
The Global Warming Potential of Building Materials:: An Application of Life Cycle Analysis in Nepal

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Supplemental material for

The Global Warming Potential of Building Materials: An Application of Life Cycle Analysis in Nepal “Global Warming and Building Materials: A Perspective From the Himalayas” by Silu Bhochhibhoya, Michela Zanetti, Francesca Pierobon, Paola Gatto, Ramesh Kumar Maskey, and Raffaele Cavalli, published in *Mountain Research and Development* 37(1), 2017. (See <http://www.bioone.org/toc/mred/37/1>)

FIGURE S1. Location of Sagarmatha National Park and its buffer zone. (Map by Salerno F, Flury B, Thakuri S, Basani M, Maskey RM, Khanal S, Sapkota A, Bhuju D, Jha P, Bhochhibhoya S. 2009. Management-Oriented Environmental Research in Sagarmatha National Park and Buffer Zone. HKKH Technical Paper, Kathmandu Nepal, courtesy of the authors)

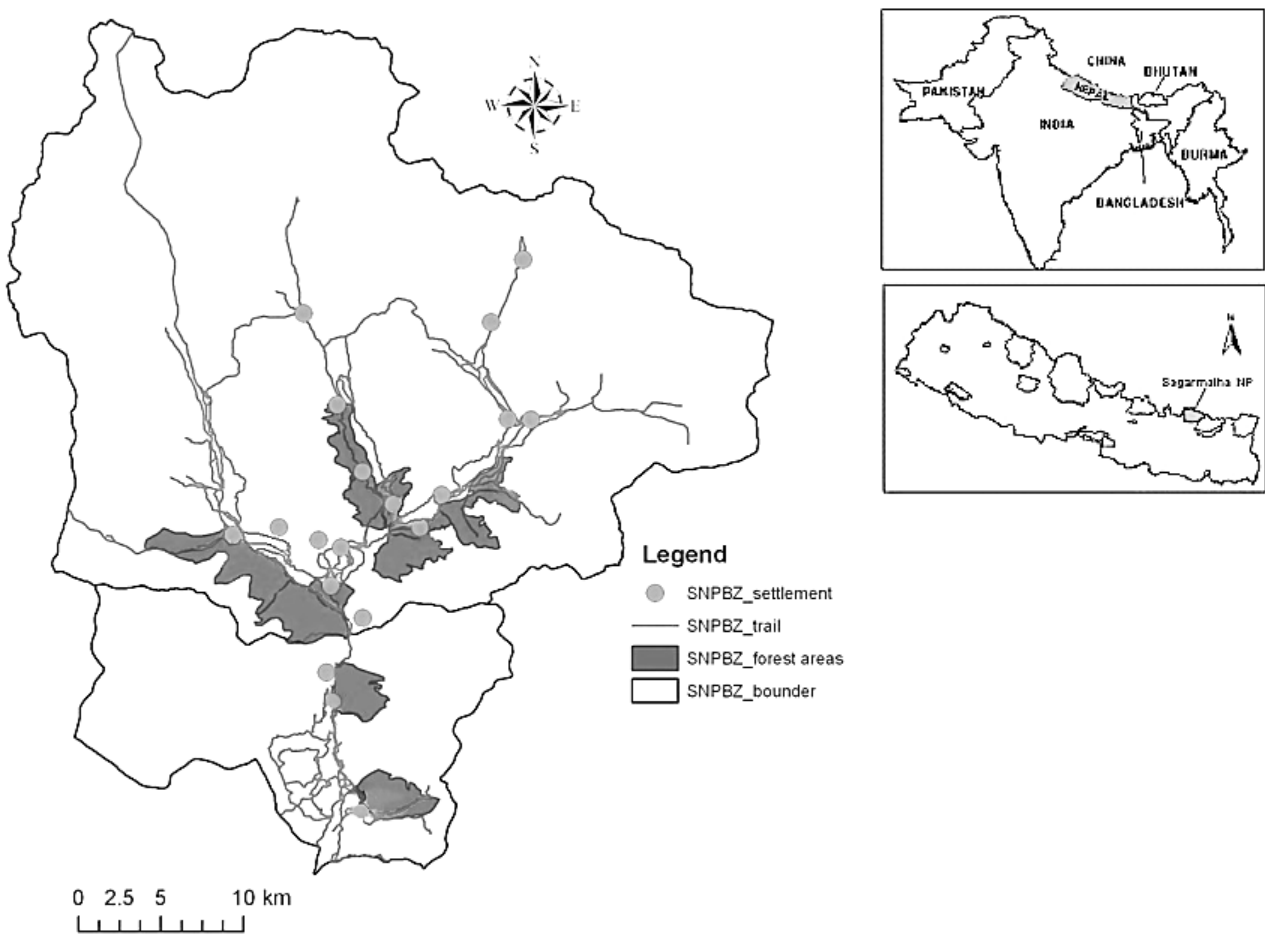
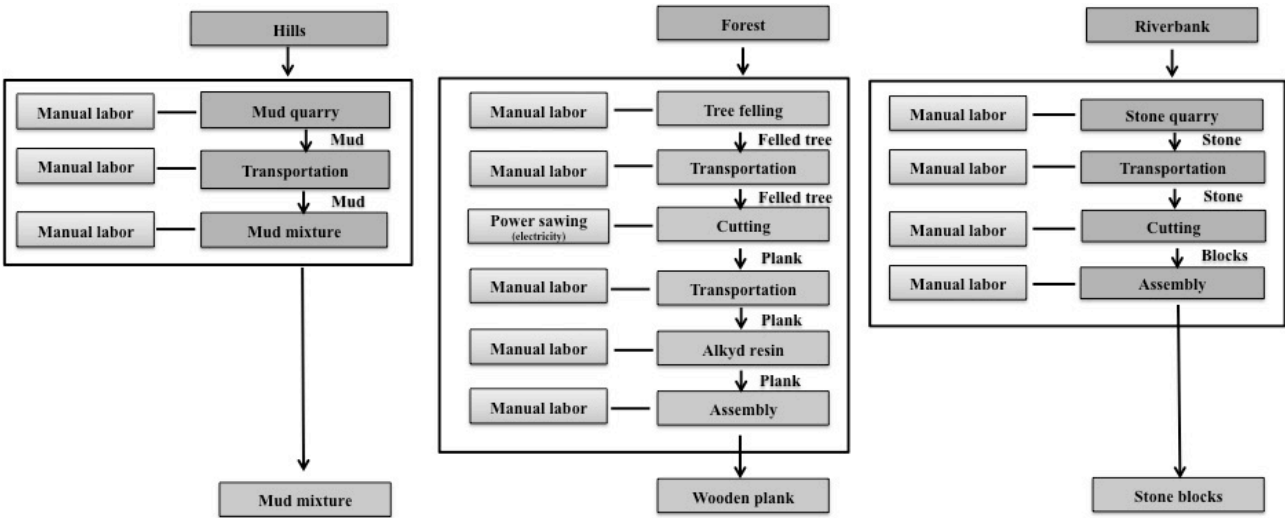


FIGURE S2 Material and process flowcharts for 1 m² of wall of traditional, semimodern, and modern buildings.



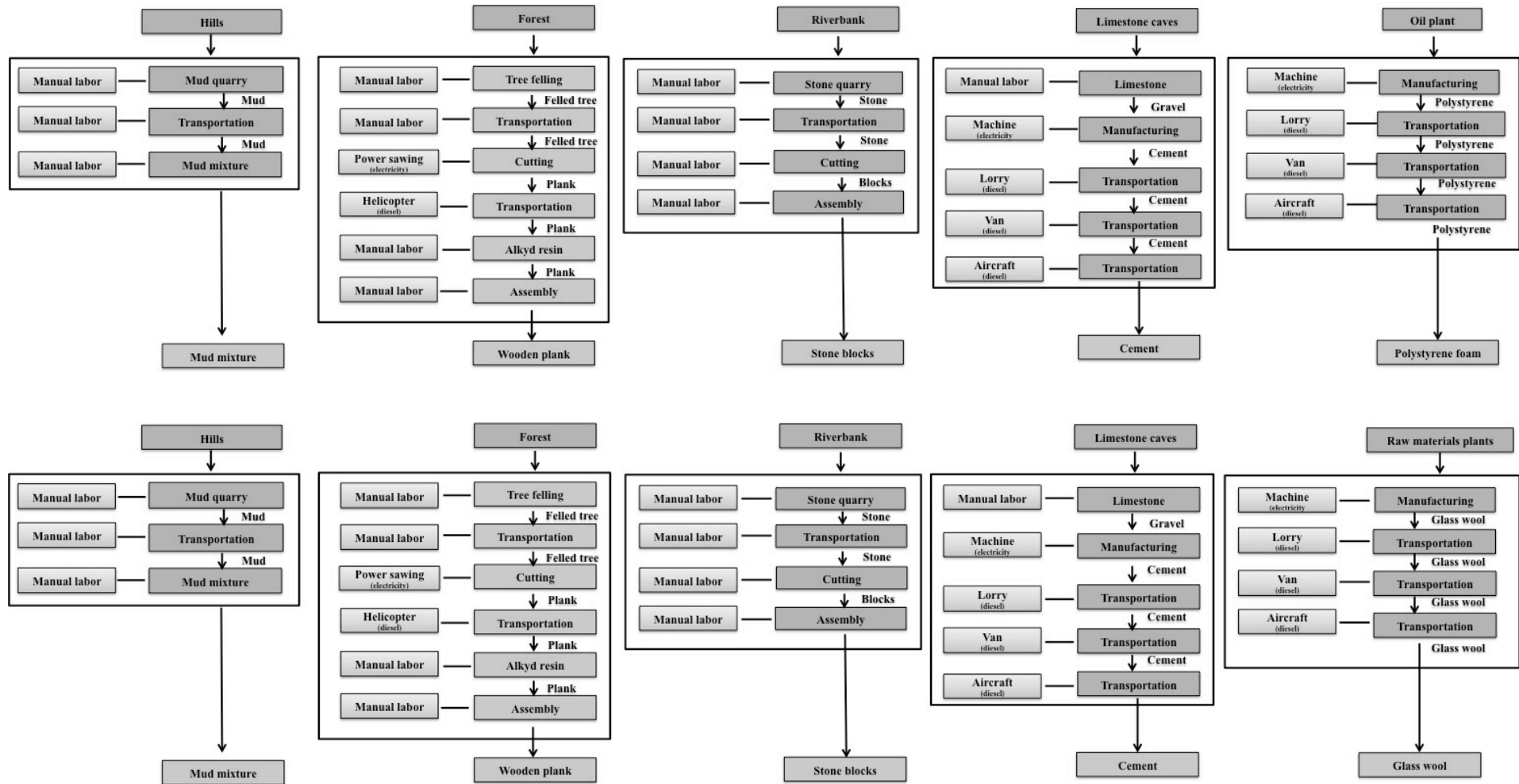


TABLE S1 Primary data collected for the material needed to build 1 m² of wall. Where relevant, type of building is indicated.

Material	Origin	Amount of material (kg 1m ²)	Transportation distance (km)	Means of transportation
Wooden plank (density: 670 kg/m ³)	National Park Forest Buffer Zone (traditional) Jiri (semimodern, modern)	34.04 (all types of building)	5 from within the park 51 from Jiri	Manual Lorry 3.5–16t Helicopter
Stone (density: 2610 kg/m ³)	Riverbank and cropland in the buffer zone	Traditional = 1456.38 Semimodern = 1192.77 Modern = 1325.88	1	Manual
Mud (density: 1906 kg/m ³)	Hills and cropland in the buffer zone	Traditional = 96.82 Semimodern = 24.20	3	Manual
Cement (density: 2162 kg/m ³)	Jagdamba Cement Factory, Nepal	Semimodern = 2.75 Modern = 3.24	Total: 446 km 10 (mine to plant) 290 (Bhairahawa to Kathmandu) 10 (retailer to Kathmandu airport) 136 (Kathmandu to Lukla)	Tractor Lorry 3.5–16 t Van <3.5 t Cargo aircraft
Glass wool (density: 30 kg/m ³)	China	Modern = 1.63	Total: 1145 km 999 (China to Kathmandu) 10 (retailer to Kathmandu airport) 136 (Kathmandu to Lukla)	Lorry >16 t Van <3.5 t Cargo aircraft
Polystyrene foam (density: 30 kg/m ³)	India	Semimodern = 0.36	Total: 1032 km 886 (India to Kathmandu) 10 (retailer to Kathmandu airport) 136 (Kathmandu to Lukla)	Lorry >16 t Van <3.5 t Cargo aircraft
Alkyd resin (density: 1090 kg/m ³)	Asian Paint Nepal	0.14 (all types of building)	Total: 228 km 82 (Hetauda to Kathmandu) 10 (retailer to Kathmandu airport) 136 (Kathmandu to Lukla)	Truck Van <3.5 t Cargo aircraft

* Bhairahawa, Lukla and Hetauda are towns located in Nepal

TABLE S2 Greenhouse gases emissions (g CO_{2eq}) per 1 m² of building material.

Material (type of building)	Process	Total emissions	Carbon dioxide (abiotic)	Carbon dioxide (biotic)	Nitrous oxide	Sulfur hexafluoride	Nonmethane	Methane (abiotic)	Methane (biotic)
Alkyd resin (traditional)	Manufacture	490.20	361.78	4.38	90.11	0.27	0.56	32.90	0.21
	Transport by aircraft	20.34	19.98	0.02	0.06	0.00	0.00	0.27	0.0008
	Transport by lorry	1.49	1.41	0.00	0.01	0.00	0.01	0.05	0.0001
	Transport by van	0.15	0.02	0.01	0.03	0.00	0.00	0.08	0.0006
Wooden planks from park (traditional)	Shaping with power saw	552.18	449.90	1.53	56.38	3.56	0.19	40.56	0.06
Total resin + planks (traditional)		1064.37	833.10	5.95	146.59	3.83	0.77	73.85	0.27
Alkyd resin (semimodern, modern)	Manufacture	245.10	180.89	2.19	45.05	0.13	0.28	16.45	0.10
	Transport by aircraft	10.17	9.99	0.01	0.03	0.00	0.00	0.14	0.00
	Transport by lorry	0.74	0.71	0.00	0.01	0.00	0.00	0.03	0.00
	Transport by van	0.07	0.01	0.01	0.01	0.00	0.00	0.04	0.00
Wooden planks from Jiri (semimodern, modern)	Shaping with power saw	276.09	224.95	0.76	28.19	1.78	0.10	20.28	0.03
	Transport by helicopter	102.30	100.83	0.08	0.07	0.01	0.01	1.30	0.00
	Transport by lorry	65.78	61.76	0.24	1.14	0.02	0.46	2.16	0.01
Total resin + planks (semimodern, modern)		700.27	579.15	3.29	74.50	1.94	0.85	40.39	0.15
Polystyrene foam (semimodern)	Manufacture	1527.67	1207.40	13.68	1.75	0.48	0.83	302.78	0.76
	Transport by aircraft	53.89	52.92	0.05	0.17	0.005	0.01	0.72	0.00
	Transport by lorry	4.35	4.13	0.01	0.04	0.001	0.02	0.15	0.0004
	Transport by van	0.40	0.06	0.04	0.07	0.004	0.01	0.21	0.0015
Total polystyrene foam (semimodern)		1586.31	1264.51	13.78	2.02	0.48	0.88	303.86	0.77
Glass wool (modern)	Manufacture	2521.70	2241.86	93.25	15.16	4.27	4.92	159.14	3.10
	Transport by lorry	216.76	205.90	0.58	1.92	0.04	0.88	7.40	0.02
	Transport by van	1.78	0.27	0.17	0.31	0.02	0.06	0.95	0.01
	Transport by aircraft	243.13	238.78	0.25	0.77	0.02	0.06	3.24	0.01
Total glass wool (modern)		2983.37	2686.80	94.25	18.17	4.35	5.92	170.74	3.14
Cement (semimodern)	Manufacture	566.39	510.59	43.40	0.86	0.15	0.17	11.09	0.12
	Transport by tractor and trailer	8.83	7.89	0.33	0.07	0.00	0.22	0.31	0.00
	Transport by aircraft	410.66	403.32	0.41	1.30	0.04	0.10	5.47	0.02
	Transport by lorry	205.20	192.66	0.74	3.54	0.06	1.42	6.74	0.03
	Transport by van	3.19	0.63	0.29	0.53	0.03	0.10	1.60	0.01
Total cement (semimodern)		1194.26	1115.09	45.17	6.30	0.28	2.01	25.23	0.18
Cement (modern)	Manufacture	668.96	603.06	51.26	1.01	0.18	0.20	13.10	0.14
	Transport by tractor and trailer	10.40	9.30	0.39	0.08	0.00	0.26	0.37	0.00
	Transport by aircraft	485.03	476.36	0.49	1.54	0.04	0.12	6.47	0.02
	Transport by lorry	242.36	227.56	0.87	4.18	0.07	1.68	7.97	0.03
	Transport by van	3.77	0.75	0.34	0.63	0.03	0.12	1.90	0.01
Total cement (modern)		1410.52	1317.02	53.35	7.44	0.33	2.38	29.80	0.21

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