

Mission Report

Entomological fieldwork Bhutan May-June 2017



Jan van Tol

for C. Gielis, F.K. Gielis, W.F. Klein, J. van Tol & O. Vorst (the Netherlands),
and Ch. Dorji, P. Dorji, T. Gyeltshen, T. Nidup & K. Wangdi (Bhutan)

December 2017



Team Klein in Phuentshogthang

From left to right: (standing) Thinley Gyeltshen, Phurpa Dorji, Cheten Dorji, Wim Klein, Oscar Vorst, Tshering Nidup; (sitting) Jan van Tol and Kuenzang Choeda.

Internal report of Naturalis Biodiversity Center, Leiden, The Netherlands
December 2017

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1. Introduction

Three years ago, the National Biodiversity Centre (Bhutan) and Naturalis Biodiversity Center signed a Memorandum of Understanding for scientific cooperation. An important partner for the scientific and outreach activities was the Bhutan Trust Fund for Environmental Conservation (Thimphu), which provided a grant of USD 150,000 for the period 2014-2016. Although the grant ended by the end of 2016, but it was decided that further entomological fieldwork was needed, for instance to prepare for the next phase which will focus on applied entomology and water quality assessment. Costs of the Bhutanese counterparts for this fieldwork were covered by a grant of Naturalis.

We would like to thank for support our colleagues in Naturalis (Prof. dr. Koos Biesmeijer, Dr. Maaïke Romijn, Dr. Vincent Kalkman), the management of NBC Bhutan (Dr. Tashi Yangzome Dorji, Ms. Sangay Dema), who all contributed significantly to the outcome of this trip.

2. Participants, contacts

Netherlands team

- Cees and Siska Gielis (Lepidoptera)
- Wim Klein (Hymenoptera, with special reference to Sphecidae) (teamleader Naturalis)
- Jan van Tol (Odonata and other aquatic insects)
- Oscar Vorst (Coleoptera, with special reference to Coccinellidae and Hydrophilidae)

Bhutanese team

- Phurpa Dorji (Hymenoptera)
- Cheten Dorji (Coleoptera)
- Thinley Gyeltshen (Odonata)
- Tshering Nidup (Hymenoptera)
- Karma Wangdi (Lepidoptera)

Drivers of cars

- Dechen (driver for Cees en Siska Gielis)
- Kuenzang Choeda ('Ata') (driver for team Klein)
[+975 17620132]

Other contacts

- Rinchen Dorji (biodiversity supervisor National Biodiversity Centre, Serbithang; fern specialist)
[rdmagma@gmail.com]
- Choki Gyeltshen (senior biodiversity officer)

Address

- Cornelis Klein: Kunzang Lam 25A, Thimphu, Bhutan. [+975 17276472].
Email: cornelisklein@gmail.com

3. Itinerary, meetings

[*] Sundays

14 May 2017 [*]	Amsterdam-Dubai Dubai-Delhi
15 May 2017	Delhi-Paro Paro-Thimphu Staying in home Cornelis [Kees] and Namgai Klein
16 May 2017	Shopping in Thimphu
17 May 2017	Cees and Siska Gielis leaving from Thimphu; staying in UWICE guesthouse Darla, Chhukha Team Wim Klein: walk from Buddha statue to home Kees Klein
18 May 2017	Team Gielis: Darla Team Klein: From Thimphu to Paro; Paro to Bumthang (by plane); from Bumthang to Yong Khola (Trogon Villa) [lodge 27.29467N 91.16516E, 1528 m].
19 May 2017	Team Gielis: Darla to Phuentsholing; stay in hotel Team Klein: Yong Khola to Trashi Yangtse
20 May 2017	Team Gielis: Phuentsholing to Deothang CST guesthouse (route via India) Team Klein: Trashi Yangtse, collecting in Bumdeling Wildlife Reserve
21 May 2017 [*]	Team Gielis: Deothang Team Klein: Trashi Yangtse
22 May 2017	Team Gielis: Deothang to Phuentshogthang [= Phuentshotang]; stay in hotel Team Klein: Trashi Yangtse
23 May 2017	Team Gielis: Phuentshogthang Team Klein: Trashi Yangtse to Kanglung (Sherubtse college) [guesthouse 27.28651N 91.52151E, 1816 m]
24 May 2017	Team Gielis: Phuentshotang to Wamrong; stay in camp near Wamrong Forest Range Office Team Klein: From Kanglung to Phuentshogthang [Phuentshotang] [hotel 26.88499N 91.68734E].
25 May 2017	Team Gielis: Wamrong to Kanglung; stay in Sherubtse guesthouse Team Klein: Phuentshogthang
26 May 2017	Team Gielis: Kanglung to Trashi Yangtse; stay in Park guesthouse Team Klein: Phuentshogthang
27 May 2017	Team Gielis: Trashi Yangtse Team Klein: Phuentshogthang
28 May 2017 [*]	Team Gielis: Trashi Yangtse to Korila (Mongar); stay in NRDCL guesthouse Team Klein: Phuentshogthang
29 May 2017	Team Gielis: Korila Team Klein: From Phuentshogthang to Pemakatsel (near Bartseri) [hotel 27.04529N 91.41988E, 1663 m]
30 May 2017	Team Gielis: Korila to Autsho (Lhuentse); stay in Forest Office guesthouse Team Klein: Pemakatsel

31 May 2017	Team Gielis: Autrsho to Lhuentse Team Klein: Pemakatschel
1 June 2017	Team Gielis: Lhuentse to Yong Khola; stay in hotel Team Klein: Pemakatschel
2 June 2017	Team Gielis: Yong Khola Team Klein: From Pemakatschel to Kanglung (Sherubtse) [guesthouse 27.28651N 91.52151E, 1816 m]
3 June 2017	Team Gielis: Yong Khola to Bumthang; stay in UWICE guesthouse Team Klein: Kanglung
4 June 2017 [*]	Team Gielis: Bumthang Team Klein: Kanglung
5 June 2017	Team Gielis: Bumthang to Zhemgang; stay in Forest Office guesthouse Team Klein: Kanglung
6 June 2017	Team Gielis: Zhemgang to Tingtibi; stay in Park Manas guesthouse Team Klein: Kanglung to Yong Khola (Trogon villa)
7 June 2017	Team Gielis: Tingtibi Team Klein: Yong Khola
8 June 2017	Team Gielis: Tingtibi to Gelephu; stay in hotel Team Klein: Yong Khola
9 June 2017	Team Gielis: Gelephu to Damphu; stay in Forest Office guesthouse Team Klein: Yong Khola
10 June 2017	Team Gielis: Damphu Team Klein: Yong Khola to Jakar (UWICE)
11 June 2017 [*]	Team Gielis: Damphu to Thimphu. Stay at Kees Klein residence. Team Klein: From Bumthang to Paro. Visiting flowershow in Thimphu. Meeting Dr. Tashi and Mrs. Sangai. Stay at Kees Klein residence.
12 June 2017	Both teams: Thimphu. Wim Klein to NBC and Bafra to collect permits (MTA)
13 June 2017	Both teams: Thimphu
14 June 2017	Both teams: From Thimphu to Paro. Paro to Delhi. Delhi to Dubai. Hotel in Dubai.
15 June 2017	Both teams: Dubai to Amsterdam.

4. Sampling localities

Jan van Tol

Spelling of names of towns and villages according to World Mapping Project map Bhutan, 1:250,000.

18 May 2017

- 18 May 2017-A. Shingkar. Small brooklet. 27.50500N 90.85115E. 3200 m.

19 May 2017

- 19 May 2017-A. Kang Gula. Roadside. 27.2882N 91.2272E. 1124 m.
- 19 May 2017-B. North of Trashigang. Small stream near bridge. 27.4003N 91.5507E. 800 m.,

20 May 2017

- 20 May 2017-A. Trashiyangtse. 27.6408N 91.4700E, 1827 m.
- 20 May 2017-B. Bumdeling. Acorus pool. 27.65841N 91.45360E. 1889 m.
- 20 May 2017-C. Bumdeling. Polygonum pool. 1885 m. 27.65861N 91.45306E.

21 May 2017

- 21 May 2017-A. Bumdeling. Rivulet, half shaded. 27.65990N 91.44927E. 1905 m.
- 21 May 2017-B. As 20170520-C.

22 May 2017

- 22 May 2017-A. Trashiyangtse. Small stream. 27.62871N 91.49904E. 2026 m.
- 22 May 2017-B. Trashiyangtse. Rivulet and vegetated banks. 27.61759N 91.50121E. 1887 m.

23 May 2017

- 23 May 2017-A. Duksem. Swamp and shallow pools. 27.43534N 91.57862E. 848 m.

24 May 2017

- 24 May 2017-A. Phuentshogthang. At light near hotel. 26.88499N 91.68734E. 349 m.



Ceriagrion fallax, male [20 May 2017 sample B].



Indolestes cyaneus [20 May 2017 sample B].



Epiophlebia laidlawii [21 May 2017 sample A].



Aristocypha quadrimaculata, male (26 May 2017 sample A)

25 May 2017

- 25 May 2017-A. Phuentshogthang. Small stream. 26.91874N 91.68080E. 368 m.
- 25 May 2017-B. Phuentshogthang. Very small and narrow brook. 26.93985N 91.67635E. 709 m.

26 May 2017

- 26 May 2017-A. Phuentshogthang. Larger stream. 26.92845N 91.67451E. 353 m.
- 26 May 2017-B. Phuentshogthang. Small steep shaded stream. 26.93215N 91.67170E. 543 m.



Corydalidae (Neuroptera) (24 May 2017 sample A)

27 May 2017

- 27 May 2017-A. East of Phuentshogthang. Brook in steep valley, just before outlet in large river. 26.88663N 91.74529E. 326 m.
- 27 May 2017-B. Source and small brook in river valley. 26.88495N 91.74757E. 337 m.



Euphaea ochracea, pair (28 May 2017 sample B)

28 May 2017

- 28 May 2017-A. Rivulet with fast running water. 26.89033N 91.72158E. 389 m.
- 28 May 2017-B. As 27 May 2017-B.

29 May 2017

- 29 May 2017-A. Pemagatshel. Hotel near Bartseri. At light. 27.04529N 91.42000E. 1650 m.



Coellicia svihleri, male (28 May 2017 sample B)

30 May 2017

- 30 May 2017-A. Pemagatshel, near Bartseri. Brooklet. 27.03950N 91.41912E. 1371 m.
- 30 May 2017-B. Pemagatshel. River. 27.01703N 91.39645E. 670 m. [according to Google Earth: 27.01729N 91.39630E].

31 May 2017

- No collecting

1 June 2017

- 1 June 2017-A. Pemagatshel. As 30 May 2017-B.
- 1 June 2017-B. Pemagatshel. Hygropetric zone near river. 27.02198N 91.39590E. 632 m [Google Earth: 680 m].



Brahmaea wallichii moth at light (29 May 2017, not collected)

3 June 2017

- 3 June 2017-A. South of Kanglung. Seepage area along large stream. 27.27100N 91.53055E. 1780 m.
- 3 June 2017-B. West of Kanglung; Panthang. Seepages and trickles. 27.28196N 91.50176E. 1844 m.
- 3 June 2017-C. West of Kanglung; Panthang. Hygropetric zone. 27.28710N 91.50758E. 1705 m.

4 June 2017

- 4 June 2017-A. S of Kanglung: Guchu. Stream. 27.22036N 91.58417E. 2175 m.
- 4 June 2017-B. SW of Kanglung: Chhiya. Pond in agricultural area. 27.21763N 91.47149E. 1999 m.

5 June 2017

- 5 June 2017-A. East of Trashigang. Gamri river valley. Small stream in disturbed environment. 27.34403N 91.57504E. 868 m.
- 5 June 2017-B. East of Trashigang. Stream with ponded sites. 27.35122N 91.59331E. 850 m.
- 5 June 2017-C. East of Trashigang. Seepage and swampy site along road near Gamri river. 27.34534N 91.60090E. 834 m.

7 June 2017

- 7 June 2017-A. Yong Khola. Small stream in agricultural area. 27.29247N 91.14594E. 931 m.
- 7 June 2017-B. Yong Khola. Rivulet, some seepages. 27.27651N 91.14679E. 746 m.
- 7 June 2017-C. Yong Khola. Brooklet. 27.29885N 91.15559E. 1085 m.

8 June 2017

- 8 June 2017-A. Yong Khola. Small shaded stream. 27.32702N 91.13520E. 1897 m.
- 8 June 2017-B. Yong Khola. Thrumshing La (= Phumtshungla) NP. Small steep stream. 27.34980N 91.12230E. 2187 m.

9 June 2017

- 9 June 2017-A. South of Mongar. Kuri Chhu valley. Small tributary in narrow gorge. 27.18106N 91.24108E. 498 m.
- 9 June 2017-B. South of Mongar. Kuri Chhu valley. Waterfall with pool. 27.16406N 91.24198E. 460 m.



Paracypha unimaculata, male (1 Jun 2017 sample A)



Bayadera indica, female (1 June 2017 sample A)



Bayadera indica, male (7 June 2017 sample B)



Aristocypha cf. *quadrimaculata*, female (7 June 2017 sample B)

Photographs of sampling localities of wasps and bees
by Wim Klein



Tangsibi, 18 May 2017



Yong Khola, 18 May 2017



Ghunkarah, 19 May 2017



Bumdeling, 20 May 2017



Bumdeling, 21 May 2017



Bumdeling, 21 May 2017



Bayling, 22 May 2017

Wim Klein

- Thimphu. Thimphu, Kunzam Lam 25A. 16.v.2017. N 27°28'22.0" E 89°37'31.0"
- Thimphu. Thimphu, Bhuda Point trail. 17.v.2017. N 27°27'30.0" E 89°37'42.6"
- Bumthang. Tangsibi, 5 km east in direction Sengor. 18.v.2017. N 27°30'16.9" E 90°51'05.8"
- Mongar. Yong Khola, hotel Trogon Villa. 18.v.2017. N 27°17'41.7" E 91°09'54.3"
- Trashy Yangtse. Ghunkarah. 19.v.2017. N 27°24'00.5" E 91°33'00.1"
- Trashy Yangtse. Tashi Yangtse, road to Bumdeling. 20.v.2017. N 27°38'16.3" E 91°28'36.5"
- Trashy Yangtse. Bumdeling, in the village. 20.v.2017. N 27°39'29.4" E 91°27'13.6"
- Trashy Yangtse. Bumdeling, along road 2 km North of village. 21.v.2017. N 27°39'45.2" E 91°26'04.9"
- Trashy Yangtse. Bumdeling, 3 km north of village. 21.v.2017. N 27°39'59.4" E 91°26'18.7"
- Trashy Yangtse. Bumdeling, 5 km north of village. 21.v.2017. N 27°40'10.7" E 91°26'11.6"
- Trashy Yangtse. Tashi Yangtse, Norbu Yanghel Hotel. 21.v.2017. N 27°36'32.4" E 91°29'46.3"
- Trashy Yangtse. Tashi Yangtse, Bayling. 22.v.2017. N 27°37'44.0" E 91°29'47.4"
- Trashy Yangtse. Tashi Yangtse, road 2 km east of Bayling. 22.v.2017. N 27°37'43.8" E 91°29'47.3"
- Trashy Yangtse. Tashi Yangtse, on thee road east of Bayling. 22.v.2017. N 27°37'57.8" E 91°29'39.6"
- Trashy Yangtse. Tashi Yangtse. 22.v.2017. N 27°36'44.9" E 91°29'52.3"
- Trashy Yangtse. Doksum, just outside village. 23.v.2017. N 27°26'10.9" E 91°34'39.2"
- Trashy Yangtse. Doksum. 23.v.2017. N 27°26'15.7" E 91°34'59.8"
- Trashy Yangtse. Ghunkarah, shoulder of the road. 23.v.2017. N 27°24'49.7" E 91°33'37.1"
- Samdrup Jongkhar. Bhangtar, Tsangchutham. 24.v.2017. N 26°53'02.0" E 91°41'17.2"
- Samdrup Jongkhar. Bhangtar, Minjigang. 25.v.2017. N 26°55'07.4" E 91°40'54.0"
- Samdrup Jongkhar. Martshala, in the village. 25.v.2017. N 26°56'29.7" E 91°41'04.9"
- Samdrup Jongkhar. Bhangtar, Tsangchutham. 25.v.2017. N 26°53'02.0" E 91°41'17.2"
- Samdrup Jongkhar. Samdrup Choling, in the vil- lage. 26.v.2017. N 26°53'20.9" E 91°42'43.0"
- Samdrup Jongkhar. Pemathang, along bor- der Warongkhola. 26.v.2017. N 26°53'21.2" E 91°43'13.4"
- Samdrup Jongkhar. Pemathang, in the village. 26.v.2017. N 26°53'27.0" E 91°43'59.3"
- Samdrup Jongkhar. Bhangtar, Tsangchutham. 27.v.2017. N 26°53'02.0" E 91°41'17.2"
- Samdrup Jongkhar. Bhangtar, Tsangchutham. 26.v.2017. N 26°53'02.0" E 91°41'17.2"
- Samdrup Jongkhar. Samrang, road to Sam- rang from Bhangtar. 27.v.2017. N 26°53'12.7" E 91°47'54.5"
- Samdrup Jongkhar. Samrang, in the village. 27.v.2017. N 26°53'33.5" E 91°49'30.7"
- Samdrup Jongkhar. Bhangtar, Phuentshogthang. 27.v.2017. N 26°53'19.0" E 91°41'36.7"
- Samdrup Jongkhar. Bhangtar, Tsangchutham. 28.v.2017. N 26°53'02.0" E 91°41'17.2"
- Samdrup Jongkhar. Martshala. 28.v.2017. N 26°56'28.0" E 91°40'55.9"
- Samdrup Jongkhar. Martshala. 28.v.2017. N 26°56'23.9" E 91°40'37.2"
- Samdrup Jongkhar. Martshala, desolated house along road. 28.v.2017. N 26°56'03.0" E 91°40'19.5"
- Samdrup Jongkhar. Pemathang, Adminstrative centre of the Gewog. 28.v.2017. N 26°54'00.3" E 91°44'43.7"
- Samdrup Jongkhar. Bhangtar, Tsangchutham. 29.v.2017. N 26°53'02.0" E 91°41'17.2"
- Pema Gatshel. Bartseri, Dungsum Lodge. 29.v.2017. N 27°02'42.9" E 91°25'11.6"
- Pema Gatshel. Pemagatsel, Dechi. 30.v.2017. N 27°01'01.0" E 91°23'47.3"
- Pema Gatshel. Bartseri, Dungsum Lodge. 30.v.2017. N 27°02'42.9" E 91°25'11.6"
- Pema Gatshel. Bartseri, around Dungsum Lodge. 31.v.2017. N 27°02'42.9" E 91°25'11.6"
- Pema Gatshel. Mongling. 31.v.2017. N 27°01'48.2" E 91°27'17.8"
- Pema Gatshel. Zobel. 31.v.2017. N 27°02'35.7" E 91°27'38.7"
- Pema Gatshel. Bartseri, Dungsum Lodge. 1.vi.2017.



Pemathang, 26 May 2017



Pemathang, 26 May 2017



Samrang, 27 May 2017



Samrang, 27 May 2017



Martshala, 28 May 2017



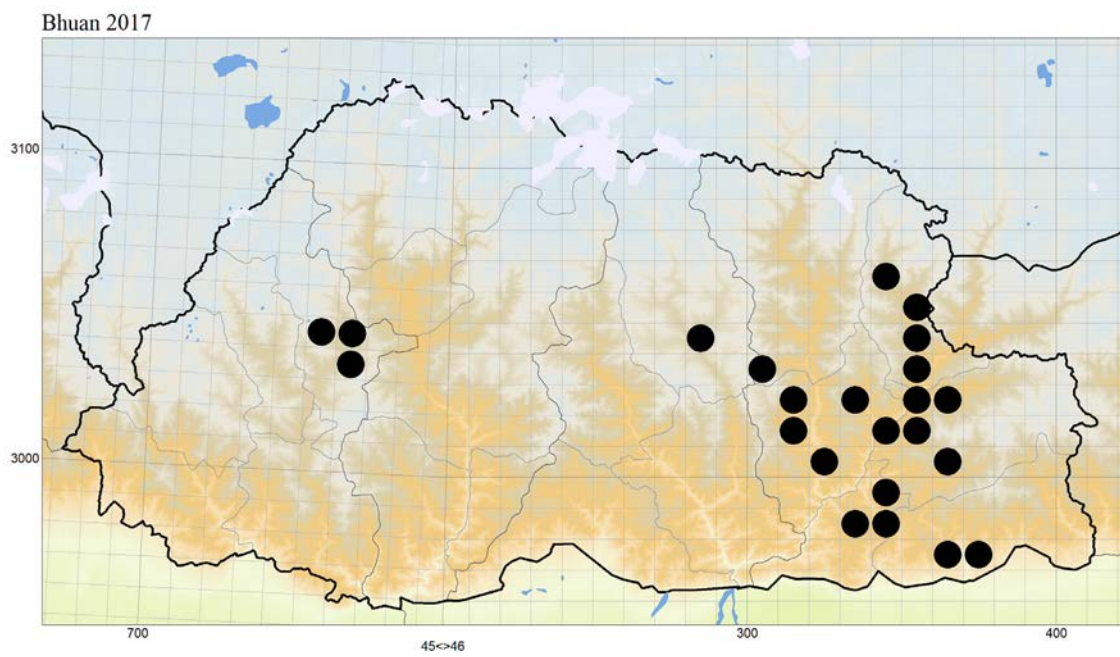
Dechi, 30 May 2017



Bartseri, 31 May 2017

- N 27°02'42.9" E 91°25'11.6"
- Pema Gatshel. Pemagatsel, Dechi. 1.vi.2017. N 27°01'01.8" E 91°23'45.4"
 - Pema Gatshel. Pratangma, near Khar. 1.vi.2017,
 - Trashigang. Kahling, along highway 13 km South. 2.vi.2017. N 27°10'14.9" E 91°36'53.3"
 - Trashigang. Kanglung, Guesthouse Sheruptse College. 2.vi.2017. N 27°17'11.9" E 91°31'17.9"
 - Trashigang. Kanglung, Balfai. 3.vi.2017. N 27°16'15.5" E 91°31'50.6"
 - Trashigang. Rhongthung, along highway. 3.vi.2017. N 27°16'32.9" E 91°32'00.6"
 - Trashigang. Kanglung, Upper Market. 3.vi.2017. N 27°16'52.5" E 91°30'35.0"
 - Trashigang. Gumchu, along highway. 4.vi.2017. N 27°13'17.5" E 91°34'59.8"
 - Trashigang. Balfai, Rongthung. 4.vi.2017. N 27°13'10.4" E 91°29'03.3"
 - Trashigang. Reju, shoulder of the road. 5.vi.2017. N 27°20'38.7" E 91°34'29.0"
 - Trashigang. Godi, river bank. 5.vi.2017. N 27°21'05.5" E 91°35'38.5"
 - Trashigang. Godi, river bank. 5.vi.2017. N 27°20'42.3" E 91°36'05.1"
 - Trashigang. Rangjung, Buna. 5.vi.2017. N 27°21'26.8" E 91°39'12.6"
 - Trashigang. Kanglung, Guesthouse Sheruptse College. 5.vi.2017. N 27°17'11.9" E 91°31'17.9"
 - Trashigang. Kanglung, Guesthouse Sheruptse College. 6.vi.2017. N 27°17'11.9" E 91°31'17.9"
 - Mongar. Damecha, along highway. 6.vi.2017. N 27°16'24.5" E 91°22'29.7"
 - Mongar. Mongar, hotel. 6.vi.2017. N 27°16'37.1" E 91°14'12.7"
 - Mongar. Lingmethang, Shongar Dzong. 7.vi.2017. N 27°17'33.2" E 91°08'44.6"
 - Mongar. Lingmethang, Shongar Dzong. 7.vi.2017. N 27°16'33.0" E 91°08'48.4"
 - Mongar. Yong Khola, Thridangbi. 7.vi.2017. N 27°17'56.5" E 91°09'15.6"
 - Mongar. Yong Khola, Hotel Drogon Villa. 7.vi.2017. N 27°17'40.8" E 91°09'53.7"
 - Mongar. Namling, along the road. 8.vi.2017. N 27°19'37.8" E 91°08'02.7"
 - Mongar. Namling, along the road. 8.vi.2017. N 27°20'59.3" E 91°07'14.2"
 - Mongar. Yong Khola, along the road. 8.vi.2017. N 27°18'04.6" E 91°10'00.3"
 - Mongar. Yong Khola, Hotel Drogon Villa. 8.vi.2017. N 27°17'40.8" E 91°09'53.7"
 - Mongar. Yong Khola, Hotel Drogon Villa. 9.vi.2017. N 27°17'40.8" E 91°09'53.7"
 - Mongar. Gyelpoishing, Tongla Kenga. 9.vi.2017. N 27°10'42.8" E 91°14'39.2"
 - Mongar. Gyelpoishing, Tongla Kenga. 9.vi.2017. N 27°10'39.0" E 91°14'18.2"
 - Lhuntse. Sengor, Trumpsala Pass. 10.vi.2017. N 27°23'14.2" E 91°00'11.5"
 - Bumthang. Sengor, Trumpsala Pass. 10.vi.2017. N 27°23'21.4" E 90°58'55.8"
 - Bumthang. Sengor, Trumpsala Pass. 10.vi.2017. N 27°24'06.3" E 90°59'22.1"
- ***

Below: Sampling localities Oscar Vorst



Oscar Vorst

Aquatic, semiaquatic and terrestrial samples

- Bt201, Thimphu: Thimphu, 16.v.2017, 2463 m, N 27°28'24" E 89°37'32" [27.47345 89.62558], Garden, gutter.
- Bt202, Thimphu: Thimphu, Dechenphodrang, 16.v.2017, 2424 m, N 27°29'56" E 89°37'56" [27.49911 89.63244], Ruderal slope.
- Bt203, Thimphu: Semthoka, 17.v.2017, 2636 m, N 27°26'46" E 89°38'30" [27.44652 89.64192], Horse dung, Pinus.
- Bt204, Thimphu: Semthoka, 17.v.2017, 2636 m, N 27°26'46" E 89°38'30" [27.44652 89.64192], Shrubland.
- Bt205, Bumthang: Shertang La, 18.v.2017, 3200 m, N 27°30'18" E 90°51'04" [27.5050v 90.8510v], Cow dung.
- Bt206, Mongar: Lingmethang, Trogon Villa, 18.v.2017, 1509 m, N 27°17'40" E 91°09'54" [27.29464 91.16509], At light.
- Bt207, Trashi Yangtse: Jamkhar, 19.v.2017, 859 m, N 27°24'02" E 91°33'02" [27.40075 91.55110], Montane brook.
- Bt208, Trashi Yangtse: Shali, 19.v.2017, 1542 m, N 27°31'56" E 91°30'54" [27.53271 91.51522], Near waterfall.
- Bt209, Trashi Yangtse: Bumdeling, 20.v.2017, 1900 m, N 27°39'40" E 91°26'56" [27.66127 91.44939], Riverine plain.
- Bt210, Trashi Yangtse: Bumdeling, 20.v.2017, 1903 m, N 27°39'44" E 91°26'50" [27.66248 91.44746], Pond, vegetated.
- Bt211, Trashi Yangtse: Bumdeling, 20.v.2017, 1903 m, N 27°39'44" E 91°26'50" [27.66248 91.44746], Cow dung, field.
- Bt212, Trashi Yangtse: Bumdeling, 21.v.2017, 1907 m, N 27°39'40" E 91°26'52" [27.66149 91.44792], Pond, vegetated.
- Bt213, Trashi Yangtse: Bumdeling, 21.v.2017, 1907 m, N 27°39'40" E 91°26'52" [27.66149 91.44792], Road verge.
- Bt214, Trashi Yangtse: Bumdeling, 21.v.2017, 1907 m, N 27°39'40" E 91°26'52" [27.66149 91.44792], Alnus, near river.
- Bt215, Trashi Yangtse: Bumdeling, 21.v.2017, 1903 m, N 27°39'44" E 91°26'50" [27.66231 91.44768], Cow dung, pasture.
- Bt216, Trashi Yangtse: Bumdeling, 21.v.2017, 1914 m, N 27°39'36" E 91°26'52" [27.66030 91.44826], Marsh nr brook.
- Bt217, Trashi Yangtse: Bumdeling, 21.v.2017, 1914 m, N 27°39'36" E 91°26'52" [27.66030 91.44826], Grassland.
- Bt218, Trashi Yangtse: Trashi Yangtse, 2 km N of, 22.v.2017, 2042 m, N 27°37'42" E 91°29'56" [27.62873 91.49908], Steep brooklet.
- Bt219, Trashi Yangtse: Trashi Yangtse, 2 km N of, 22.v.2017, 2042 m, N 27°37'42" E 91°29'56" [27.62873 91.49908], Cow dung, forest edge.
- Bt220, Trashi Yangtse: Trashi Yangtse, 2 km N of, 22.v.2017, 2042 m, N 27°37'42" E 91°29'56" [27.628 91.499], Forest edge.
- Bt221, Trashi Yangtse: Trashi Yangtse, 2 km N of, 22.v.2017, 2041 m, N 27°37'42" E 91°29'52" [27.62888 91.49808], Loamy seepage.
- Bt222, Trashi Yangtse: Trashi Yangtse, 1 km N of, 22.v.2017, 1878 m, N 27°37'02" E 91°30'02" [27.61775 91.50077], Seepage meadow.
- Bt223, Trashi Yangtse: Trashi Yangtse, 1 km N of, 22.v.2017, 1878 m, N 27°37'02" E 91°30'02" [27.6175v 91.5005v], Cow dung.
- Bt224, Trashi Yangtse: Trashi Yangtse, 21.v.2017, 1729 m, N 27°36'32" E 91°29'44" [27.60902 91.49593], At light, town.
- Bt225, Trashi Yangtse: Trashi Yangtse, 1 km N of, 22.v.2017, 1871 m, N 27°37'02" E 91°30'04" [27.61767 91.50131], Montane brook.
- Bt226, Trashi Yangtse: Trashi Yangtse, Khulong Chhu, 22.v.2017, 1740 m, N 27°36'46" E 91°29'32" [27.61325 91.49252], Beach, river.
- Bt227, Trashi Yangtse: Trashi Yangtse, Khulong Chhu, 22.v.2017, 1739 m, N 27°36'48" E 91°29'30" [27.61334 91.49213], River dunes.
- Bt228, Trashi Yangtse: Trashi Yangtse, Khulong Chhu, 22.v.2017, 1739 m, N 27°36'48" E 91°29'30" [27.61334 91.49213], River dunes.



Participants in Thimphu

From left to right: Jan van Tol, Siska Gielis, Cees Gielis, Oscar Vorst, Wim Klein and Kees Klein (Consul of Bhutan in the Netherlands)

- Bt229, Trashi Yangtse: Doksum, 23.v.2017, 868 m, N 27°26'12" E 91°34'52" [27.43712 91.58116], Cow dung, dry.
- Bt230, Trashi Yangtse: Doksum, 23.v.2017, 869 m, N 27°26'06" E 91°34'42" [27.43533 91.57861], Grazed marsh.
- Bt231, Trashi Yangtse: Doksum, 23.v.2017, 833 m, N 27°26'06" E 91°34'40" [27.43506 91.57811], Stoney brook.
- Bt232, Trashi Yangtse: Gom Kora, 23.v.2017, 845 m, N 27°25'36" E 91°33'48" [27.42681 91.56372], Brooklet in ravine.
- Bt233, Samdrup Jongkhar: Phuentshothang, 24.v.2017, 332 m, N 26°53'04" E 91°41'14" [26.88496 91.68737], At light, fields.
- Bt234, Samdrup Jongkhar: Kagpadung, 25.v.2017, 358 m, N 26°55'06" E 91°40'48" [26.91857 91.68046], River in forest.
- Bt235, Samdrup Jongkhar: Kagpadung, 25.v.2017, 358 m, N 26°55'06" E 91°40'48" [26.91857 91.68046], Rockpool nr river.
- Bt236, Samdrup Jongkhar: Kagpadung, 25.v.2017, 314 m, N 26°55'06" E 91°40'50" [26.91858 91.68104], Brooklet, forest.
- Bt237, Samdrup Jongkhar: Kagpadung, 25.v.2017, 314 m, N 26°55'06" E 91°40'50" [26.91858 91.68104], In fungus on wood.
- Bt238, Samdrup Jongkhar: Phuentshothang, 25.v.2017, 332 m, N 26°53'04" E 91°41'14" [26.88496 91.68737], At light, fields.
- Bt239, Samdrup Jongkhar: Laishingri, 26.v.2017, 389 m, N 26°55'42" E 91°40'28" [26.92853 91.67450], Brooklet, ruderal.
- Bt240, Samdrup Jongkhar: Phuentshothang, 27 t/m 29.v.2017, 332 m, N 26°53'04" E 91°41'14" [26.8845v 91.6870v], Bottle trap, banana.

- Bt241, Samdrup Jongkhar: Laishingri, 26.v.2017, 381 m, N 26°55'42" E 91°40'28" [26.92874 91.67459], Shaded pool.
- Bt242, Samdrup Jongkhar: Laishingri, 26.v.2017, 379 m, N 26°55'44" E 91°40'28" [26.92913 91.67476], Brook, side channel.
- Bt243, Samdrup Jongkhar: Laishingri, 26.v.2017, 539 m, N 26°55'54" E 91°40'16" [26.93215 91.67151], Brooklet.
- Bt244, Samdrup Jongkhar: Laishingri, 26.v.2017, 539 m, N 26°55'54" E 91°40'16" [26.93215 91.67151], Road verge.
- Bt245, Samdrup Jongkhar: Kagpadung, 26.v.2017, 350 m, N 26°54'36" E 91°40'56" [26.91005 91.68241], Cow dung, paddy.
- Bt246, Samdrup Jongkhar: Kagpadung, 26.v.2017, 350 m, N 26°54'36" E 91°40'56" [26.91005 91.68241], Paddy.
- Bt247, Samdrup Jongkhar: Phuentshothang, 26.v.2017, 332 m, N 26°53'04" E 91°41'14" [26.88496 91.68737], At light, fields.
- Bt248, Samdrup Jongkhar: Phuentshothang, 27.v.2017, 332 m, N 26°53'04" E 91°41'14" [26.88496 91.68737], At light, fields.
- Bt249, Samdrup Jongkhar: Pemathang, 28.v.2017, 350 m, N 26°53'22" E 91°43'14" [26.88974 91.72083], Trickle nr brook.
- Bt250, Samdrup Jongkhar: Pemathang, 28.v.2017, 350 m, N 26°53'22" E 91°43'14" [26.88974 91.72083], Brook, bank.
- Bt251, Samdrup Jongkhar: Phuentshothang, 28.v.2017, 349 m, N 26°52'56" E 91°42'20" [26.88226 91.70558], Elephant dung.
- Bt252, Samdrup Jongkhar: Pemathang, 28.v.2017, 308 m, N 26°53'10" E 91°44'50" [26.88621 91.74730], Remnant pool.
- Bt253, Samdrup Jongkhar: Pemathang, 28.v.2017, 313 m, N 26°53'10" E 91°44'48" [26.88640 91.74701], Large river, gravel.
- Bt254, Pema Gatshel: Pemagatsel, 30.v.2017, 1341 m, N 27°02'20" E 91°25'08" [27.03937 91.41913], Steep montane brook.
- Bt255, Pema Gatshel: Kothakpa, 30.v.2017, 666 m, N 27°01'00" E 91°23'46" [27.01692 91.39655], Montane stream.
- Bt256, Pema Gatshel: Kothakpa, 30.v.2017, 666 m, N 27°01'00" E 91°23'46" [27.01692 91.39655], On vegetation.
- Bt257, Pema Gatshel: Kothakpa, 30.v.2017, 666 m, N 27°01'00" E 91°23'46" [27.01692 91.39655], Cow dung.
- Bt258, Pema Gatshel: Kothakpa, 30.v.2017, 661 m, N 27°01'02" E 91°23'46" [27.01764 91.39658], Small marsh.
- Bt259, Pema Gatshel: Pemagatsel, 31.v.2017, 1723 m, N 27°02'38" E 91°24'48" [27.04442 91.41367], Forest edge.
- Bt260, Pema Gatshel: Resminang, 31.v.2017, 2198 m, N 27°01'46" E 91°27'14" [27.02954 91.45422], Grazed forest.
- Bt261, Pema Gatshel: Kothakpa, 1.vi.2017, 672 m, N 27°01'00" E 91°23'46" [27.01719 91.39650], Ruderal vegetation.
- Bt262, Pema Gatshel: Kothakpa, 1.vi.2017, 672 m, N 27°01'00" E 91°23'46" [27.01719 91.39650], Remnant pool.
- Bt263, Pema Gatshel: Tsebar, 1.vi.2017, 1067 m, N 26°59'10" E 91°22'52" [26.98643 91.38133], Montane brook.
- Bt264, Pema Gatshel: Tsebar, 1.vi.2017, 1067 m, N 26°59'10" E 91°22'52" [26.98643 91.38133], Forest.
- Bt265, Pema Gatshel: Kothakpa, 1.vi.2017, 649 m, N 27°01'20" E 91°23'42" [27.02242 91.39540], Loamy trickle.
- Bt266, Pema Gatshel: Kothakpa, 1.vi.2017, 649 m, N 27°01'20" E 91°23'42" [27.02242 91.39540], Road verge.
- Bt267, Trashigang: Kharung La, 2.vi.2017, 2398 m, N 27°10'14" E 91°36'52" [27.17082 91.61482], Montane brook.
- Bt268, Trashigang: Kharung La, 2.vi.2017, 2398 m, N 27°10'14" E 91°36'52" [27.17082 91.61482], Cow dung.
- Bt269, Trashigang: Sherubtse, 2 km SE of, 3.vi.2017, 1780 m, N 27°16'14" E 91°31'48" [27.27100 91.53055], Montane brook, steep.
- Bt270, Trashigang: Sherubtse, 2 km SE of, 3.vi.2017, 1734 m, N 27°16'18" E 91°31'50" [27.27214 91.53072], Rain water puddle.

- Bt271, Trashigang: Sherubtse, 2 km W of, 3.vi.2017, 1866 m, N 27°16'54" E 91°30'06" [27.28184 91.50179], Ruderal vegetation.
- Bt272, Trashigang: Sherubtse, 2 km W of, 3.vi.2017, 1692 m, N 27°17'12" E 91°30'26" [27.28700 91.50757], Hygropetric rock.
- Bt273, Trashigang: Khaling, 2 km NW of, 4.vi.2017, 2208 m, N 27°13'14" E 91°35'00" [27.22064 91.58384], Montane stream.
- Bt274, Trashigang: Bartsam, 4.vi.2017, 2481 m, N 27°14'14" E 91°32'18" [27.23755 91.53858], Hygropetric rock.
- Bt275, Trashigang: Chhiya, 4.vi.2017, 2015 m, N 27°13'02" E 91°28'16" [27.21759 91.47150], Small lake.
- Bt276, Trashigang: Chhiya, 4.vi.2017, 2015 m, N 27°13'02" E 91°28'16" [27.21759 91.47150], Lake, floating.
- Bt277, Trashigang: Trashigang, 2 km NO of, 5.vi.2017, 803 m, N 27°20'36" E 91°34'28" [27.34375 91.57465], Brooklet in ravine.
- Bt278, Trashigang: Galing, 5.vi.2017, 832 m, N 27°20'42" E 91°36'02" [27.34511 91.60105], Seepage marsh.
- Bt279, Trashigang: Galing, 5.vi.2017, 832 m, N 27°20'42" E 91°36'02" [27.34511 91.60105], Cow dung.
- Bt280, Trashigang: Galing, Gamri Chhu, 5.vi.2017, 973 m, N 27°21'24" E 91°38'48" [27.35679 91.64699], Large river, gravel.
- Bt281, Mongar: Ngatshang, 6.vi.2017, 1751 m, N 27°18'44" E 91°19'42" [27.31243 91.32855], Pond.
- Bt282, Mongar: Lingmethang, Trogon Villa, 6.vi.2017, 1509 m, N 27°17'40" E 91°09'54" [27.29464 91.16509], At light.
- Bt283, Mongar: Lingmethang, 5 km NW of, 7.vi.2017, 937 m, N 27°17'38" E 91°08'46" [27.29394 91.14624], Brooklet.
- Bt284, Mongar: Lingmethang, 5 km NW of, 7.vi.2017, 937 m, N 27°17'38" E 91°08'46" [27.29394 91.14624], Ruderal vegetation.
- Bt285, Mongar: Lingmethang, 4 km W of, 7.vi.2017, 760 m, N 27°16'32" E 91°08'46" [27.27557 91.14622], Montane stream.
- Bt286, Mongar: Yong Khola, 8.vi.2017, 1897 m, N 27°19'36" E 91°08'06" [27.32702 91.13520], Steep brooklet.
- Bt287, Mongar: Yong Khola, 8.vi.2017, 2183 m, N 27°20'58" E 91°07'20" [27.34990 91.12255], Brook in ravine.
- Bt288, Mongar: Yong Khola, 8.vi.2017, 2183 m, N 27°20'58" E 91°07'20" [27.34990 91.12255], Cow dung, forest.
- Bt289, Mongar: Yong Khola, 8.vi.2017, 2183 m, N 27°20'58" E 91°07'20" [27.34990 91.12255], Broad-leaved forest.
- Bt290, Mongar: Yong Khola, 8.vi.2017, 2217 m, N 27°20'38" E 91°06'28" [27.34413 91.10808], Hygr. rock + trickle.
- Bt291, Mongar: Yong Khola, 8.vi.2017, 2485 m, N 27°20'12" E 91°05'34" [27.33695 91.09331], Rock nr waterfall.
- Bt292, Mongar: Yong Khola, 8.vi.2017, 2366 m, N 27°20'26" E 91°05'50" [27.34110 91.09761], Rocky brook.
- Bt293, Mongar: Resa, 9.vi.2017, 550 m, N 27°10'52" E 91°14'26" [27.18122 91.24101], Brook in ravine.
- Bt294, Mongar: Resa, 9.vi.2017, 539 m, N 27°10'50" E 91°14'30" [27.18102 91.24210], Hygropetric rock.
- Bt295, Mongar: Resa, 9.vi.2017, 584 m, N 27°10'52" E 91°14'32" [27.18141 91.24228], Brook in ravine.
- Bt296, Lhuntse: Thrumseng La, 10.vi.2017, 3312 m, N 27°23'20" E 91°00'10" [27.38893 91.00293], Cow dung.
- Bt297, Bumthang: Thrumseng La, 10.vi.2017, 3642 m, N 27°23'24" E 90°58'58" [27.39041 90.98313], Seepage, mosses.

5. Costs estimate, visa etc

This fieldwork was executed within the framework of the MoU between the National Biodiversity Centre (Bhutan) and Naturalis. The compulsory spending of USD 250.- per day, as to be paid by visitors, is waived within this contract. The necessary visa for Bhutan were arranged by NBC Bhutan. The costs of USD 40.- have to be paid on arrival at the airport of Paro.

Transit in India (Delhi airport) is problematic. Checked-in baggage cannot be labelled to Paro, should be personally collected from the belt, and then again checked-in at the Drukair desk. Although it must be possible to have this arranged by airport staff, Emirates checked at Schiphol whether we had visa for India. We all had visa, some only eVisa (double entry), which was sufficient since we had a print of the confirmation. It is also possible to go for a tourist visa, which can be arranged at the embassy or consulate of India in the Netherlands. The eVisa had to be confirmed at Delhi airport, which took more than one hour. Thereafter, check-in was straightforward.

On our return flight, the baggage was labelled to Amsterdam by Drukair staff. Although this caused some discussion, it appeared to be possible to use the transit-facilities in Delhi (so not entering and leaving India within an hour or so).

Cees Gielis had obtained a multi-entry visa for India, since he wished to travel from west to east Bhutan via India. It should be remembered that in such cases a multi-entry visa is also needed for Bhutan (extra costs USD 40 per person).

Within Bhutan permits for travelling per dzongkhag have to be issued. These are arranged by the counterparts, but stamps have to be collected on the visa-mail at each checkpoint.

Costs

All prices are as they were paid in May-June 2017.

- Hotel accommodation: the Bhutanese counterparts usually choose inexpensive hotels, USD 10-15 per room per night. Accommodation in Sherubtse or UWICE is less than USD 10.
- Costs for food: About USD 10.- per person per day.
- Costs team Gielis, inclusive accommodations, food, drinks, etc., for whole team EUR 1350.
- Costs of counterparts: NBC expected that Naturalis paid the daily allowance of the counterparts (1000 BTN [Ngultrum] per day). We deducted 200 BTN per day for costs of hotel and food. Also the costs for travelling have to be paid. These costs were all covered by Naturalis.
- Air tickets. Amsterdam – Dubai – Delhi: EUR 578.30.
Delhi-Paro: USD 673.15
Paro-Bumthang: USD 314.00
- The total costs for three participants were thus EUR 7500.-, excluding the costs of the counterparts. For team Gielis EUR 6500.
- NB. In Thimphu we stayed with Kees and Namgai Klein; costs of hotels in Thimphu and Paro are significantly higher.
- Rent of a four-wheel drive car (Landcruiser), including driver: USD 1500 per month; for Cees Gielis a Hyundai Sante Fe with driver EUR 1550.



Examples of plant species found (Photos by Jan van Tol)

6. Observations and suggestions for future fieldwork

Leiden issues

- a) Honorary staff of Naturalis, participating in fieldwork or any other activities based on the MoU, shall be instructed on the consequences of participation, including (but not limited to) health and safety regulations, export of specimens, administration of specimens in the Netherlands, follow-up in publications,
- b) The present MoU and the MTA's based on this MoU all mention that all specimens collected shall be returned to Bhutan. We suggest that this has to be discussed when the MoU will be renewed. It would be beneficial for the collection and for future research if duplicates can be retained by Naturalis. Several options are open, including a longterm / eternal loan from Bhutan to Naturalis,
- c) Most sampling sites for aquatic animals are small (frequently just where the stream crossed the road at a bridge). Planning of fieldwork for a more extensive aquatic research project needs to include planning of only small groups per site (two, or three researchers maximum),
- d) Use of specimens under the present MoU / MTA is limited to morphological study. A subsequent MoU shall at least include DNA-barcoding, which may result in registration under the Nagoya-protocol. We have to decide what to do with the present collection.

Preparations

- e) Preparations started about nine months before we left. We suggest to start the first contacts with Bhutan one year in advance,
- f) Administration of permits etc when arriving in Bhutan. One day seems to be sufficient, since our counterparts can handle this,
- g) Handling of the material transfer agreement and Bafra permits is also possible in one day (although one has to start early),

Contacts within Bhutan

- h) Funding in Bhutan is essential. We suggest to support our colleagues in NBC as much as

possible to enhance the chance for positive outcome of grant applications,

- i) If costs of our counterparts have to be covered by Naturalis (or any other Dutch grant), their daily allowance and travel costs have to be agreed upon early,
- j) The role of Cornelis Klein, Bhutanese honorary consul in the Netherlands, and staying in Thimphu several months every year, shall not be underestimated. He knows the Bhutanese government, and can advise on all aspects of bureaucracy in Bhutan.
- k) Several students of Sherubtse college have expressed their interest in a study in the Netherlands. Naturalis shall collect the information of options for Bhutanese students to follow a BSc, MSc or PhD programme,
- l) Botanical staff of NBC has expressed interest in cooperation. This has to be further explored between the directors of NBC and Naturalis; informal contact between the fern expert with Dr. Peter Hovenkamp has already been established,

Travelling and working in Bhutan

- m) Travelling to eastern Bhutan will be facilitated as soon as the new airport near Kanglung is operational later in 2017,
- n) Purchase of a new and compact generator (Honda EU 10i, c. EUR 1000) is necessary when collecting further from power supply is proposed,
- o) Although the road network is extended and improved, there are still vast regions in Bhutan that can only be reached by foot or helicopter. It should be investigated (i) options for hiring helicopter, (ii) financial support from Naturalis sponsors to facilitate hiring helicopter,

Appendix 1

Photographs of localities of aquatic insects

Photographs by J. van Tol, except labelled “OV”, i.e.

Oscar Vorst.



18 May 2017,
Bhutan, Bumthang, Shingkar. 3200
m. 27.50500N 90.85115E.



19 May 2017
Bhutan, Trashy Yangtse, Ghunkarah,
800 m. 27.4003N 91.5507E.



20 May 2017
Bhutan, Trashy Yangtse, Shapang,
1827 m. 27.6408N 91.4700E.



20 May 2017
Bhutan, Trashi Yangtse, Bumde-
ling, *Acorus* pool. 1889 m. 27.65841N
91.45360E.



20 May 2017
Bhutan, Trashi Yangtse, Bumdeling,
Polygonum pool. 1885 m. 27.65861N
91.45306E.



21 May 2017
Bhutan, Trashi Yangtse, Bumdeling,
1905 m. 27.65990N 91.44927E.



22 May 2017
Bhutan, Trashi Yangtse. Small stream.
2026 m. 27.62871N 91.49904E.



22 May 2017
Bhutan, Trashi Yangtse. Rivulet and
vegetated banks. 1887 m. 27.61759N
91.50121E.



23 May 2017 [photo OV]
Bhutan, Duksem. Swamp and shallow
pools. 848 m. 27.43534N 91.57862E.



24 May 2017
Bhutan, Phuentshogthang. At
light near hotel. 349 m. 26.88499N
91.68734E.



25 May 2017
Bhutan, Phuentshogthang. Small
stream. 368 m. 26.91874N 91.68080E.



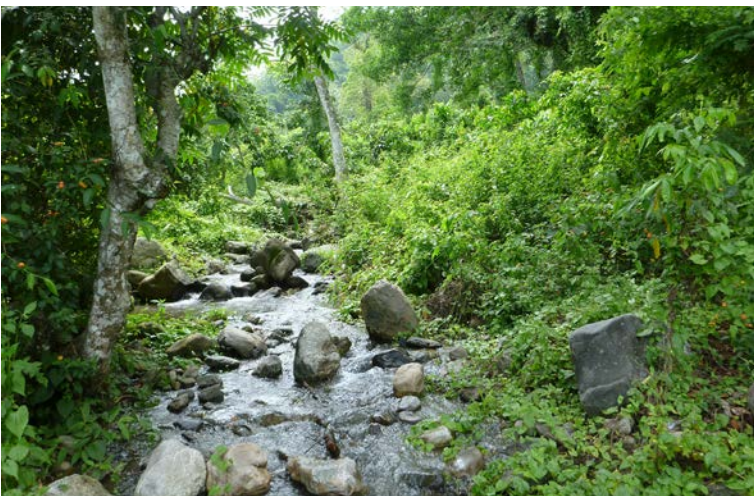
25 May 2017
Bhutan, Phuentshogthang. Small
steep and shaded stream. 709 m.
26.93985N 91.67635E.



26 May 2017
Bhutan, Phuentshogthang. Larger
stream. 353 m. 26.92845N 91.67451E.



26 May 2017
Bhutan, Phuentshogthang. Small
steep shaded stream. 543 m.
26.93321N 91.67170E.



27 May 2017
Bhutan, Phuentshogthang. Brook
in steep valley. 326 m. 26.88663N
91.74529E.



27 and 28 May 2017 (Photo OV)
Bhutan, Phuentshogthang. Source
and small brooklet. 337 m. 26.88495N
91.74757E.



30 May 2017
Bhutan, Pemagatshel. Brooklet
near Bartseri. 1371 m. 27.03950N
91.41912E.



30 May and 1 June 2017
Bhutan, Pemagatshel. River. 670 m.
27.01729N 91.39630E.



1 June 2017
Bhutan, Pemagatshel. Hygroscopic
zone. 680 m. 27.02198N 91.39590E.



3 June 2017 (Photo OV)
Bhutan, Kanglung. River with
seepages on banks.



3 June 2017
Bhutan, Kanglung, Source and
seepages near Panthang. 1844 m.
27.28196N 91.50176E.



3 June 2017
Bhutan. Kanglung. Hygropetric zone
near Panthang. 1705 m. 27.28710N
91.50758E.



4 June 2017
Bhutan, Guchu. 2175 m. 27.22036N
91.58417E.



4 June 2017
Bhutan, Chhiya. Pond in agricultural
area, 1999 m. 27.21763N 91.47149E.



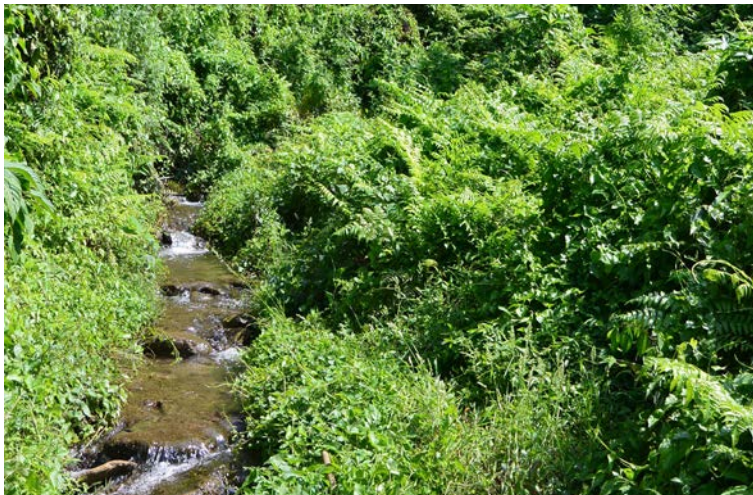
5 June 2017
Bhutan, Reju. Small stream in
Gamri river valley. Disturbed
environment. 868 m. 27.34403N
91.57504E.



5 June 2017
Bhutan, Godi. Stream with ponded
sides. 850 m. 27.35122N 91.59331E.



5 June 2017
Bhutan, Godi. Seepage and swamps
along river. 834 m. 27.34534N
91.60090E.



7 June 2017 (Photo OV)
Bhutan, Yong Khola. Small stream.
931 m. 27.29247N 91.14594E.



7 June 2017
Bhutan, Yong Khola. Rivulet and
pools. 746 m. 27.27651N 91.14679E.



7 June 2017
Bhutan, Yong Khola. Small stream.
1085 m. 27.29885N 91.15559E.



8 June 2017
Bhutan, Yong Khola. Small shaded
stream near road. 1897 m. 27.32702N
91.13520E.



8 June 2017
Bhutan, Phumtshungla. Small steep
stream. 2187 m. 27.34980N 91.12230E.



9 June 2017
Bhutan, Mongar. Kuri Chhu valley. Tributary. 498 m. 27.18106N
91.24108E.



9 June 2017
Bhutan, Mongar. Kuri Chhu valley. Waterfall with pool. 460 m. 27.16406N
91.24198E.

Appendix 2

Maps









Appendix 3

Permits



ལྷ་འབྲུག་རང་བཞིན་རྒྱ་རྒྱུང་འཕེན་བསྐྱེད་ཞིབ་འཇོལ་རྩོགས་ལྷན་ཁྲེེ།
Royal Government of Bhutan
Ministry of Agriculture
Council for RNR Research of Bhutan
Thimphu
“ Walking the Extra Mile ”



CORRB/TCO/D-2/ 5-68

24 Dec 2014

Program Director,
 National Biodiversity Centre,
 Ministry of Agriculture and Forests,
 Thimphu.

Subject: Technical clearance on research proposals

Madam,

We are pleased to receive, scrutinize and issue technical clearance on the following research proposals from various institutions/agencies under your overall project coordination:

1. Inventory and documentation of Odonata (dragonflies and damselflies)
2. Inventory and documentation of Molluscs (snails and slugs)
3. Inventory and documentation of Lepidoptera (moths)
4. Inventory and documentation of Hymenoptera (bees and wasps)
5. Inventory and documentation of Coccinellids (beetles)

P.S: These research activities are entered into CoRRB's research database for the sake of streamlining, monitoring and evaluation of research program. In the event they are cancelled or discontinued, we request the concerned to inform CoRRB with justification. This applies to the earlier proposals that your centre has submitted and got cleared.

Thanking You.

Yours Sincerely

Namgay Wangchuk
 DIRECTOR GENERAL

(Signature)
Director General
Council for RNR Research of Bhutan (CoRRB)
Ministry of Agriculture and Forests
Royal Government of Bhutan
Thimphu

CC:

1. H.E. Hon'ble Minister, MoAF, for kind information
2. Hon'ble Secretary, MoAF, for kind information



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ROYAL GOVERNMENT OF BHUTAN
Ministry of Agriculture
National Biodiversity Center
Serbithang: Thimphu.



“Walking the Extra Mile”

NBC/BIMS/01/Inver/2014-15/ 467

Dt: 24th Nov, 2014

Note Sheet

Sub: Seeking administrative approval to visit different sites to document selected taxonomic group of invertebrates..

This is to apprise that as per the instruction received from the Hon'ble Secretary of MoAF, vide letter no. CoRRB/GEN/A-3/113 dated 23rd August, 2011; the Centre has been acting as a coordinating agency to initiate documentation of invertebrate diversity in the country. Accordingly, the Centre has started working with the interested and relevant stakeholder agencies and experts from Naturalis (National Biodiversity Centre of Netherland) after being able to source funds from BTFEC recently for inventory and documentation of selected groups of invertebrate.

In order to implement the project, a consultative workshop was held on 27th October, 2014 with the stakeholder agencies and we have currently finalized five taxonomic groups of invertebrate, viz. Mollusk(Snails and Slugs), Lepidoptera(Moth), Coccinellids, Odonata(Dragon flies and Damselflies) and hymenoptera(Bees and Wasps), documentation through the project.

In this regard, the Centre, on behalf of all stakeholder agencies(researcher/collaborator), would like to seek your kind approval to visit those places(attached in the work plan) to undertake inventory and documentation of Invertebrates mentioned.

The details of the project proposal along with the sites to be visited are enclosed herewith for your kind references and necessary actions.

Submitted for your kind approval

(Dr. Tashi Yangzome Dorji)
Program Director

Director General, Department of Forests and Parks Services, Thimphu.



National Biodiversity Centre
Ministry of Agriculture & Forests
Royal Government of Bhutan



Material Transfer Agreement

Reference No: NBC/ BRD/1-7/2016-2017/ 1380

Article 1 – Parties to the Agreement

1.1 This Agreement is made between.

National Biodiversity Center (NBC), Ministry of Agriculture and Forests, Serbithang, Thimphu, Post Box No. 875. (*National Focal Agency on Access to Genetic Resources and execution of Material Transfer Agreement*).

Provider: National Biodiversity Centre represented by, Mr. Penna Leda, Administration Officer, National ID no. 10907001927 (Hereinafter referred to as "Provider")

And

Recipient: Dr. Willem Ferdinand Klein, Naturalis Biodiversity Centre, The Netherlands bearing Passport Number NU6L6J4K9 (Hereinafter referred to as "Recipient")

Article 2 – Preamble

2.1 The Material Transfer Agreement is executed in fulfillment of Article 9 of the Biodiversity Act of Bhutan 2003 and based on the Ministry's approval note-sheet no. NBC/BRD/7/2016-2017/1379 dated 12th June 2017.

2.2 The Provider and the Recipient acknowledge that the Royal Government of Bhutan (hereinafter referred to as RGoB) retains legal ownership of the Material. The Provider is authorized to transfer to the Recipient the Material specified under Article 4 of this agreement upon execution of this Material Transfer Agreement (MTA) between the Provider and the Recipient.

2.3 The Provider and Recipient shall jointly be referred to as "Parties".

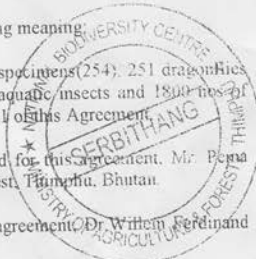
Article 3– Definitions

3.1 In this Agreement the expression set out below shall have the following meaning:

"Material" shall mean two hundred fifty four wasps and bees dead specimens(254), 251 dragonflies dead specimens, 1944 dead specimens beetles, 12 snail(shells)174 aquatic insects and 1800 nos of moths specimens (including juvenile shells) as mentioned in article 4.1 of this Agreement.

"Provider" means the person/institution providing the material and for this agreement, Mr. Penna Leda, Administration Officer, NBC, Ministry of Agriculture and Forests, Thimphu, Bhutan.

"Recipient" means the person receiving the material and for this agreement, Dr. Willem Ferdinand Klein, Naturalis Biodiversity Center, The Netherlands.



Article 4 - Subject Matter of the Material Transfer Agreement

4.1 Two hundred fifty four wasps and bees dead specimens(254), 251 dragonflies dead specimens, 1944 dead specimens beetles, 12 snail(shells)174 aquatic insects and 1800 nos of moths specimens

Initials Provider

Initials NBC

Initials Recipient

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Wk

collected from eastern and central Bhutan is hereby transferred from the Provider to the Recipient subject to the terms and conditions set out in this Agreement.

Article 5 – Destination

- 5.1 The destination of the material shall be Naturalis Biodiversity Center, Darwinweg 2, 2333, Leiden, The Netherlands.

Article 6 -Terms and Conditions

- 6.1 The Recipient undertakes that the transferred Material shall be used only to determine species identity through morphological examination, as a part of the collaboration between National Biodiversity Centre (NBC), Bhutan and Naturalis Biodiversity Centre, The Netherlands, to inventory and document the invertebrates of Bhutan. In the case of change of intent, the Recipient shall seek the prior written approval from the Ministry of Agriculture and Forests (MoAF), Royal Government of Bhutan through National Biodiversity Center (provider of the material).
- 6.2 The Recipient shall take full responsibility for the safety and protection of the material and shall be liable of misuse by any third party.
- 6.3 Any publications resulting from these specimens transfer and collaboration shall have joint authorship with appropriate Bhutanese counterpart, which shall be identified by National Biodiversity Center, Bhutan for this agreement.
- 6.4 The Recipient shall provide regular updates on the progress of the study to MoAF through NBC. The full study results including new and confidential information shall be submitted to NBC accordingly, upon completion of the study or not later than 12th December 2017.
- 6.5 The Recipient shall take full responsibility to return all the materials along with the determined species names and/or results of the species determination study as soon as the study (Species determination) is completed but not later than 12th December 2017.
- 6.6 It is the responsibility of the Recipient to bring to the notice of relevant authorities of Naturalis Biodiversity Center, Leiden, The Netherlands about the conditions set in the agreement and the usage of the transferred Material.
- 6.7 In case of any new discovery (ies) resulting from the use of the transferred materials, the Recipient and the Provider shall inform MoAF through NBC of such discovery (ies) immediately without fail.
- 6.8 The Recipient and the Provider shall not apply for any intellectual property rights without prior written approval from the MoAF.
- 6.9 Provider makes no warranties as to the safety of the Material, nor so to the accuracy of any passport or other data provided with the Material. Neither does it make any warranties as to the quality or purity (genetic or mechanical) of the Material being supplied. The Recipient assumes full responsibility for complying with the counterpart nation's quarantine and biosafety regulations and rules as to the import of the Material.

Article 7 – Settlement

- 7.1 The Parties shall discuss sincerely and settle amicably on matters which are not stipulated in this Agreement or interpretation of this Agreement.
- 7.2 This Agreement shall be governed by and construed in accordance with the laws of Bhutan.

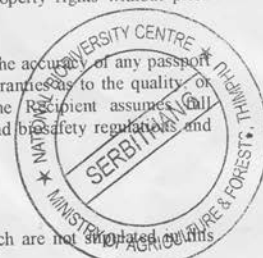


Initials Provider



Initials NBC

Initials Recipient



Article 8.- Signature and Acceptance

In conformity of above terms and conditions, the parties have executed this Material Transfer Agreement on the dates set forth below.

For the National Biodiversity Center:

Seal & Signature []

Date: 12th June 2017

Name: Asta Maya Tamang

Designation: Offg. Program Director

Contact Number: 351416/351417

Mailing Address: National Biodiversity Center, Ministry of Agriculture and Forests
Serbithang, Thimphu, Post Box No. 875



For the Provider: I, Mr. Pema Leda, represent and warrant that I have the authority to execute this Agreement on behalf of the Provider.

Seal & Signature []

Date: 12th June 2017

Name: Pema Leda

Designation: Administration Officer

Mailing Address:

For the Recipient: I, Dr. Willem Ferdinand Klein, represent and warrant that I have the authority to execute this Agreement on behalf of the Recipient and acknowledge to abide by the provisions of this Agreement, both by letter and in principle, in order to promote the conservation and sustainable use of biological resources and sharing of benefits derived thereof.

Seal & Signature []

Date: 12th June 2017

Name: Dr. Willem Ferdinand Klein

Designation: Researcher

Passport Number: NWC4F4815

Mailing Address: wim.klein@icloud.com



Initials Provider



Initials NBC

Initials Recipient

WK



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མི་ནུས་དང་ནགས་ཚོལ་ལྷན་ཁག་།

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ROYAL GOVERNMENT OF BHUTAN
Ministry of Agriculture and Forests
Bhutan Agriculture and Food Regulatory Authority (BAFRA)
Tashichodzong, Thimphu: Bhutan



Sl.No.09

12/06/2017

TO WHOM IT MAY CONCERN

As per the Material Transfer Agreement reference no. NBC/BRD/1-7/2016-2017/1380 dated 12/06/2017, 254 nos. of wasps, 254 nos. of bees dead specimens, 251 dragonflies dead specimens, 1944 dead specimens beetles, 12 snail (shells), 174 aquatic insects and 1800 nos of moths specimens provided by Mr. Pema Leda, Administrative Officer, National Biodiversity Centre, Ministry of Agriculture and Forests, Thimphu Bhutan to recipient Dr. Willem Ferdinand Klein, Naturalis Biodiversity Center, The Netherlands.

Since, the transferred material shall be used only to determine species identity through morphological examination, as part of the collaboration between National Biodiversity Centre (NBC), Bhutan and Naturalis Biodiversity Centre, concerned officials may kindly allow export without any hindrance.


Dachen Chen
EID 200308043
Sr. Regulatory & Quarantine Inspector
Bhutan Agriculture & Food Regulatory Authority
Tashichodzong, Thimphu, Bhutan



Post Box. No. 1071
PABX - 975-2-327031/325790/325993; Fax No. 975 - 2 - 327032/335540; bafraheadoffice@gmail.com
Website: www.bafra.gov.bt

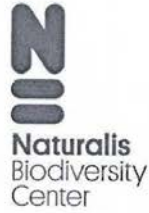
Appendix 4

Memorandum of Understanding



དཔལ་ལྷན་འབྲུག་གཞུང་།
སྲི་ལམ་རྩམ་ལག།

ROYAL GOVERNMENT OF BHUTAN
Ministry of Agriculture and Forests
National Biodiversity Centre
Serbithang: Thimphu



Memorandum of Understanding
Between
The National Biodiversity Centre, Ministry of Agriculture and Forests,
Bhutan
And
Naturalis Biodiversity Center,
Leiden, The Netherlands
Concerning
Collaborative Research on the Invertebrate Biota of Bhutan

The National Biodiversity Centre, Ministry of Agriculture and Forests, (hereinafter referred to as "NBC"), and Naturalis Biodiversity Center, Leiden, The Netherlands (hereinafter referred to as "Naturalis"), both hereinafter referred to as the "Parties".

Desiring to strengthen scientific cooperation based on principles of mutual benefits;

Pursuant to the prevailing laws and regulations to their respective countries as well as their respective governments' procedures and policies on international technical cooperation;

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མཉམ་སྲུང་ལྷན་ཁང་།

ROYAL GOVERNMENT OF BHUTAN
Ministry of Agriculture and Forests
National Biodiversity Centre
Serbihang: Thimphu



རྒྱལ་ཡོངས་རྒྱུ་རྩལ་ལྷན་ཁང་།
མཉམ་སྲུང་ལྷན་ཁང་།
ROYAL GOVERNMENT OF BHUTAN
Ministry of Agriculture and Forests
National Biodiversity Centre
Serbihang: Thimphu



HAVE REACHED THE FOLLOWING UNDERSTANDING:

**Article 1
Objectives**

The objectives of the cooperation are:

1. To provide a framework for the exchange of scientific and technical knowledge;
2. To establish a framework to promote research on the invertebrate diversity of Bhutan;
3. To enhance scientific and technical capabilities for both Parties with respect to research on the invertebrate diversity of Bhutan;
4. To provide opportunities for technical and professional training in the field and in museums through formal and informal education programs in Bhutan, the Netherlands, and other countries;
5. To increase technical capacity for biotic information management using appropriate hardware and software;
6. To promote the development of the library and documentation facilities of both NBC and Naturalis with special reference to their collections of taxonomic literature and documentation on the invertebrate diversity of Bhutan.

**Article 2
Scope of Activities**

1. The activities of the cooperation under the Memorandum of Understanding (MoU) may consist of:
 - a. Exchange of scientific technical information and researchers/technicians;
 - b. Cooperative research on the invertebrate diversity of Bhutan.

Page 2 of 9

2. Specific areas of cooperation may include -but are not limited to- such areas of mutual interest as follows:

- a. Inventories and taxonomic, ecological, phylogenetic, and biogeographic analyses of extant invertebrate diversity of Bhutan;
- b. Technical and professional training;
- c. Project coordination and management;
- d. Development of libraries and other documentation collections;
- e. Publications, symposiums and seminars.

**Article 3
Plan of Operation**

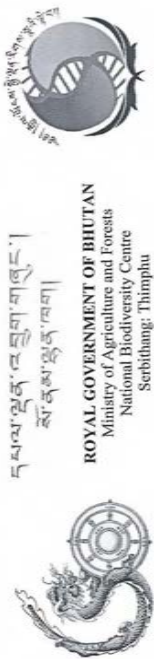
1. A detailed description of the scope of activities to be conducted in Bhutan will be defined in a plan of operation (PO).
2. The PO will be drawn up annually and agreed upon by the Parties, and approved by the Ministry of Agriculture and Forests, Royal Government of Bhutan, and the General Director of Naturalis.

**Article 4
Contribution by NBC**

In accordance with the prevailing laws and regulations in Bhutan and subject to personnel, space and budget limitation, NBC will:

1. Provide necessary basic facilities for the execution of the obligation of NBC as specified in the PO;

Page 3 of 9



2. Assist in arranging the necessary permits for approved Naturalis expert staff and collaborators who are needed to enter and leave Bhutan as per PO, including their research, work and stay permits with local authorities and government institutions for joint NBC and Naturalis field work;
3. Assist in arranging the permits for export of materials for further analysis in The Netherlands as per the mutually agreed terms and conditions;
4. Assign qualified experts and collaborating researchers for implementation of activities under this MoU;
5. Assist in arranging the exemption of taxes and duties for the import of equipment, supplies, and items required for the project;
6. Provide any helpful knowledge, references, and involvement of prominent Bhutanese scientists in the project.

**Article 5
Contribution by Naturalis**

In accordance with the prevailing laws and regulations in The Netherlands, and subject to personnel, space and budget limitation, Naturalis will:

1. Provide necessary funding for the execution of obligations of Naturalis as specified in the PO;
2. Provide partial funding for NBC's participation of the field work;
3. Seek external funding and other forms of support in consultation with Royal Government of Bhutan (RCOB) to promote the various objectives of the proposed collaboration with NBC;



4. Assign qualified experts and researchers to assist in the implementation of activities under this MoU;
5. Provide professional and technical staff for the field work;
6. Assist in arranging for necessary permits for approved NBC's staff and experts, who are needed to enter and leave The Netherlands whenever necessary including their work and stay permits;
7. Accept and train scientists from Bhutan on the project implementation if and when the required funding has become available;
8. Provide available facilities at Naturalis to NBC's staff for their research in The Netherlands;
9. Identify and create educational opportunities for the qualified NBC staff and collaborators, by utilizing the staff of Naturalis, their research contacts, and associated universities;
10. Arrange for the procurement of necessary supplies and equipment if and when the required funding has become available.

**Article 6
Research Cooperation**

All specimens and their part, including DNA specimens collected through this project will remain in the host country except when it is absolutely necessary for further analysis to determine species identity, which would then be transferred under mutually agreed terms and conditions.

All activities under the present MoU will be conducted in strict compliance with the terms and the spirit of the Convention on Biological Diversity (CBD), the Convention on International Trade in Endangered Species (CITES), all other relevant international agreements and treaties; and in compliance with the domestic laws of Bhutan.

for commercial purposes by one Party, the other Party will be entitled to a share of the royalties obtained from the exploitation of such property on the basis of the principle of equitable contribution. In such case, the object of the research activities conducted under this MoU will constitute a part of contribution of the Party from which the object derives. The value of the object as part of contribution will be measured by taking into account the following factors:

- a. The scarcity of the object (the rarer the object is, the higher its value will be);
 - b. The commercial value of the result of the research (the higher its commercial value is the higher its worth as part of the contribution will be).
3. Either Party wishes to disclose confidential data and/or information that resulted from cooperation activities under this MoU to any third Party, the disclosing Party must obtain prior consent from the other Party before any disclosure can be made.
4. The utilization of the object of the research activities and their findings under this MoU outside the territories of the Kingdom of Bhutan and The Netherlands by one of the Parties will have to get prior written approval from the other Party on a case-by-case basis.
5. Whenever either Party requires the cooperation of another party outside Bhutan and Netherlands for any commercial undertaking resulting from intellectual property covered by this MoU, this Party will give first preference of the cooperation to the other Party under this MoU, which will be waived, if the other Party is unable to participate in a mutually beneficial manner.

**Article 9
Limitation of the Personnel Activities**

The Parties will ensure that its personnel engaged in the activities under this MoU will not engage in any ventures or activities in Bhutan and The Netherlands outside the program of cooperation under this MoU without the prior approval of their respective Government.



NBC and Naturalis will inform each other mutually on their respective scientific activities related to the assessment of invertebrate diversity covered under the mutually agreed PO, such as: field expeditions, conferences, and major publications; and will stimulate the participation of the other party in plans regarding such activities.

**Article 7
Utilization of Equipment**

1. During project work, both institutions may use supplies and equipment to undertake projects subject to any stipulations and/or contractual limitations required by relevant funding agencies;
2. At the end of the project, the final utilization of supplies and equipment will be determined by mutual agreement of the Parties.

**Article 8
Intellectual Property Rights and Publication**

1. Any Intellectual Property Right (IPR) brought by one of the Parties for the implementation of activities under this MoU will remain the property of that Party. However, that Party will guarantee that the IPR did not result from the infringement of any third Party's legitimate rights. Further that Party will be liable for any claim made by any third Party on the ownership and legality of the use of the IPR which is brought in by the aforementioned Party for the implementation of the cooperation activities under this MoU.
2. Any IPR, data and information resulting from research activities conducted under this MoU will be jointly owned by both Parties, and both Parties will be allowed to use such property for non-commercial purposes free of royalty. Should the intellectual property, data and information resulted from the cooperation activities under this MoU be used





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ROYAL GOVERNMENT OF BHUTAN
Ministry of Agriculture and Forests
National Biodiversity Centre
Serbithang, Thimphu



**Article 10
Settlement of Differences**

Any differences and controversy arising out of the interpretation or application and implementation of this MoU will be settled amicably through consultation and negotiation between the Parties within the spirit of collaboration.

**Article 11
Amendment**

This MoU may be amended at any time by mutual written consent of the Parties. Such amendment will form as an integral part of this MoU and will enter into force on such a date as determined by the Parties.

**Article 12
Duration and Termination**

1. This MoU will be in effect from the date of its signing and be valid for the duration of 3 (three) years from the date, and will be automatically renewed thereafter on an annual basis until the next 3 (three) years, unless terminated or replaced with a new MoU.
2. This MoU may be renewed, extended, altered or terminated by either Parties by written notice given at least 6 (six) months in advance. In case the MoU ceases to have effect on account of the termination thereof, the provision of the PO will continue to apply to extent necessary to secure the completion of existing activities projects as agreed upon in the PO, based on Article 3.
3. This MoU does not constitute a binding document and no provision shall be construed as creation of legal rights and commitments thereof between the parties.



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ROYAL GOVERNMENT OF BHUTAN
Ministry of Agriculture and Forests
National Biodiversity Centre
Serbithang, Thimphu



The authorized representatives, has signed this Memorandum of Understanding.

Signed at *Thimphu* on this *23rd* of *June* in the year two thousand and fifteen, in the English Language.

FOR
NATIONAL BIODIVERSITY CENTRE
MOAF, SERBITHANG
THIMPHU, BHUTAN

Dr. Tashi Yangzom Dorji
PROGRAM DIRECTOR

FOR
NATURALIS BIODIVERSITY
CENTER
LEIDEN, THE NETHERLANDS

Edwin van Huis
GENERAL DIRECTOR

Appendix 5

Research proposal 2017

The boundary between the Oriental and the Palearctic regions in Bhutan, does it vary between ecologically defined groups of invertebrates?

A research proposal by Cees Gielis, Wim Klein, Jan van Tol and Oscar Vorst

Introduction

The National Biodiversity Centre, Bhutan, and Naturalis Biodiversity Center, The Netherlands are cooperating in capacity building and development of infrastructure of biodiversity collections in Bhutan. The last few years, this cooperation focussed on building up knowledge and collections of several groups of invertebrates. Since basic knowledge of some of these groups is available now, it is opportune to start a programme with a research question. Nevertheless it should be stressed that much basic research is still needed for most groups of insects and other invertebrates, and an analysis as here proposed is impossible for these groups.

We here present a project to start a study the origin of selected groups of insects, based on their distributions and phylogenetic relationships, while we will also describe the autecology of the species of these groups. We will investigate whether the boundary between the Oriental and Palearctic faunas in Bhutan varies between ecologically defined groups. This study shall be considered a pilot for a research-oriented cooperation programme for 2018–2020.

The distribution of plants and animals

Plants and animals usually have restricted ranges. Very few organisms can be found in the Old and New World, or even globally. Most really global distributions are antropogenic. The distribution of each individual species depends on its dispersal capacity and ecology, and the geological history and characteristics of the region.

It is well-known that many species share a similar distribution. They may be well adapted to the climate of hot deserts, or to rain forests, and their distributions follow these ecological conditions. A further clustering principle of species distributions, however, is the geological history of the

earth. Such patterns are typically much older. The break up of Gondwana, for instance, started in the early Jurassic, about 184 million years ago (Ma), and the distributions of many groups of animals and plants can still be understood from this perspective, such as the relationships between plants and animals of South Africa and southwestern Australia. Such patterns can only be understood after a careful reconstruction of the phylogeny of the biota.

A complex geological history is also known for the region north and south of the Himalayas, since this mountain range was formed when the Indian Plate collided with Laurasia since about 45 Ma. Since that time, a process started of interchange of floras and faunas originating from landmasses of China, India and Indochina. This has been a dynamic process, where these landmasses were uplifted and some groups evolved to live under completely new ecological conditions. Other groups of species apparently simply moved onto new land after both continents collided, and their descendants became isolated with increasing height of the Himalayas. Bhutan at the southern side of the Himalayas is a particularly valuable region to study the results of the exchange and evolution of biotas since the uplifting of these mountains.

Our research questions

- What is the geographical and altitudinal distribution in Bhutan of species or species groups with Oriental and Palearctic affinities?
- What are the phylogenetic relationships of the species of some selected groups of invertebrates found in Bhutan?
- What are the ecological preferences of the species of some selected groups of invertebrates?

- Do the distribution patterns discovered differ between various ecologically defined groups, e.g. the species living at various altitudes, or predators versus plant feeders, or the species confined to terrestrial versus aquatic habitats?
- If such patterns differ between the ecological groups, what processes may have caused these patterns, and do these patterns differ between species of Palaearctic or Oriental origin?

Bhutan as a study area

We here explain why our study is both timely and feasible, and which elements need more attention during the next few expeditions.

(a) the fauna of selected groups of invertebrates in Bhutan is sufficiently known. – Studies as proposed can only be executed efficiently when the faunal elements are relatively well known, at least at the genus level. This should not only be true for the fauna of the region studied, but also for the wider area. Many groups of invertebrates are still poorly known at the foothills of the Himalayas (both at north and south side), but the groups proposed are sufficiently well known (i.e., nearly all species can be identified at species level) for a successful study.

(b) the distribution of the fauna of Bhutan needs more data. – Although the identification of most species will cause no serious problems, the pattern of distribution of the species needs more attention. The detailed analysis as proposed needs high quality data, for identification as well as for locality (position, ecological data).

(c) taxonomic expertise in Bhutan, and elsewhere. – Data collection in a country difficult to travel as Bhutan, is a challenge. Data will become available slowly, making it utmost important to (a) mobilise and improve taxonomic knowledge, (b) choose sampling localities carefully. Fortunately, Bhutanese expertise is significant, while foreign researchers are very motivated to co-operate with their Bhutanese colleagues to further the knowledge of the fauna of this country.

Proposed fieldwork in 2017

We propose to focus our fieldwork of 2017 in the eastern half of Bhutan. We wish to make a transect from the subtropical extreme southeast, to the foothills of the Himalayas in northerly direction. For this first reconnaissance of a transect, collecting near the road (one to two kilometers from the main roads at a maximum) is considered sufficient. It should be emphasised, however, that future fieldwork may ask for more advanced transport to collect data for answering this research question in detail.

Our fieldwork will focus on (a) Lepidoptera, with special attention to Tortricidae and Pterophoridae, (b) Hymenoptera, with special attention to Vespidae, Crabronidae and Vespidae, (b) Coleoptera, with special attention to Coccinellidae and Hydrophilidae, (c) Odonata.

It is important to introduce a semi-quantitative sampling technique, so that results from various sites can be compared. It is also important to describe the localities carefully, including, but not limited to altitude, vegetation, soil type, orientation of the valley, water temperature, and current velocity.

Follow-up of fieldwork

The results of our field work shall, if possible, be combined with previously obtained data or analyses. Phylogenetic reconstructions may be available for some groups, but own studies may be needed for others, e.g. based on molecular data. Ecological preferences will have to be compared with maps showing isotherms, altitude or soil type.

After our fieldwork of 2017, and the first analysis of the results, we will be able to further define our research programme for the new period 2018-2020.

