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**Ecosystem Services May Provide Large Economic Values in
Kenya and Vietnam**

**A Value Transfer Application Based on Results from
a Systematic Literature Review**

Upeksha Hettiarachchi

Wei Zhang

Thuy Thu Pham

Kristin Davis

Carlo Fadda

Natural Resources and Resilience Unit

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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AUTHORS

Upeksha Hettiarachchi (U.Hettiarachchi@cgiar.org) is a research analyst in the Natural Resources and Resilience unit (NRR), Transformation Strategies Department of the International Food Policy Research Institute, Washington DC, USA.

Wei Zhang (w.zhang@cgiar.org) is a senior research fellow in the Natural Resources and Resilience unit, Transformation Strategies Department of the International Food Policy Research Institute, Washington DC, USA.

Thuy Thu Pham (t.pham@CIFOR-ICRAF.org; thuthuy.pham@adelaide.edu.au) is a senior associate at Center for International Forestry Research, Bogor, Indonesia and Future Making Fellow at University of Adelaide, Adelaide, Australia.

Kristin Davis (k.davis@cgiar.org) is a senior research fellow in the Natural Resources and Resilience unit, Transformation Strategies Department of the International Food Policy Research Institute, Knysna, South Africa.

Carlo Fadda (c.fadda@cgiar.org) is Lever Director (principal scientist), Biodiversity for Food & Agriculture, of the Alliance Bioversity International and CIAT, Nairobi, Kenya

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ABSTRACT

This study focuses on the valuation of ecosystem services in Kenya and Vietnam, two countries that have received much attention from the international development community for their biodiversity significance, opportunities for scaling, climate and poverty challenges, and political will. Using The Economics of Ecosystems and Biodiversity (TEEB) framework and the Millenium Ecosystem Assessment (MEA), this study estimates per hectare values of ecosystem services in Kenya and Vietnam based on a systematic literature review of studies on the values of ecosystem services in both countries. Provisioning services, such as medicines, timber, and non-timber forest products were better studied than regulating, supporting and cultural ecosystem services, underscoring the need for further research to better estimate the values of non-tangible services which would improve the estimation of total value of ecosystem services in Kenya and Vietnam. To complement the national level analysis, we selected forest biomes to conduct a value transfer analysis. Forests provide ecosystem service benefits worth \$25.78 billion for Kenya and \$35.6 billion in Vietnam in 2022 USD. In comparison, the agricultural sector contributed \$48.50 billion to Vietnam's GDP and \$24.10 billion to Kenya's GDP in 2021. The per hectare values for ecosystem services are used in a value transfer analysis to estimate the total value of forest ecosystem services in Vietnam and Kenya. The average per hectare value of ecosystem services provided by forests in Kenya is \$5,718.50 ha⁻¹ yr⁻¹ estimated within a range spanning \$1,609.44 to \$15,606.62 ha⁻¹ yr⁻¹, while Vietnam's forests demonstrate an average value of \$3,650.20 ha⁻¹ yr⁻¹, with a range of \$84.93 to \$8,978.16 ha⁻¹ yr⁻¹. We project the loss of forests into 2050 and estimate the annual economic loss of ecosystem services at \$48.08 million for Kenya and \$76.29 million for Vietnam, respectively, if deforestation and forest degradation continue at the current rates. Our approach presents a comprehensive overview of diverse ecosystem services, equipping policymakers with a nuanced comprehension of ecosystems' inherent value. By consolidating values from the literature into a national-level estimate, we provide compelling evidence at a broader scale for informed decision-making. Despite the well-known limitations of value transfer method and with caveats, the values presented in our paper can provide a guiding reference for incorporating these estimations into broader policymaking endeavors.

Keywords: biodiversity, deforestation, ecosystem services, ecosystems, forests, Kenya, policy, valuation, value transfer, Vietnam

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Introduction

Climate change and natural resource degradation impede our ability to meet people's food demands and nutritional needs, affecting agroecosystems and all life on Earth in the long run. Many agrifood system players now recognize the critical need to prevent biodiversity loss and degradation of water, land, and forests (FAO, 2019). These ecosystems provide crucial services such as provision of timber, food and genetic resources and non-tangible services such as carbon sequestration, maintenance of soil fertility and protection against extreme events. Despite the provision of these services, ecosystems are threatened by human activity which has resulted in deforestation and degradation of natural resources. As many of these services are not reflected on the market, societies lack complete information about the value of these ecosystem services, leading to suboptimal decisions about ecosystem management. Valuation of these services serves as a tool to "recalibrate the faulty economic compass" (TEEB, 2010) and integrating the economic valuation of ecosystem services provided by ecosystems into decision-making is essential to ensure the long-term resilience of the natural resources that support human life.

The Millennium Ecosystem Assessment (2005) defines ecosystem services as "the benefits people obtain from ecosystems." Expressing the complex relationships between nature and society in monetary terms has grown increasingly popular in environmental science, economics, and policy as ecosystem service valuation can be used to understand the trade-offs associated with land use decisions, conservation efforts, and policies (TEEB, 2010; UNEP, 2011; Hasan et al., 2020; Sandhu et al., 2023). For example, according to IPBES report (2019) the steep increase in crop production and raw timber harvesting resulted in land degradation which could lead to reduced productivity up to 23% while loss of pollinators alone is estimated to cost between \$235 billion and \$577 billion in annual global crop output. Ecosystem services also provide the pathway through which the goals of global frameworks such as the Sustainable Development Goals and the Convention on Biological Diversity can be achieved (De Groot et al., 2003; Yang et al., 2020).

This study focuses on the valuation of ecosystem services in Kenya and Vietnam, two countries that have received much attention from the international development community for their biodiversity significance, opportunities for scaling, climate and poverty challenges, and political will.

Ecosystem services in Kenya are wide and varied, ranging from soil protection and carbon sequestration provided by mangrove forests to cultural values provided from species such as the *mugumo* (native fig) tree (Karangi, 2008; UNEP, 2019). Kenyan forests play a significant role in soil erosion control and water catchment protection. They serve as a valuable source of timber and fuel for local communities, while also yielding non-timber forest products (NTFPs) like medicine, resin, and essential oils. Forest ecosystems in Kenya are incredibly important for biodiversity as they provide habitats for approximately 40% of larger mammals, 30% of birds, and 35% of butterflies in Kenya (Wass, 1995). However, biodiversity faces threats such as encroachment and loss of migration corridors (Okello and Kiringe, 2010). According to the Global Forest Watch (GFW) (2022), Kenya has experienced a 10% decrease in tree cover from 2000 - 2020. Between the years 2002 to 2022, Kenya lost 50.7 thousand hectares of primary forest, and tree cover decreased by 375 thousand hectares during the same period, with shifting agriculture being the primary driver of deforestation.

In Vietnam, mangrove forests provide provisioning ecosystem services through mangrove-shrimp farming in coastal ecosystems and other supporting and regulating services such as protection against extreme events and nurseries for juvenile fish for example (Dang et al, 2022; Yen, 2020; Getzner and Islam, 2020; Nguyen et al., 2022). Forests in Vietnam provide services such soil protection, water regulation and provision of food (Pham et al., 2021; Ton et al., 2017). Vietnam is also a crucial global biodiversity hotspot ranked among the top 10 globally but the country faces a severe threat from the alarming rate of biodiversity loss (Nguyen and Jones, 2022). This rapid biodiversity loss is attributed to logging, agricultural conversion, and wildfires, exacerbating the challenges posed by deforestation (Duwe, 2022). The provision of ecosystem services is being undermined as the GFW data reveals that

from 2001 to 2022, Vietnam lost 3.42 million hectares of tree cover, primarily due to commodity driven deforestation. The dominant drivers of this loss include the establishment of mono-crop plantations as planted forests (GFW, 2022). These plantations are of a lower forest quality compared to diverse primary forests, and offer fewer ecosystem services (McElwee et al., 2014). The decline in forest quality is also attributed to uncontrolled resource extraction (Cochard et al., 2016).

The importance of ecosystem services in Kenya and Vietnam is amplified as local communities rely heavily on these services for their livelihoods (Kinuthia et al. 2023; Langat et al., 2016). In Kenya, 71% of the population lives in rural areas, while in Vietnam, this figure stands at 61% (World Bank, 2022). Rural communities depend on activities such as harvesting forest products and subsistence agriculture (Mutoko et al., 2015; Tuan et al., 2009) and on forest resources such as fuelwood for energy and heating (Kiptala et al., 2018).

Both Kenya and Vietnam have established frameworks for the sustainable management of natural resources. In 2010, Kenya included a 10% tree cover by 2020 target in its National Constitution. Kenya's REDD+ program identifies conservation priorities and actions to achieve transformational change in the forestry sector to combat deforestation, mitigate emissions and improve livelihoods. The government has also committed to restoring 5.1 million hectares by 2030 as part of the Bonn Challenge and the Africa 100 million hectares of forests commitment. Vietnam became a REDD pilot country in 2008 and, in 2010, established a nationwide policy on Payments for Forest Environmental Services (PFES), a pioneering initiative in Asia. The UN and the Forest Carbon Partnership Facility, supported by the World Bank, have also implemented reforestation initiatives. As outlined in Vietnam's Nationally Determined Contributions (NDCs), the country has committed to increasing its forest cover to 45% by 2030 as part of its strategy to mitigate greenhouse gas emissions. NDCs outline a country's commitment to mitigate greenhouse gas emissions and adapt to climate change as part of global efforts outlined under the Paris Agreement.

Ecosystem services provide a pathway to fulfilling the goals of these frameworks. Ecosystem service valuation is therefore a crucial part of this process. In this study, we estimate the value of ecosystem services at the country level for Kenya and Vietnam through a systematic literature review of published valuation studies. The analysis is developed further using a value transfer method to estimate the total value of ecosystem services provided by forests in Kenya and Vietnam. Value transfer approaches encompass a range of methods aimed at adapting already existing economic valuations of ecosystem services from one context to another (Boyd and Wainger, 2003). By leveraging existing valuation estimates derived from comparable ecosystems or functions, value transfer facilitates the estimation of economic worth in areas where direct assessments might be impractical or unfeasible (Richardson et al., 2015). Value transfers have been extensively utilized in various contexts globally. For instance, within the United States, the Environmental Protection Agency has leveraged value transfer approaches to appraise ecosystem services, which inform national regulatory frameworks (Newbold et al., 2018). In developing county contexts, examples include the assessment of ecosystem service values within the Yancheng wetland area in Jiangsu, China (Zhou et al. in 2020) and in examining the ramifications of climate change on protected areas across Africa (Velarde et al., 2004). Although the method is not without its limitations and will never take the place of a primary study (Bateman et al., 2011), it can bridge critical data gaps, enabling a more comprehensive assessment of the economic implications associated with natural resource degradation or conservation efforts.

We highlight the wide range of ecosystem services provided by these ecosystems and estimate the economic loss caused by deforestation up to 2050 projected based on the current trend suggested by the GFW data. As many ecosystem service valuation studies are conducted at a local scale within specific ecosystems, aggregating these values to produce an estimate for these services at a larger scale can offer greater utility to policymakers who make decisions at a broader level, despite the caveats which we highlight in the conclusion.

Methods

Analytical Framework and Systematic Literature Review

This analysis adopts the frameworks provided by the Millenium Ecosystem Assessment (MEA, 2005) and The Economics of Ecosystems and Biodiversity (TEEB), an initiative launched by the European Commission in 2007 with the goal of "making nature's values visible" (TEEB, 2022). Both frameworks provide a structure to collect standardized data on ecosystem service valuation. The categorizations recognize that ecosystem services are wide and varied, and cover a large spectrum of ecosystem services, including provisioning, regulating, cultural, supporting services and additional and general services. Values were categorised under 'additional and general services' if the values were values for multiple services. In addition to the categorization of ecosystem services, the TEEB framework also provides a structure for categorizing studies into biome type, ecosystem type and valuation method, among others (Ploeg et al, 2010).

Through a systematic literature review, a database of values for ecosystem services in Kenya and Vietnam was constructed. The review followed the protocol provided by Cochrane (2023) and reporting of results followed the PRISMA statement (Page et al., 2020). The search period for literature was from July 15, 2005, to September 15, 2022. The Scopus database and the Ecosystem Services Valuation database were used to identify relevant papers. The search resulted in 3968 peer-reviewed studies to be assessed further, out of which 123 papers were selected for use in this study, 54 for Kenya and 69 for Vietnam. The data collected from each paper for the database included the type of biome, ecosystem service, raw data for the ecosystem service value and the method of ecosystem service value estimation.

The three topics for the key words chosen for the literature search were 'ecosystem,' 'valuation,' and 'area.' The key words in the category of 'ecosystem' included all the biomes in the TEEB database and synonyms for the word 'environment'. The words listed under the 'valuation' category were selected using the types of methodologies listed in the TEEB framework. 'Area' included Vietnam and Kenya. The search string for both countries is provided in Appendix 1. Appendix 2 provides the flow diagrams for the search and screening process for Kenya and Vietnam.

Economic valuation

For comparability, all the values for ecosystem services in the database were converted to USD 2022 per hectare per year values. This was done by 1) Converting the raw data to a per hectare value. 2) Converting the per hectare value to USD in the year that the value was obtained. 3) Converting the study year USD values to USD 2022.

Obtaining per hectare values

Where papers did not provide a per hectare value for the ecosystem services values in the paper, a hectare value was calculated. Calculating the per hectare value often needed the data for the size of the study area, the number of households in the area or the population of the area. If these data were not provided in the paper, external sources were used.

Population and number of households in a province, district or county in Kenya were obtained from the Kenya National Bureau of Statistics. The size of study areas was also obtained from the Kenya National Bureau of Statistics and the General Statistics Office of Vietnam.

Where the total number of households or population in a study area could not be calculated, the sample size was used to calculate per hectare value. This led to an underestimated per hectare value, but this option was preferable to removing the value from the database entirely.

Obtaining USD 2022 per hectare per year values

To standardize the data, all the values in the database were converted to a USD 2022 per hectare per year value. The value was first converted into USD for the year of valuation and then converted to USD

2022. The values given in Vietnamese Dong and in Kenyan Shillings were converted to USD using conversion rates retrieved from [World Development Indicators | The World Bank](#). To convert values in Euros, exchange rate data from the European Central Bank was used. To adjust the USD values for inflation and convert them to USD 2022, the Consumer Price Index (CPI) from the U.S. Bureau of Labor Statistics was used.

The formula for calculating inflation adjusted values is given below:

$$USD\ 2022\ value = \frac{CPI\ in\ 2022}{CPI\ in\ year\ value\ was\ calculated} \times USD\ value$$

The average values of each ecosystem services are given in Table 1. The results were calculated by dividing the total value of each ecosystem service across papers by the number of values for each ecosystem service. The total value across papers was obtained by summing all the values per hectare that were in the database for each ecosystem service. Net present values (NPV) were divided by the number of years over which the NPV analysis was conducted.

Removing outliers

Outlier analysis was employed to identify abnormal values in the dataset. The literature review covered a diverse array of studies, resulting in a wide range of values for ecosystem services due to variations in study site characteristics and valuation methodologies employed. To avoid overestimating or underestimating values, outliers were removed from the original dataset. In this study, outliers were defined as a data point that was 1.5 times the lower and upper bounds of the interquartile range (Kaul et al., 2013). Outliers within this range were removed from the values for each ecosystem service for both countries.

A data point was considered an outlier if it was within the range below:

$$(Q_1 - 1.5 \times IQR) > x > (Q_3 + 1.5 \times IQR)$$

For ecosystem services with less than five observations, outliers were not removed. The original dataset contained 1574 values. After removing outliers, the number of observations is 1128.

Results

Trends in ecosystem service studies

Kenya

Figure 1 shows the number of studies that valued ecosystem services over the years 2006-2022 in Kenya. There were no values for 2005. Provisioning services like food, water, and raw materials have consistently been the subject of research across most of the years. This is unsurprising as these are direct use values which are easier to estimate as the values are reflected in the market. Conversely, studies examining indirect values, such as cultural and inspirational aspects, have been relatively scarce, with cultural values appearing in 2022 and inspirational values appearing only in 2015 and 2021. The number of studies in Figure 1 is higher than the actual number of studies reviewed. Some of the studies are double counted as some studies had values for multiple ecosystem services. The year 2022 stands out for its high diversity in ecosystem services estimated. The highest number of ecosystem service studies were found in 2011, 2018 and 2022. On the other hand, 2007, 2012, and 2020 had comparatively fewer studies. There is no linear trend indicating a consistent increase in ecosystem service valuation studies over time. The years alternate between low and high numbers of studies, making it challenging to establish a clear pattern.

The trends in studies could be seen to follow political interests in ecosystem services. Kenya published Vision 2030 in 2008, which outlined Kenya’s plans for environment which included rehabilitation and protection of indigenous forests and compensation for environmental services program for 2008-2012 (Government of Kenya, 2008). The number of studies increase in 2008 and 2009 following the publication of Vision 2030. Studies increase again in 2011, after Kenya established the National Climate Change Action Plan (NCCAP) in 2010. The NCCAP underscored the need to evaluate the impact of national management plans on ecosystem services (Government of Kenya, 2010), which may have corresponded with an increase in research on ecosystem services in 2011. In 2015, Kenya signed the Paris Agreement and submitted its NDCs in 2016. The increase in studies in 2016 may reflect this. In 2020, Kenya revised its NDCs and this may be reflected in the large number of studies in 2022.

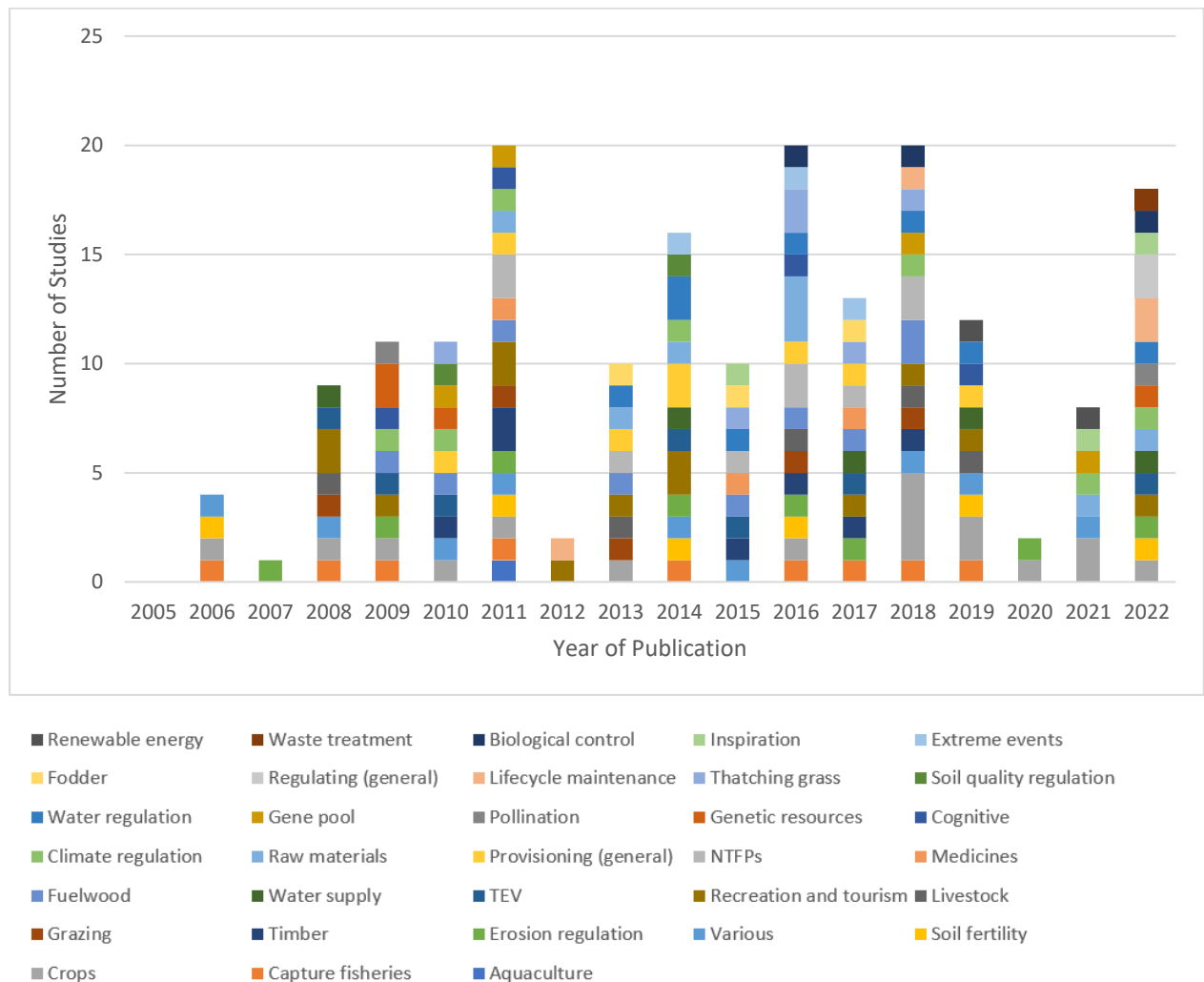


Figure 1: Number of studies that had a value for ecosystem services in Kenya. (Source: Authors).

Vietnam

Studies based in Vietnam follow some of the trends seen in Kenya. There have been a consistent number of studies that estimate the values of provisioning services, such as food provision and raw materials across all years. Values for regulating services are less common, with ecosystem services such as climate regulation present in 2013 and the moderation of extreme events present in 2016 and in 2022. 2022 marked the first time that a value for the moderation of extreme events was seen, and all three studies that estimated this value looked at coastal wetlands. This may underscore the growing recognition of the role that coastal wetlands play in mitigating the effects of extreme events. Vietnam has many ‘various’ values as many studies reported the values for payments for ecosystem services,

which encompass multiple ecosystem services. As in Kenya’s case, 2022 had the greatest diversity of ecosystem services and the largest number of studies, despite the review period for this study ending in September 2022. There are no values for 2006 and 2011 as studies during those years were dropped when removing outliers.

Figure 2 illustrates Vietnam's political momentum regarding ecosystem services research. The surge in studies in 2008 likely corresponds to the enactment of the Law on Biodiversity, emphasizing the importance of valuing ecosystem services. Simultaneously, the government initiated the national Payment for Forest Environmental Services (PFES) scheme, attracting investments from both international donors and the Vietnamese government, potentially contributing to an increased number of research outcomes. Subsequent spikes in research activity in 2012 and 2014 could be related to the push for studies as the government evaluated the PFES scheme during those years. A compelling pattern is seen in 2016 after Vietnam signed the Paris Agreement and developed NDCs that clearly state the need to incorporate the value of ecosystem services into planning (Socialist Republic of Vietnam, 2022a). This is seen again in 2020 and 2022 during the revision of the NDCs.

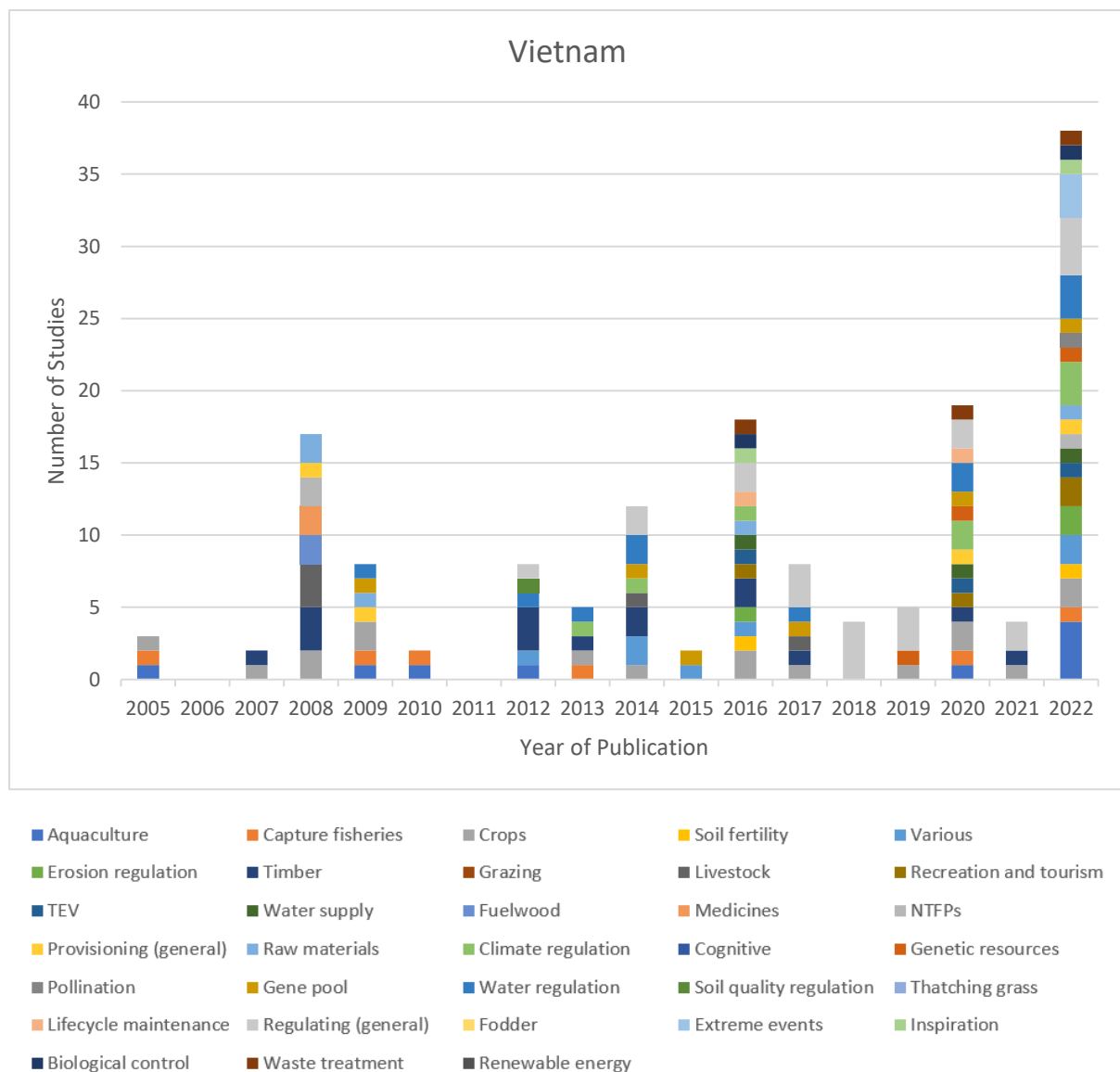


Figure 2: Number of studies that had a value for ecosystem services in Vietnam. (Source Authors).

Valuation of ecosystem services

The results of the economic analysis are given in Table 1. A total of 33 ecosystem services were identified and quantified across all ecosystems in Kenya and 28 ecosystem services were identified for Vietnam. Aggregated across all ecosystem services, ecosystems provide an average value of \$1556.02 ha⁻¹ yr⁻¹ worth of services for Kenya and \$1308.17 ha⁻¹ yr⁻¹ worth of services for Vietnam.

Table 1: Economic values of ecosystem services for Kenya and Vietnam.

Ecosystem Service	Kenya (\$ ha ⁻¹ yr ⁻¹)			Vietnam (\$ ha ⁻¹ yr ⁻¹)		
	Mean	Min	Max	Mean	Min	Max
Provisioning						
Aquaculture	7.25	7.25	7.25	1,566.67	9.80	3,908.29
Capture fisheries	292.39	0.01	1,743.51	480.47	24.77	2,649.69
Crops	443.72	0.02	2,295.88	579.88	1.86	2,537.00
Fodder	143.08	3.14	300.42	-	-	-
Fuelwood	24.65	0.003	144.04	29.81	0.70	55.89
Genetic resources	39.44	0.02	167.92	13.16	0.003	89.35
Livestock	130.99	0.000	2,028.79	44.51	0.70	192.13
Medicines	9.67	0.12	25.76	0.16	0.01	0.30
NTFP	113.05	0.07	2,050.16	1.19	0.02	2.83
Provisioning (general)	134.56	0.05	548.50	2,796.52	0.37	8,607.68
Raw materials	51.01	0.01	210.30	209.21	0.01	666.69
Renewable energy	5.88	0.84	16.06	-	-	-
Thatching grass	13.79	0.02	110.05	-	-	-
Timber	15.29	0.12	49.44	1,211.37	0.01	4,991.04
Water supply	356.02	0.40	2,409.39	87.58	10.90	186.66
<i>Sub total</i>	1,780.80	12.07	12,107.47	7,020.54	49.16	23,887.56
Regulating						
Biological control	212.07	192.14	235.12	13.06	3.07	32.72
Climate regulation	88.56	0.06	357.49	1,746.65	0.31	9,469.80
Erosion regulation	593.13	0.09	2,397.91	112.10	6.78	529.23
Extreme events	423.32	0.01	1,118.75	614.84	4.71	1,825.94
Pollination	1,651.78	89.92	6,790.93	5.41	1.84	8.94
Regulating	15.04	1.96	23.07	51.89	0.000	523.31
Soil quality regulation	228.31	20.93	402.18	21.30	21.30	21.30
Waste treatment	831.92	743.73	920.12	151.97	5.83	292.70
Water regulation	88.32	0.02	510.96	25.53	0.12	75.60
<i>Sub total</i>	4,132.45	1,048.86	12,756.54	2,742.77	43.97	12,779.54
Cultural						
Cognitive	362.14	0.01	1,164.04	-	-	-
Inspiration	8.94	1.63	17.59	26.24	3.07	79.83
Recreation and tourism	15.58	0.01	85.32	292.34	20.85	753.79
<i>Sub total</i>	386.66	1.64	1,266.95	318.58	23.93	833.62
Supporting						
Gene pool	45.90	4.35	182.92	69.97	0.18	302.11
Grazing	47.04	0.01	161.82	-	-	-
Lifecycle maintenance	58.51	0.05	208.47	378.89	98.16	597.62
Soil fertility	309.43	9.07	768.31	538.08	5.55	1,958.84

<i>Sub total</i>	460.88	13.49	1,321.52	986.94	103.89	2,858.57
Additional and General						
Various	655.92	0.26	3,074.57	777.05	0.71	4,426.28
<i>Sub total</i>	655.92	0.26	3,074.57	777.05	0.71	4,426.28
Grand total	1,556.02	744.15	4,228.93	1,308.07	104.71	5,316.91

Notes: “-“ indicates the absence of values for the ecosystem service in the literature. (Source Authors).

Kenya

Regulating services are the most economically valuable, averaging \$4,132.45, followed by provisioning services at \$1,780.80, supporting services at \$460.88, cultural services at \$386.66, and additional and general services at \$655.92 per hectare per year. Pollination and waste treatment had the highest values, amounting to \$1,651.78 and \$831.92, respectively. However, it's worth noting that the valuation of pollination is derived from one study focused on estimating its impact on crop production in small-holder farms in Kakamega (Kasina, 2009).

For provisioning services, water supply had the highest economic value, followed closely by food. Studies focused on water supply estimated the value of water supply for hydropower stations and communities in and around watersheds. Values for food included NTFPs such as mushrooms and honey, fisheries, as well as crop and livestock products.

Surprisingly, cultural values ranked the lowest. The value for tourism and recreation is \$15.58, which is surprising as tourism is a key sector and contributed 8.8% to Kenya's GDP in 2018 (Government of Kenya, 2020a). Lastly, supporting services' highest economic value was attributed to soil fertility, which included studies estimating the worth of soil formation and nutrient cycling.

Vietnam

Provisioning services had the highest economic value among ecosystem services, amounting to \$7,020.54. Regulating services are worth \$2,741.89, supporting services are \$968.94, additional, and general services at \$836.69, and cultural services at \$318.58.

Provisioning (general) and food have the largest values for provisioning ecosystem services. Provisioning (general) included values from studies that were either unspecified or combined various provisioning elements, such as timber, firewood, and honey.

Climate regulation had the largest value for regulating services, which included the value of carbon sequestration. This value was particularly significant for Vietnam, given the implementation of Payment for Ecosystem Services (PES) and Reducing Emissions from Deforestation and Forest Degradation (REDD+) programs in the country. Erosion regulation incorporated values from coastal ecosystems like mangrove forests and PES initiatives aimed at curbing soil erosion. Mirroring the findings in Kenya, soil fertility held the highest value among supporting services, encompassing estimates for nutrient cycling and soil formation.

Like Kenya, cultural services had the lowest economic value for Vietnam. This is largely because most ecosystem service valuation studies in the literature did not consider values associated with tourism for both countries, which is a research gap. The few tourism values available are from studies exploring PES payments related to tourism for both countries.

Valuation of ecosystem services provided by forests

We adopted a value transfer method to estimate the value of ecosystem services provided by forests in Kenya and Vietnam. Forest biomes were chosen for deeper analysis due to the availability of area data, while other biomes like coastal wetlands and grasslands in the database presented challenges in obtaining area data. We use tree cover extent data for the years 2000, 2005, 2010, 2015 and 2020 provided by GFW as a proxy for forest cover. Tree cover extent is defined as tree height greater than 5 metres for a 30 meter pixel (GFW, 2022).

The alternative to GFW data is data from the forest resources assessment published by the FAO. GFW uses satellite data to map tree cover and FAO data is from government reported data and national inventories and is collected by country governments. Country reported data may be inconsistent as different methodologies are employed to collect the information. Additionally, GFW data is available at a sub-national level while FAO data is available only at a national level. GFW data uses consistent definitions on tree cover. GFW data has been widely used in the scientific community, such as in Zhang et al., (2020) who evaluated the accuracy of the GFW dataset for forests in China in 2000 and found that overall accuracy was 94.5%.

The alternative to GFW data is the Forest Resources Assessment (FRA) data published by the FAO. While GFW relies on satellite data to map tree cover, FAO data is derived from government reported data in national inventories. However, country-reported data might exhibit inconsistencies due to variations in definitions and methodologies used, which often means that there is a lack of comparable long term data (Grainger, 2007). Notably, GFW data is available at a sub-national level, whereas FAO data is limited to a national scale. GFW maintains consistent definitions regarding tree cover, contributing to its reliability. GFW data has been widely used in scientific community, as evidenced by studies such as Zhang et al. (2020), which assessed the accuracy of GFW datasets for China's forests in 2000, revealing an overall accuracy of 94.5% and to identify and map global deforestation patterns (Curtis et al., 2018).

The number of ecosystem services provided by forests identified and quantified for Kenya and Vietnam are 28 and 17, respectively and are given in Table 2. We estimate that forest land in Kenya provides ecosystem services worth \$5,718.50 ha⁻¹ yr⁻¹, with a range of \$1,609.44 - \$15,606.62 ha⁻¹ yr⁻¹. Forests in Vietnam provides ecosystem services worth \$3,650.20 ha⁻¹ yr⁻¹ with a range of \$84.93 - \$8,978.16 ha⁻¹ yr⁻¹.

There are lower values for ecosystem services provided by forests in Vietnam. In 36 out of the 69 studies on Vietnam, forest was the study area. In Kenya, while only 12 out of the 54 studies looked at forests, a broader range of ecosystem services were evaluated in the studies.

In Kenya, regulating services provided by forests are worth the most, at \$3,591.42 ha⁻¹ yr⁻¹, followed by provisioning services at \$1,595.48 ha⁻¹ yr⁻¹. Supporting services contribute \$446.91 ha⁻¹ yr⁻¹, while cultural services represent the lowest value at \$17.43 ha⁻¹ yr⁻¹. The large value for regulating services is from the value of pollination, which is worth \$1651.78 ha⁻¹ yr⁻¹. Provisioning services include the value of crops grown in forests, NTFPs and genetic resources. The values for NTFPs were mostly from honey. Comparing the total value of \$5,651.25 ha⁻¹ yr⁻¹ that we estimate to the total economic value (TEV) of \$4,686.11 ha⁻¹ yr⁻¹, our value is higher by \$1032.39 ha⁻¹ yr⁻¹. The TEV value in Table 2 is estimated using 2 studies in Tindret Forest and Cherangany Hills Water Tower. The grand total aggregates values from forests across Kenya, while the TEV value in Table 2 is from two locations and may not have included all the ecosystem services that are included in our valuation.

A large difference is evident when comparing the values of forest-provided provisioning services between Kenya and Vietnam. Most studies assessing this ecosystem service in Vietnam focus on valuing plantations established for timber production, and timber production has a large value of \$1500.75 ha⁻¹ yr⁻¹. The category of additional and general services holds the second-largest value among all services, prominently driven by numerous studies centered on the Payments for Ecosystem Services (PFES) scheme. These studies encompass a wide array of ecosystem services, categorized under the umbrella term 'various.' The large value reflects the diverse range of ecosystem benefits evaluated within the PFES framework. Vietnam has fewer values than Kenya for ecosystem services, which resulted in very low values for other services, regulating has a value of \$249.74 ha⁻¹ yr⁻¹ and supporting services has a value of \$86.15 ha⁻¹ yr⁻¹. The TEV for forests in Vietnam is \$4214.59 ha⁻¹ yr⁻¹, which is \$564.39 larger than the value that we estimate. The TEV value is drawn from one study in Dalat. This discrepancy suggests a lack of availability of comprehensive data concerning ecosystem services within the existing literature.

Table 2: Economic values of ecosystem services provided by forests in Kenya and Vietnam.

Ecosystem Service	Kenya (\$ ha ⁻¹ yr ⁻¹)			Vietnam (\$ ha ⁻¹ yr ⁻¹)		
	Mean	Min	Max	Mean	Min	Max
Provisioning						
Crops	853.84	1.01	1,760.26	131.38	1.86	541.64
Fodder	53.95	3.14	104.77	-	-	-
Fuelwood	26.63	0.59	123.55	1.12	0.70	1.55
Genetic resources	156.80	145.67	167.92	0.005	0.003	0.01
Livestock	-	-	-	46.70	0.70	192.13
Medicines	1.81	0.12	2.95	0.16	0.01	0.30
NTPF	244.59	0.07	2,050.16	1.26	0.02	2.83
Provisioning (general)	108.68	0.50	393.79	27.44	0.37	54.50
Raw materials	78.65	1.77	210.30	0.32	0.01	1.03
Thatching grass	38.76	0.12	110.05	-	-	-
Timber	11.35	0.77	36.22	1,500.75	0.44	4,991.04
Water supply	20.43	0.40	37.08	-	-	-
<i>Sub total</i>	1,595.48	154.16	4,997.05	1,709.14	4.12	5,785.03
Regulating						
Biological control	207.85	199.56	216.15	-	-	-
Climate regulation	68.61	49.75	86.68	164.84	56.37	365.75
Erosion regulation	572.79	2.00	1,143.58	11.99	6.78	17.89
Pollination	1,651.78	89.92	6,790.93	-	-	-
Regulating	21.59	20.11	23.07	51.96	0.0004	523.31
Soil quality regulation	191.85	191.85	191.85	-	-	-
Waste treatment	831.92	743.73	920.12	-	-	-
Water regulation	45.04	41.87	48.20	20.95	0.12	50.66
<i>Sub total</i>	3,591.42	1,338.78	9,420.58	249.74	63.27	957.61
Cultural						
Inspiration	6.06	1.63	8.87	-	-	-
Recreation and tourism	11.37	0.93	23.31	-	-	-
<i>Sub total</i>	17.43	2.55	32.18	-	-	-
Supporting						
Gene pool	65.18	4.35	182.92	86.15	3.03	231.66

Grazing	0.92	0.66	1.18	-	-	-
Lifecycle maintenance	73.93	68.61	79.25	-	-	-
Soil fertility	306.88	29.96	768.31	-	-	-
<i>Sub total</i>	446.91	103.58	1,031.67	86.15	3.03	231.66
Additional and General						
Various	67.26	9.37	125.14	1,605.17	14.51	2,003.86
<i>Sub total</i>	67.26	9.37	125.14	1,605.17	14.51	2,003.86
Grand total	5,718.50	1,608.44	15,606.62	3,650.20	84.93	8,978.16

Note: “-” is used to indicate the absence of values for the ecosystem service in the literature. (Source Authors).

The values of ecosystem services provided by forests in Kenya and Vietnam are illustrated in Figure 3 and Figure 5, respectively. Areas with high values for ecosystem services are represented with dark green for Kenya, and dark blue for Vietnam. These areas align directly with counties or cities with the most tree cover. Tree cover extent for administrative districts are provided in Figures 4 and 6. The exact values for each county in Kenya and city in Vietnam are presented in Appendix 3.

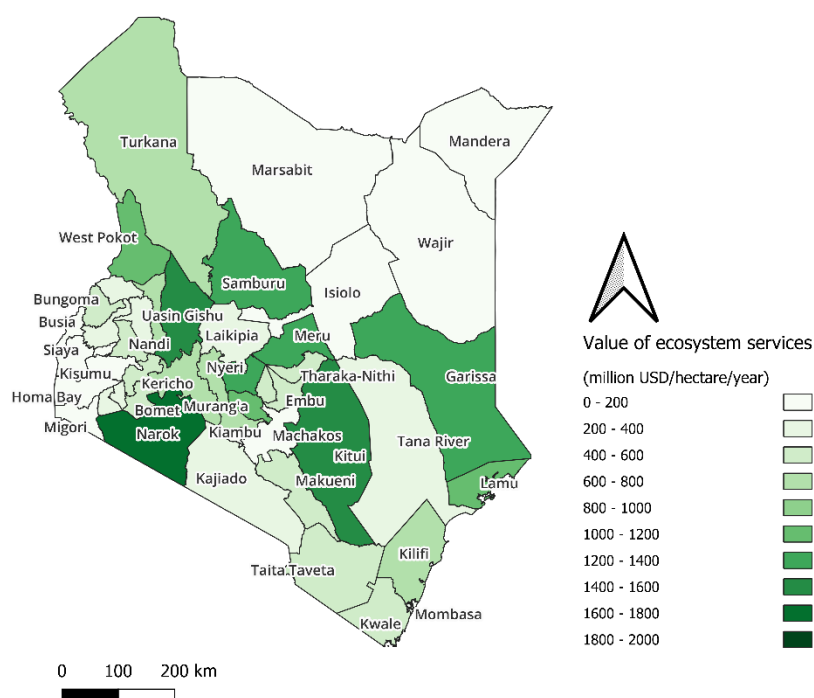


Figure 3: Value of ecosystem services provided by forests in Kenya. (Source Authors). Shapefiles retrieved from: [Kenya - Subnational Administrative Boundaries - Humanitarian Data Exchange \(humdata.org\)](http://humdata.org)

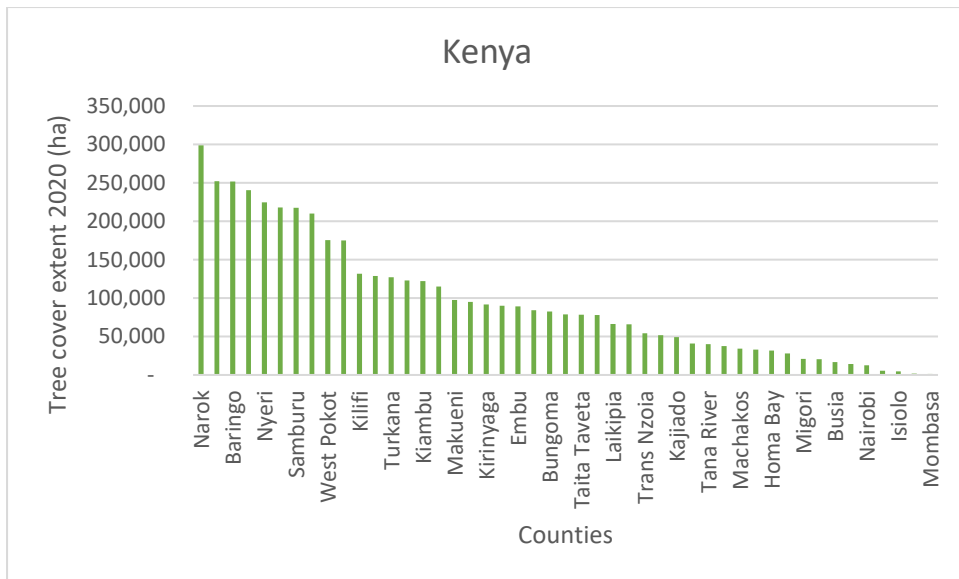


Figure 4: Tree cover in Kenyan counties in 2020. Source: Global Forest Watch.

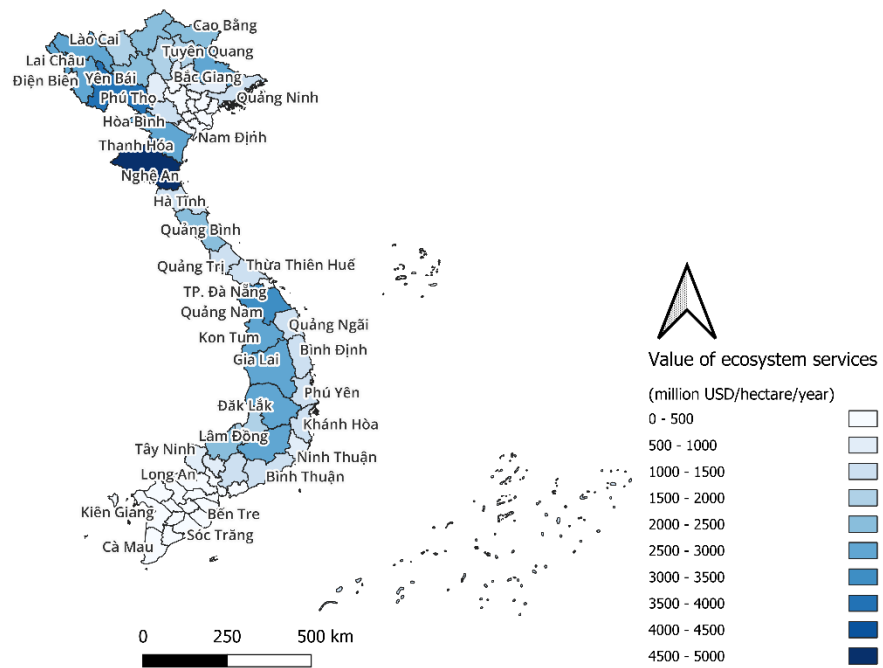


Figure 5: Value of ecosystem services provided by forests in Vietnam. (Source Authors). Shapefiles retrieved from: [Viet Nam - Subnational Administrative Boundaries - Humanitarian Data Exchange \(humdata.org\)](https://humdata.org/)

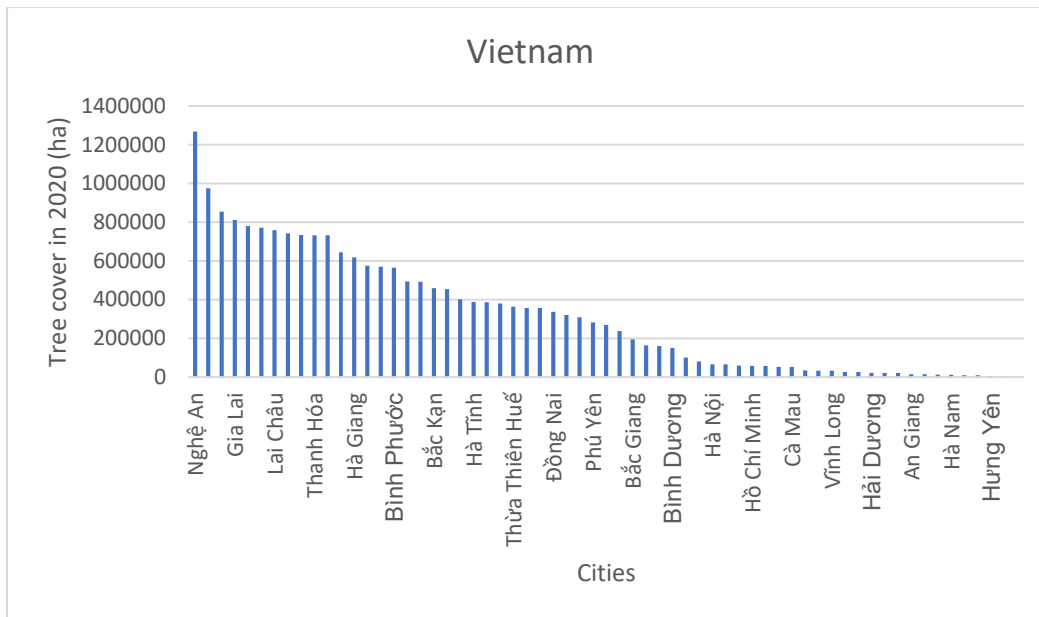


Figure 6: Tree cover in Vietnamese provinces in 2020. Source: Global Forest Watch.

Future value of forests to 2050

Based on GFW data, the annual average loss of tree cover over 2015-2020 is 20,899 hectares in Vietnam and 8408 hectares in Kenya at an average annual rate of loss of 0.10% and 0.18% for Vietnam and Kenya, respectively. Assuming that the historical annual loss rates carry into the future, we make projections of tree cover areas and estimate the associated change in the economic value of forest ecosystem services for the years from 2020 to 2050. Figures 5 and 6 present the loss of economic value of ecosystem services for the years 2020, 2030, 2040 and 2050. With the loss of tree cover, the economic value of ecosystem services will decline from \$25.78 billion in 2020 to \$24.33 billion in 2050 for Kenya. Vietnam will experience a decrease in ecosystem service value from \$72.94 billion to \$70.65 billion from 2020 to 2050. This is an annual loss of \$48.08 million for Kenya and \$76.29 million for Vietnam.

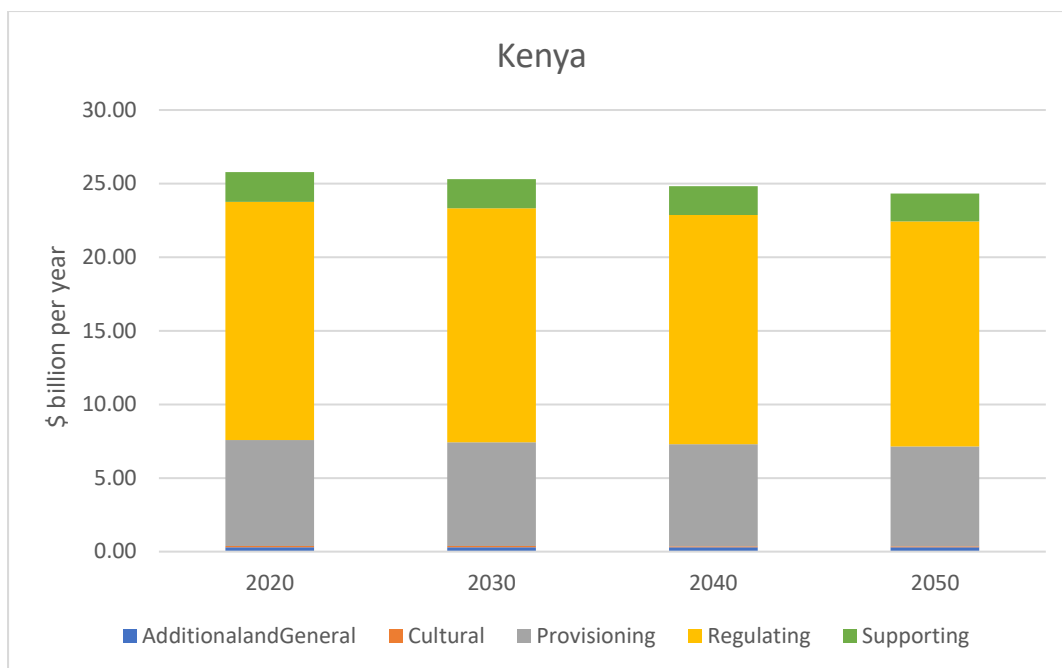


Figure 7: Economic value of ecosystem services provided by forests in Kenya from 2020 to 2050. (Source Authors).

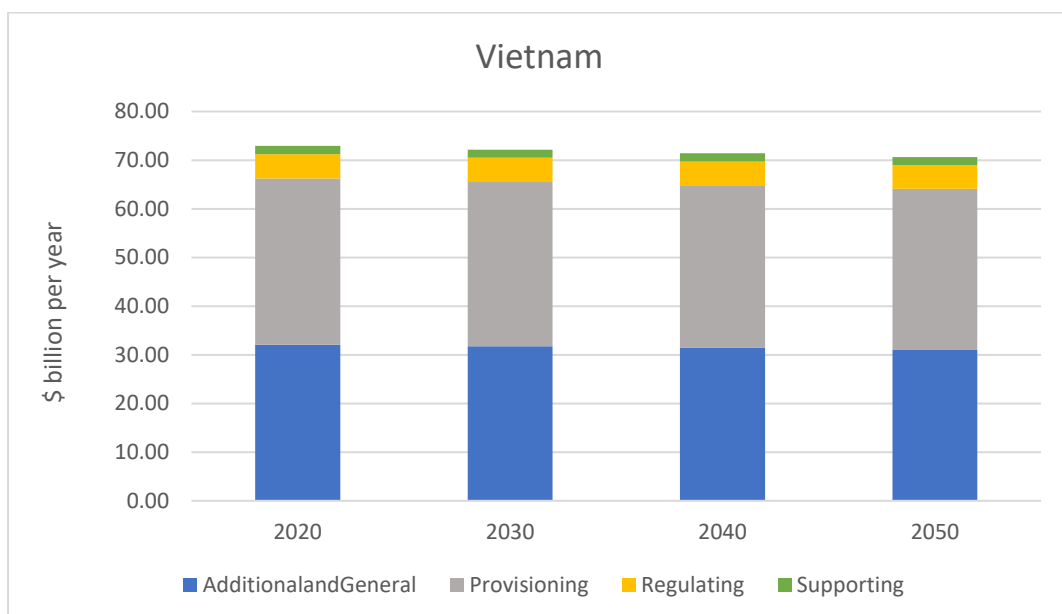


Figure 8: Economic value of ecosystem services provided by forests in Vietnam from 2020 to 2050. (Source Authors).

Discussion

This study contributes to the growing body of knowledge on ecosystem services and their valuation in developing countries. The findings cast a spotlight on the richness of the ecosystem services that are provided by environments in Kenya and Vietnam. This is the first study that uses published studies to estimate the value of ecosystem services both nationally and for forests in Kenya and Vietnam. This further advances the study of ecosystem service valuation by using the value transfer method to estimate the total value of ecosystem services in forest ecosystems in Kenya and Vietnam. We take this valuation further by projecting the loss of forests into 2050 and estimating the economic loss of ecosystem services if deforestation and forest degradation continue at the current rates.

Valuation of ecosystem services has been recognised as an important component in understanding the trade-offs for policy decisions as it allows for the consideration of all benefits, tangible, and intangible, allowing for a more holistic approach to policy making (Costanza, 2020). Provisioning services make up roughly half of the services in the studies, with provisioning services making up 49% of the ecosystem services for Kenya and 51% of the ecosystem services for Vietnam. These included services such as medicines, timber, and NTFPs. Regulating services, such as moderation of extreme events, water regulation and erosion control accounted for the second largest share of ecosystem services, 29% and 32% of ecosystem services for Kenya and Vietnam respectively.

The ecosystem services that are reviewed in this study range from food provision to the moderation of extreme events and the opportunities for recreation and many of the other ecosystem services in the TEEB and MEA framework. In both countries, provisioning services, particularly food and water and raw materials have been the topic of research over most of the years covered. Regulating services such as climate control and erosion prevention have also been the focus of many studies. While a wide range of ecosystem services are covered in the literature, the values of the ecosystem services also vary widely within Kenya and Vietnam.

To complement the national level analysis, we selected forest biomes to conduct a value transfer analysis. Forests provide ecosystem service benefits worth \$25.78 billion for Kenya and \$35.6 billion in Vietnam in 2022. In comparison, the agricultural sector contributed \$48.50 billion to Vietnam's GDP and \$24.10 billion to Kenya's GDP in 2021 (World Bank, 2021).

Both Vietnam and Kenya have embarked on substantial national reforestation programs, aiming for significant forest cover percentages by 2030; Kenya targeting 20% and Vietnam aiming 45%. However, despite these extensive reforestation initiatives, the planted monoculture forests, which constitute a considerable portion, tend to fall short in quality compared to natural forests. There exists a wide range of literature about the quality of planted monoculture forests. Despite the large-scale reforestation programs, the quality of such planted forests in terms of providing ecosystem services is not as high as these forests are less biodiverse and as a result offer lower ecosystem services than natural forests (Wang et al., 2021) GFW data reports that primary forest cover in both countries is decreasing at an alarming rate, which will ultimately decrease the value of ecosystem services provided by forests considerably. The loss of biodiversity associated with the decline of primary forests might be partially mitigated through the establishment of secondary and plantation forests. Nevertheless, the value of primary forests is incomparable. The effectiveness of secondary and planted forests in providing vital habitats for biodiversity hinges upon whether these forests are composed of mixed or native species rather than monocultures and exotic varieties (Barlow et al., 2007). While reforestation efforts will increase in both countries, the ability of such efforts to restore the value of ecosystem services lost to the deforestation of primary forests will depend on the type of trees in the forests.

Historically, Vietnam has prioritized wood production forests in the past for large scale reforestation programmes, using non-native species such as acacia, eucalyptus and casuarina (McElwee and Huu Nghi, 2021). In the mid-20th century, exotic tree plantations were planted inside existing forests by the Kenya Forest Service (Harvey-Brown and Shaw, 2020). The plantations were established using non-native species including pine, cypress and eucalyptus. Today, Kenya's reforestation policy as a response to the Bonn Challenge, acknowledges the significance of cultivating indigenous trees in addition to non-native species.

Many of Vietnam's ecosystem service values were from studies that focused on PES, which could be due to the PFES policy that was passed into law 2008. The policy generates an average of USD 120-130 million annually for forest protection in 66% of natural forests in the country (VNFF, 2020). This policy is reflected in an increase in the number of papers reporting values associated with PES after 2008. Most of the studies report values for PFES from beneficiaries of ecosystem services. These beneficiaries include private companies managing hydropower plants and water supply companies.

They are mandated to pay for ecosystem services that include watershed protection, protection of natural landscape beauty and conservation of forest biodiversity. Ecosystem providers, the communities living in the area, are paid for forest conservation activities by the beneficiaries of the ecosystem services (Loft et al., 2017; To et al., 2012). The studies also encompassed REDD+ payments for carbon monitoring and sustainable management of forests (Bayrak and Marafa, 2017; Hoang et al., 2013). In contrast, Kenya's PES-related studies are relatively limited, with a focus on tourism-based conservation payments in 3 papers, while the other 2 papers look at agroforestry and watershed PES schemes.

Despite the existence of numerous papers estimating ecosystem service values provided by forests for both countries, both the range and availability of valued ecosystem services differ starkly. While Kenya has values for 28 ecosystem services, data is only available for 17 ecosystem services in Vietnam. The lack of data for ecosystem services provided by forests in Vietnam is significant considering the importance of forests in Vietnam and the concern over the degradation of forests (Nguyen et al., 2020). This gap in data could be significant in the way in which policy efforts address conservation of forest resources in Vietnam.

The value transfer method is used when primary valuation of ecosystem services is unavailable for the area of interest. It involves using economic values from one site to estimate the value of a different site with similar characteristics (Plummer, 2009). Ideally, value transfer methods should be used in situations where the site for which valuation data is available is identical (Boyle and Bergstrom, 1992); however, this is rarely the case. As values are aggregated across a range of ecosystems and areas in this study, the total value of ecosystem services that we estimate may not accurately reflect the true value of ecosystem services in specific contexts. The values presented in our paper should be considered as a guiding reference for incorporating these estimations into broader policymaking endeavors rather than as exact representations of localized values.

Limitations

An integral part of this analysis includes the acknowledgement of the limitations of this study. Firstly, the literature review only included papers published in English. Studies published in Vietnamese were not included, and we may have further underestimated the value of ES services in Vietnam due to this reason. Furthermore, the value of 'cultural' values in this study is very low as values of tourism, an important income earner in both countries, was not specifically targeted in the literature review. The values for tourism captured in this paper are from PES payments for tourism ecosystem services.

Additionally, as we aggregate the values across multiple study sites to calculate mean values for each ecosystem service, the nuances in the contexts of different biomes are lost. This is a product of the value transfer methodology. values for a few of the ecosystem services are based on only a few studies, in some cases one or two. For example, the value for pollination in Kenya was from one study.

While the GFW data is the best and most consistent data on tree cover available, the data only captures trees greater than 5m. This means that dryland forests, which at maturity are a maximum of 2 metres (Government of Kenya, 2020b), are excluded from the dataset.

Conclusion

The findings from the value transfer method provide a crucial defence against deforestation and forest degradation by offering insights into estimating the costs associated with these threats. While these outcomes represent an important step, they might offer a conservative estimate of forests' true value due to the lack of data on ecosystem services, like air quality regulation and sustainable energy provision. Closing the gaps in available data within the literature becomes imperative for a more comprehensive understanding of the overall economic value of ecosystem services in both countries. This underscores the necessity for future research to evaluate these ecosystem services, improving the knowledge base for more informed natural resource management decisions.

We provide insights regarding the complexities of estimating the value of all ecosystem services, both tangible and intangible. The imperative role of ecosystem services in enhancing decision-making for the management of natural resources cannot be overstated. We offer a holistic picture of all ecosystem services, providing policymakers with a nuanced understanding of the intrinsic value ecosystems provide. Moreover, the aggregation of the values from the literature to provide a national-level estimate, allows policymakers to make more informed decisions at a larger scale for the sustainable management of ecosystems.

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Appendix 1

Search string for Kenya for SCOPUS

```
( TITLE-ABS-KEY ( {ecosystem service} ) OR TITLE-ABS-KEY ( {ecosystem good} ) OR TITLE-ABS-KEY ( ecosystem ) OR TITLE-ABS-KEY ( forest ) OR TITLE-ABS-KEY ( environment ) OR TITLE-ABS-KEY ( environmental ) OR TITLE-ABS-KEY ( biodiversity ) OR TITLE-ABS-KEY ( biome ) OR TITLE-ABS-KEY ( commons ) OR TITLE-ABS-KEY ( mangrove ) OR TITLE-ABS-KEY ( wetland ) OR TITLE-ABS-KEY ( river ) OR TITLE-ABS-KEY ( lake ) OR TITLE-ABS-KEY ( desert ) OR TITLE-ABS-KEY ( mountain ) OR TITLE-ABS-KEY ( habitat ) OR TITLE-ABS-KEY ( crop ) OR TITLE-ABS-KEY ( perennial ) OR TITLE-ABS-KEY ( grassland ) OR TITLE-ABS-KEY ( woodland ) OR TITLE-ABS-KEY ( scrubland ) OR TITLE-ABS-KEY ( savanna ) OR TITLE-ABS-KEY ( conservation ) OR TITLE-ABS-KEY ( {natural capital} ) AND TITLE-ABS-KEY ( valuation ) OR TITLE-ABS-KEY ( value ) OR TITLE-ABS-KEY ( assessment ) OR TITLE-ABS-KEY ( monetary ) OR TITLE-ABS-KEY ( benefit ) OR TITLE-ABS-KEY ( cost ) OR TITLE-ABS-KEY ( economic ) OR TITLE-ABS-KEY ( {economic valuation} ) OR TITLE-ABS-KEY ( {cost-benefit analysis} ) ) AND TITLE-ABS-KEY ( kenya ) OR TITLE-ABS-KEY ( kenyan ) ) AND PUBYEAR > 1999 AND ( EXCLUDE ( SUBJAREA , "medi" ) OR EXCLUDE ( SUBJAREA , "bioc" ) OR EXCLUDE ( SUBJAREA , "engi" ) OR EXCLUDE ( SUBJAREA , "immu" ) )
```

Search string for Vietnam for SCOPUS

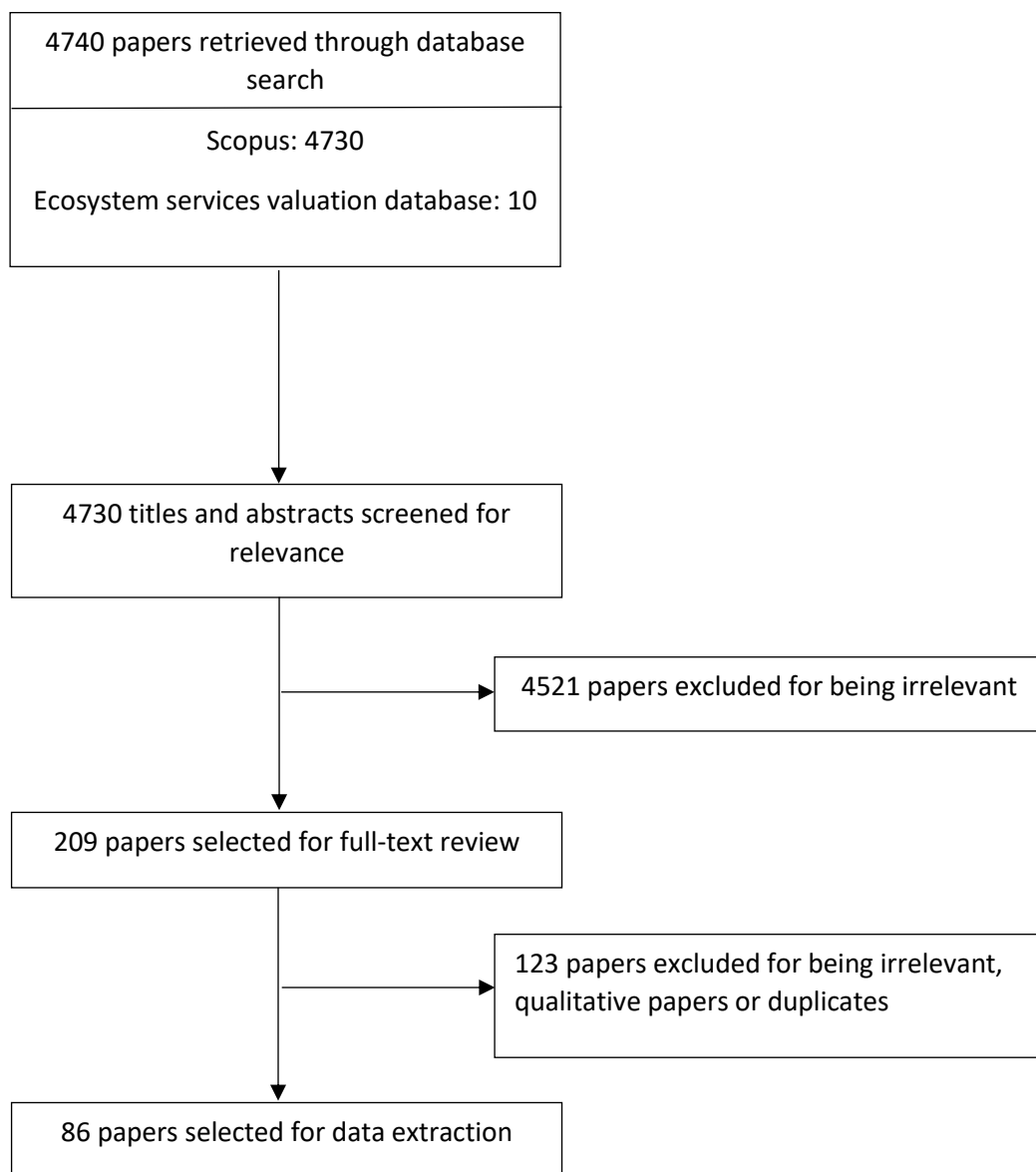
```
( TITLE-ABS-KEY ( {ecosystem service} ) OR TITLE-ABS-KEY ( {ecosystem good} ) OR TITLE-ABS-KEY ( ecosystem ) OR TITLE-ABS-KEY ( forest ) OR TITLE-ABS-KEY ( environment ) OR TITLE-ABS-KEY ( environmental ) OR TITLE-ABS-KEY ( biodiversity ) OR TITLE-ABS-KEY ( biome ) OR TITLE-ABS-KEY ( commons ) OR TITLE-ABS-KEY ( mangrove ) OR TITLE-ABS-KEY ( wetland ) OR TITLE-ABS-KEY ( river ) OR TITLE-ABS-KEY ( lake ) OR TITLE-ABS-KEY ( desert ) OR TITLE-ABS-KEY ( mountain ) OR TITLE-ABS-KEY ( habitat ) OR TITLE-ABS-KEY ( crop ) OR TITLE-ABS-KEY ( perennial ) OR TITLE-ABS-KEY ( grassland ) OR TITLE-ABS-KEY ( woodland ) OR TITLE-ABS-KEY ( scrubland ) OR TITLE-ABS-KEY ( savanna ) OR TITLE-ABS-KEY ( conservation ) OR TITLE-ABS-KEY ( {natural capital} ) AND TITLE-ABS-KEY ( valuation ) OR TITLE-ABS-KEY ( value ) OR TITLE-ABS-KEY ( assessment ) OR TITLE-ABS-KEY ( monetary ) OR TITLE-ABS-KEY ( benefit ) OR TITLE-ABS-KEY ( cost ) OR TITLE-ABS-KEY ( economic ) OR TITLE-ABS-KEY ( {economic valuation} ) OR TITLE-ABS-KEY ( {cost-benefit analysis} ) ) AND TITLE-ABS-KEY ( vietnam ) OR TITLE-ABS-KEY ( vietnamese ) ) AND PUBYEAR > 2004 AND ( EXCLUDE ( SUBJAREA , "medi" ) OR EXCLUDE ( SUBJAREA , "bioc" ) OR EXCLUDE ( SUBJAREA , "engi" ) OR EXCLUDE ( SUBJAREA , "immu" ) )
```

Appendix 2

Search and screening process for Kenya



Search and screening process for Vietnam



Appendix 3

Value of ecosystem services provided by forests in Kenya

Kenya	
District	Value of Ecosystem Services (\$/year)
Baringo	1,439,261,089.12
Bomet	450,098,463.95
Bungoma	471,878,391.91
Busia	96,361,503.77
Elgeyo-Marakwet	704,160,801.98
Embu	509,847,514.00
Garissa	1,247,287,194.92
Homa Bay	182,302,108.78
Isiolo	26,869,480.02
Kajiado	282,101,105.82
Kakamega	295,596,192.21
Kericho	543,609,573.08
Kiambu	698,213,717.68
Kilifi	752,074,188.73
Kirinyaga	524,413,288.31
Kisii	376,248,818.10
Kisumu	82,052,252.70
Kitui	1,442,007,156.12
Kwale	446,109,466.15
Laikipia	378,193,812.51
Lamu	1,200,957,542.58
Machakos	196,337,244.10
Makueni	556,756,082.43
Mandera	10,030,590.66
Marsabit	187,898,979.53
Meru	1,376,090,910.91
Migori	120,160,478.30
Mombasa	6,475,677.65
Murang'a	1,001,477,786.48
Nairobi	71,096,623.68
Nakuru	736,885,312.51
Nandi	480,666,051.77
Narok	1,709,632,904.92
Nyamira	214,506,208.52
Nyandarua	657,247,324.02
Nyeri	1,285,361,872.03
Samburu	1,244,902,387.93
Siaya	116,821,175.74
Taita Taveta	447,241,932.40
Tana River	228,244,726.05
Tharaka-Nithi	514,007,118.16
Trans Nzoia	311,008,043.18
Turkana	725,899,408.02

Uasin Gishu	234,976,926.95
Vihiga	159,402,806.67
Wajir	31,646,049.18
West Pokot	1,002,528,018.00

Value of ecosystem services provided by forests in Vietnam

Vietnam	
Province	Value of Ecosystem Services (\$/year)
An Giang	53,093,122.59
Bà Rịa - Vũng Tàu	293,055,221.22
Bắc Giang	709,798,202.99
Bắc Kạn	1,675,910,975.04
Bạc Liêu	9,131,402.09
Bắc Ninh	13,571,463.39
Bến Tre	365,726,132.21
Bình Định	1,463,413,522.23
Bình Dương	545,655,459.40
Bình Phước	2,064,507,266.64
Bình Thuận	1,409,177,789.10
Cà Mau	189,573,109.17
Cần Thơ	36,123,967.56
Cao Bằng	2,082,530,305.49
Đà Nẵng	240,139,213.42
Đắk Lắk	2,815,378,153.21
Đắk Nông	1,657,792,775.09
Điện Biên	2,676,279,035.06
Đồng Nai	1,233,291,284.87
Đồng Tháp	50,915,592.72
Gia Lai	2,964,873,198.58
Hà Giang	2,255,449,882.93
Hà Nam	39,486,100.78
Hà Nội	241,341,765.30
Hà Tĩnh	1,417,248,195.69
Hải Dương	79,394,500.12
Hải Phòng	96,217,357.65
Hậu Giang	76,078,084.87
Hồ Chí Minh	213,280,076.69
Hoà Bình	1,304,201,884.78
Hưng Yên	20,072,558.41
Khánh Hòa	1,129,314,741.46
Kiên Giang	215,183,976.06
Kon Tum	2,845,790,084.02
Lai Châu	2,768,364,165.73
Lâm Đồng	2,708,870,189.00
Lạng Sơn	2,671,775,645.91
Lào Cai	1,803,045,193.05
Long An	77,778,454.62

Nam Định	33,781,514.36
Nghệ An	4,627,700,707.21
Ninh Bình	121,093,689.19
Ninh Thuận	597,221,601.87
Phú Thọ	868,334,230.47
Phú Yên	1,033,000,868.11
Quảng Bình	2,352,386,536.61
Quảng Nam	3,119,155,423.16
Quảng Ngãi	1,302,000,310.64
Quảng Ninh	1,385,572,417.06
Quảng Trị	1,172,079,667.16
Sóc Trăng	93,002,876.54
Sơn La	3,557,670,994.43
Tây Ninh	582,264,037.42
Thái Bình	46,227,299.79
Thái Nguyên	986,004,151.85
Thanh Hóa	2,671,887,739.60
Thừa Thiên Huế	1,326,751,679.74
Tiền Giang	211,759,530.95
Trà Vinh	127,328,604.04
Tuyên Quang	1,796,998,907.16
Vĩnh Long	120,823,445.20
Vĩnh Phúc	190,563,665.14
Yên Bái	2,099,244,455.85

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