Central European Journal of Geography and Sustainable Development
ISSN 2668-4322, ISSN-L 2668-4322

2021, Volume 3, Issue 1, Pages: 21-31
https://doi.org/10.47246/CEJGSD.2021.3.1.2

Effect of Governance on Accelerating Literacy Rate to Ensure Sustainable Forestland: A Multiple Regression Analysis on Developing Countries

Tanbir Hossain*
North Western University, Khulna, Department of Economics, 236, M.A. Bari Road, Sonadanga, Khulna-9100, Bangladesh;
tanbir_shovon_ku@yahoo.com

Received: 3 February 2021; Revised: 26 April 2021; Accepted: 4 May 2021; Published online: 24 May 2021

Abstract: Deforestation has long been considered an alarming issue, while every developing country focuses on accelerating the GDP growth, while backlogging the environment quality. The literacy rate is a handy and effective tool that has a long-lasting impact on the economy; an efficient government body can launch a sustainable learning system which can develop and enrich the practice of a green economy. This paper aims to investigate the joint effect of good governance and literacy rate on sustainable forestland in developing countries. The researcher uses World Bank secondary open data, on which a multiple regression model is applied with the aim of analising the impact on forestland. Due to the use of secondary data, several missing values exist, where the author implies interpolation in R studio to imply regression Model. A sound and effective educational policy, coupled with government intervention can maintain a good balance among ecology, economy and socio-culture.

Key words: Forestland, deforestation, literacy rate, good governance, local people

Citation: Hossain, T. (2021). Effect of Governance on Accelerating Literacy Rate to Ensure Sustainable Forestland: A Multiple Regression Analysis on Developing Countries. *Central European Journal of Geography and Sustainable Development*, *3*(1), 21–31. https://doi.org/10.47246/CEJGSD.2021.3.1.2

1. INTRODUCTION

Deforestation has become one of the threatening and most concerning issues in recent times because people sacrifice the image and value of environment by forcing an acceleration of the economic growth. Deforestation is closely linked with sudden climatic change, greater carbon gas emissions, economic development and changing the nature of biodiversity wherein civilization is significantly impacted in the long-term due to the removal of forest land to achieve short term benefits. According to the view of some researcher's, deforestation means the removal of forest land and using the land for other purposes like industrialization and habitation etc. Despite all necessary initiatives, the world is experiencing the loss of about 15 hectares of forest land annualy which severely affects biodiversity on which numerous living organs are closely dependent [1]. In essence, deforestation is caused by two major issues. Several researchers work to find how a governing body impacts the development of the forestland while they consider a group of relevant governance factors to understand the effect of it [2]. In addition, the world loses 50 acres of land every hour due to slash and burn; however intentional fire setting cannot always be controlled due to unpredictable behavior of human-beings. A group of researchers highlighted a study showing the linkage between deforestation and climate change in Pakistan [3]. A recent study shows that a piece of normal timber is being purchased at US$20 per m^3 in Singapore and Indonesia which generally sells at US$ 1000 per m^3 in USA and to Canadian buyers after processing; yet the government is losing huge amounts of revenue due to this illegal log-trade. In general, the governments of these countries like Indonesia and Singapore lose US$10 billion annually due to black-market trade of timber [4].

* Corresponding author: tanbir_shovon_ku@yahoo.com; Tel.: +88-162-346-4600

In most developing countries, governing bodies in charge of forestlands are badly corrupted and these institutions are directly or indirectly related with deforestation while most of the local populace is not concerned about the negative effect of deforestation on their life. The massive deforestation can impede the local ecological efforts and it can raise the health-cost of local people, while forest-land is described as carbon-sink. Most of the wild animals and birds find shelter in forests, forming an essential part of the environment, but their existence is severely threatened due to massive clearance of woodland. Most of the people in developing countries are not serious about forestland protection, because they lack the notion of environmental education. A literate person can understand the blessing of forestland, understanding that he cannot destroy the forestland due to ethical purposes mainly, but an illiterate person does not understand the long-term impact of deforestation, that threatens the environment.

2. LITERATURE REVIEW

Ongoing deforestation is one of the biggest threats on developing economies where numerous living factors are intensively connected with forestland but the forestland is in danger of extinction due to illegal activities by human beings. The author attempted to show the relationship between economic development and forest cover from satellite data. The author will measure the differences of deforestation activities across different countries where per-capita income was proved a robust variable using Kuznets curve [11].

The Food and Agriculture Organization (FAO) reports that South-Asian countries are the core providers of round-wood and precious environmental services wherein deforestation causes a major threat for sustainable use of forestland and reflecting the bad image of breaking the circle of biological diversity, lessening the quality of environment, land productivity and lowering the agricultural productivity etc. Contrarily, it helps to enhance the income of local people ensuring large amount of supply of fuelwood and timber. The author conducted an intensive investigation identifying the connection between governance structures and forestland destruction in Indonesia, where weak governance is the root cause for the destruction of forestland [6].

There are several forces working negatively to reduce forestland where poor regulation of forest governance, dislocation of aboriginal people, reckless migration activities, imbalance factor allocation etc. A research mentioned that the Indonesian government loses about $1 billion to $1.9 billion in revenues due to illegal log trade that causes huge losses for the national government as well [11]. This report shows that the Indonesian economy demands 60 million cubic on average every year in which sustainable forest land supply 20 million cubic meters per year, the 40 million demand is fulfilled by illegal activities of trade. In addition, A paper mentioned that due to poor governance performance, Philippines government losses about $1.8 billion (over ten years) due to illegal trade of logging and forest wood smugglers [14,18].

Illegal logging trade is one of the most profitable businesses in China, Thailand and Myanmar where it destroys the forestland recklessly causing the sudden change of climate and biodiversity as well. A study mentioned Myanmar is being considered as one of the major log exporter to Thailand but armed conflict in this border impacted the log harvesting negatively. In addition, forest-pirates of Myanmar conducted illegal log-trading with Indonesia due to weak performance of central government and inadequate environmental understanding [15].

Considering the region of the Brazilian Amazon, it has been encountering a huge destructive mode of deforestation due to illegal logging and land capturing of land-pirates, it causes huge crisis of environmental quality and human-life [21,29]. A statistic shows that about 2% of rainforest had experienced deforestation but this number jumps as high as 14 % in 2000. In addition, this value jumps again 20 percent in 2009, indicating the fact that future generations will be encountering severe environmental challenges. A study mentioned the situation that how deforestation is closely connected with the tragedy of commons that Nigeria loses 35.7% averagely from year 1990 to 2005 [26]. A group of researchers try to find the connection between climate change and forestland in the long term but they try to focus on green economy and sustainable policies to ensure forestland [32].

According to a recent study, about 40% of rainforest disappeared in the last few decades, 1.6 billion people being badly affected, especially in livelihood and climatic change for this unpleasant condition. Deforestation is the main reason for drastic climatic change and aggravating the vulnerability of local-people [30]. A study highlighted that most of economic activities solely depends on rainforest, women are closely engaged on zonal forest. Sub-Saharian zone encountered a huge crisis of deforestation, 15.4 million from 1980 to 1990, As late as 1990, the sub-Saharian countries loses 528 million hectares of forestland due to direct intervention of human-being [8].

A researcher investigated the effect of poor-governance on deforestation, where it impacts the standard of livelihood. At the end, it is proved that the huge level of corruption and unplanned structure of poor-governance are the core factor for deforestation [22].

The study of social-networking based corruption besides neighbouring countries are the prime reason for the increase in illegal logging trade where bribery and random forest laws breaking can be considered an essential factor for deforestation [27]. Besides this, the study tried to maintain a connection among environmental policy, democratic behavior and institutional polices on deforestation [20]. On the other hand, a paper conducted a survey on corruption, welfare and forest policy that connect with huge level of deforestation, but stakeholders feel problems to implement forest policies due to war, government weakness and poor governing bodies [9]. A researcher published an article based on forest governance and land allocation policies in Vietnam where the paper tried to trace the role of local inhabitants as local-actors on forestland [13]. A study highlighted that most of economic activates solely depends on rainforest, women are closely engaged on zonal forest. Sub-Saharian zone encountered a huge crisis of deforestation, 15.4 million from 1980 to 1990, At the last period of 1990 where the sub-Saharian countries losses 528 million hectares of forestland due to direct intervention of human-being [10].

In addition, community-based forest conversation with effective forest-governance can enable a sustainable capacity of forestland in Vietnam. A paper highlighted the effect of institutions and forest-devaluation policies on forestland in wider perspective as well [16]. Besides, an article indicated the connectivity of local-livelihood and forestland where forest devolution polices can be handy strategy to ensure sustainable forestland [5]. A paper highlighting the forestland and sustainability from Congo perspective as well. In Congo, about 107 million hectares are covered in forestland that majority of rural-people depending on them to sustain their minimum livelihood [23]. The ignorance of bad-governance system affects the livelihood and poverty badly where defective bureaucratic system, massive corruption, institutional incapacities make the situation worst on the forestland in Congo.

A investigation mentioning that effective forest management is the first and foremost condition to ensure sustainable forest management and diminishing forest degradation in African zone [4]. Basically, forest governance is described as policy creation, regulatory quality and institutional efficiency where transparency, accountability, equity and effectiveness are well maintained to ensure the sustainability of forest area. Forest management is closely involved with governmental bodies and law-enforcement agencies. Besides that, private bodies, civil groups, local stakeholders and local level people are mostly connected with forest sustainability. A paper based on accessing and monitoring the effect of forest governance showed that local governance is the main responsible factor to ensure forest sustainability [19].

The paper addressed the relationship between deforestation and climate change. The author mentioned that about 46-58 thousand square miles are lost every year due to deforestation [4]. In addition, the world loses 50 acres of land every hour due to slash and burn activities but intentionally fire setting cannot be controlled sometimes due to unpredictable way of human-beings. A group of researchers highlighted a paper showing the linkage between deforestation and climate change in Pakistan perspective at all [2]. Rapid industrialization in Pakistan and worst disasters are the main responsible factor for this sudden climatic change in Pakistan. Continuous emissions of greenhouse gases are the main responsible factors for deforestation that leads to rise the unpredictable sea-level, that causes the encountering situation of food crisis and fresh water scarcity in earth [1,31].

A researcher mentioned that deforestation causes rising sea-level, health-disaster, salinity increases, and displacement of local inhabitants [24]. A paper highlighted that carbon emissions are one of the main responsible factor for deforestation because forestland, specially rainforest works as filter of carbon emissions [25]. Forestland performs as a hub to maintain food chain ensuring the biodiversity, ensuring hydrochloric cycle maintaining, soil protection, water purification by bonding with soil etc.

Deforestation has negative impact on climate change and extinction of wild species that all living organisms directly or indirectly depend on forestland [17,28]. A report shows that a powerful forest ecosystem can counter in amazon where image of amazon forest has been declined due to rapid increasing of cattle farming, soy cultivation in Brazilian state by household at large level [33]. A statistic shows that about 2% of rainforest had experienced as deforestation but this number jumps at 14 % at 2000. In addition, this digit jumps again 20 percent at 2009 but this number leads the future generations into dangerous situation at all.

In this paper, the author tries to measure the joint effect of governance and literacy rate on forestland in developing countries perspective from 1996 to 2017, where the deforestation issue was being proved as burning factor for policy generating authority.

3. METHODS AND DATA

A pair of researchers investigates to find out the effectiveness of short-term policies to protect forestland while they consider 6 variables of good governance from World Bank (WB) to measure the effect of these variables on forestland [22].

Table 1. Variables Indication of Independent Variables that affect Dependent Variable

Independent Variable Name	Measurement Unit	Literature Reference
Agricultural Land (AL)	In Square	[2]
Wages Level (WL)	Wage and salaried workers, total (% of total employment) (Modelled ILO estimate)	[2]
Infrastructural Quality (IQ)	WEF (1=extremely underdeveloped to 7=well developed and efficient by international standards)	[2]
CPIA property rights and rule-based governance rating (PR)	(1=low to 6=high)	[2]
Costing over Science & Technology (ST)	Percentage in GDP	[2]
GDP per Capita (GDP)	IN US$	[28]
Population (PP)	In Number	[28]
External debt Shocks (EDS)	External debt stocks (% of GNI)	[18]
Terms of Trade (TOT)	In percentage	[30]
Economic Growth (EG)	In percentage	Author own compilation
Population Density (PD)	People per sq. km of land area)	[30]
Literacy Rate (LR)	In percentage	[08]
Voice and Accountability (VA)	Definition given in main text. Scaled to lie between -2.5 and +2,5 with higher values corresponding to better outcomes (Kaufmann et al. 1999a)	[22]
Voice and Accountability (VA)	Definition given in main text. Scaled to lie between -2.5 and +2,5 with higher values corresponding to better outcomes (Kaufmann et al. 1999a)	[22]
Political Stability and Lack of Violence (PS)	Definition given in main text. Scaled to lie between -2.5 and +2,5 with higher values corresponding to better outcomes (Kaufmann et al. 1999a)	[22]
Government Effectiveness (GE)	Definition given in main text. Scaled to lie between -2.5 and +2,5 with higher values corresponding to better outcomes (Kaufmann et al. 1999a)	[22]
Regulatory Quality (RQ)	Definition given in main text. Scaled to lie between -2.5 and +2,5 with higher values corresponding to better outcomes (Kaufmann et al. 1999a)	[22]
Control of Corruption (CC)	Definition given in main text. Scaled to lie between -2.5 and +2,5 with higher values corresponding to better outcomes (Kaufmann et al. 1999a)	[22]
Rule of Law (RL)	Definition given in main text. Scaled to lie between -2.5 and +2,5 with higher values corresponding to better outcomes (Kaufmann et al. 1999a)	[22]
Dependent Variable : Forestland in Square Kilometers		

Source: Author Own Compilation based on World Bank Open Data Source, 2020 [35]

The author considers secondary data of year 1996-2017 from world bank website to conduct this study. There are 58 Upper Middle Income countries and 46 lower middle income countries listed by World Bank open data (Income basis) where all developing countries are considered to conduct this study. The author considers one dependent variable forest land measured by squared kilometers, 12 independent variables and 5 government variables (Table 1) to measure the impact of independent variables on forestland. Moreover, the author considers some interacted variable (Good governance variables with literacy rate) to measure the effect of all interacted variables on forestland using multiple regression. A report of World Bank (WB) shows that sustainable forestland helps to protect ecological and environmental balance at positive way that can lessen the effect of climate change [34].

In this paper, the author measures the joint effect of literacy and good governance on forestland in developing countries characterized by income level of WB.

4. MERGING EFFECT OF GOVERNANCE AND LITERACY RATE ON FORESTLAND

In recent times, forestland has been reduced drastically to ensure economic growth but it nevertheless endangers the quality of the environment. A strong and well-organized governing body can protect forestland from illegal logging and save forestland from black-market trade. In recent times, climate change mitigation can be implemented strategically if good governance handles this crucial issue from top to bottom level.

Table 2. Multiple Regression Analysis for UMI and LMI countries with Interacted and without Interacted Variables

Dependent Variable: Forest Land (Per Square kilometers)							
	Variable Name	**Variable Indicator**	**World Bank Indicators**	**1. Multiple Regression UMI_Without Interacted Variable**	**2. Multiple Regression UMI_With Interacted Variable**	**3. Multiple Regression LMI_Without Interacted Variable**	**4. Multiple Regression LMI_With Interacted Variable**
1	*Agricultural Land*	*AL*	AG.LND.AGRI.K2	1.377*** (0.062)	1.426*** (0.063)	0.128*** (0.022)	0.168*** (0.022)
2	*Wages Level*	*WL*	SL.EMP.WORK.ZS	6,055.543*** (1,563.113)	6,950.443*** (1,571.405)	-3,858.804*** (328.414)	-3,956.201*** (318.682)
3	*Infrastructural Quality*	*IQ*	IQ.WEF.PORT.XQ	-20,409.250 (25,173.000)	-21,757.690 (24,902.690)	-21,328.560*** (5,032.222)	-14,417.470*** (5,172.444)
4	*CPIA property rights and rule-based governance rating*	*PR*	IQ.CPA.PROP.XQ	-26,578.150*** (8,770.462)	-24,509.580*** (8,717.497)	1,156.388 (10,857.250)	8,107.881 (10,615.390)
5	*Costing over Science & Technology*	*ST*	GB.XPD.RSDV.GD.ZS	223,558.000*** (46,180.400)	234,281.800*** (46,492.710)	-54,918.320*** (19,140.640)	-42,919.590** (18,746.490)
6	*GDP per Capita*	*GDP*	NY.GDP.PCAP.CD	-3.032 (9.278)	-8.381 (9.591)	2.348 (5.653)	-4.785 (5.628)
7	*Population*	*TP*	SP.POP.TOTL	-0.004*** (0.0003)	-0.004*** (0.0003)	0.00001 (0.0001)	-0.00001 (0.0001)
8	*External Debt Shocks*	*EDS*	DT.DOD.DLXF.CD	0.00000*** (0.00000)	0.00000*** (0.00000)	0.00000*** (0.00000)	0.00000*** (0.00000)
9	*Terms of Trade*	*TOT*	TT.PRI.MRCH.XD.WD	-130.341 (715.577)	109.102 (713.263)	376.676** (148.292)	441.155*** (143.876)
10	*Economic Growth*	*EG*	NY.GDP.MKTP.KD.ZG	-88.608 (2,441.428)	251.259 (2,430.836)	694.617 (1,118.276)	848.526 (1,081.963
11	*Population Density*	*PD*	EN.POP.DNST	217.586 (141.621)	342.762** (141.353)	-202.828*** (27.879)	-231.530*** (27.965)
12	*Literacy Rate*	*LR*	SE.ADT.LITR.ZS	10,339.280*** (3,476.845)	13,750.630*** (4,363.407)	2,760.762*** (313.715)	3,937.297*** (584.061)
13	*Government Effectiveness*	*GE*	GE.EST	-552,165.400*** (94,746.050)	-454,956.400 (1,374,671.00	46,648.100*** (17,649.580)	75,472.700 (74,892.030)
14	*Political Stability*	*PS*	PS.EST	-190,800.500*** (40,830.670)	2,905,271.000*** (487,743.200)	-15,305.300** (7,757.380)	189,034.900*** (31,004.430)
15	*Regulatory Quality*	*RQ*	RQ.EST	339,309.100*** (68,233.910)	848,192.100 (799,657.200)	5,188.580 (13,394.740)	197,665.200*** (63,549.090)
16	*Control of Corruption*	*CC*	CC.EST	70,453.490 (83,126.960)	-213,465.400 (1,193,309.000)	-40,144.410** (16,337.030)	-379,701.900*** (73,854.680)
17	*Rule of Law*	*RL*	RL.EST	69,214.380 (78,773.310)	-3,085,242.000*** (1,123,423.000)	-43,321.950** (17,262.210)	182,365.000** (80,584.860)
18	*Government Effectiveness* Literacy Rate*	*GE*LR*			-911.354 (14,716.180)		-338.595 (1,016.273)
19	*Political Stability* Literacy Rate*	*PS*LR*			-33,876.030*** (5,294.111)		-2,753.382*** (408.390)
20	*Regulatory Quality* Literacy Rate*	*RQ*LR*			-6,274.474 (8,633.363)		2,495.914*** (793.533)
21	*Control of Corruption* Literacy Rate*	*CC*LR*			3,411.939 (12,684.620)		4,486.891*** (985.014)
22	*Rule of Law* Literacy Rate*	*RL*LR*			34,102.820*** (11,858.460)		-2,862.279*** (1,067.520)
	Constant			*-1,400,707.000**** *(383,031.400)*	*-1,790,836.000**** *(453,459.000)*	*47,118.900* *(45,739.750)*	*-77,385.630* *(61,360.000)*

	Observations		*1276*	*1276*	*990*	*990*
	R2		*0.526*	*0.542*	*0.566*	*0.598*
	Adjusted R2		*0.52*	*0.534*	*0.558*	*0.588*
	F Statistic		*82.229****	*67.398****	*74.537****	*65.253****
	Significance Level: *p<0.1; **p<0.05; ***p<0.01					
Formula	Model 1: UMI: Gini Index = β0 + β1 AL + β2 WL+ β3 IQ + β4 PR+ β5 ST + β6 GDP + β7 TP + β8 EDS + β9 TOT + β10 EG + β11 PD+ β12 LR+ β13GE+ β14 PS + β15 RQ + β16 CC + β17 RL + ui					
	Model 2: UMI_IV: Gini Index = α 0 + α 1 AL + α 2 WL+ α 3 IQ + α 4 PR+ α 5 ST + α 6 GDP + α 7 TP + α 8 EDS + α 9 TOT + α 10 EG + α 11 PD+ α 12GE*LR+ α 13 PS*LR + α 14 RQ*LR + α 15 CC*LR + α 16 RL*LR + ui					
	Model 3: LMI: Gini Index = μ 0 + β1 AL + μ 2 WL+ μ 3 IQ + μ 4 PR+ μ 5 ST + μ 6 GDP + μ 7 TP + μ 8 EDS + μ 9 TOT + μ 10 EG + μ 11 PD+ μ 12 LR+ μ 13GE+ μ 14 PS + μ 15 RQ + μ 16 CC + μ 17 RL + ui					
	Model 4: LMI_IV: Gini Index = γ 0 + γ 1 AL + γ 2 WL+ γ 3 IQ + γ 4 PR+ γ 5 ST + γ 6 GDP + γ 7 TP + γ 8 EDS + γ 9 TOT + γ 10 EG + γ 11 PD+ γ 12GE*LR+ γ 13 PS*LR + γ 14 RQ*LR + γ 15 CC*LR + γ 16 RL*LR + ui					
	Note: IV means interacted variables					

Source: Author Own Compilation based on World Bank Open Data Source, 2020

4.1. Multiple Regression Result for UMI Countries (Model 1 and Model 2)

From the above Table no 2, it is highlighted that if the agricultural land is increased by one squared kilometers, then forest land will be increased at 1.377 (Model 1) and 1.426 (Model 2) square kilometers significantly. It is statistically significant at 1 percent level of significance. If the wage level increases by 1 percent of total employment, forest land will be increased at 6,055.54 (1st Model) and 6,950.44 (2nd Model) square kilometers, that two value are statistically significant at 1 percent level of significance. In addition, property rights mean the legal access of property that is counted by governance based index ranked from 1 to 6 score. If the property rights increased by 1 rank, forestland will be reduced at 26,578.15 (Model 1) and 24,509.58 (Model 2) square kilometers per year. When the people try to get more access of CPIA property rights, they will try to expand into the forestland which causes deforestation in UMI. This is a bad sign if the goal is to ensure forest sustainability. These values are statistically significant at 1 percent level of significance. If the expenditure of science and technology cost increases by 1 percent of total GDP in UMI countries, forestland will be increased at 2,23,558 (Model 1) and 2,34,281 (Model 2) squared kilometers in UMI, these are statistically significant at 1 percent level of significance. When innovation and new technologies are adapted by local people easily, they will not be highly dependent on forestland. The forestland expansion is highly dependent on the latest innovation of science and technological sector.

From the population view from Table 2, it is observed that, with the increasing of 1000 people in UMI, forestland will be diminished by 4.00 (Model 1) and 4.00 (Model 2) squared kilometers, these value are statistically significant at 1 percent level of significance. When population growth has gone beyond control, people settle their home on forestland and depend on it to earn their livelihood, this creating a negative impact on forest sustainability. Not only it hampers forestland but it destroys the ecological chain of forest. If the external debt shocks increase 1 percent of total GNI in UMI, forestland will be decreased significantly at 1 percent level.

From the point of view of literacy from Table 2, if the literacy rate is increased by 1 percent in UMI, forestland will be increased at 10,339.28 (Model 1) and 13,750.63 (Model 2) squared kilometers, these value are statistically significant at 1 percent level of significance. When the people are becoming educated, they will get more environmental knowledge about sustainability and climate change. A literate man cannot destroy forestland recklessly because he knows the importance forestland has on climate. Literacy is one of the crucial variables that can ensure sustainability of forestland.

From the perspective of government effectiveness from Table 2, if GE increases by 1 point then it leads to decrease the forestland by 5,52,165.400 (Model 1) squared kilometers for UMI. This variable is statistically significant at 1 percent level of significance. In addition, if PS increases by 1 points, it will reduce 1,90,800.500 square kilometers of forestland (Model 1) and increases 29,05,271 square kilometers of forestland in UMI. These values statistically significant at 1 percent level of significance. With the increases of point of RQ in UMI it will increased forestland by 3,39,309.100 (Model 1) square kilometers of forestland. This variable is statistically significant at 1 percent level of significance. With the increases of point of RL in UMI it will increased forestland by 30,85,242.00 (Model 2) square kilometers of forestland. This variable is statistically significant at 1 percent level of significance.

4.1.1. Effect of Interacted Variables on UMI Countries

From Table 2, it is seen that when the good governance variables are interacted with literacy rate as seen in Model 2 starting from column no 18, if PS*LR increases by 1 point, it will reduce forestland by 33,876.030 square kilometers, this variable is statistically significant at 1 percent level of significance. In

addition, if if RL*LR increases by 1 point, it will increase forestland by 34,102.820 square kilometers, this variable is statistically significant at 1 percent level of significance for UMI. Only this interacted variable (RL*LR) create positive effect to ensure the sustainability of forestland. A better and effective government rules can enrich the forestland which is pre-condition to achieve maximum sustainability of forest. Sustainability of forestland can ensure ecological balance and effective chain of food diversity.

The value of constant means that if all variables are not activated in these two Models then it lessens the forestland by 14,00,707.00 (Model 1) and 17,90,836.00 (Model 2) square kilometers. These variables are statistically significant at 1 percent level of significance. The value of R^2 are 0.52 (Model 1) and 0.54 (Model 2) so independent variables represent the dependent variable (forestland) by 0.52 and 0.54 percent respectively.

4.2 Multiple Regression Result for LMI Countries (Model 3 and Model 4)

From the Table 2 in Models 3 and 4, it is highlighted that if the agricultural land is increased by one squared kilometers, then forest land will be increased at 0.128 (Model 3) and 0.168 (Model 4) square kilometers significantly. It is statistically significant at 1 percent level of significance. If the wage level increases by 1 percent of total employment, forest land will be decreased at 3,858.80 (Model 3) and 3,956.20 (Model 4) square kilometers, that two value are It is statistically significant at 1 percent level of significance.

In addition, from Table 2, the infrastructural quality increases from 1 to 3 scale based on business executive perception based on world class standard. If the infrastructural quality increased by 1 rank, forestland will be reduced at 21,328.56 (Model 3) and 14,417.47 (Model 4) square kilometers per year. When people decides to extend road and port quality for better communication facilities, it should lessen forestland at the time of road extension. Generally, with the increasing of infrastructural quality, it normally lessens the forest area significantly.

If the expenditure of science and technology cost increases by 1 percent of total GDP in LMI countries, forestland will be decreased at 54,918.32 (Model 3) and 42,919.59 (Model 4) squared kilometers in LMI, these are statistically significant at 1 percent and 5 percent level of significance respectively. At the time of increasing costing pattern of behind science and technology sector, entrepreneurs set up new industries and infrastructure to accelerate the growth of modern technological based business where it lessens the forestland automatically. From the perspective of debt shocks of LMI, increasing the debt shocks by 1 percent lessens the forestland significantly. In addition, from the viewpoint of TOT, it means that how much export units or volume will be compulsory to purchase 1 unit of import goods.

Suppose, if Germany exports more goods (in monetary amount) while it purchases fewer import goods, then the TOT will be positive in Germany. Besides, if the TOT percent ratio increases by 1 percent, forestland will be increased by 376.67 (Model 3) and 441.15 (Model 4) square kilometers points holding other variables constant. It is statistically significant at 5 and 1 percent level of significance respectively. If the population density increases by 1, forestland will be reduced at 202.82 (Model 3) and 231.53 (Model 4) square kilometers, these variables are 1 percent level of significance respectively.

From the point of view of literacy, if the literacy rate is increased by 1 percent in LMI, forestland will be increased at 2,760.76 (Model 3) and 3,937.29 (Model 4) squared kilometers, these value are statistically significant at 1 percent level of significance.

If the GE increases by 1 points then it increases forestland by 46,648.100 (Model 3) square kilometers of forestland holding other variables constant, it is significant at 1 percent level of significance.

If the PS increases by 1 point then it decreases 15,305.30 (Model 3) and increases 1,89,034.90 (Model 4) square kilometers of forestland holding other variables constant, both variables are significant at 1 percent level of significance.

If the RQ increases by 1 points then it decreases forestland by 1,97,665.200 (Model 4) square kilometers of forestland holding other variables constant, it is significant at 1 percent level of significance.

If the CC increases by 1 point then it decreases 40,144 (Model 3) and increases 3,79,701.900 (Model 4) square kilometers of forestland holding other variables constant, both variables are significant at 5 percent and 1 percent level of significance respectively.

If the RL increases by 1 point then it decreases 43,321.95 (Model 3) and increases 1,82,365 (Model 4) square kilometers of forestland holding other variables constant, both variables are significant at 5 percent level of significance.

4.2.1 Effect of Interacted Variables on LMI Countries

If Political stability interacted with literacy (PS*LR) increases by 1 point then it decreases forestland by 2,753.38 square kilometers holding other variables constant, it is significant at 1 percent level of significance. If Regulatory quality interacted with literacy (RQ*LR) increases by 1 point then it increases forestland by 2,495.91 square kilometers holding other variables constant, it is significant at 1 percent level of significance. If Control of corruption interacted with literacy (CC*LR) increases by 1 point then it increases forestland by 4,486.89 square kilometers holding other variables constant, it is significant at 1 percent level of significance. If Rules of law interacted with literacy (RL*LR) increases by 1 point then it decreases forestland by 2,862.27 square kilometers holding other variables constant, it is significant at 1 percent level of significance.

The value of R^2 are 0.55 (Model 3) and 0.58 (Model 4) so independent variables represent the dependent variable (forestland) by 0.55 and 0.58 percent respectively.

From the four Models, it is seen that, some interacted variables act negatively with forestland. Besides, some other interacted variables activate positively with forestland where (CC*LR) and (RL*LR) variables can ensure sustainable forestland, that helps to ensure environmental benefits on economy. If the government takes necessary steps to control corruption from upper to lower level because most of the corruption causes due to bureaucratic complexity. Furthermore, forest governance is being corrupted severely because they clear forest due to profitable logging business, and wild-animal trafficking.

5. DISCUSSION

From the viewpoint of UMI countries in Table 2, Illegal logging business causes forest clearance because corrupted bodies exports wood to illegal buyers with less than market value, wherein central governance loses huge level of revenue every year due to unexpected illegal wood-trade.

In addition, if the rules of law are implemented strictly all over the countries with forest governance, forestland will be increased significantly that is good sign for ensuring environmental sustainability. Conversely, from the viewpoint of LMI, the variables (RQ*LR) and (CC*LR) work positively with ensuring the forestland. Actually, lower middle income countries are suffering badly due to bad regulatory control and poor administrative wings that are highly polluted due to bad governance. If the governmental bodies implement sound and sustainable polices to ensure the sustainability of forestland, it will create a positive impact on environment. The author finds some difference on the implementation of interacted variables between UMI and LMI countries. Education is always proved as effective factor to create awareness for societal variable like education and poverty. In this case, the author tries to interact the variables of good governance with literacy rate (that raises awareness within people) on forestland. In this paper, one interacted variable (RQ*LR) work negatively (-6,274) to lessen forestland but the same variable works positively (2,495) to increase forestland significantly. Moreover, the variable (RL*LR) work positively (34,102) to increase forestland in UMI countries significantly but the same work negatively (-2,862) on forestland in LMI countries.

From the following viewpoint, it is evident that forestland is being cleared due to ensuring economic sufficiency and economic growth at desired prices, it backlogs our environmental knowledge about plantation. The losses of forestland cause desertification, drastic climate change, soil erosion, flooding as well as other climate shifts which can increase the global temperature in recent time.

a. Firstly, the central government should take important steps to reduce the level of corruption among forest governing bodies, then the deforestation percentage should be lowered and the government can earn more revenue from legal logging business.

b. Legal frameworks should be maintained with public participation, forest related polices and active participation for policy sanctions and implementation.

c. Government bodies should justify different sustainable polices regarding forest with civil society, native people and forest-communities for any decision making purposes.

d. Transparency should be maintained about forest related products like timber and log where transparency should be ensured for revenue allocation, budgeting, expenses and redistribution and audit system as well.

e. An internal monitoring shell needs to be established for accountability and performance testing of employees and regular contact maintaining with native people.

f. Most of the people in LMI countries do not have the knowledge of environmental literacy that causes negative effect on forestland. They even do not have the ideas how forestland protect them from disaster and natural calamities. So, it is really important to launch a programme to literate local people with better environmental knowledge.

6. CONCLUSIONS

The paper tries to find the effective procedures about forest sustainability which play a significant role in balancing the ecological system and coping up with climatic change. Policy-makers should adopt appropriate polices to ensure sustainable forestland because forestland is the biggest source of revenue; governments in developing countries lose huge amount of revenue due to illegal logging and wild-animal trafficking due to corrupted systems. If the governing bodies of developing countries take diversified steps to tend the value towards +2.5 (According to WB website), it can ensure a sustainable forestland, safeguarding the local livelihood ensuring biodiversity, reducing rural poverty with sustainable earning scopes and mitigating the vulnerable effects of climate change which is a most concerning issue in recent times. Due to high pressure of population, a sound and conservative ecosystems are correlated with sustainable forestland, where the joint impact of literacy and good governance can increase the sustainable forestland significantly. In developing nations, the practice of sustainable forestland has not been so popular because forest-governing body does not consider this issue as important one for the local citizen.

There is some interacted variable like (Regulatory Quality* Literacy Rate) and (Control of Corruption*Literacy Rate) that should be considered as an effective variable that can increase forestland in sustainable nature in LMI countries. On the other hand, if the rules of law merged with the literacy rate, the forestland will be increased in UMI countries. Not all variables act in the same manner in UMI and LMI so that governing bodies can take necessary steps based on country-wise socio-economic characteristics.

The population living in regions surrounded by forestlands cut down trees for their daily livelihood, which that damages the quality of the environment, breaks down ecological systems and reduces land fertility. A strategic and applied educational system lauched by central goverance can enrich the forestland and focus the view of green economy positively.

ACKNOWLEDGMENT

I would like to thank all honourable reviewers who help to improve the quality of this paper. Especially, I would like to thank my colleague Md. Mahbubul Hasan, Lecturer, Department of English and Literature, North Western University, Khulna who reviewed my paper as a language reviewer.

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