carrying capacity in the Province of East Kalimantan is also surplus. Even so, the carrying capacity as the supplier of agricultural product has come to deficit. The two highest ecological footprint values came from the cropland and grazing land component. This shows high demand and consumption level for agricultural and farming products. The highest biocapacity value, compared to other components, is on forest land.

I. Ecological Footprint of Indonesia

Table 18. Recapitulation of Ecological Footprint & Biocapacity in Indonesia 2007

Land Use	$EF_{Production}$		EF_{Import}		EF_{Export}		$EF_{Consumption}$		Biocapacity (BC)		BC – EF [gha/ person]
	[gha]	[gha/ person]	[gha]	[gha/ person]	[gha]	[gha/ person]	[gha]	[gha/ person]	[gha]	[gha/ person]	
Cropland	132,128,012	0.57	11,005,696	0.05	61,028,663	0.26	82,105,045	0.35	81,179,238	0.35	0.00
Grazing Land	0	0.00	936,824	0.00	129,466	0.00	807,357	0.00	15,563,052	0.07	0.07
Forest Land	14,428,007	0.06	1,127,545	0.00	3,728,450	0.02	11,827,101	0.05	49,951,783	0.21	0.16
Fishing Grounds	41,679,658	0.18	1,404,101	0.01	214,550	0.00	42,869,209	0.18	103,461,548	0.44	0.26
Carbon Uptake Land	99,619,221	0.43	33,165	0.00	12,022	0.00	99,640,364	0.43	0	0.00	-0.43
Built Up Land	11,452,235	0.05	0	0,00	0	0.00	11,452,235	0.05	11,452,235	0.00	-0.05
TOTAL	299,307,133	1.29	14,507,331	0.06	65,113,152	0.28	**248,701,312**	**1.07**	**261,607,856**	**1.12**	**0.05**

Table 18 showed the calculation of each component of ecological footprint and biocapacity in Indonesia. We could see from the table there are surplus on land carrying capacity (the difference between biocapacity and ecological footprint) of grazing land, forest land, and fishing grounds. The highest component for the land carrying capacity is fishing grounds (0.26 gha/person). High biocapacity level for fishing ground is mainly due to the location of most regions in Indonesia are on the coastlines with high potential for fishing grounds with high biodiversity of the marine-ecology. For the cropland components the ratio between the ecological footprint value and its biocapacity value are similar, that is 0.35 gha/person. This shows that the demand from the population towards the agricultural product and the environmental capacity as the supplier of agricultural product are still aligned.

The carrying capacity for forest land supplier is the second highest in Indonesia (right after the fishing grounds) that is 0.16 gha/person. Forest land in Indonesia has two very opposite functions, as a location to preserve the environment and the ecosystem, and part of the forest land is also used for other activities, such as plantation, agriculture, housing and mining. This would potentially lower the carrying capacity of forest land. Nevertheless, the ratio between the biocapacity and ecological footprint value for this component is still high, compared to the other components. So it is safe to say, that in utilizing the forest land, Indonesian still does prioritize the achievement of sustainability.

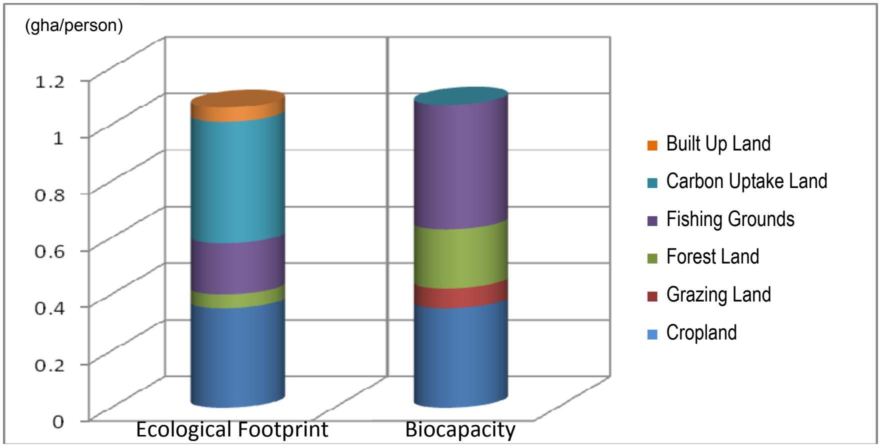

Figure 7. Ecological Footprint per Component of Indonesia 2007

Meanwhile, the carrying capacities that have suffered deficit are the carbon uptake land and built up land. The high value for both of the components is mainly contributed by its ecological footprint production value. For the carbon uptake land, its ecological footprint value is high all throughout the country. The contributing factors for high ecological footprint are the use of high-emission private vehicles, a lot of plantations (palm oil, rubber tree, etc) do not manage their waste properly, a lot of forest land conversion to other functions (non-forestry) such as agricultural activities, plantation, built-up land, or industrial activity.

Table 19. Recapitulation of Ecological Footprint and Biocapacity per Capita of the Islands in Indonesia 2007

Island/Isles	EF (gha/person)	BC (gha/person)	ED (gha/person)	Category (BC-EF)
Sumatera	1.56	1.96	0.40	Reserve
Jawa	1.01	0.20	-0.81	Deficit
Bali	1.76	0.24	-1.52	Deficit
Kalimantan	1.26	4.05	2.79	Reserve
Sulawesi	1.46	1.63	0.17	Reserve
Nusa Tenggara	0.45	0.47	0.02	Reserve
Maluku	1.20	1.25	0.05	Reserve
Papua	0.79	7.43	6.64	Reserve
Indonesia	1,07	1,12	0,05	Reserve

Table 19 shows ecological footprint, biocapacity, and ecological footprint deficit value that depict whether a region has exceeded its carrying capacity. The calculation shows that the people of the Island of Java and the Island of Bali have used up their natural resources beyond its carrying capacity, with each ecological footprint deficit -0.81 gha/person and -1.52 gha/person consequtively. On the other hand, the highest two surplus regions in Indonesia are the Island of Papua and the Island of Borneo, with 6.64 gha/person and 2.79 gha/person respectively.

The highest ecological footprint value is in the Island of Bali with 1.76 gha/person, and the lowest is in the Lesser Sunda Isles with 0.45 gha/person. The highest biocapacity value is in the Island of Papua with 7.43 gha/person, and the lowest is in the Island of Java with 0.20 gha/person.

The overall biocapacity value in Indonesia is 1.12 gha/person still higher than its ecological footprint value of 1.07 gha/person, but the difference is already not significant. This result suggests as reference for Indonesia, that in order to fulfill the needs and to utilize the natural resources, it needs to consider carefully and wisely the carrying capacity of related region in particular, and of national concerns in general.

D. RECOMMENDATION

The universal concept of sustainability is heavily relying on the people ability to keep and preserve the natural capital continuously, for current generation without disregarding the future generation. Ecological footprint concept that was developed by William Rees and Mathis Wackernagel (1996) of GFN-USA, is a method that offers more practical way to implement and comprehend the sustainability of a region. Its ecological footprint concept is based on the calculation of the consumption level of natural resources by human beings.

The result and analysis of the calculation are suggested as a reference by stakeholders in order to put formulate policy and development programs mainstreaming sustainable development that do concern the future generations.

On macro policy level, the execution of development needs to focus on distributing “burden” equally, so that no region will suffer higher level of deficiency like that of the Island of Java and Bali. This might seems very hard, but nees to be considered. Albeit that fact, we could still come with another approach on lessening the environmental burden of the two regions for instance by stimulating growth in other regions aside of Java and Bali, which hopefully attract the population to move to those regions, creating a more efficient collecting-distributing pattern and the use of technology.

On the micro policy level, policies that emphasized on increasing the regional biocapacity and also the efficient use of natural resources needs to be implemented. The purpose of increasing the biocapacity level is to supply the natural resources in sufficient level, including the supply in environmental services. Meanwhile the efficiency of the utilization of natural resources is necessary in order to lessen the “pressure” to the environment.

Specifically, the regional policy can be focus on the ecological footprint components (agriculture, energy, fishery, forestry, farmland, and built-up land). With the proper policy, the productivity of cropland, grazing land, fishing ground, forestry, and built-up land can be increased. In other words, an effort is required to increase the yield factor from each of those components. Aside from that, there is also a need of community to change the consumption pattern so we do not use resources profusely, either in using energy and any form of emitting waste.

The following are some recommendations for development policies and strategies based on ecological footprint:

POLICY	STRATEGY
Spatial Management based on Ecological Footprint	To develop optimized service center system and infrastructure network that can support the production process and distribution process to its maximum, namely, distributing socio-economic centers according to population distribution pattern and developing integrated transportation system (land, sea and air). To regulate efficient land use in order to decrease the demand for transportation and the use of energy accordingly, by implementing the concept of compact city development. To implement smart growth concept for urban areas or regional development that can effectively and comprehensively measure and repressed the ecological footprint. Disaster mitigation (natural and manmade) to protect the population and productive cultivated areas through regional management, infrastructure development, as well as implementation of good environmental management and zoning regulation.

POLICY	STRATEGY
Improving land productivity, decreasing deforestation for the use of agriculture, farming, and fishing	To reclaim the lands that have low bioproductivity. To develop and utilize alternative energy in order to decrease the use of fossil fuels. To preserve, conserve and revitalize forests as suppliers to environmental services, including preservation and conservation of water resources and carbon intake, as well as observation and conservation of biodiversity. To rehabilitate critical lands, either to be developed as productive cultivated region (plantation, horticulture, and built-up land) or as conservation area (protected forest and conservation forest). To manage the exploitation of natural resources to ensure the supply for the needs of future generation, including exploitation of fishing grounds so it does not exceed the sustainable production level. To develop and utilize variety of vegetation that can produce the highest amount of crops, to implement integrated agricultural management, and to increase efficiency on the use of irrigation system. To avoid extensive practices that increase production level. To develop and implement agriculture, fishery, and farming technologies that increase productivity per land unit. To develop prime agricultural products that is appropriate for the regional capacity for each region. To develop and use variety of agricultural crops that can give the most valuable harvest. To optimize the use of fertilizer and pesticide in agricultural and fishery, with minimizing the development of intensive farming.

POLICY	STRATEGY
Improving knowledge and technology awareness and mastership for production of goods (extraction, processing, etc)	To improve the public awareness to change consumption pattern so it will not use the resources profusely, including campaigns to reduce, reuse and recycle (3R) in waste management. To push forward the development and utilization of clean development management ang technology. To develop environmental friendly technology in processing essential goods for the people. Knowledge sharing between region/provinces and/or cross-sector, especially in the development of natural resources and sustainable production. To enhance basic knowledge on agricultural, farming (grazing), fishing management and extraction and processing. To improve the involvement of research institutes, universities and non-government organization to disseminate knowledge on production and post-consumption technology.
Increasing welfare without rising consumption level	To foster sustainability principals in utilizing natural resources. To preserve the biodiversity stock and granting services from every ecosystem to support every living activity (locally and globally). To ensure the functions of the natural ecosystem for every agricultural, grazing, fishing, activities, and also forest ecosystem that function as public forest or other functions. To develop sustainable production activity on every sectors. To ensure the delivery of basic needs for every people. To increase awareness and attention to sustainable consumption. To use the unrenewable goods wisely and efficiently. To utilize and develop alternative energy to decrease the use of fossil fuels.

POLICY	STRATEGY
Regulating export activity	To redesign the existing export policy including the investment policy, especially in agriculture, inland fishing and forestry. To enhance supervision on export activities, especially of natural produced goods (fish, woods); including law enforcement on illegal activities (illegal logging and illegal fishing).

E. CLOSING REMARKS

Ecological footprint is a tool to recognize the level of sustainability of a region, from its consumption pattern and environmental capacity in supplying resources. As a tool, the accuracy of ecological footprint are relying on the quality of data used in the calculation.

In the calculation of ecological footprint of Indonesia, the availability of data is one of the constraints, such as:

a. Limited information and data of the consumption pattern and provincial export-import;

b. The difficulty of accessing data that is not available in Central Statistical Bureau (BPS) such as energy supply to a region;

c. The relevancy of the information with the current conditions 2009 calculation relied on data published in 2008 which is calculated from 2007.

Aside from the difficulty of obtaining data, the methods that was developed by GFN has yet to be perfectly compatible with the real condition of Indonesia. This is shown by the variety of commodities set up by GFN that is not available in the tropical regions. In contrary a lot of Indonesian commodity is not available on GFN's list.

Albeit all the constraints given, the result of the study of ecological footprint is expected to give a portrait of where we are right now in terms of ecological sustainability in Indonesia. This knowledge is hoped to become deciding factor in formulating policy, strategy, and development programs that is more conscious to the sustainable issues, including the implementation of spatial management.

It is recommended that the study such as ecological footprint is conducted periodically. Aside from having to know the state of current development, it is also an opportunity to give chance to modify the method of calculation so that it becomes more applicable to the condition of Indonesia. The latter will of course need collaborations from the Ministry of Public Works cq. Directorate General of Spatial Management, research institutions/universities, other ministries, as well as the Global Footprint Network.

REFERENCES

Direktorat Jenderal Penataan Ruang, Kementerian Pekerjaan Umum. 2009. Kajian Telapak Ekologis Pulau Sumatera dan Pulau Sulawesi.

Direktorat Jenderal Penataan Ruang, Kementerian Pekerjaan Umum. 2009. Kajian Telapak Ekologis Pulau Bali, Kepulauan Nusa Tenggara, Kepulauan Maluku, dan Pulau Papua.

Khanna. 1999. *Carrying-Capacity As A Basic For Sustainable Development*.

Kitzes, J., A. Galli, S.M. Rizk, A. REED and M. Wackernagel. 2008. *Guidebook to the National Footprint Accounts : 2008 Edition*. Oakland : Global Footprint Network.

Wackernagel, Mathis and Ress, William E. 1996. *Our Ecological Footprint: Reducing Human Impact on The Earth*. Canada: New Society Publishers.

World Wide Fund on Nature (WWF) – China Council for International Cooperation on Environment and Development (CCICED).2006. *Report on Ecological Footprint in China*.

APPENDIX

Tabel L-1. Ecological Footprint & Biocapacity of Province of NAD

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	3,397,569	815	9,773	3,388,611	6,193,990	Reserve
Grazing Land	5,717	0	0	5,717	5,717	-
Forest Land	2,106,113	0	0	2,106,113	1,248,296	Deficit
Fishing Grounds	1,583,130	77,157	553,008	1,107,279	18,932	Deficit
Carbon Uptake Land	3,610	0	0	3,610	0	-
Built Up Land	721,004	0	0	721,004	721,004	-
TOTAL	7,817,143	77,972	562,781	**7,332,334**	**8,187,939**	**Reserve**

Tabel L-2. Ecological Footprint & Biocapacity of Province of North Sumatera

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	14,812,846	686,211	8,746,046	6,753,011	19,072,722	Reserve
Grazing Land	0	4,276	18	4,258	0	-
Forest Land	259,911	94	369	259,636	127,162	Deficit
Fishing Grounds	2,980,023	0	0	2,980,023	57,575	Deficit
Carbon Uptake Land	13,600	55	2,638	11,017	0	-
Built Up Land	1,973,341	0	0	1,973,341	1,973,341	-
TOTAL	20,039,722	690,636	8,749,072	**11,981,286**	**21,230,801**	**Reserve**

Tabel L-3. Ecological Footprint & Biocapacity of Province of West Sumatera

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	3,037,905	2,238	2,261,039	779,104	5,553,218	Reserve
Grazing Land	914	0	0	914	914	-
Forest Land	43,437	94	3	43,529	41,835	Deficit
Fishing Grounds	1,493,486	0	0	1,493,486	67,799	Deficit
Carbon Uptake Land	4,858	4	706	4,155	0	-
Built Up Land	323,775	0	0	323,775	323,775	-
TOTAL	4,904,376	2,336	2,261,748	**2,644,964**	**8,322,181**	**Reserve**

Tabel L-4. Ecological Footprint & Biocapacity of Province of Riau

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	12,291,441	20,100	222,003	12,089,537	4,195,846	Deficit
Grazing Land	488,344	135	0	488,478	488,344	-
Forest Land	86,753	5	4,953	81,805	1,500,912	Reserve
Fishing Grounds	500,942	890	0	501,832	0	-
Carbon Uptake Land	6,628	0	8	6,621	0	-
Built Up Land	464,295	0	0	464,295	464,295	-
TOTAL	13,838,403	21,130	226,964	**13,632,568**	**6,649,397**	**Deficit**

Tabel L-5. Ecological Footprint & Biocapacity of Province of Kepulauan Riau

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	576,659	65,593	791,368	0	2,532,381	-
Grazing Land	33,698	18,297	3	51,992	2,749	Deficit
Forest Land	0	30	118	0	0	-
Fishing Grounds	1,151,446	6,047	0	1,157,493	947	Deficit
Carbon Uptake Land	2,707	35	560	2,182	0	-
Built Up Land	849,820	0	0	849,820	849,820	-
TOTAL	2,614,329	90,002	792,048	**2,061,486**	**3,385,896**	**Reserve**

Tabel L-6. Ecological Footprint & Biocapacity of Province of Bangka Belitung

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	741,346	0	181,488	559,858	2,247,611	Reserve
Grazing Land	35,879	0	0	35,879	35,615	-
Forest Land	0	1	0	1	0	-
Fishing Grounds	1,257,477	0	0	1,257,477	561	Deficit
Carbon Uptake Land	933	0	131	802	0	-
Built Up Land	287,230	0	0	287,230	287,230	-
TOTAL	2,322,865	1	181,619	**2,141,247**	**2,571,017**	**Reserve**

Tabel L-7. Ecological Footprint & Biocapacity of Province of Jambi

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	9,397,837	4,019	5,169	9,396,687	6,780,299	Deficit
Grazing Land	0	88	0	88	1,431	Reserve
Forest Land	299,455	0	773,133	0	714,134	-
Fishing Grounds	70,468	1,349	0	71,817	2,614	Deficit
Carbon Uptake Land	3,619	0	0	3,618	0	-
Built Up Land	1,187,085	0	0	1,187,085	1,187,085	-
TOTAL	10,958,464	5,456	778,302	**10,659,295**	**8,685,563**	**Deficit**

Tabel L-8. Ecological Footprint & Biocapacity of Province of Bengkulu

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	2,296,968	1,628	851	2,297,744	608,989	Deficit
Grazing Land	0	0	0	0	60,066	-
Forest Land	10,608	0	26,710	0	732,025	-
Fishing Grounds	363,968	0	0	363,968	0	-
Carbon Uptake Land	1,256	3	1,324	0	0	-
Built Up Land	44,672	0	0	44,672	44,672	-
TOTAL	2,717,472	1,631	28,885	**2,706,385**	**1,445,753**	**Deficit**

Tabel L-9. Ecological Footprint & Biocapacity of Province of South Sumatera

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	16,886,586	22,017	1,086,917	15,821,686	24,307,647	Reserve
Grazing Land	0	0	0	0	183,379	-
Forest Land	1,482,656	3	6,010,126	0	1,219,514	-
Fishing Grounds	313,363	77,157	553,008	0	28,752	-
Carbon Uptake Land	5,606	0	348	5,258	0	-
Built Up Land	1,734,570	0	0	1,734,570	1,734,570	-
TOTAL	20,422,780	99,177	7,650,400	**17,561,514**	**27,473,861**	**Reserve**

Tabel L-10. Ecological Footprint & Biocapacity of Province of Lampung

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	5,082,346	242,604	922,267	4,402,684	4,168,835	Deficit
Grazing Land	731,823	7	0	731,831	0	-
Forest Land	257,486	423	0	257,910	460,890	Reserve
Fishing Grounds	801,051	36	0	801,086	104	Deficit
Carbon Uptake Land	4,434	173	895	3,713	0	-
Built Up Land	663,642	0	0	663,642	663,623	-
TOTAL	7,540,783	243,243	923,161	**6,860,865**	**5,293,452**	**Deficit**

Tabel L-11 Ecological Footprint & Biocapacity of Province of North Sulawesi

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	1,184,576	0.01	1,931,463	0	2,498,379	-
Grazing Land	0	0.00	0	0	402,278	-
Forest Land	11,783	0.00	4	11,780	240,239	Reserve
Fishing Grounds	3,776,800	0.06	0	3,776,800	106,729	Deficit
Carbon Uptake Land	298	0.01	797	0	0	-
Built Up Land	127,161	0.00	0	127,161	127,161	-
TOTAL	5,100,618	0.08	1,932,264	**3,915,741**	**3,374,786**	**Deficit**

Tabel L-12. Ecological Footprint & Biocapacity of Province of Central Sulawesi

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	1,520,425	0	0	1,520,425	2,878,813	Reserve
Grazing Land	0	0	0	0	695,654	-
Forest Land	19,813	0	5	19,807	2,327,811	Reserve
Fishing Grounds	947,037	0	3	947,034	3,932	Deficit
Carbon Uptake Land	1,887	0	32	1,855	0	-
Built Up Land	254,313	0	0	254,313	254,313	-
TOTAL	2,743,475	0	40	**2,743,434**	**6,160,523**	**Reserve**

Tabel L-13. Ecological Footprint & Biocapacity of Province of South Sulawesi

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	2,782,395	23,648	0	2,806,043	5,691,986	Reserve
Grazing Land	0	0	0	0	147,596	-
Forest Land	16,669	16	40	16,644	1,177,451	Reserve
Fishing Grounds	2,038,340	32	0	2,038,372	13,175	Deficit
Carbon Uptake Land	4,166	0	2,149	2,016	0	-
Built Up Land	289,347	0	0	289,347	289,347	-
TOTAL	5,130,916	23,695	2,190	**5,152,422**	**7,319,554**	**Reserve**

Tabel L-14. Ecological Footprint & Biocapacity of Province of Southeast Sulawesi

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	1,165,031	0	18,080	1,146,951	1,976,784	Reserve
Grazing Land	0	0	0	0	993,066	-
Forest Land	37,786	0	8	37,778	1,024,424	Reserve
Fishing Grounds	1,637,658	0	0	1,637,658	13,928	Deficit
Carbon Uptake Land	1,685	0	21,203	0	0	-
Built Up Land	271,452	0	0	271,452	271,452	-
TOTAL	3,113,612	0	39,291	**3,093,839**	**4,279,653**	**Reserve**

Tabel L-15. Ecological Footprint & Biocapacity of Province of Gorontalo

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	673,821	5,053	45,729	633,145	461,423	Deficit
Grazing Land	0	0	0	0	151,242	-
Forest Land	16,669	0	620	16,049	349,432	Reserve
Fishing Grounds	719,521	0	0	719,521	2,730,146	Reserve
Carbon Uptake Land	1,040	0	27	1,013	0	-
Built Up Land	35,811	0	0	35,811	35,811	-
TOTAL	1,446,862	5,053	46,377	**1,405,538**	**3,728,054**	**Reserve**

Tabel L-16. Ecological Footprint & Biocapacity of Province of West Sulawesi

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	909,245	0	0	909,245	1,011,994	Reserve
Grazing Land	0	0	0	0	0	-
Forest Land	2,341	0	0	2,341	720,785	Reserve
Fishing Grounds	599,402	0	0	599,402	0	-
Carbon Uptake Land	605	0	39	566	0	-
Built Up Land	17,097	0	0	17,097	17,097	-
TOTAL	1,528,690	0	39	**1,528,651**	**1,749,876**	**Reserve**

Tabel L-17 Ecological Footprint & Biocapacity of Province of West Nusa Tenggara

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	2,125,497	129,724	25,841	2,229,380	432,392	Deficit
Grazing Land	13,411	0	0	13,411	681,910	Reserve
Forest Land	22,768	0	0	22,768	270,963	Reserve
Fishing Grounds	527,957	0	12	527,944	7,991	Deficit
Carbon Uptake Land	2	0	0	2	0	-
Built Up Land	35,702	0	0	35,702	35,702	-
TOTAL	2,725,336	129,724	25,853	**2,829,207**	**1,428,959**	**Deficit**

Tabel L-18. Ecological Footprint & Biocapacity of Province of East Nusa Tenggara

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	1,294,132	12,614	717,084	589,662	416,311	Deficit
Grazing Land	385,677	0	21,016	364,661	1,173,877	Reserve
Forest Land	3,149	0	26	3,123	638,278	Reserve
Fishing Grounds	433,287	0	5	433,283	1,291	Deficit
Carbon Uptake Land	9	108	0	116	0	-
Built Up Land	65,635	0	0	65,635	65,635	-
TOTAL	2,181,889	12,721	738,131	**1,456,479**	**2,295,392**	**Reserve**

Tabel L-19. Ecological Footprint & Biocapacity of Province of Maluku

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	783,303	9,854	130,044	663,114	658,248	Deficit
Grazing Land	14,360	0	0	14,360	746,437	Reserve
Forest Land	8,495	0	0	8,495	1,002	Deficit
Fishing Grounds	682,087	610	7,808	674,889	26,587	Deficit
Carbon Uptake Land	2	0	0	2	0	-
Built Up Land	17,958	0	0	17.958	17,958	-
TOTAL	1,506,206	10,464	137,851	**1,378,819**	**1.450,233**	**Reserve**

Tabel L-20. Ecological Footprint & Biocapacity of Provinceof North Maluku

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	159,418	0	0	159,418	54,683	Deficit
Grazing Land	92,913	0	0	92,913	92,913	-
Forest Land	136,607	0	467	136,141	1,488,364	Reserve
Fishing Grounds	460,898	0	33,588	427,310	5,123	Deficit
Carbon Uptake Land	3	0	3	1	0	-
Built Up Land	7,485	0	0	7,485	7,485	-
TOTAL	857,325	0	34,058	**823,267**	**1,648,567**	**Reserve**

Tabel L-21. Ecological Footprint & Biocapacity of Province of Papua

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	756,729	380	104,056	653,053	8,463,199	Reserve
Grazing Land	46,175	0	103,075	0	46,175	-
Forest Land	377,730	0	53,810	323,920	5,648,398	Reserve
Fishing Grounds	71,843	231	295	71,779	335,445	Reserve
Carbon Uptake Land	10	0	0	10	0	-
Built Up Land	253,947	0	0	253,947	253,947	-
TOTAL	1,506,434	611	261,236	**1,302,709**	**14,747,164**	Reserve

Tabel L-22 Ecological Footprint & Biocapacity of Province Papua Barat

Land Use	$EF_{Production}$ (gha)	EF_{Import} (gha)	EF_{Export} (gha)	$EF_{Consumption}$ (gha)	Biocapacity (BC) (gha)	BC-EF
Cropland	106,169	0	0	106,169	1,379,613	Reserve
Grazing Land	36,398	0	0	36,398	311,015	Reserve
Forest Land	5,274	0	0	5,274	3,517,349	Reserve
Fishing Grounds	210,212	0	57	210,155	66,121	Deficit
Carbon Uptake Land	9	0	0	9	0	-
Built Up Land	227,851	0	0	227,851	227,851	-
TOTAL	585,912	0	57	**585,855**	**5,501,950**	Reserve

Tabel L-23. Recapitulation of Ecological Footprint & Biocapacity Per Provinve in Indonesia

Province (Island/Isles)	EF (gha/person)	BC (gha/person)	BC – EF (gha/person)	Category
NAD	1.74	1.94	0.20	Reserve
North Sumatera	0.93	1.65	0.72	Reserve
West Sumatera	0.56	1.21	0.65	Reserve
Riau	2.69	1.31	-1.38	Deficit
Jambi	3.89	3.17	-0.72	Deficit
South Sumatera	2.50	3.91	1.41	Reserve
Bengkulu	1.67	0.89	-0.78	Deficit
Lampung	0.94	0.73	-0.21	Deficit
Bangka Belitung	1.93	2.32	0.39	Reserve
Kepulauan Riau	1.48	2.43	0.95	Reserve
Island of Sumatera	1.56	1.96	0.40	**Reserve**
North Sulawesi	1.79	1.54	-0.25	Deficit
Central Sulawesi	1.14	2.57	1.43	Reserve
South Sulawesi	0.67	0.95	0.28	Reserve
Southeast Sulawesi	1.52	2.11	0.59	Reserve
Gorontalo	1.46	3.88	2.42	Reserve
West Sulawesi	1.50	1.72	0.22	Reserve
Island of Sulawesi	1.46	1.63	0.17	**Reserve**
Bali	1.76	0.24	-1.52	Deficit
West Nusa Tenggara	0.65	0.33	-0.32	Deficit
East Nusa Tenggara	0.33	0.52	0.19	Reserve
Isles of Nusa Tenggara	0.45	0.47	0.02	**Reserve**
West Papua	0.81	7.61	6.80	Reserve
Papua	0.65	7.32	6.67	Reserve
Island of Papua	0.79	7.43	6.64	**Reserve**

Province (Island/Isles)	EF (gha/person)	BC (gha/person)	BC – EF (gha/person)	Category
Maluku	0.97	1.02	0.05	Reserve
North Maluku	0.87	1.74	0.87	Reserve
Isles of Maluku	1.20	1.25	0.05	**Reserve**
DKI Jakarta	1.48	0.02	-1.46	Deficit
Banten	0.30	0.28	-0.02	Deficit
West Java	0.42	0.24	-0.18	Deficit
Central Java	1.81	0.14	-1.67	Deficit
East Java	1.29	0.27	-1.08	Deficit
DI Yogyakarta	0.74	0.21	-0.53	Deficit
Island of Java	1.01	0.20	-0.81	**Deficit**
West Kalimantan	0.44	2.65	2.21	Reserve
Central Kalimantan	0.33	7.44	7.11	Reserve
South Kalimantan	1.91	2.81	0.90	Reserve
East Kalimantan	2.35	3.33	0.98	Reserve
Island of Kalimantan	1.26	4.05	2.79	Reserve
Indonesia	1.07	1.12	0.05	**Reserve**