Forest Cover Change and its impact on Ecosystem Service Value of the Chure and Terai Region of Nepal

Er. Binita Shahi, Er. Anirudra Prasad Koirala, Er. Krishna Prasad Sharma Er. Sanjeevan Shrestha

INTRODUCTION

Forest cover in general refers to the relative or sure (in square kilometers/square miles) land area that is covered by forests or the forest canopy or open woodland. Ecosystem provide a wide range of valuable goods and services that contribute to supporting nature and human well-being.The ecosystem service value are dominantly influenced by the degradation of the forest.In total, between 1990 and 2005, Nepal lost 24.5% of its forest cover, or around 1,181,000 hectares. Nepal lost 42,000 hectares of its primary forest cover during that time.

OBJECTIVES

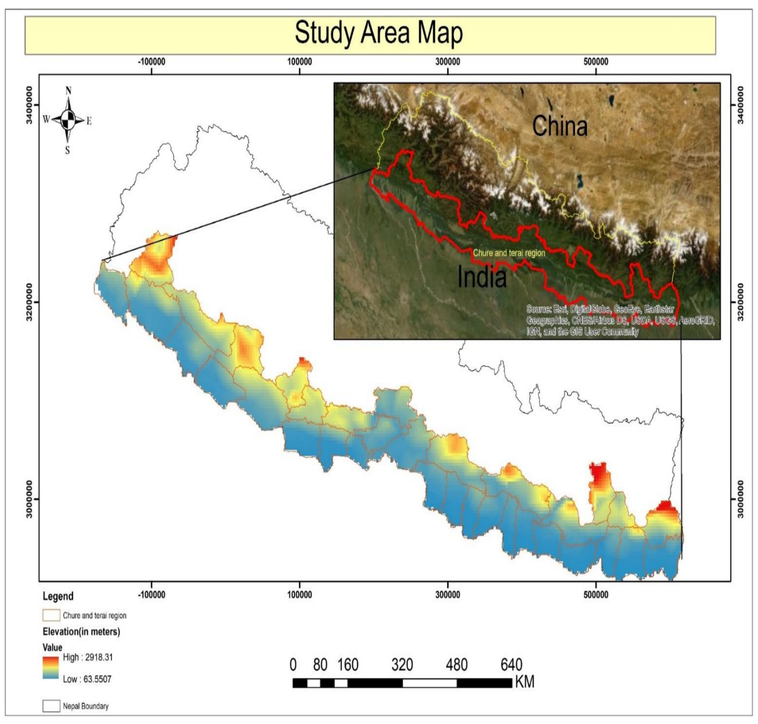
The main objective of the project is to assess the ecosystem service value (ESV) changes corresponding to the forest cover changes of the Terai and Chure belt of Nepal in the period of 1994-2018 using Landsat imageries.

Secondary objectives are:-

- To prepare time series forest cover map in the period of 1994-2018 at interval of 5 years.
- To assess the forest cover changes in the period of 1994-2018 at interval of 5 years.
- To assess the Ecosystem service value(ESV) and its change corresponding to forest cover changes.

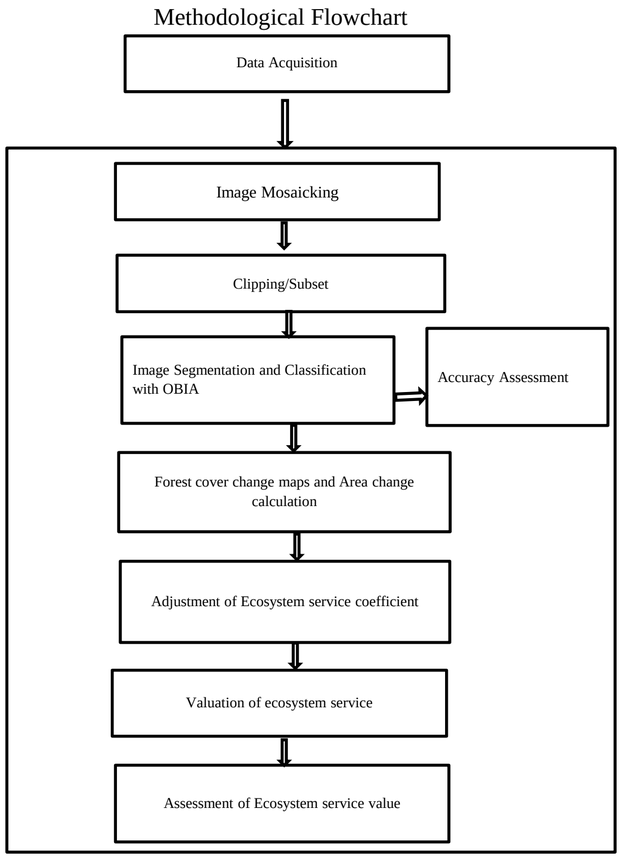
STUDY AREA

The study area covers the Chure and Terai belt of Nepal about 849 km in length and 24 to 72 km in breadth and has an area of 39, 236 sq.km between 26.36º to 29.17º North latitude and 80.05º to 88.20º East longitudes.

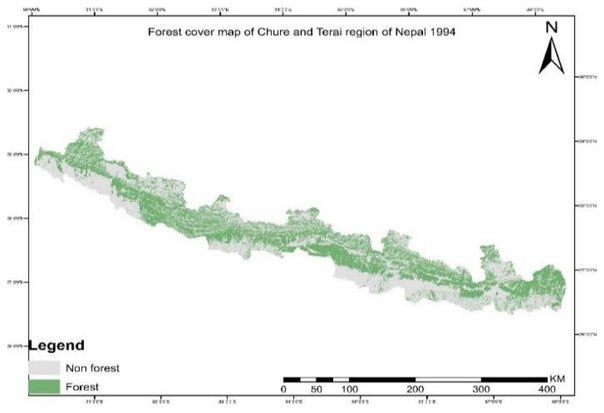


METHODOLOGY

Methodological Flowchart



RESULTS



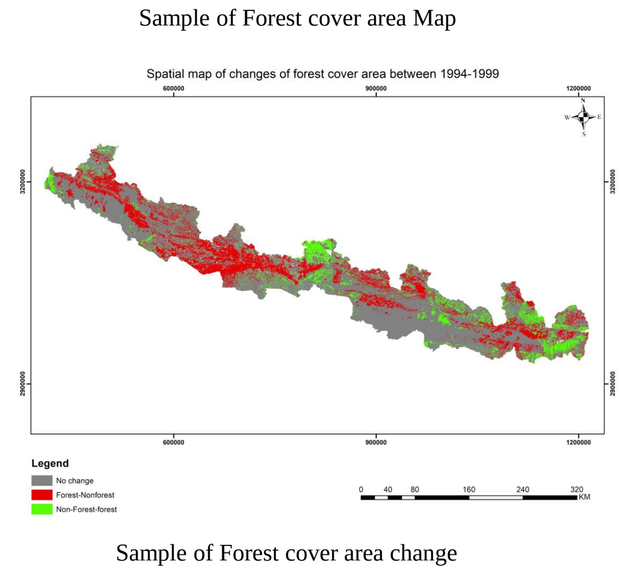
Sample of Forest cover area Map

year(AD)	Forest cover(hectare)	Total land cover area(hectare)	Percent Forest cover(%)
1994	2683357.92	5829970.10	40.02
1999	1904320.50	5829970.10	32.66
2004	1683498.52	5829970.10	28.87
2009	1651903.38	5829970.10	28.33
2014	1569459.96	5829970.10	26.92
2018	1545579.19	5829970.10	26.52

Forest cover area of 1994-2018

Forest cover(ha)						
Districts\Y	1994	1999	2004	2009	2014	2018
Arghakha	51721.59	32108.75	79962.82	101578.08	48450.46	48823.66
Banke	114960.74	79258.78	140164.89	132777.60	52032.05	100900.51
Bara	48914.98	31932.46	50779.17	26435.24	13637.88	12555.73
Bardiya	80478.03	18605.34	80011.61	76383.32	77863.19	52579.87
Bhojpur	64167.52	89512.08	75822.76	37207.12	46121.69	20576.98
Chitwan	138919.18	67197.39	131128.51	119763.63	101437.6	61857.67
Dang	198988.50	89611.57	246870.75	266445.03	122153.5	132112.69
Dhankuta	21039.35	51358.14	63876.71	16366.53	146884	12471.29
Dhanusa	38427.89	32227.63	75798.97	7837.07	1071.54	5241.55
Doti	111410.76	90260.52	143220.42	118124.05	112679.8	69602.87
Ilam	140866.52	98143.21	165361.62	113031.02	122643.2	54173.56
Jhapa	63048.47	97621.96	79486.73	60500.37	146292.2	14662.75
Kailali	117002.53	37924.86	184934.60	122552.73	110140.6	74925.05
Kanchanpu	50851.38	43226.04	80874.28	45336.14	28061.63	33889.56
Kapilbastu	83728.39	25234.43	122905.85	97373.57	29840.93	85315.05
Mahottari	23361.34	28820.61	41552.09	475.53	8775.63	4656.04
Makwanpo	134088.45	14154.74	207035.39	139478.29	144406.7	86902.96
Morang	95479.41	130018.66	112345.86	72718.30	147308.3	36888.13
Nawalpara	118376.40	75474.84	139195.62	93482.28	40855.86	69749.29
Palpa	70179.34	57915.82	95321.29	126980.58	46621.65	56471.04
Parsa	75497.68	141.39	77350.62	39839.36	54477.27	14363.40
Peuthan	63411.85	26952.51	112495.64	78885.47	64026.97	42191.05
Rautahat	34738.07	31469.31	30248.39	8176.02	5085.72	11008.47
Rupandehi	51158.90	29110.05	74793.60	37462.11	9248.94	43889.24
Salyan	79418.68	63387.42	180641.96	97024.41	133819.1	63610.25
saptari	33929.85	45381.68	94776.82	40052.60	54151.31	29818.54
sarlahi	33636.91	39840.99	51197.65	4227.35	8122.86	12011.60
sindhuli	141245.23	74392.21	200259.15	102584.37	66924.09	70676.69
Siraha	16539.42	28552.74	67458.59	4224.00	19459.75	7095.73
Sunsari	33913.52	47616.14	88898.29	46605.44	143449.6	12303.84
Surkhet	83638.65	31636.17	110710.54	93863.02	173417.7	83013.35
Tanahu	66580.41	97873.29	55003.59	16291.82	38094.41	35976.75
Udayapur	144489.53	191090.16	225518.46	77927.85	77225.85	40808.49

District wise Forest Cover Statistics



Sample of Forest cover area change

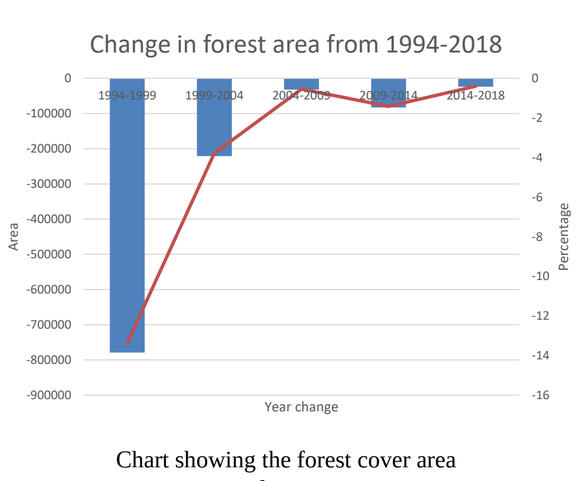


Chart showing the forest cover area change

Year(AD)	ESV Value(10^8) at 2019	Year from-to(AD)	ESV Change(10^8$)
1994	78.7	1994-1999	22.8
1999	55.8	1999-2004	6.6
2004	49.2	2004-2009	0.7
2009	48.5	2009-2014	1.5
2014	46.9	2014-2018	3.7
2018	43.2		

Adjusted Esv Coefficient

Year(AD)	Xie et al.(2003)	1994	1999	2004	2009	2014	2019
ESV coefficient($ per ha)	2168.84	1745.1	1961.15	2210.62	2520.28	2792.11	2958.63

Year(AD)	Total Forest Cover(ha)	ESV coefficient(USD per ha)	Total ESV(10^8$)
1994	2683357.9	1745.10	46.8
1999	1904320.5	1961.15	37.3
2004	1683498.5	2210.62	37.2
2009	1651903.4	2520.28	41.6
2014	1569460	2792.11	43.82
2018	1545579.2	2958.63	45.7

Total Estimated ESV

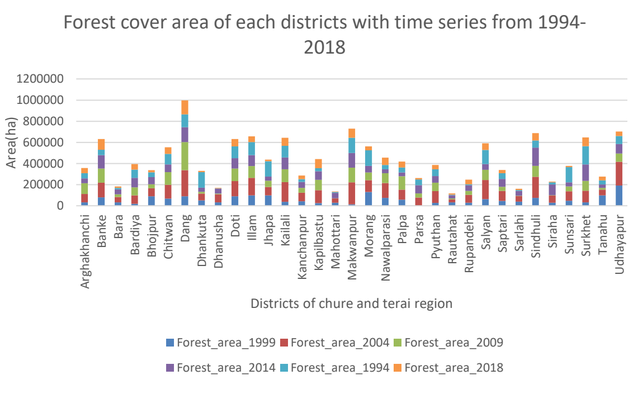
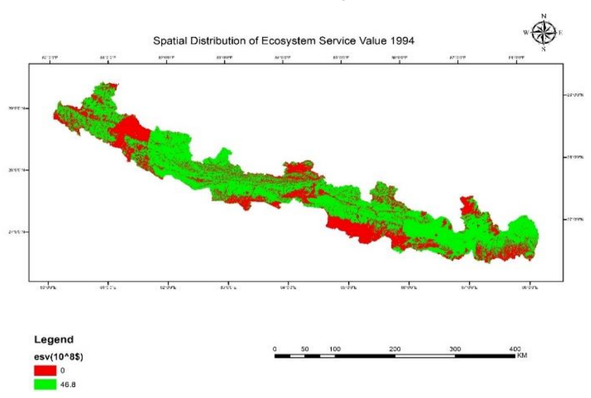


Chart showing District wise Forest Cover Statistics

ESV value change



Sample of ESV Map

CONCLUSION

In our study, we discussed the spatio-temporal pattern of forest cover and its dynamics over the past two decades in the Chure and Terai regions of Nepal using Landsat imageries from 1994 to 2018AD. Furthermore, we have evaluated and analyzed the ESV contributed by forest cover. Forest covered the highest area in Chure areas, there are both faster and slower decrease of forest cover in last two decades in Chure and Terai. Due to this forest cover change, ESV for Chure and Terai decreased by 35.5*10^8$ in last 25 years, and this loss mainly occurred in Chure regions where forest cover is more abundant. The decrease in ESV shows declining Ecosystem services and forest cover is one of the driving factors of changes of ESV in the Chure and Terai.

RECOMMENDATION

We recommend using the better resolution after monsoon images so that shrub land and agricultural and would not falsely be classified into forest cover class and also considering other (carbon stock etc.) factors to accurately value the ecosystem services.