

Supplement of Proc. IAHS, 379, 67–72, 2018  
<https://doi.org/10.5194/piahs-379-67-2018-supplement>  
© Author(s) 2018. This work is distributed under  
the Creative Commons Attribution 4.0 License.



*Supplement of*

## **Assessment of freshwater ecosystem services in the Beas River Basin, Himalayas region, India**

**Sikhululekile Ncube et al.**

*Correspondence to:* Sikhululekile Ncube (s.ncube@hw.ac.uk, snmancue@gmail.com)

The copyright of individual parts of the supplement might differ from the CC BY 4.0 License.

**Supplementary material (S1) for Methods section 2.3: Lotic invertebrate Index for Flow Evaluation (LIFE) scoring system**

Table S1.1: Freshwater macroinvertebrate flow groups, their ecological associations and defined current velocities.

<b>Group</b>	<b>Ecological flow association</b>	<b>Mean current velocity</b>
I.	Taxa primarily associated with rapid flows	Typically >100 cms <sup>-1</sup>
II.	Taxa primarily associated with moderate to fast flows	Typical 20-100 cms <sup>-1</sup>
III.	Taxa primarily associated with slow to sluggish flows	Typically <20 cms <sup>-1</sup>
IV.	Taxa primarily associated with flowing (usually slow) and standing waters	-----
V.	Taxa primarily associated with standing waters	-----
VI.	Taxa frequently associated with drying or drought impacted sites	-----

Table S1.2: Macroinvertebrate abundance categories

Category	Estimated number of individuals in sample
0	0
1=A	1-9
2=B	10-99
3=C	100-999
4=D	1000-9999
5=E	10000+

LIFE calculation is based on assigning flow scores (values between 1 and 12) for each scoring taxon present in the sample according to its assigned flow group association and its estimated abundance class shown in the table below. The value of LIFE is the average of the flow scores for each of the taxa present in the sample:

$$\text{LIFE} = \sum_{i=1}^n f_{si}/n$$

Table S1.3: Flow scores (fs) for different abundance categories of taxa associated with each flow group (I – VI)

<b>Flow group</b>		<b>Abundance categories</b>			
		<b>1 (A)</b>	<b>2 (B)</b>	<b>3 (C)</b>	<b>4/5/(D/E)</b>
I	Rapid	9	10	11	12
II	Moderate/fast	8	9	10	11
III	Slow/sluggish	7	7	7	7
IV	Flowing/standing	6	5	4	3
V	Standing	5	4	3	2
VI	Drought resistant	4	3	2	1

## Supplementary material (S2) for Results section (3.2): Calculated LIFE scores

Table S2.1: LIFE scores overtime in the Beas River Basin

	Data source	site	Hydrological year	season	month	LIFE score
1	Manesh (2005)	A1	2004	winter	9,10,11,12,1,2	8.4
2	Manesh (2005)	A1	2004	summer	3,4,5	9.3
3	Manesh (2005)	A1	2004	Monsoon	6,7,8	5
4	Manesh (2005)	A1	2005	winter	9,10,11,12,1,2	8.7
5	Manesh (2005)	A1	2005	summer	3,4,5	9.3
6	Manesh (2005)	A1	2006	winter	9,10,11,12,1,2	8.9
7	Manesh (2005)	A2	2004	winter	9,10,11,12,1,2	8.7
8	Manesh (2005)	A2	2004	summer	3,4,5	8.9
9	Manesh (2005)	A2	2004	Monsoon	6,7,8	5
10	Manesh (2005)	A2	2005	winter	9,10,11,12,1,2	8.7
11	Manesh (2005)	A2	2005	summer	3,4,5	9.1
12	Manesh (2005)	A2	2006	winter	9,10,11,12,1,2	8.8
13	Manesh (2005)	A3	2004	winter	9,10,11,12,1,2	8.7
14	Manesh (2005)	A3	2004	summer	3,4,5	9.1
15	Manesh (2005)	A3	2004	Monsoon	6,7,8	5
16	Manesh (2005)	A3	2005	winter	9,10,11,12,1,2	8.9
17	Manesh (2005)	A3	2005	summer	3,4,5	9.2
18	Manesh (2005)	A3	2005	Monsoon	6,7,8	5
19	Manesh (2005)	A3	2006	winter	9,10,11,12,1,2	9.3
20	Manesh (2005)	A4	2004	winter	9,10,11,12,1,2	8.9
21	Manesh (2005)	A4	2004	summer	3,4,5	9.5
22	Manesh (2005)	A4	2004	Monsoon	6,7,8	5
23	Manesh (2005)	A4	2005	winter	9,10,11,12,1,2	9.2
24	Manesh (2005)	A4	2005	summer	3,4,5	9.5
25	Manesh (2005)	A4	2005	Monsoon	6,7,8	5
26	Manesh (2005)	A4	2006	winter	9,10,11,12,1,2	9.4
27	Manesh (2005)	B1	2004	winter	9,10,11,12,1,2	8.5
28	Manesh (2005)	B1	2004	summer	3,4,5	9
29	Manesh (2005)	B1	2004	Monsoon	6,7,8	5
30	Manesh (2005)	B1	2005	winter	9,10,11,12,1,2	8.6
31	Manesh (2005)	B1	2005	summer	3,4,5	9.2
32	Manesh (2005)	B1	2005	Monsoon	6,7,8	5
33	Manesh (2005)	B1	2006	winter	9,10,11,12,1,2	8.9
34	Manesh (2005)	B2	2004	winter	9,10,11,12,1,2	9
35	Manesh (2005)	B2	2004	summer	3,4,5	9.6
36	Manesh (2005)	B2	2004	Monsoon	6,7,8	4.7
37	Manesh (2005)	B2	2005	winter	9,10,11,12,1,2	9.1
38	Manesh (2005)	B2	2005	summer	3,4,5	9.8
39	Manesh (2005)	B2	2005	Monsoon	6,7,8	5
40	Manesh (2005)	B2	2006	winter	9,10,11,12,1,2	9.3
41	Manesh (2005)	B3	2004	winter	9,10,11,12,1,2	8.9
42	Manesh (2005)	B3	2004	summer	3,4,5	9.1
43	Manesh (2005)	B3	2004	Monsoon	6,7,8	4.3
44	Manesh (2005)	B3	2005	winter	9,10,11,12,1,2	9.2
45	Manesh (2005)	B3	2005	summer	3,4,5	9.2
46	Manesh (2005)	B3	2005	Monsoon	6,7,8	4.5
47	Manesh (2005)	B3	2006	winter	9,10,11,12,1,2	9.5
48	Manesh (2005)	B4	2004	winter	9,10,11,12,1,2	9.1
49	Manesh (2005)	B4	2004	summer	3,4,5	9.6
50	Manesh (2005)	B4	2004	Monsoon	6,7,8	4
51	Manesh (2005)	B4	2005	winter	9,10,11,12,1,2	9.4
52	Manesh (2005)	B4	2005	summer	3,4,5	9.6
53	Manesh (2005)	B4	2005	Monsoon	6,7,8	4.7
54	Manesh (2005)	B4	2006	winter	9,10,11,12,1,2	9.6
55	Sharma and Dhanze (2012)	C1	2007	winter	9,10,11,12,1,2	7.9
56	Sharma and Dhanze (2012)	C1	2007	summer	3,4,5	8
57	Sharma and Dhanze (2012)	C1	2007	Monsoon	6,7,8	6.3
58	Sharma and Dhanze (2012)	C2	2007	winter	9,10,11,12,1,2	7.9
59	Sharma and Dhanze (2012)	C2	2007	summer	3,4,5	8
60	Sharma and Dhanze (2012)	C2	2007	Monsoon	6,7,8	6.3
61	Sharma and Dhanze (2012)	C3	2007	winter	9,10,11,12,1,2	7.9
62	Sharma and Dhanze (2012)	C3	2007	summer	3,4,5	8
63	Sharma and Dhanze (2012)	C3	2007	Monsoon	6,7,8	6.3
64	Sharma and Dhanze (2012)	C4	2007	winter	9,10,11,12,1,2	7.9
65	Sharma and Dhanze (2012)	C4	2007	summer	3,4,5	8
66	Sharma and Dhanze (2012)	C4	2007	Monsoon	6,7,8	6.3
67	Sharma and Dhanze (2012)	C5	2007	winter	9,10,11,12,1,2	7.9
68	Sharma and Dhanze (2012)	C5	2007	summer	3,4,5	8
69	Sharma and Dhanze (2012)	C5	2007	Monsoon	6,7,8	6.3
70	Sharma and Dhanze (2012)	D1	2007	winter	9,10,11,12,1,2	7.7
71	Sharma and Dhanze (2012)	D1	2007	summer	3,4,5	7.7
72	Sharma and Dhanze (2012)	D1	2007	Monsoon	6,7,8	6.7
73	Sharma and Dhanze (2012)	D2	2007	winter	9,10,11,12,1,2	7.9
74	Sharma and Dhanze (2012)	D2	2007	summer	3,4,5	7.7
75	Sharma and Dhanze (2012)	D2	2007	Monsoon	6,7,8	6.3
76	Sharma and Dhanze (2012)	D3	2007	winter	9,10,11,12,1,2	7.7
77	Sharma and Dhanze (2012)	D3	2007	summer	3,4,5	7.7
78	Sharma and Dhanze (2012)	D3	2007	Monsoon	6,7,8	6.3
79	2017 Sampling site	E	2017	Winter	9,10,11,12,1,2	8
80	2017 Sampling site	F	2017	Winter	9,10,11,12,1,2	8.5