

Annexes

Annex 1: Protected areas with indicators of vulnerability in order of vulnerability rank

Rank	Area Name	Country	Designation	IUCN Category	EST_DATE	AREA_HA	ALT_MIN	ALT_MAX	vul_index	ac_index	cc_exposure	sens_ind
1	Hootenannies	Myanmar	Wildlife Sanctuary	III	1/1/1974	215074	0	0	0.630	0.000	0.512	0.379
2	Orang	India	Sanctuary	IV	1/1/1985	7260	500	500	0.580	0.281	0.461	0.560
3	Pabha	India	Sanctuary	IV		4900	0	0	0.575	0.302	0.494	0.532
4	D' Ering Memorial	India	Sanctuary	IV	1/1/1978	19000	150	0	0.570	0.314	0.534	0.491
5	Laakhwa	India	Sanctuary	IV	1/1/1972	7011	500	500	0.568	0.297	0.453	0.549
6	Kaziranga	India	National Park	II	1/1/1974	84979	40	80	0.568	0.318	0.474	0.548
7	Sonai-Rupai	India	Sanctuary	IV	1/1/1998	22000	100	100	0.565	0.305	0.471	0.529
8	Manas	India	Sanctuary	IV	1/1/1928	39100	40	150	0.560	0.333	0.486	0.526
9	Jaldapara	India	Sanctuary	IV	1/1/1990	21651	0	0	0.560	0.289	0.486	0.482
10	Koshi Tappu	Nepal	Wildlife Reserve	IV	1/1/1976	17500	80	95	0.559	0.426	0.505	0.599
11	Mahananda	India	Sanctuary	IV	1/1/1976	12722	50	800	0.556	0.294	0.495	0.466
12	Pabitora	India	Sanctuary	IV	1/1/1987	3883	0	0	0.554	0.322	0.454	0.530
13	Garumara	India	Sanctuary	IV	1/1/1984	852	0	0	0.548	0.318	0.492	0.471
14	Barnadi	India	Sanctuary	IV	1/1/1980	2622	150	720	0.547	0.365	0.475	0.531
15	Sepahijala	India	Sanctuary	IV	1/1/1987	1853	0	0	0.541	0.300	0.445	0.478
16	Manas	India	National Park	II	1/1/1990	50000	0	0	0.541	0.372	0.488	0.507
17	Trishna	India	Sanctuary	IV	1/1/1988	19470	500	500	0.539	0.309	0.442	0.483
18	Keibul-Lamjao	India	National Park	II	1/1/1975	4000	767	813	0.533	0.322	0.471	0.451
19	Garampani	India	Sanctuary	IV	1/1/1952	605	500	500	0.533	0.334	0.467	0.467
20	Nokrek	India	National Park	II	1/1/1985	4748	600	1412	0.520	0.380	0.454	0.485
21	Nameri	India	Sanctuary	IV	1/1/1985	7560	0	0	0.519	0.387	0.475	0.469
22	Yaluzangbudaxiagu	China	Nature Reserve	V		961800	0	0	0.519	0.359	0.539	0.375
23	Nongkhyllem	India	Sanctuary	IV	1/1/1981	2900	1000	1000	0.517	0.368	0.485	0.433
24	Dibang	India	Sanctuary	IV	1/1/1991	414900	0	0	0.516	0.359	0.537	0.369
25	Parsa	Nepal	Wildlife Reserve	IV	1/1/1984	49900	100	950	0.514	0.461	0.527	0.475
26	Kane	India	Sanctuary	IV	1/1/1991	5500	0	0	0.513	0.334	0.502	0.371
27	Neora Valley	India	National Park	II	1/1/1992	8800	30	3200	0.512	0.346	0.486	0.396
28	Mehao	India	Sanctuary	IV	1/1/1980	28150	404	3560	0.510	0.397	0.530	0.398
29	Puliebadze	India	Sanctuary	IV	1/1/1980	923	1000	1500	0.509	0.381	0.473	0.437
30	Gumti	India	Sanctuary	IV	1/1/1988	38954	0	0	0.506	0.337	0.418	0.436

Annex 1: cont.

31	Baghmara Pitcher Plant	India	Sanctuary	IV	1/1/1984	2	500	500	0.505	0.377	0.452	0.439
32	Intanki	India	Sanctuary	IV	1/1/1975	20202	1000	1000	0.502	0.383	0.459	0.429
33	Royal Chitwan	Nepal	National Park-Buffer Zone	VI	1/1/1996	75000	0	0	0.500	0.494	0.509	0.486
34	Buxa	India	Sanctuary	IV	1/1/1986	36899	1000	3000	0.499	0.424	0.488	0.433
35	Yangoupokpi-Lokchao	India	Sanctuary	IV	1/1/1989	18480	0	0	0.499	0.407	0.463	0.440
36	Royal Chitwan	Nepal	National Park	II	1/1/1973	93200	150	815	0.492	0.503	0.504	0.476
37	Balphakram	India	National Park	II	1/1/1986	22000	50	1026	0.491	0.408	0.464	0.416
38	Siju	India	Sanctuary	IV	1/1/1979	518	40	260	0.490	0.412	0.466	0.416
39	Shivapuri	Nepal	National Park	II	1/1/2002	14400	1366	2732	0.490	0.469	0.520	0.419
40	Sagarmatha	Nepal	National Park	II	1/1/1976	114800	2845	8848	0.487	0.417	0.539	0.340
41	Itanagar	India	Sanctuary	IV	1/1/1978	14030	210	1164	0.485	0.395	0.485	0.364
42	Mouling	India	National Park	II	1/1/1986	48300	750	3064	0.482	0.420	0.502	0.365
43	Makalu-Barun	Nepal	National Park	II	1/1/1991	15000	456	8463	0.470	0.464	0.510	0.364
44	Kangchenjunga	Nepal	Conservation Area	VI	3/1/1998	203500	1200	8586	0.467	0.414	0.511	0.303
45	Pakhui	India	Sanctuary	IV	1/1/1977	86195	200	1000	0.463	0.424	0.475	0.337
46	Langtang	Nepal	National Park	II	1/1/1976	171000	792	7245	0.463	0.447	0.506	0.329
47	Eagle Nest	India	Sanctuary	IV	1/1/1989	21700	0	0	0.461	0.426	0.471	0.337
48	Sessa Orchid	India	Sanctuary	IV	1/1/1989	10000	0	0	0.459	0.428	0.471	0.333
49	Singalila	India	National Park	II	1/1/1992	7860	2256	3874	0.458	0.437	0.452	0.360
50	Khangchendzonga	India	National Park	II	1/1/1977	178400	1829	8586	0.458	0.421	0.501	0.294
51	Manaslu	Nepal	Conservation Area	VI	12/1/1998	166300	0	0	0.457	0.452	0.478	0.344
52	Barsey Rhododendron	India	Sanctuary	IV	1/1/1998	10400	0	0	0.451	0.443	0.466	0.331
53	Zhangmukouan	China	Nature Reserve	V	1/1/1985	6852	1800	5900	0.451	0.474	0.511	0.316
54	Habaxueshan	China	Nature Reserve	V	1/1/1984	21908	1700	5396	0.444	0.526	0.469	0.390
55	Bitahai	China	Nature Reserve	V	1/1/1984	26869	3180	4159	0.442	0.564	0.493	0.398
56	Mangkang	China	Nature Reserve	V	1/1/1990	185300	3000	3500	0.442	0.514	0.544	0.295
57	Maenam	India	Sanctuary	IV	1/1/1987	3534	0	0	0.438	0.481	0.479	0.315
58	Phibsoo	Bhutan	Wildlife Sanctuary	IV	1/1/1993	27800	0	0	0.437	0.542	0.486	0.366
59	Annapurna	Nepal	Conservation Area	VI	1/1/1992	762900	1151	8091	0.436	0.502	0.472	0.337
60	Dhorpatan	Nepal	Hunting Reserve	VI	1/1/1987	132500	2850	5500	0.434	0.487	0.460	0.331
61	Kyongnosla Alpine	India	Sanctuary	IV	1/1/1977	3100	0	0	0.433	0.434	0.443	0.290

Annex 1: cont.

62	Fambong Lho	India	Sanctuary	IV		1/1/1984	5176	1280	2652	0.433	0.480	0.480	0.480	0.299
63	Khakaborazi	Myanmar	National Park	II		1/1/1996	381248	0	0	0.427	0.530	0.530	0.493	0.319
64	Bumhpabum	Myanmar	Wildlife Sanctuary	III		1/1/2002	186221	0	0	0.425	0.569	0.569	0.513	0.331
65	Hponkanrazi	Myanmar	Wildlife Sanctuary	III		1/1/2001	270396	0	0	0.423	0.562	0.562	0.506	0.325
66	Dampa	India	Sanctuary	IV		1/1/1985	50000	200	900	0.423	0.601	0.601	0.424	0.446
67	Hukaung Valley	Myanmar	Wildlife Sanctuary	III		1/1/2001	645946	0	0	0.422	0.577	0.577	0.530	0.314
68	Gaoligongshan (Yunnan)	China	Nature Reserve	V		1/1/1986	405200	1090	3917	0.422	0.525	0.525	0.471	0.321
69	Royal Manas	Bhutan	National Park	II		1/1/1993	102300	200	2310	0.419	0.566	0.566	0.485	0.337
70	Baimaxueshan	China	Nature Reserve	V		1/1/1988	281640	1950	5430	0.418	0.526	0.526	0.491	0.288
71	Phawngpui (Blue Mountain)	India	National Park	II		1/1/1992	5000	0	0	0.415	0.609	0.609	0.416	0.439
72	Murlen	India	National Park	II		1/1/1991	20000	0	0	0.414	0.609	0.609	0.420	0.431
73	Ngengpui	India	Sanctuary	IV		1/1/1992	11000	0	0	0.412	0.611	0.611	0.413	0.436
74	Kulong Chu	Bhutan	Wildlife Sanctuary	IV		1/1/1993	130000	0	0	0.410	0.553	0.553	0.497	0.286
75	Khawnglung	India	Sanctuary	IV		1/1/1991	4100	0	0	0.408	0.619	0.619	0.415	0.427
76	Sakteng	Bhutan	Wildlife Sanctuary	IV		1/1/1993	65000	0	0	0.407	0.557	0.557	0.484	0.293
77	Jigme Dorji	Bhutan	National Park	II		1/1/1993	435000	3000	7554	0.403	0.645	0.645	0.509	0.344
78	Bomdeling	Bhutan	Wildlife Sanctuary	IV		1/1/1995	153800	1400	6000	0.396	0.589	0.589	0.491	0.286
79	Thrumingla	Bhutan	National Park	II		1/1/1998	88900	1400	4535	0.390	0.612	0.612	0.482	0.300
80	Jigme Singye Wangchuck	Bhutan	National Park	II		1/1/1995	173000	640	4925	0.384	0.607	0.607	0.479	0.279
81	Quomolangma	China	Nature Preserve	VI		3/1/1989	3400000	3000	8000	0.379	0.152	0.152	0.174	0.115
82	Valmiki	India	Sanctuary	IV		1/1/1978	54467	200	800	0.371	0.000	0.000	0.000	0.113
83	Toorsa	Bhutan	Strict Nature Reserve	Ia		1/1/1993	65000	0	0	0.356	0.699	0.699	0.461	0.307
84	Zhumulangmafeng	China	Nature Reserve	V		1/1/1989	3391022	5000	8848	0.339	0.000	0.000	0.000	0.017
#N/A	Fakim	India	Sanctuary	IV		1/1/1980	641	2000	3000					
#N/A	Rangapahar	India	Sanctuary	IV		1/1/1986	470	0	0					
#N/A	Roa	India	Sanctuary	IV		1/1/1988	85	0	0					
#N/A	Rema-Kalenga	Bangladesh	Wildlife Sanctuary	IV		1/1/1996	1975.54	0	0					
#N/A	Jiangcun	China	Nature Reserve	V		1/1/1985	34060	1800	7300					
#N/A	Napahai	China	Nature Reserve	V		1/1/1984	6201	3260	3260					
#N/A	Yading	China	Nature Reserve	V			56000	0	0					

Annex 2: Ecological region ranked by vulnerability

Rank	EH_ECO_ID	ECO_NAME	%_area_EH %	REALM	BIOME	ani_Tot_rich count	Tot_str_end count	Tot_nr_end count	Carbon balance C/km ² /yr	TOT_PA km ²	MAN_AREA	Vul_ind	Ac_index	cc_exposure	sens_index
1	1	Brahmaputra Valley semi-evergreen forests	100.00	IM	1	511	0	6	3.86	2065.9	0.91941	0.833655	0.000291	0.000317	0.000317
2	5	Lower Gangetic Plains moist deciduous forests	6.76	IM	1	557	1	9	-20.41	5146.6	0.962645	0.80702	0.540415	0.415148	0.461762
3	6	Meghalaya subtropical forests	100.00	IM	1	633	5	23	10.61	215.7	0.569123	0.75612	0.305134	0.450873	0.479434
4	17	Terai-Duar savanna and grasslands	57.97	IM	7	463	1	5	-9.44	3331	0.730362	0.753296	0.480416	0.476188	0.372761
5	19	Northeastern Himalayan sub-alpine conifer forests	12.12	PA	5	368	0	1	37.00	7749.2	0.141084	0.6941	0.5369	0.492239	0.378746
6	11	North East India-Myanmar pine forests	100.00	IM	3	357	0	2	48.37	4	0.676228	0.671723	0.481479	0.496833	0.373122
7	12	Eastern Himalayan broadleaf forests	100.00	IM	4	630	3	18	4.18	6578.4	0.390545	0.637423	0.430764	0.474467	0.424621
8	3	Himalayan subtropical broadleaf forests	63.95	IM	1	444	0	3	4.40	3435.8	0.493146	0.628257	0.573185	0.416945	0.415754
9	16	Western Himalayan sub-alpine conifer forests	2.86	IM	5	376	1	10	115.85	2236.1	0.409511	0.625924	0.486429	0.487844	0.328325
10	10	Himalayan subtropical pine forests	16.62	IM	3	594	0	14	16.36	2622.3	0.426537	0.625781	0.482273	0.505189	0.322474
11	25	Rock and ice			99	0	0	0	0.01	750110.3	0.014526	0.622356	0.42203	0.503855	0.288977
12	21	Eastern Himalayan alpine shrub and meadows	28.38	PA	10	485	2	10	3.74	50002.9	0.090909	0.608713	0.539998	0.469125	0.305281
13	15	Eastern Himalayan sub-alpine conifer forests	100.00	IM	5	294	3	9	10.69	7229.3	0.239261	0.607018	0.498761	0.478039	0.347321
14	14	Western Himalayan broadleaf forests	2.91	IM	4	213	3	8	153.76	3043	0.407653	0.600748	0.35492	0.507688	0.352191
15	4	Irrawaddy moist deciduous forests	1.85	IM	1	521	0	14	129.04	1496.9	0.657292	0.593879	0.485701	0.498987	0.41626
16	23	Western Himalayan alpine shrub and meadows	3.24	PA	10	411	1	11	47.12	7344	0.075262	0.57831	0.543924	0.538444	0.353945

17	18	Hengduan Mountains sub-alpine conifer forests	11.67	PA	5	947	2	10	28.91	2564.5	0.037052	0.571505	0.405291	0.514483	0.559829
18	22	Southeast Tibet shrublands and meadows	0.07	PA	10	570	1	6	684.43	149471.9	0.040027	0.562036	0.468698	0.49401	0.322475
19	2	Chin Hills-Arakan Yoma montane forests	45.93	IM	1	520	0	3	38.25	0	0.66576	0.548678	0.314447	0.479969	0.535052
20	20	Nuijiang Langcang Gorge alpine conifer and mixed forests	25.96	PA	5	599	2	4	14.12	11016.6	0.056503	0.545786	0.372015	0.493598	0.349999
21	7	Mizoram-Manipur-Kachin rainforests	51.67	IM	1	803	4	19	8.44	1913.2	0.63975	0.539498	0.365366	0.468412	0.445886
22	8	Northern Indochina subtropical forests	0.24	IM	1	1209	16	44	497.24	21962.1	0.559428	0.522169	0.413333	0.460644	0.418336
23	9	Northern Triangle subtropical forests	83.94	IM	1	569	8	21	15.26	15.2	0.241674	0.433807	0.49748	0.400283	0.371245
24	13	Northern Triangle temperate forests	100.00	IM	4	490	3	15	45.52	0.1	0.215264	0.317662	0.458661	0.491085	0.348967
#N/A	24	Yarlung Tsangpo arid steppe	0.00	PA	10	246	0	0	150033.17	13449	0.043904		0.505081	0.458804	0.321881

Annex 3: Administrative units ranked by vulnerability

Rank	Administrative Unit*	ear	tlr	fgp_pc	tdr	ac_index	cc_exposure	sens_index	vul_index
1	Sarlahi	0.473	0.068	0.174	0.694	0.371	0.529	0.574	0.577
2	Mahottari	0.400	0.036	0.191	0.701	0.364	0.524	0.565	0.575
3	Dhanusa	0.372	0.287	0.209	0.711	0.387	0.520	0.589	0.574
4	Rautahat	0.528	0.000	0.183	0.694	0.372	0.528	0.558	0.571
5	Bara	0.262	0.179	0.283	0.696	0.387	0.527	0.573	0.571
6	Siraha	0.392	0.143	0.221	0.713	0.390	0.512	0.580	0.568
7	Saptari	0.397	0.303	0.252	0.739	0.409	0.507	0.587	0.562
8	Assam	0.102	0.566	0.097	0.244	0.315	0.476	0.520	0.560
9	Sunsari	0.348	0.500	0.229	0.774	0.454	0.499	0.602	0.549
10	Parsa	0.421	0.177	0.251	0.728	0.436	0.533	0.534	0.544
11	Kapilbastu	0.510	0.163	0.267	0.679	0.420	0.550	0.499	0.543
12	Rupandehi	0.272	0.600	0.223	0.726	0.443	0.553	0.517	0.542
13	Morang	0.475	0.436	0.263	0.813	0.487	0.496	0.595	0.534
14	Darjeeling	0.000	0.720	0.113	0.000	0.334	0.486	0.449	0.534
15	Bhaktapur	0.434	0.679	0.117	0.907	0.459	0.505	0.532	0.526
16	Tripura	0.022	0.734	0.103	0.052	0.338	0.442	0.463	0.522
17	Jhapa	0.383	0.617	0.330	0.846	0.501	0.500	0.553	0.518
18	Meghalaya	0.134	0.549	0.054	0.311	0.375	0.476	0.433	0.511
19	Kathmandu	0.300	0.798	0.048	0.984	0.467	0.509	0.485	0.509
20	Nawalparasi	0.597	0.369	0.212	0.708	0.484	0.532	0.478	0.508
21	Assam Hills	0.102	0.502	0.097	0.244	0.361	0.463	0.417	0.506
22	Udaypur	0.531	0.375	0.138	0.675	0.460	0.493	0.484	0.506
23	Chitawan	0.367	0.688	0.239	0.792	0.531	0.527	0.515	0.503
24	Lalitpur	0.369	0.685	0.077	0.945	0.472	0.507	0.463	0.500
25	Negaland	0.161	0.617	0.085	0.363	0.410	0.479	0.427	0.499
26	Sindhuli	0.585	0.319	0.151	0.646	0.452	0.495	0.439	0.494
27	Argakhanchi	0.510	0.419	0.162	0.591	0.447	0.520	0.396	0.490
28	Arunachal	0.188	0.395	0.115	0.415	0.414	0.511	0.367	0.488
29	Makawanpur	0.351	0.550	0.131	0.700	0.472	0.512	0.418	0.486
30	Ap	0.188	0.395	0.070	0.415	0.394	0.499	0.353	0.486
31	Manipur	0.205	0.648	0.098	0.444	0.454	0.472	0.426	0.481

* Bhutan and Nepal = Districts; NE India = States

Annex 3: cont.

32	Kaski	0.348	0.706	0.158	0.810	0.474	0.490	0.423	0.480
33	Gulmi	0.565	0.450	0.144	0.566	0.459	0.515	0.373	0.476
34	Ramechhap	0.760	0.120	0.158	0.597	0.445	0.496	0.378	0.476
35	Kavre	0.462	0.561	0.186	0.705	0.474	0.498	0.395	0.473
36	Syangja	0.489	0.609	0.204	0.626	0.494	0.517	0.388	0.470
37	Nuwakot	0.611	0.335	0.225	0.684	0.467	0.510	0.367	0.470
38	Palpa	0.445	0.600	0.190	0.628	0.497	0.522	0.382	0.469
39	Dhading	0.731	0.197	0.140	0.659	0.458	0.501	0.360	0.468
40	Tanahun	0.533	0.525	0.213	0.673	0.504	0.510	0.395	0.467
41	Solukhumbu	0.801	0.237	0.163	0.702	0.462	0.514	0.339	0.464
42	Dolakha	0.753	0.330	0.086	0.717	0.474	0.510	0.354	0.463
43	Okhaldhunga	0.752	0.298	0.195	0.628	0.475	0.490	0.368	0.461
44	Parbat	0.646	0.436	0.226	0.645	0.490	0.514	0.359	0.461
45	Gorkha	0.633	0.387	0.200	0.660	0.473	0.493	0.362	0.461
46	Rasuwa	0.893	0.029	0.117	0.721	0.456	0.507	0.329	0.460
47	Sindhupalchok	0.796	0.142	0.196	0.687	0.477	0.510	0.346	0.460
48	Baglung	0.470	0.520	0.158	0.641	0.477	0.492	0.363	0.459
49	Sankhuwasabha	0.550	0.385	0.222	0.701	0.488	0.483	0.370	0.455
49	Bhojpur	0.616	0.396	0.306	0.684	0.494	0.467	0.392	0.455
51	Sikkim	0.290	0.663	0.117	0.578	0.441	0.494	0.304	0.452
52	Khotang	0.762	0.314	0.235	0.630	0.504	0.478	0.372	0.449
53	Myagdi	0.632	0.418	0.173	0.668	0.476	0.476	0.343	0.448
54	Zhongdian	0.510	0.606	0.000	0.948	0.540	0.493	0.383	0.445
55	Taplejung	0.681	0.357	0.200	0.670	0.454	0.490	0.299	0.445
56	Terhathum	0.565	0.477	0.234	0.715	0.481	0.447	0.368	0.445
57	Lamjung	0.636	0.434	0.235	0.697	0.494	0.488	0.336	0.443
58	Dhankuta	0.576	0.566	0.266	0.763	0.523	0.453	0.379	0.436
59	Ilam	0.472	0.606	0.185	0.782	0.525	0.474	0.360	0.436
60	Manang	0.631	0.497	0.061	0.957	0.486	0.479	0.302	0.432
61	Panchthar	0.561	0.407	0.211	0.664	0.511	0.452	0.337	0.426
62	Thimphu	0.521	0.704	0.093	0.993	0.604	0.488	0.389	0.424

Annex 3: cont.

63	Fugong	0.510	0.606	0.000	0.948	0.538	0.441	0.369	0.424
64	Gongshan	0.510	0.606	0.000	0.948	0.526	0.475	0.322	0.424
65	Chin state	0.118	0.920	0.100	0.861	0.567	0.418	0.420	0.423
66	Samtse	0.582	0.303	0.119	0.881	0.531	0.481	0.311	0.420
67	Mustang	0.877	0.348	0.106	0.925	0.532	0.470	0.319	0.419
68	Mizoram	0.376	1.000	0.086	0.689	0.603	0.420	0.438	0.419
69	Samdrup Jongkhar	0.711	0.396	0.253	0.867	0.567	0.483	0.338	0.418
70	Deqin	0.510	0.606	0.000	0.948	0.535	0.500	0.284	0.417
71	Kachine State	0.118	0.866	0.167	0.861	0.573	0.498	0.324	0.416
72	Trashiyangtse	0.627	0.262	0.297	0.815	0.543	0.494	0.294	0.415
73	Gasa	0.919	0.136	1.000	0.896	0.634	0.528	0.347	0.413
74	Sarpang	0.721	0.480	0.246	0.904	0.591	0.484	0.331	0.408
75	Wangduephodrang	0.680	0.333	0.127	0.852	0.570	0.488	0.297	0.405
76	Zhemgang	0.711	0.332	0.062	0.815	0.567	0.484	0.297	0.405
77	Chhukha	0.607	0.446	0.096	1.000	0.590	0.476	0.327	0.404
78	Trashigang	0.821	0.262	0.080	0.852	0.567	0.481	0.298	0.404
79	Bumthang	0.627	0.547	0.298	0.926	0.617	0.499	0.328	0.403
80	Weixi	0.510	0.606	0.000	0.948	0.549	0.455	0.299	0.402
81	Paro	0.600	0.358	0.138	0.941	0.562	0.472	0.295	0.401
82	Mongar	0.957	0.246	0.123	0.844	0.590	0.482	0.313	0.401
83	Lhuentse	0.812	0.317	0.121	0.819	0.580	0.495	0.277	0.397
84	Pema gatsel	0.763	0.267	0.552	0.822	0.617	0.484	0.292	0.386
85	Dagana	0.938	0.375	0.152	0.800	0.614	0.478	0.283	0.382
86	Trongsa	0.682	0.543	0.145	0.822	0.620	0.481	0.277	0.379
87	Punakha	0.671	0.362	0.741	0.889	0.668	0.480	0.294	0.369
88	Tsirang	1.000	0.382	0.287	0.859	0.648	0.481	0.267	0.367
89	Haa	0.777	0.581	0.609	0.915	0.693	0.463	0.303	0.358

Annex 4: Knowledge gaps and research priorities for different systems in each country

Nepal	
Knowledge gap	Research and capacity area
Biodiversity	
<ol style="list-style-type: none"> 1. Information on mountains 2. Impact of climate change on biodiversity 3. Coping strategies 	<ol style="list-style-type: none"> a. Mountain research on ecosystems, peoples, traditional knowledge, and others b. Impact of human actions on biodiversity c. Research on coping and adaptation d. Identification of vulnerable species (morphology, habits); ecosystems e. Species competition (invasive species) f. Traditional knowledge g. Historical migration patterns of biodiversity h. Coping patterns of humans in the past
Livelihood and wellbeing	
<ol style="list-style-type: none"> 1. Documentation of traditional knowledge for adaptation to a changing environment 2. Hydrological and meteorological data at micro level 3. Scientific verification of encountered changes in the environment due to climate change 4. Analytical instruments to assess impacts of climate change on livelihoods 5. Emergence and transmission pattern of diseases 6. Climate change implications for agricultural production 	<ol style="list-style-type: none"> a. Documentation of changing patterns of climate at micro level b. Identifying impact areas of climate change on livelihoods – health, food security, resource availability, and so on c. Documentation of local people’s experiences and adaptation to climate change d. Identification of coping mechanisms e. Knowledge sharing f. Stakeholder involvement at all levels of policy innovations g. Policy implementation h. Capacity building
Water, wetlands and hazards	
<ol style="list-style-type: none"> 1. Acquisition of baseline data for climate change studies with emphasis on high altitudes 2. Cryospheric research on snow and glaciers 3. High altitude hydrology and meteorology 4. Watershed status (biophysical, socioeconomic, paleoclimatic data) 5. Capacity building in regional climate modelling 6. Impact assessment of water, wetlands, and hazards 7. Developing two-way awareness mechanism between scientific and local communities 	<ol style="list-style-type: none"> a. Better data and information sharing mechanisms b. Establishment of metadata centre c. Research on climate change tolerant/resistant crop varieties d. Understanding sedimentation procedures resulting from extreme events e. Documentation of human activities on water utilisation f. Climatic (hydrometeo) hazard mapping g. Understanding monsoon and westerly dynamics under climate change scenarios

North East India and Bhutan

Knowledge gap	Research and capacity area
Biodiversity	
<ol style="list-style-type: none"> 1. Phenology in relation to productivity 2. Comprehensive inventory and database on biodiversity, status and access 3. Documentation of indigenous knowledge and practices in relation to climate change adaptation and mitigation 4. Awareness within vulnerable groups including women and children 5. Reorientation of management plans (protected areas) and other activities to address climate change issues 6. Prioritisation of protected areas, critical ecosystems, and habitats (micro-level) 7. Policy research linking conservation, livelihoods, NRM, and climate change 8. Study on the adaptability of species and the resilience of their habitats 9. Capacity building on taxonomy and conservation biology 	<ol style="list-style-type: none"> a. Small habitats and ecological niches b. Methane emission from wetlands c. How some important species adapt to climate change d. Specific ecosystems net carbon sequestration e. Climate change impact on agricultural productivity as it is the mainstay of livelihoods f. Prioritise critical ecosystems
Livelihood and wellbeing	
<ol style="list-style-type: none"> 1. Baseline and needs assessment, capacity building, and information on sector-wise interests, and others 2. Need to build awareness about the issues and close the gaps in information through educational materials for both teachers and students 3. Need to better understand traditional institutions and panchayats 4. Skills and knowledge for data collection and documentation 5. Lack of awareness and social responsibilities among government departments 6. Advanced soft skills (e.g., leadership, communication skills) and technical information skills 7. Need to enable communities to respond to the threats and changes requiring immediate attention 8. Need for participatory action research across sectors 	<ol style="list-style-type: none"> a. The in- and out-migration pattern and the consequences for the socioeconomy of the region b. Enhance data and information base to strengthen evidence with proper feedback mechanisms for verification and validation c. Establish modalities for payment for environmental services for community-managed forests d. Analyse traditional practices to cope with adverse impacts of climate change e. Improve inventory and database of alpine lakes and monitor these lakes (particularly in Bhutan) f. Validate traditional ecosystem knowledge through participatory action research
Water, wetlands and hazards	
<ol style="list-style-type: none"> 1. Limited institutional capacity in the use of high resolution models for localised climate prediction 2. Inadequate data on: <ul style="list-style-type: none"> – Biodiversity and indicator species of wetlands – Water quality – Water productivity 3. Ecological responses of wetlands to changes in hydrological regime 4. Categorisation of vulnerable groups 5. Lack of awareness on climate change issues among policy implementers at local and regional levels 6. Insignificant contribution by education and research institutes to research efforts on water, wetlands, and hazards 7. Significance of wetlands as GHG source 8. Insufficient capacity and proactive planning in risk/hazard prevention, preparedness 9. Non-existent or ineffective local institutions to support anticipatory actions and preparedness 10. Practical and applicable hydrological models for watershed and basin-level modelling to match demand with supply 11. Isolated interventions and lack of integrated approaches in water resources management 12. Poor water quality 	<ol style="list-style-type: none"> a. Need meteorological data and data sharing network b. Improve the observation/monitoring stations of required spatial coverage and temporal continuity c. Water policy analysis d. Strengthen traditional knowledge and practices e. Awareness of climate change issues at the local and regional level and among policy makers f. Development of weather-based index for crop and property insurance <p>Wetlands</p> <ol style="list-style-type: none"> g. Inventorying of and research on aquatic and wetland ecosystems by universities and research institutes h. Impact of acid rain on water and wetland ecosystems i. Assessment of methane emission from wetlands <p>Hazards</p> <ol style="list-style-type: none"> j. Hazard and risk vulnerability mapping k. High-altitude wetlands and glaciers and glacial lakes inventory and monitoring l. Establish flood early warning system, floodplain zoning m. Mechanisms to improve preparedness with site-specific adaptation framework for disaster risk reduction <p>Water</p> <ol style="list-style-type: none"> n. Water demand and supply scenario modelling using snow-melt runoff model and mass-balance model (basin-wise) o. Integrated wetlands and water resource management p. Improved monitoring of water quality