Demand for ecosystem services drive large-scale shifts in land-use in tropical mountainous watersheds prone to landslides

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Table S1. Results of linear models between two metrics of forest cover and time as a function of scale . <0.1, * <0.05, ** < 0.01, *** < 0.001

Watershed	Proportion of forest (pi)				Aggregation of forest (AIi)			
	Intercept	Slope	R^2	*p*	Intercept	Slope	R^2	*p*
All (R4)	0.443	0.000	0.005	7.8×10^{-1}	92.194	0.117	0.478	1.0×10^{-3} **
Nima	0.634	0.000	0.007	7.3×10^{-1}	93.835	0.099	0.615	7.0×10^{-5} ***
Bolo	0.357	0.002	0.141	1.1×10^{-1}	90.872	0.127	0.343	8.4×10^{-3} ***
Fraile	0.463	-0.001	0.094	2.0×10^{-1}	92.099	0.111	0.555	2.5×10^{-4} ***
Desbaratado	0.474	-0.001	0.057	3.2×10^{-1}	93.070	0.156	0.556	2.4×10^{-4} ***
R3 Nima (All-Nima)	0.413	0.000	0.004	8.0×10^{-1}	91.774	0.121	0.445	1.8×10^{-3} **
R3 Bolo (All-Bolo)	0.506	-0.001	0.054	3.3×10^{-1}	92.792	0.117	0.598	1.0×10^{-4} ***
R3 Fraile (All-Fraile)	0.435	0.001	0.059	3.1×10^{-1}	92.167	0.121	0.443	1.8×10^{-3} **
R3 Desbaratado (All-Desbrarado)	0.438	0.000	0.013	6.3×10^{-1}	91.997	0.112	0.460	1.4×10^{-3} **

Table S2. Results of two sets of Ancovas between the two forest cover metrics derived from the current dataset, Time (covariate), Elevation (factor), Slope (factor), and Watershed (WSi)

	Forest cover metric	Scale							Elevation					Slope				
			Effect	df	SS	MS	F value	Pr(>F)	df	SS	F value	Pr(>F)		Effect	df	SS	F value	Pr(>F)	
A)	Fractional cover		Time	1	0.00	0.00	0.01	8.0×10^{-3}											
			WSi	3	0.70	0.23	392.95	3.9×10^{2}	***										
			Time x WSi	3	0.00	0.00	2.02	2.0×10^{0}											
			Residuals	68	0.04	0.00													
	Aggregation Index		Time	1	34.40	34.40	62.29	6.2×10^{11}											
			WSi	3	91.11	30.37	54.98	5.5×10^{16}	***										
			Time x WSi	3	1.04	0.35	0.63	6.2×10^{-1}											
			Residuals	68	37.56	0.55													
B)	Fracional cover	R4	Time						1	0.00	0.94	3.3×10^{-1}		Time	1	0.00	6.01	1.7×10^{-2}	*
			Elevation						4	6.65	1278.95	2.0×10^{3}	***	Slope	2	4.86	3664.54	2.0×10^{16}	***
			Time:Elevation						4	0.03	4.79	1.5×10^{0}	***	Time:Slope	2	0.01	10.20	1.8×10^{-4}	***
			Residuals						85	0.11				Residuals	51	0.03			
		WSi	Time						1	0.00	1.64	2.0×10^{-1}		Time	1	0.01	9.82	1.9×10^{-3}	**
			Elevation						3	23.32	4638.71	2.0×10^{16}	***	Slope	2	18.50	11128.65	2.0×10^{16}	***
			WSi						3	0.20	40.09	2.0×10^{16}	***	WSi	3	0.41	164.81	2.0×10^{16}	***
			Time:Elevation						3	0.10	20.73	4.7×10^{12}	***	Time:Slope	2	0.07	43.63	2.0×10^{16}	***
			Time:WSi						3	0.02	3.40	1.8×10^{-2}	*	Time:WSi	3	0.02	6.85	2.0×10^{-4}	***
			Elevation:WSi						8	0.36	26.61	2.0×10^{16}	***	Slope:WSi	6	0.21	42.03	2.0×10^{16}	***
			Time:Elevation:WSi						8	0.01	0.48	8.7×10^{-1}		Time:Slope:WSi	6	0.00	0.40	8.8×10^{-1}	
			Residuals						255	0.43									
	Aggregation Index	R4	Time						1	16.00	2.96	8.9×10^{0}	.	Time	1	1.20	1.11	2.9×10^{-1}	
			Elevation						4	13156.00	611.41	2.0×10^{2}	***	Slope	2	1983.60	912.85	2.0×10^{16}	***
			Time:Elevation						4	9.00	0.43	7.8×10^{-1}		Time:Slope	2	12.10	5.58	6.4×10^{-3}	**
			Residuals						85	457.00				Residuals	51	55.40			
		WSi	Time						1	27.00	4.76	3.0×10^{0}	*	Time	1	0.00	0.17	6.7×10^{-1}	
			Elevation						3	40872.00	2439.58	2.0×10^{3}	***	Slope	2	8914.00	3004.81	2.0×10^{16}	***
			WSi						3	137.00	8.19	3.1×10^{0}	***	WSi	3	261.00	58.63	2.0×10^{16}	***
			Time:Elevation						3	60.00	3.57	1.4×10^{0}	*	Time:Slope	2	82.00	27.76	2.1×10^{11}	***
			Time:WSi						3	6.00	0.37	7.7×10^{-1}		Time:WSi	3	11.00	2.42	6.7×10^{-2}	.
			Elevation:WSi						8	155.00	3.47	8.0×10^{0}	***	Slope:WSi	6	190.00	21.37	2.0×10^{16}	***
			Time:Elevation:WSi						8	12.00	0.28	9.7×10^{-1}		Time:Slope:WSi	6	13.00	1.44	2.0×10^{-1}	
			Residuals						255	1424.00				Residuals	204	303.00			

Table S3A. Results of linear models between fractional forest cover and time as a function of Elevation and Slope . <0.1, * <0.05, ** < 0.01, *** < 0.001

Watershed	Elevation						Slope					
	Elevation classes	Intercept	Slope	R^2	*p*		Slope classes	Intercept	Slope	R^2	*p*	
All (R4)	Very High	0.663	-0.001	0.009	6.9×10^{-1}		Very steep	0.785	0.004	0.560	2.3×10^{-4}	***
	High	0.770	0.006	0.511	5.8×10^{-4}	***	Steep	0.703	0.003	0.331	9.9×10^{-3}	***
	Medium	0.391	-0.001	0.029	4.8×10^{-1}		Gentle	0.183	-0.002	0.152	9.8×10^{-2}	.
	Low	0.061	-0.002	0.074	2.5×10^{-1}							
Nima	Very High	0.694	-0.002	0.043	3.9×10^{-1}		Very steep	0.813	0.004	0.531	4.0×10^{-4}	***
	High	0.830	0.006	0.501	7.0×10^{-4}	***	Steep	0.773	0.003	0.346	8.1×10^{-3}	**
	Medium	0.480	-0.002	0.079	2.4×10^{-1}		Gentle	0.361	-0.005	0.419	2.7×10^{-3}	***
	Low	NA	NA	NA								
Bolo	Very High	0.697	0.003	0.214	4.6×10^{-2}	*	Very steep	0.745	0.007	0.660	2.3×10^{-5}	***
	High	0.720	0.007	0.464	1.3×10^{-3}	**	Steep	0.673	0.005	0.484	9.4×10^{-4}	***
	Medium	0.314	0.001	0.028	4.9×10^{-1}		Gentle	0.149	0.000	0.004	8.0×10^{-1}	
	Low	0.063	-0.001	0.016	6.0×10^{-1}							
Fraile	Very High	0.627	-0.003	0.070	2.7×10^{-1}		Very steep	0.781	0.003	0.235	3.5×10^{-2}	*
	High	0.752	0.006	0.546	3.0×10^{-4}	***	Steep	0.681	0.001	0.017	5.9×10^{-1}	
	Medium	0.434	-0.004	0.207	5.0×10^{-2}	*	Gentle	0.192	-0.004	0.350	7.6×10^{-3}	*
	Low	0.051	-0.002	0.238	3.4×10^{-2}	*						
Desbaratado	Very High	0.664	-0.002	0.040	4.1×10^{-1}		Very steep	0.835	0.003	0.304	1.4×10^{-2}	*
	High	0.844	0.006	0.429	2.3×10^{-3}	**	Steep	0.734	0.002	0.188	6.3×10^{-2}	.
	Medium	0.480	-0.004	0.188	6.3×10^{-2}	.	Gentle	0.164	-0.004	0.318	1.1×10^{-2}	*
	Low	0.071	-0.003	0.186	6.5×10^{-2}	.						

Table S3B. Results of linear models between index of forest aggregation and time as a function of Elevation and Slope . <0.1, * <0.05, ** < 0.01, *** < 0.001

		Elevation						Slope					
Watershed	Elevation classes	Intercept	Slope	R^2	*p*			Slope classes	Intercept	Slope	R^2	*p*	
All (R4)	Very High	94.545	0.042	0.654	2.7×10^{-5}	***		Very steep	81.268	0.091	0.736	2.6×10^{-6}	***
	High	94.030	0.156	0.560	2.2×10^{-4}	***		Steep	86.054	0.081	0.406	3.3×10^{-3}	**
	Medium	88.251	0.067	0.105	1.7×10^{-1}			Gentle	73.433	-0.092	0.092	2.0×10^{-1}	
	Low	64.336	-0.008	0.000	9.7×10^{-1}								
Nima	Very High	95.175	0.004	0.016	6.1×10^{-1}			Very steep	82.326	0.064	0.657	2.5×10^{-5}	***
	High	94.922	0.159	0.594	1.1×10^{-4}	***		Steep	87.663	0.084	0.388	4.4×10^{-3}	**
	Medium	90.044	0.080	0.209	4.8×10^{-2}	*		Gentle	76.769	-0.213	0.413	3.0×10^{-3}	**
	Low												
Bolo	Very High	95.360	0.050	0.674	1.6×10^{-5}	***		Very steep	80.753	0.116	0.662	2.2×10^{-5}	***
	High	93.537	0.165	0.444	1.8×10^{-3}	**		Steep	86.413	0.087	0.313	1.2×10^{-2}	*
	Medium	86.466	0.085	0.115	1.5×10^{-1}			Gentle	72.870	0.021	0.003	8.1×10^{-1}	
	Low	64.381	0.031	0.001	9.0×10^{-1}								
Fraile	Very High	93.529	0.041	0.335	9.4×10^{-3}	**		Very steep	81.509	0.097	0.751	1.6×10^{-6}	***
	High	93.364	0.158	0.624	5.7×10^{-5}	***		Steep	84.834	0.067	0.396	3.9×10^{-3}	**
	Medium	89.108	0.053	0.067	2.8×10^{-1}			Gentle	72.756	-0.216	0.288	1.7×10^{-2}	*
	Low	64.380	-0.209	0.053	3.4×10^{-1}								
Desbaratado	Very High	95.033	0.057	0.740	2.3×10^{-6}	***		Very steep	81.725	0.066	0.581	1.4×10^{-4}	***
	High	95.386	0.134	0.533	3.8×10^{-4}	***		Steep	85.842	0.090	0.516	5.3×10^{-4}	***
	Medium	88.551	0.115	0.270	2.2×10^{-2}	*		Gentle	70.882	-0.188	0.182	6.8×10^{-2}	.
	Low	66.008	-0.086	0.015	6.2×10^{-1}								

Table S4A. Results of linear models for sub-regions between fraction of forest cover and time as a function of Elevation and Slope . <0.1, * <0.05, ** < 0.01, *** < 0.001

	Elevation						Slope					
Watershed	Elevation classes	Intercept	Slope	R^2	*p*		Slope classes	Intercept	Slope	R^2	*p*	
R3 Nima	Very High	0.657	-0.001	0.005	7.6×10^{-1}		Very steep	0.779	0.004	0.531	4.0×10^{-4}	***
(All - Nima)	High	0.755	0.006	0.494	7.9×10^{-4}	***	Steep	0.687	0.003	0.309	1.3×10^{-2}	*
	Medium	0.372	-0.001	0.018	5.8×10^{-1}		Gentle	0.164	-0.002	0.111	1.6×10^{-1}	
	Low	0.061	-0.002	0.074	2.5×10^{-1}							
R3 Bolo	Very High	0.651	-0.002	0.060	3.1×10^{-1}		Very steep	0.803	0.003	0.372	5.5×10^{-3}	**
(All - Bolo)	High	0.798	0.006	0.532	3.9×10^{-4}	***	Steep	0.719	0.001	0.147	1.0×10^{-1}	
	Medium	0.456	-0.003	0.192	6.0×10^{-2}	.	Gentle	0.216	-0.004	0.413	3.0×10^{-3}	**
	Low	0.059	-0.002	0.216	4.5×10^{-2}	*						
R3 Fraile	Very High	0.687	0.001	0.006	7.6×10^{-1}		Very steep	0.787	0.005	0.653	2.8×10^{-5}	***
(All - Fraile)	High	0.777	0.007	0.492	8.2×10^{-4}	***	Steep	0.714	0.004	0.446	1.7×10^{-3}	**
	Medium	0.374	0.000	0.001	9.2×10^{-1}		Gentle	0.179	-0.002	0.080	2.4×10^{-1}	
	Low	0.065	-0.001	0.045	3.8×10^{-1}							
R3 Desbrarado	Very High	0.663	-0.001	0.005	7.6×10^{-1}		Very steep	0.775	0.005	0.580	1.5×10^{-4}	***
(All - Desbaratado)	High	0.757	0.007	0.520	4.9×10^{-4}	***	Steep	0.698	0.003	0.340	8.7×10^{-3}	**
	Medium	0.383	-0.001	0.020	5.6×10^{-1}		Gentle	0.185	-0.002	0.125	1.3×10^{-1}	
	Low	0.059	-0.001	0.051	3.5×10^{-1}							

Table S4B. Results of linear models for sub-regions between forest aggregation and time as a function of Elevation and Slope . <0.1, * <0.05, ** < 0.01, *** < 0.001

	Elevation						Slope					
Watershed	Elevation classes	Intercept	Slope	R^2	*p*		Slope classes	Intercept	Slope	R^2	*p*	
R3 Nima	Very High	94.416	0.050	0.693	9.8×10^{-6}	***	Very steep	81.124	0.096	0.735	2.7×10^{-6}	***
(All - Nima)	High	93.791	0.155	0.522	4.7×10^{-4}	***	Steep	85.637	0.081	0.397	3.8×10^{-3}	**
	Medium	87.777	0.065	0.092	2.0×10^{-1}		Gentle	72.552	-0.069	0.037	4.2×10^{-1}	
	Low	64.336	-0.008	0.000	9.7×10^{-1}							
R3 Bolo	Very High	94.147	0.035	0.520	4.9×10^{-4}	***	Very steep	81.527	0.080	0.732	3.0×10^{-6}	***
(All - Bolo)	High	94.280	0.151	0.619	6.4×10^{-5}	***	Steep	85.856	0.078	0.443	1.8×10^{-3}	**
	Medium	89.279	0.070	0.136	1.2×10^{-1}		Gentle	73.835	-0.205	0.398	3.8×10^{-3}	**
	Low	64.774	-0.143	0.034	4.4×10^{-1}							
R3 Fraile	Very High	95.084	0.039	0.701	7.8×10^{-6}	***	Very steep	81.132	0.087	0.680	1.4×10^{-5}	***
(All - Fraile)	High	94.295	0.155	0.533	3.8×10^{-4}	***	Steep	86.621	0.086	0.392	4.1×10^{-3}	**
	Medium	87.840	0.079	0.131	1.2×10^{-1}		Gentle	73.597	-0.051	0.030	4.8×10^{-1}	
	Low	64.584	0.012	0.000	9.5×10^{-1}							
R3 Desbrarado	Very High	94.430	0.039	0.570	1.8×10^{-4}	***	Very steep	81.106	0.095	0.738	2.4×10^{-6}	***
(All - Desbaratado)	High	93.771	0.160	0.565	2.0×10^{-4}	***	Steep	86.096	0.080	0.386	4.5×10^{-3}	**
	Medium	88.188	0.064	0.094	2.0×10^{-1}		Gentle	73.667	-0.086	0.082	2.3×10^{-1}	
	Low	64.154	0.006	0.000	9.7×10^{-1}							

Table S5A. Results of linear models for sub-regions between forest cover and time as a function of the combined effects of Elevation and Slope . <0.1, * <0.05, ** < 0.01, *** < 0.001

Watershed	Elevation	Slope	Intercept	Slope	R^2	*p*	
R3 Nima	Very High	Very steep	0.792	0.000	0.001	9.2×10^{-1}	
(All - Nima)		Steep	0.650	0.000	0.001	9.0×10^{-1}	
		Gentle	0.428	-0.004	0.118	1.4×10^{-1}	
	High	Very steep	0.783	0.008	0.617	6.6×10^{-5}	***
		Steep	0.747	0.006	0.445	1.8×10^{-3}	**
		Gentle	0.701	0.003	0.182	6.8×10^{-2}	.
	Medium	Very steep	0.701	0.006	0.411	3.1×10^{-3}	**
		Steep	0.665	0.002	0.093	2.0×10^{-1}	
		Gentle	0.232	-0.003	0.098	1.9×10^{-1}	
	Low	Very steep					
		Steep					
		Gentle	0.061	-0.002	0.074	2.5×10^{-1}	
R3 Bolo	Very High	Very steep	0.790	-0.001	0.014	6.2×10^{-1}	
(All - Bolo)		Steep	0.645	-0.002	0.044	3.9×10^{-1}	
		Gentle	0.430	-0.006	0.228	3.8×10^{-2}	*
	High	Very steep	0.824	0.008	0.678	1.4×10^{-5}	***
		Steep	0.788	0.006	0.487	8.9×10^{-4}	***
		Gentle	0.791	0.001	0.033	4.5×10^{-1}	
	Medium	Very steep	0.776	0.005	0.393	4.0×10^{-3}	**
		Steep	0.743	0.001	0.033	4.5×10^{-1}	
		Gentle	0.284	-0.006	0.389	4.3×10^{-3}	**
	Low	Very steep					
		Steep					
		Gentle	0.059	-0.002	0.216	4.5×10^{-2}	*
R3 Fraile	Very High	Very steep	0.795	0.002	0.100	1.8×10^{-1}	
(All - Fraile)		Steep	0.690	0.001	0.007	7.2×10^{-1}	
		Gentle	0.428	-0.003	0.085	2.2×10^{-1}	
	High	Very steep	0.802	0.008	0.590	1.2×10^{-4}	***
		Steep	0.773	0.007	0.472	1.1×10^{-3}	**
		Gentle	0.722	0.003	0.148	1.0×10^{-1}	
	Medium	Very steep	0.674	0.007	0.395	3.9×10^{-3}	**
		Steep	0.669	0.004	0.195	5.8×10^{-2}	.
		Gentle	0.242	-0.002	0.075	2.5×10^{-1}	
	Low	Very steep					
		Steep					
		Gentle	0.065	-0.001	0.045	3.8×10^{-1}	
R3 Desbaratado	Very High	Very steep	0.784	0.001	0.005	7.6×10^{-1}	
(All - Desbaratado)		Steep	0.665	0.000	0.000	9.4×10^{-1}	
		Gentle	0.443	-0.005	0.149	1.0×10^{-1}	
	High	Very steep	0.782	0.008	0.646	3.3×10^{-5}	***
		Steep	0.751	0.006	0.477	1.0×10^{-3}	**
		Gentle	0.713	0.003	0.178	7.2×10^{-2}	.
	Medium	Very steep	0.691	0.007	0.419	2.7×10^{-3}	**
		Steep	0.678	0.003	0.103	1.8×10^{-1}	
		Gentle	0.242	-0.003	0.122	1.4×10^{-1}	
	Low	Very steep					
		Steep					
		Gentle	0.059	-0.001	0.051	3.5×10^{-1}	

Table S5B. Results of linear models for sub-regions between forest aggregation and time as a function of the combined effects of Elevation and Slope . <0.1, * <0.05, ** < 0.01, *** < 0.001

Watershed	Elevation	Slope	Intercept	Slope	R^2	*p*	
R3 Nima	Very High	Very steep	82.225	0.030	0.289	1.7×10^{-2}	*
(All - Nima)		Steep	84.987	0.061	0.834	4.9×10^{-8}	***
		Gentle	70.394	-0.039	0.047	3.7×10^{-1}	
	High	Very steep	80.125	0.164	0.670	1.8×10^{-5}	***
		Steep	84.910	0.130	0.432	2.2×10^{-3}	**
		Gentle	62.052	0.076	0.224	4.0×10^{-2}	*
	Medium	Very steep	70.150	0.165	0.484	9.4×10^{-4}	***
		Steep	85.435	0.046	0.056	3.2×10^{-1}	
		Gentle	75.707	-0.129	0.108	1.7×10^{-1}	
	Low	Very steep					
		Steep					
		Gentle	64.336	-0.008	0.000	9.7×10^{-1}	
R3 Bolo	Very High	Very steep	82.182	0.018	0.110	1.6×10^{-1}	
(All - Bolo)		Steep	84.524	0.044	0.693	9.7×10^{-6}	***
		Gentle	71.105	-0.104	0.211	4.8×10^{-2}	*
	High	Very steep	80.909	0.139	0.723	4.0×10^{-6}	***
		Steep	85.343	0.128	0.554	2.5×10^{-4}	***
		Gentle	62.189	0.005	0.001	8.9×10^{-1}	
	Medium	Very steep	70.775	0.148	0.541	3.3×10^{-4}	***
		Steep	86.391	0.048	0.086	2.2×10^{-1}	
		Gentle	77.360	-0.258	0.402	3.5×10^{-3}	**
	Low	Very steep					
		Steep					
		Gentle	64.774	-0.143	0.034	4.4×10^{-1}	
R3 Fraile	Very High	Very steep	81.984	0.039	0.594	1.1×10^{-4}	***
(All - Fraile)		Steep	86.123	0.038	0.635	4.4×10^{-5}	***
		Gentle	70.108	-0.094	0.256	2.7×10^{-2}	*
	High	Very steep	80.436	0.126	0.594	1.1×10^{-4}	***
		Steep	86.058	0.142	0.479	1.0×10^{-3}	**
		Gentle	64.892	0.045	0.081	2.3×10^{-1}	
	Medium	Very steep	69.312	0.178	0.399	3.7×10^{-3}	**
		Steep	86.052	0.066	0.110	1.6×10^{-1}	
		Gentle	76.682	-0.100	0.098	1.9×10^{-1}	
	Low	Very steep					
		Steep					
		Gentle	64.584	0.012	0.000	9.5×10^{-1}	
R3 Desbaratado	Very High	Very steep	81.851	0.012	0.000	9.5×10^{-1}	
(All - Desbaratado)		Steep	85.162	0.024	0.207	5.0×10^{-2}	*
		Gentle	71.522	0.048	0.782	5.1×10^{-7}	***
	High	Very steep	80.513	0.159	0.687	1.1×10^{-5}	***
		Steep	85.456	0.135	0.480	1.0×10^{-3}	**
		Gentle	64.527	0.052	0.148	1.0×10^{-1}	.
	Medium	Very steep	69.057	0.185	0.524	4.5×10^{-4}	***
		Steep	86.068	0.050	0.070	2.7×10^{-1}	
		Gentle	76.436	-0.131	0.145	1.0×10^{-1}	.
	Low	Very steep					
		Steep					
		Gentle	64.154	0.006	0.000	9.7×10^{-1}	