Co-funded by the Erasmus+ Programme of the European Union

Urban Resilience and Adaptation for India and Mongolia:
curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP

WATER QUALITY STUDY OF ARTIFICIAL LAKE FORMED AFTER GRAVEL MINING IN URBAN AREA

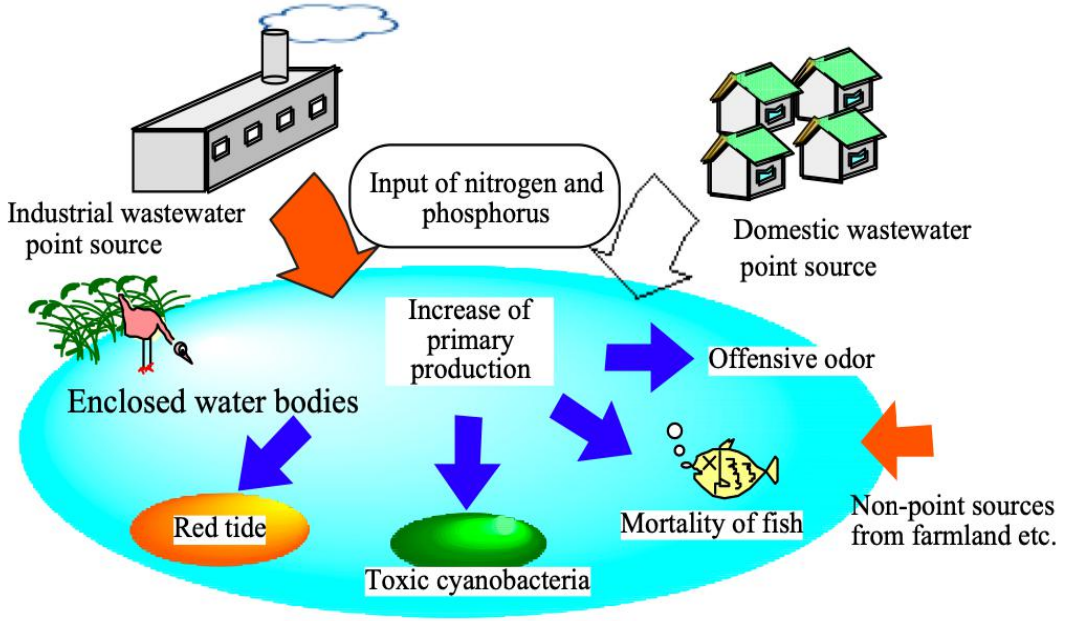
Bat-Erdene Ariunsanaa[1], Nagao Seiya[2], Ochir Altansukh[1], Shagdarsuren Rentsenkhand[1], Bavuukhand Gantsooj[1], Davaadorj Davaasuren[3]

[1]Department of Environment and Forest Engineering, National University of Mongolia
[2]Institute of Nature and Environmental Technology, Kanazawa University
[3]Department of Geography, National University of Mongolia

Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

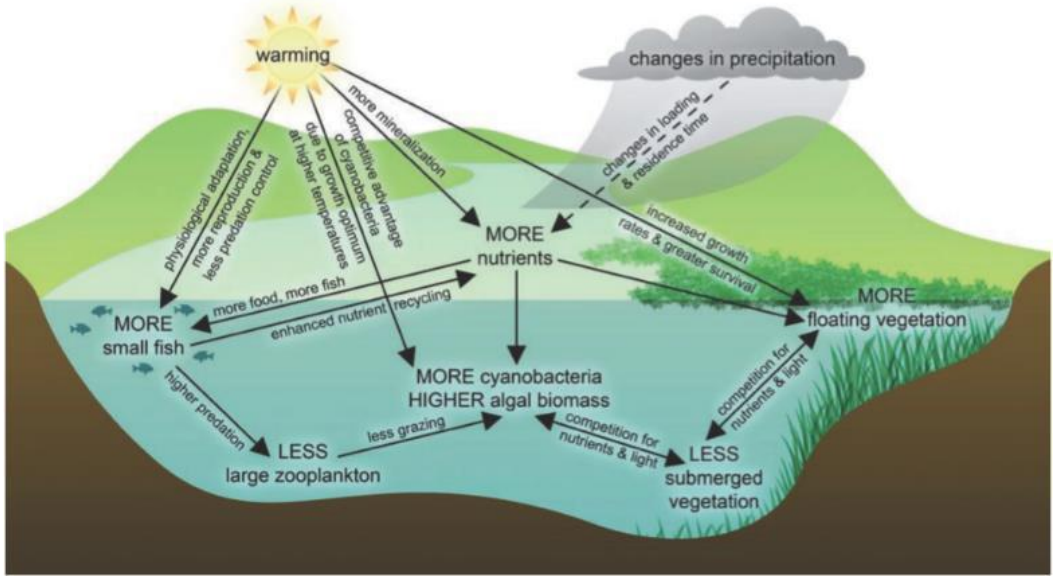
Background….

Small and shallow lakes are much more vulnerable than deepwater ecosystems because they have a low capacity for contaminants or nutrient loads. (Jorgensen, 1988)



- The shallow water Lake Hulun the concentration of COD is abnormally high and reaches about 59 mg C/L (Tang et al. 2009) – average depth 4.5m

- The COD concentration was observed 4.38 ± 0.72 mg/L in Taihu Lake. (Yun, Y. 2013) – average depth – 2.12m



The establishment of thermal stratification was strongly related to the onset of DO depletion in the lower hypolimnion. As a result of a progressively earlier onset of stratification and later overturn, the duration of stratification increased by 38 ± 8 days over the 41 years. (Brian Foley, 2012)

The objective of the research:

The objective of the research:

Evaluation of nutrient concentration level and its seasonal variation at the freshwater lake to identify the factors on eutrophication in freshwater ecosystem.

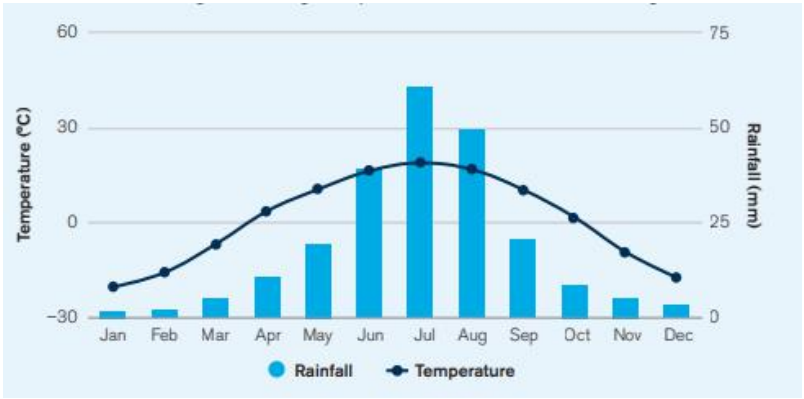
1. Spatial and temporal variation of nutrient concentration in the water in lower Kharaa basin
    - Lower reaches of Kharaa river and Lake Bulan
2. Water column characteristics of nutrient concentration in lake environment.

Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

URGENT

Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP

Co-funded by the Erasmus+ Programme of the European Union

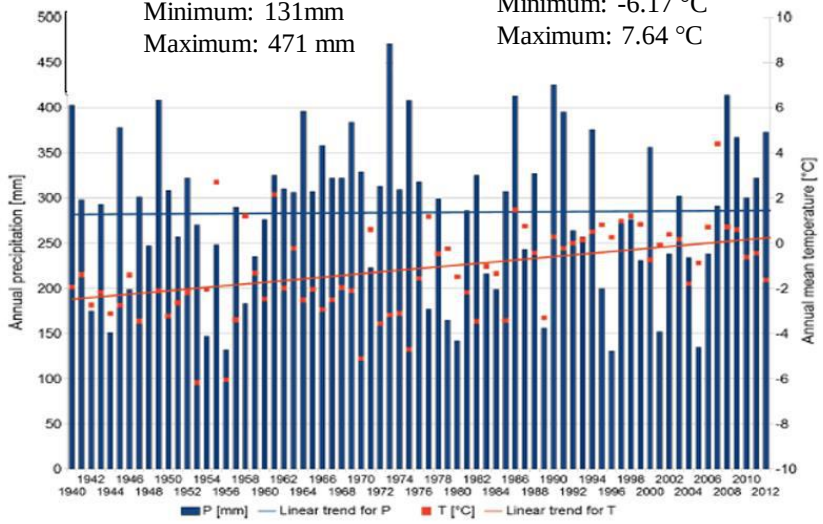


Source: WBG Climate Change Knowledge Portal (CCKP, 2020).
Climate Data: Historical.

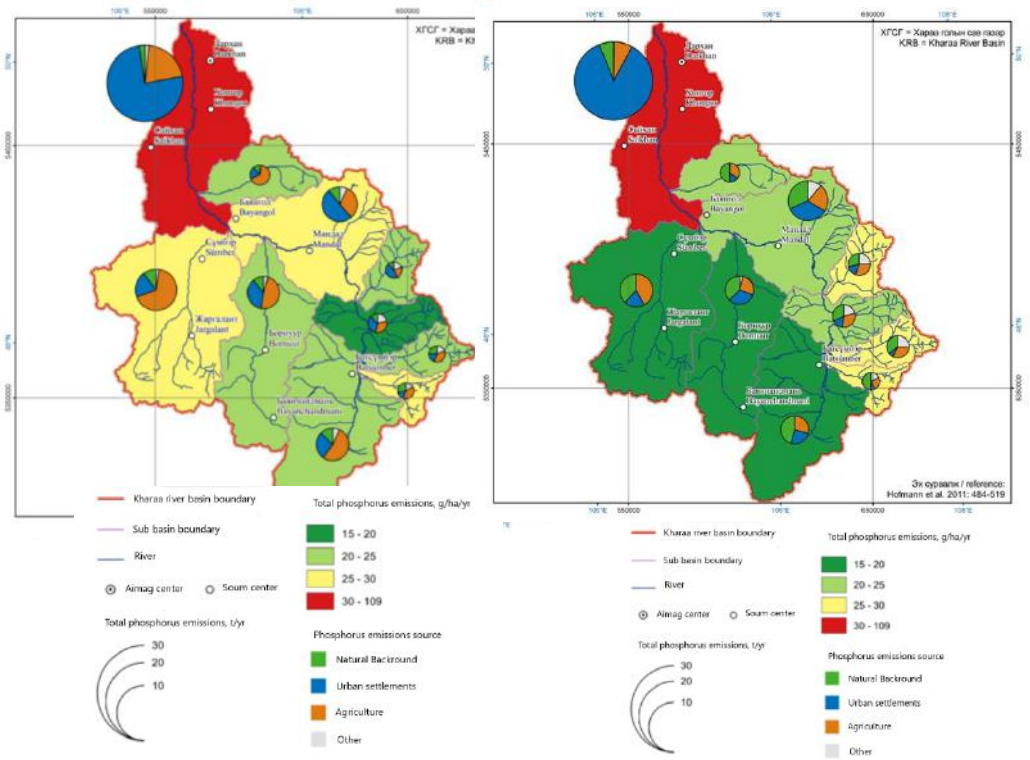
Meteorological condition in Kharaa river basin

Precipitation:
Average: 294 mm
Minimum: 131mm
Maximum: 471 mm

Temperature:
Average: -1.12 °C
Minimum: -6.17 °C
Maximum: 7.64 °C



Nitrogen emissions and source allocation (KRB, 2006-2008)

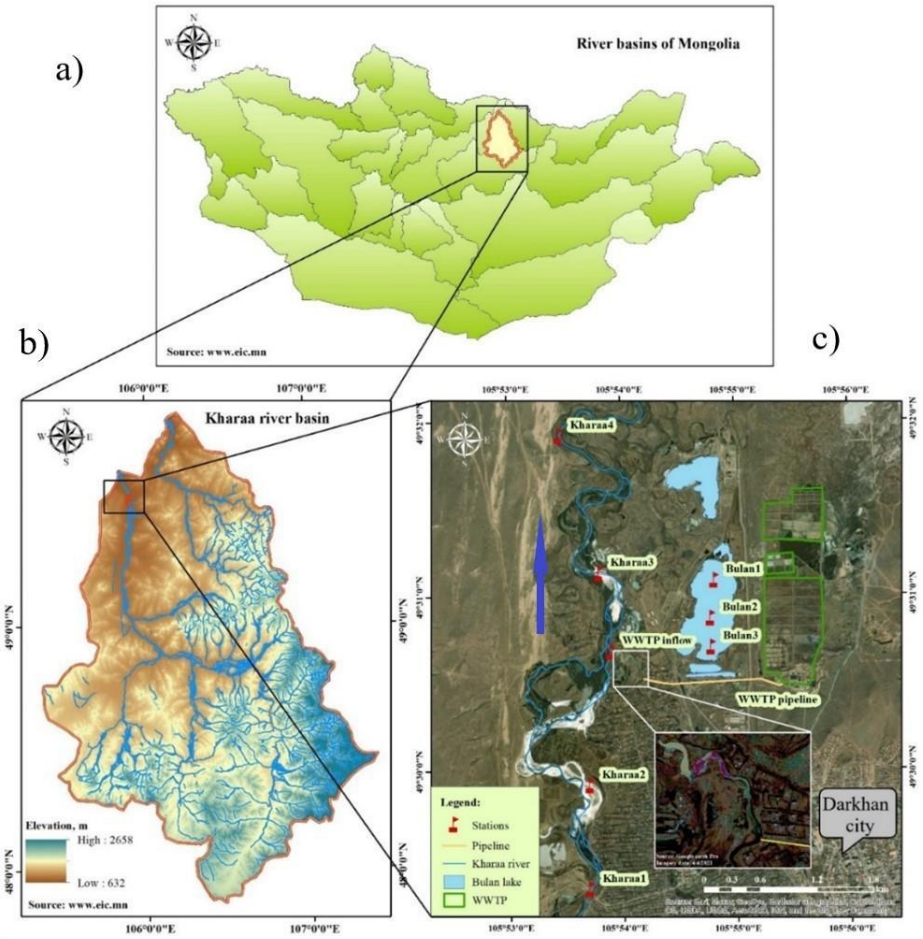


Total nitrogen emissions >500 g/ha/yr and 80% was from urban area

Total phosphorus emissions 30-109 g/ha/yr and 75% was from urban area

Source: Kharaa Yeree river basin atlas, 2017

Methods: Sampling location



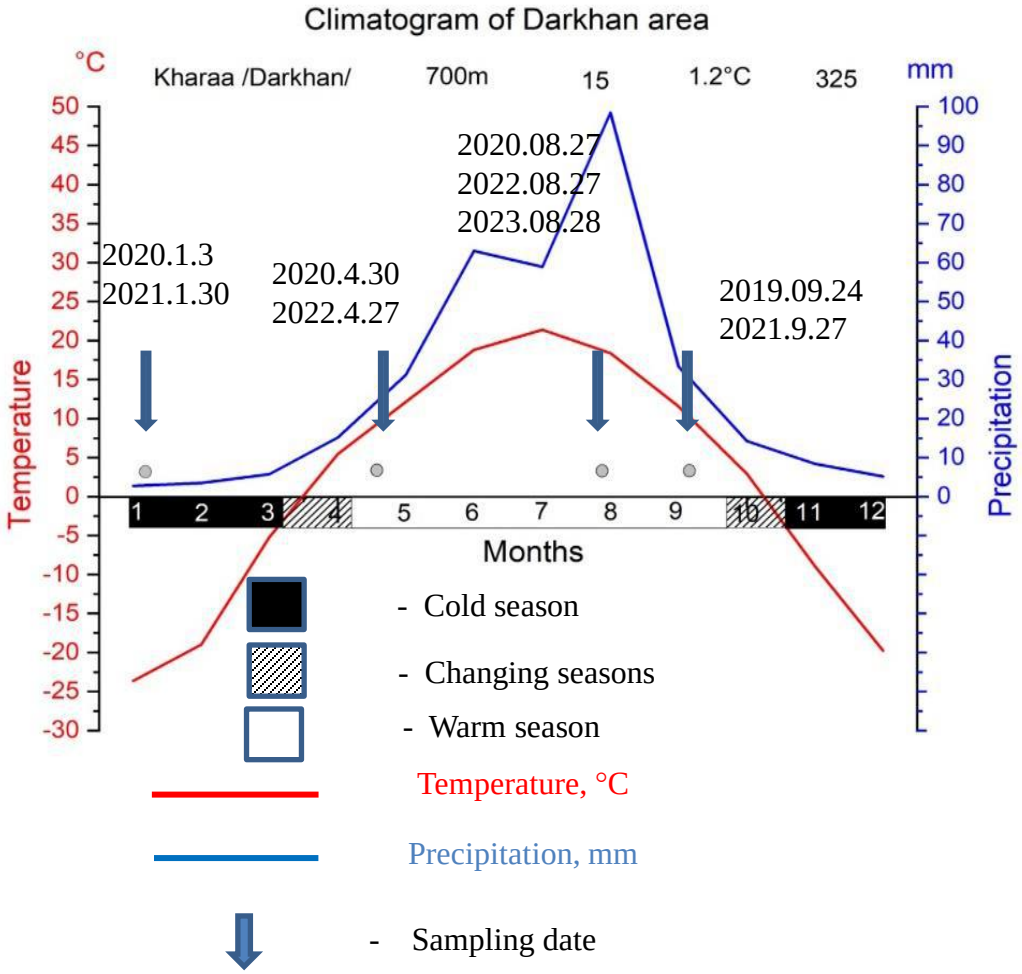
Research area: a) River basins in Mongolia; b) Elevation map of Kharaa river basin; c) Lake Bulan sampling sites. The arrow indicates flow direction of the Kharaa River

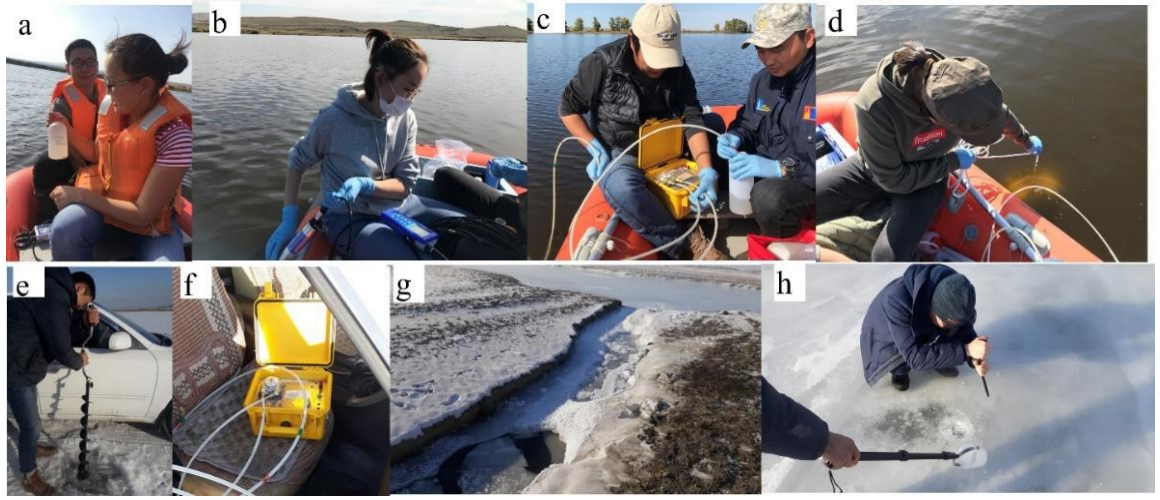
Station name	Coordinate		Description
Bulan1	49°31'5" N	105°54'49" E	7 m water depth
Bulan2 *	49°30'52" N	105°54'47" E	9 m water depth
Bulan3	49°30'42" N	105°54'47" E	7 m water depth
Kharaa1	49°31'07.75" N	105°53'48.71" E	Darkhan bridge
Kharaa 2	49°30'39.60" N	105°53'54.29" E	Before inflow WWTP
Kharaa 3	49°29'55.95" N	105°53'47.17" E	After inflow WWTP
Kharaa 4	49°30'40.93" N	105°53'55.06" E	Downstream of Darkhan city
WWTP	49°30'40.9" N	105°53'53.8" E	Inflowing point of wastewater treatment (WWTP) from the Darkhan city

- Lake Bulan is an artificial freshwater lake formed from open cast sand and gravel mining during the construction of Darkhan city in the 1960s.
- Eutrophic green color, permanent water body; surface area of 0.45 km^2 and depth of 6–15 m; 1.1 km long and 0.6 km wide; and elevation of 678 m a.s.l.
- Lake Bulan is a lentic water body without inflow or outflow water courses.
- The main recharge sources are precipitation and groundwater from the Kharaa River valley.
- Ice forms on the lake surface at the beginning of November. The lake is poor in terms of floating and bottom species /Ch. Ayushsuren, 2018/

Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

Water sampling plan /2019-2023/

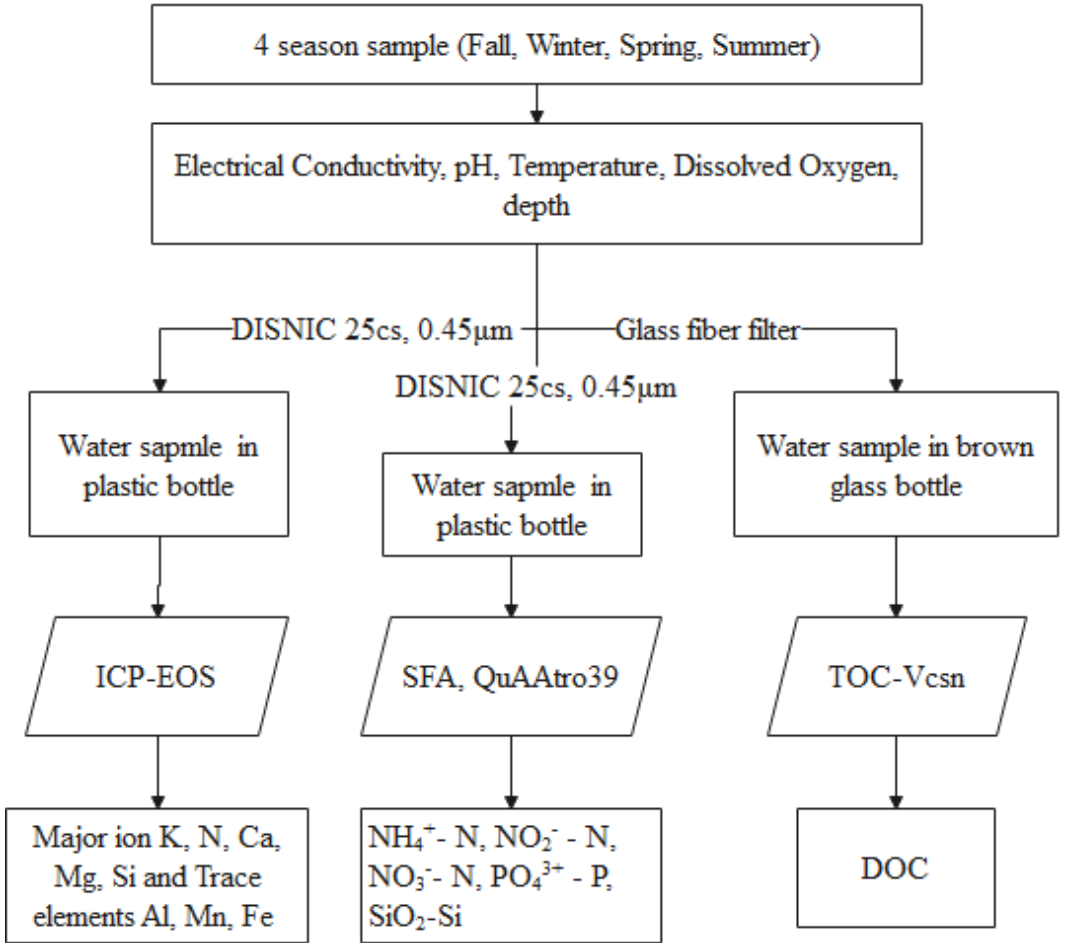




Water sampling: open water season sample, a- surface water collecting, b – WQP measurement, c – a pumping process of a depth water sample, d – transparency measurement by Secchi desk; Winter season: e – Lake ice cover drilling, f – pumping, g – inflow stream from WWTP, h- river ice cover drilling

Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

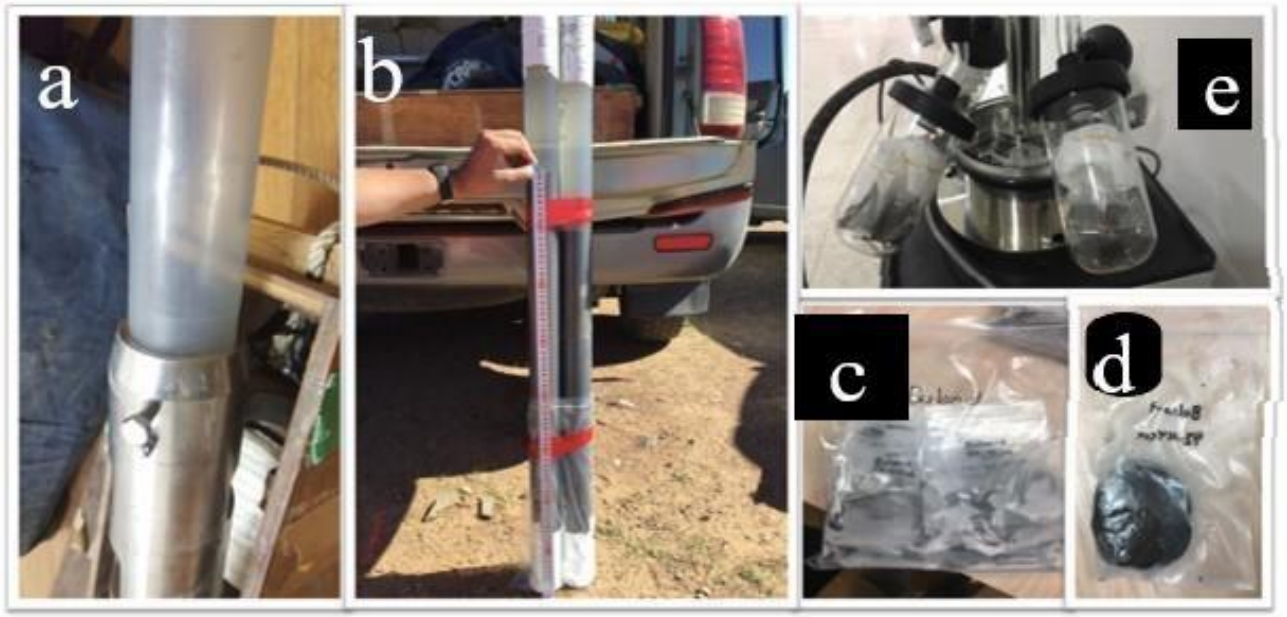
Research methods: Analytical method

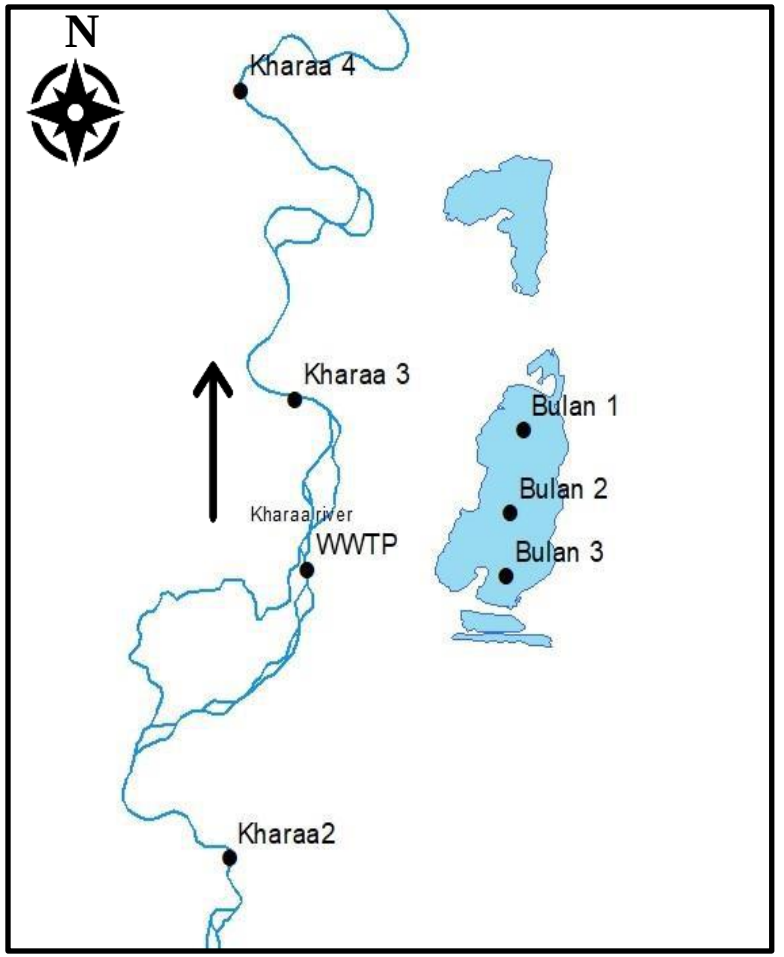


The concentration of total nitrogen ($NH_4^+ - N$, $NO_2^- - N$, $NO_3^- - N$), phosphorus ($P - PO_4^{3-}$) and silicate ($SiO_2 - Si$) were analyzed by the segmented flow analyzer (SFA, QuAAtro39) and the total concentrations of dissolved organic carbon were measured using TOC analyzer (Shimadzu, TOC-V SCN). The concentrations for main ions (Na^+, K^+, Ca^{2+} and Mg^{2+}), trace metals (Fe, Mn, Al) were measured using inductively coupled plasma optical emission spectrometry (ICP-OES, Varian-710).

Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

Research methods: The sediment analyse in Lake Bulan



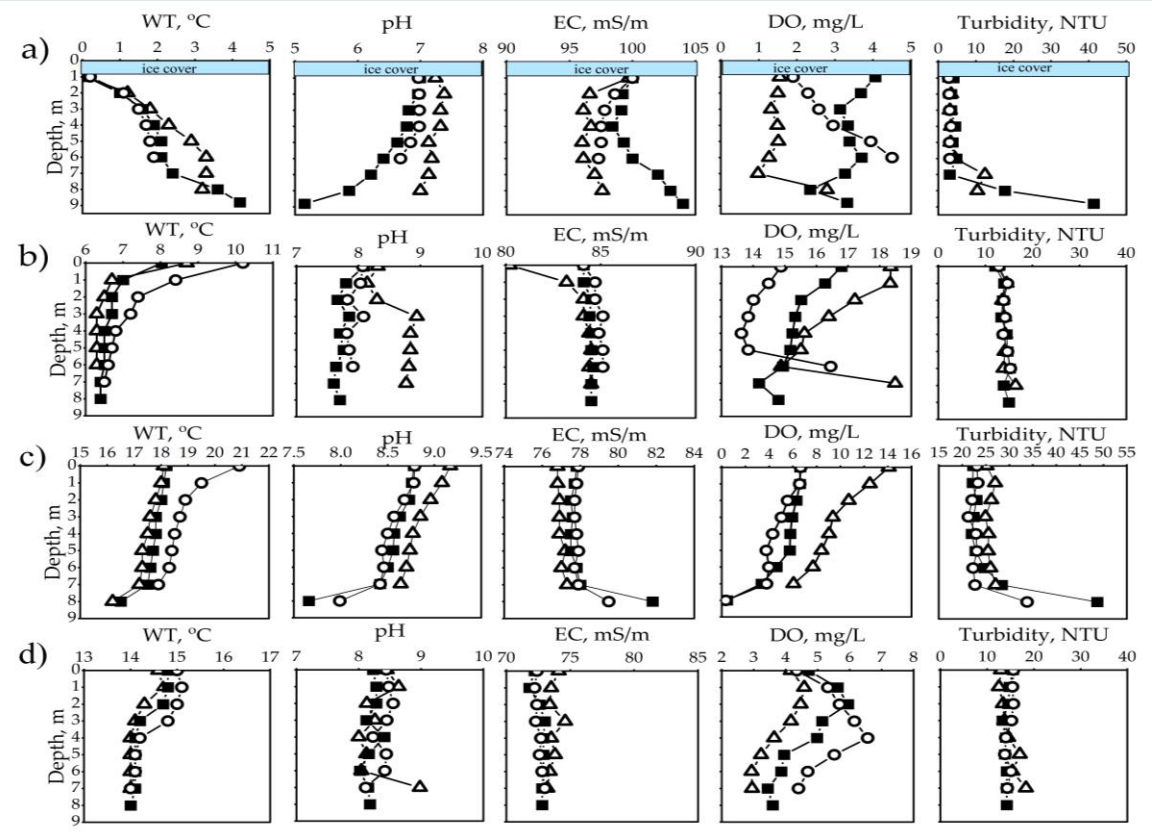


After removal of stone and plant fragments. The dried sediments were sieved through a 2 mm sieve and grounded in an agate mortar. The obtained samples were stored in a desiccator and used for chemical and mineralogical analyses. Then inorganic carbonates were removed with 1M HCl, rinsed with Milli-Q water, and dried again to analyze particulate organic carbon (POC), nitrogen (PN), and stable isotopic components ($\delta\ ^{13}C$ and $\delta\ ^{15}N$).

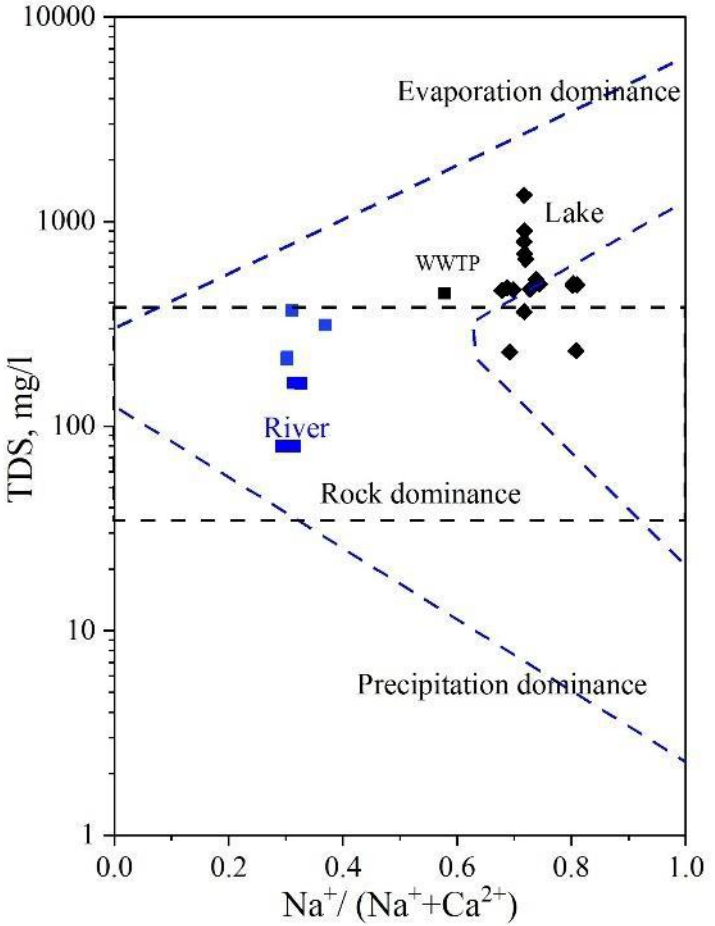
Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

Result…

Parameter	30 Ap. 2022	27 Au. 2020	24 Sep. 2021	25 Feb. 2022
WT, °C	8.03 *	20.1	14.8	0.1
pH	8.08	9.06	8.23	6.99
DO, mg/L	16.8	2.78	4.72	4.00
EC, mS/m	84.1	76.6	72.2	100
Turbidity, NTU	12.1	-	15.5	4.00



Note: (**a**) winter (25 February 2022), (**b**) spring (30 April 2022), (**c**) summer (27 August 2020), and (**d**) autumn (26 September 2021);

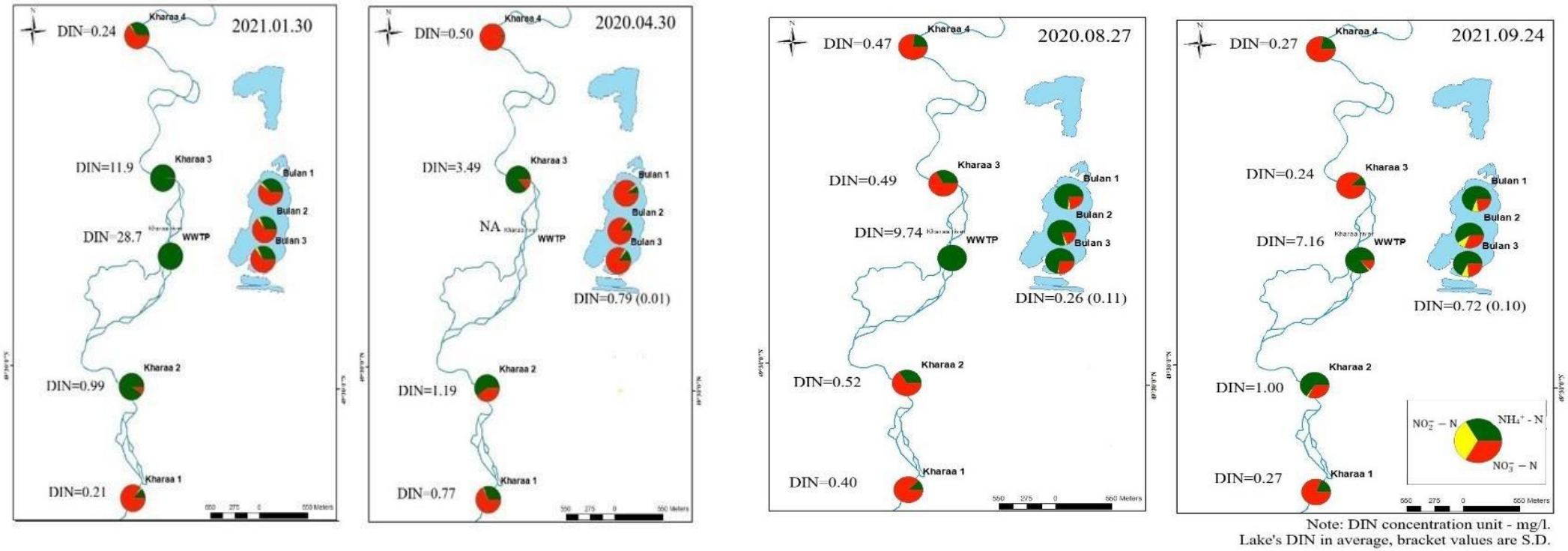


Gibbs plot of surface and bottom water samples from Lake Bulan. Note: closed circles - the ratio of cations [(Na $^{+}$)/(Na^{+} + Ca^{2+})] against TDS in water Lake Bulan

Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

Results….

A percentage $NH_4^+ : NO_3^- : NO_2^-$ of DIN in the water Lake Bulan and River Kharaa

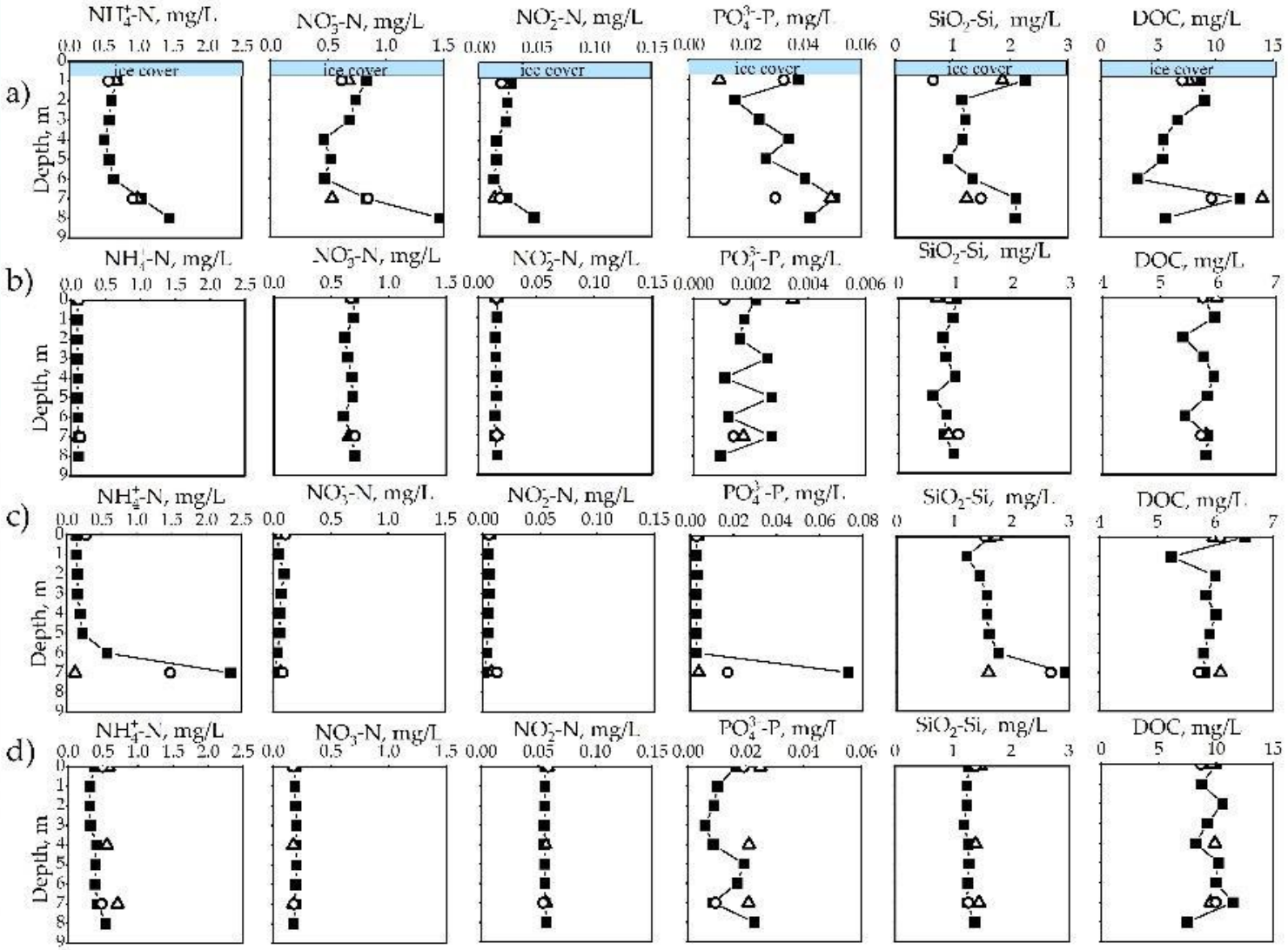


Note: DIN concentration unit - mg/l.
Lake's DIN in average, bracket values are S.D.

The amplitude of seasonal fluctuations in the level of nitrates and their percentage can serve as indicators of the eutrophication of a water body. In unpolluted surface waters, the concentration of nitrate ions does not exceed values of the order of tens of micrograms per liter. (Stepanova, 2015)

Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

Result: Spatial variation and vertical profiles of nutrient, and DOC concentrations in Lake Bulan

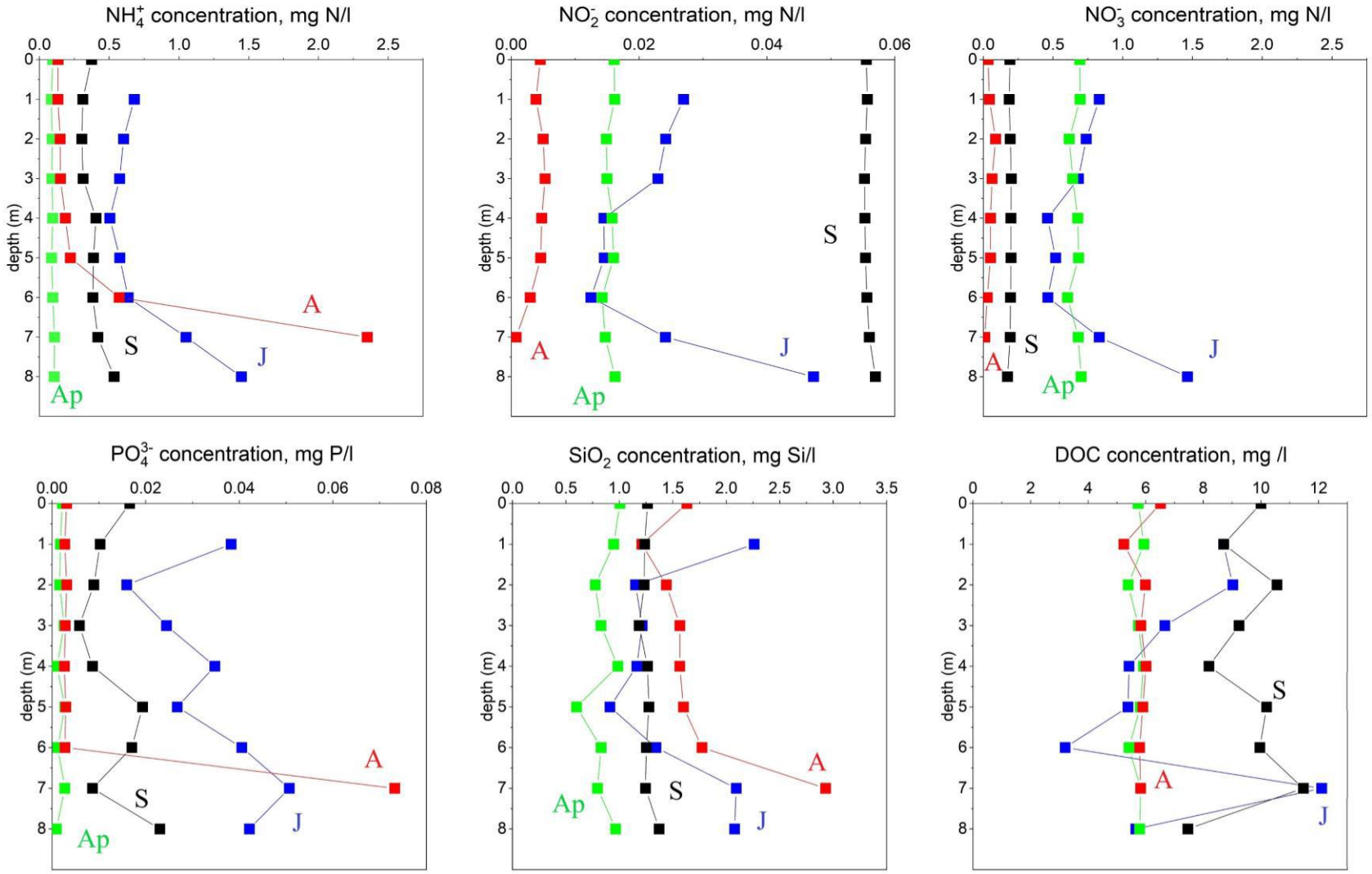


open triangle—Bulan 1,
closed square—Bulan 2,
open circle—Bulan 3;

Note: (**a**) winter (25 February 2022), (**b**) spring (30 April 2022), (**c**) summer (27 August 2020), and (**d**) autumn (26 September 2021);

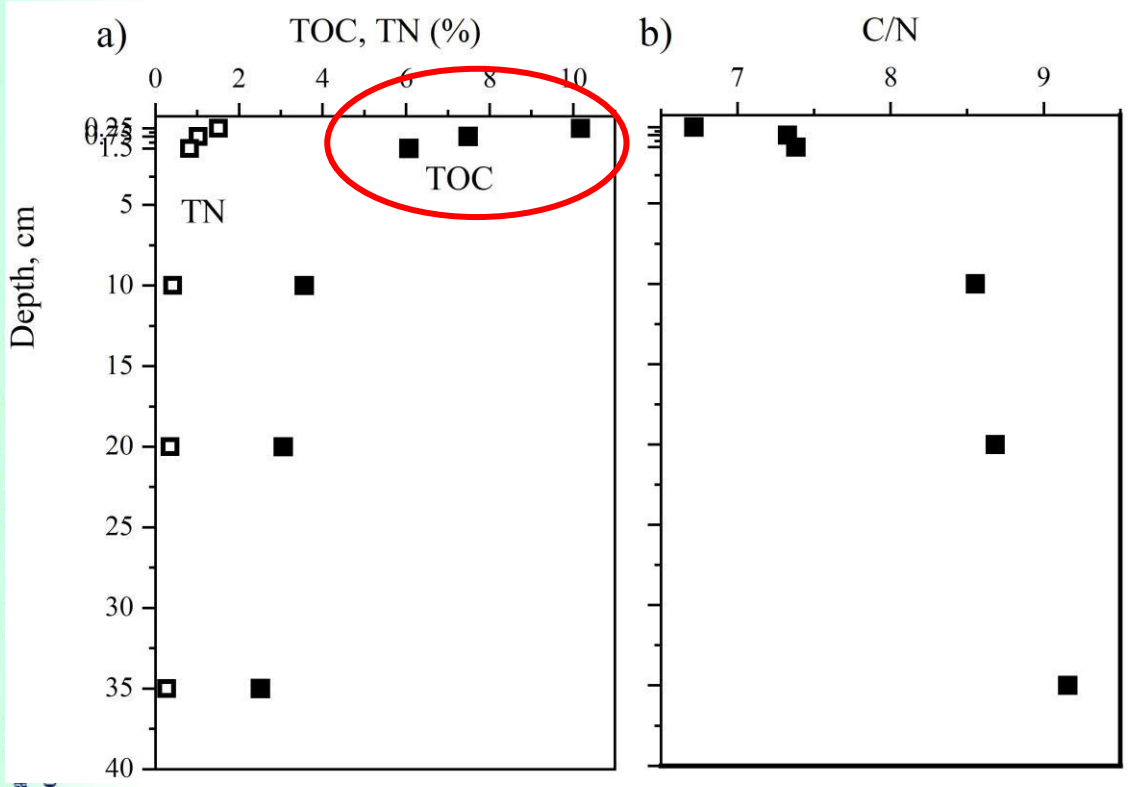
Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

Vertical profiles of nutrient, and DOC concentrations at Bulan 2



Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

Total N and total organic C content, and their isotope ratios in Lake Bulan sediment



Sediment analyses result, a) TOC and TN, b) C/N ratio

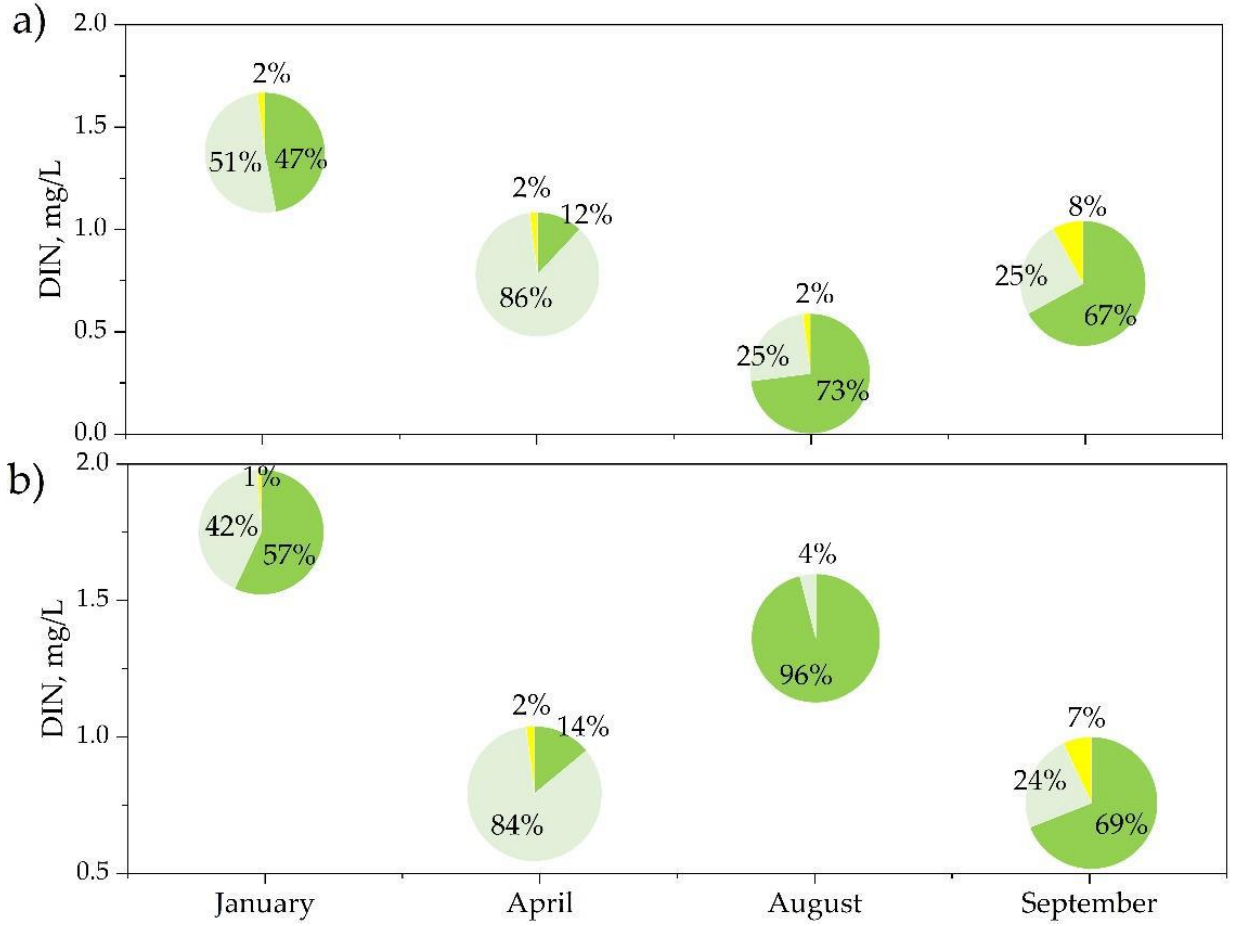
C/N ratio were measured from 6.0 to 9.2 which indicated freshly deposited OM (Mahapatra, D.M., 2011) .

Bulan	δ^{13}C-VPDB, ‰	δ^{15}N-Air, ‰	TN, %	TOC, %	C/N
0 - 0.5 cm	-28.7	10.8	1.51	10.2	6.9
1 - 2 cm	-29.0	10.7	1.02	7.49	7.3
2 - 3 cm	-28.6	10.7	0.822	6.07	7.4
10 - 12 cm	-28.1	10.1	0.416	3.56	8.6
18- 20 cm	-28.0	8.10	0.352	3.06	8.7
34- 36 cm	-27.0	7.15	0.274	2.51	9.2

Extremely high TOC content was observed in 0 - 0.5 cm - 10.8% and 0.5-1 cm – 7.49% while its content fluctuated from 1.8 to 4.3 % in freshwater Lake Bosten, China (Z.T.Yu, 2015) and from 2.86 to 7.32 in freshwater lake Kibagata, Japan (H.T. Bui, 2017).

Results of surface sediment analyses indicate high eutrophication process is occurring in Lake Bulan

Discussion….



Percentages of NH_4^+–N (green), NO_3^-–N (light green), and NO_2^-–N (yellow) in total DIN concentrations in the water from three sites at Lake Bulan; (**a**) surface and (**b**) bottom layer (7 m depth).

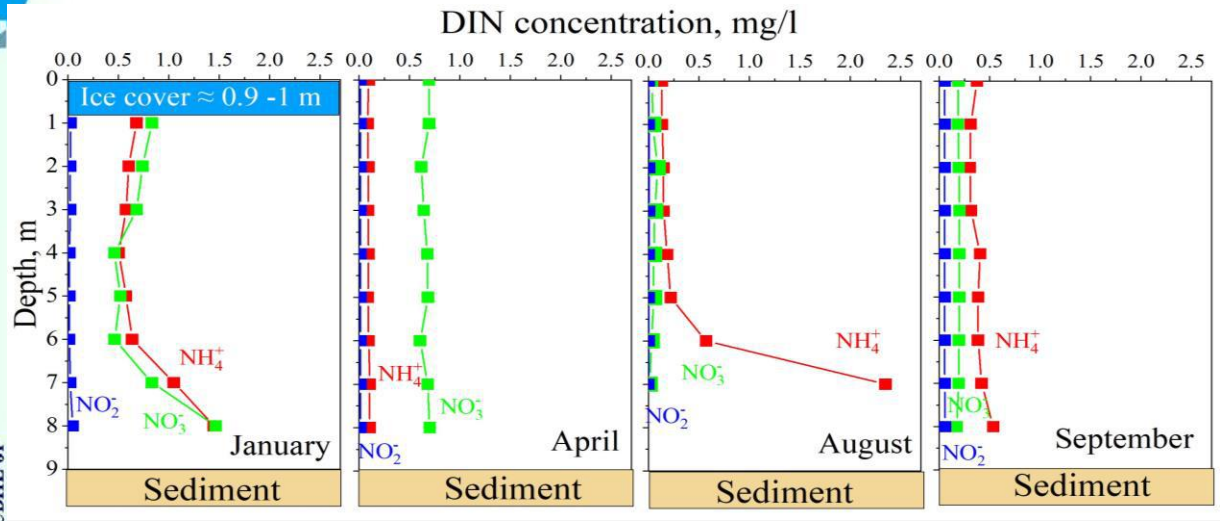
1.Phytoplankton growth: Lower DIN concentration in August shows phytoplankton bloom, which occurs in late growth season in the Mongolian plateau region (Chengxue Ma, 2019, Ye Jin, 2020)

2.Water turbulence: Water turbulence during spring and autumn seasons in temperate lakes allow the mixing of water mass. Turbulent mixing controls the vertical transfer of heat, gases and nutrients in stratified water bodies, shaping their response to environmental forcing (Castro B. F., 2021)

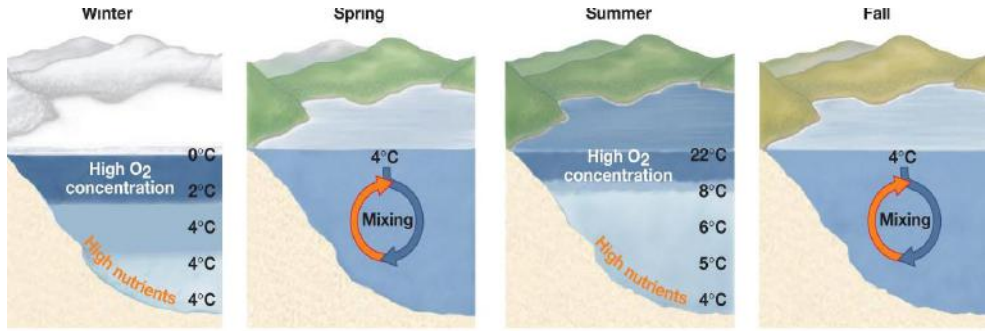
3.Thermal stratification: Early formation of thermal stratification n will cause the long strong summer stratification (Brian Foley, 2012)

Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

Discussion …..

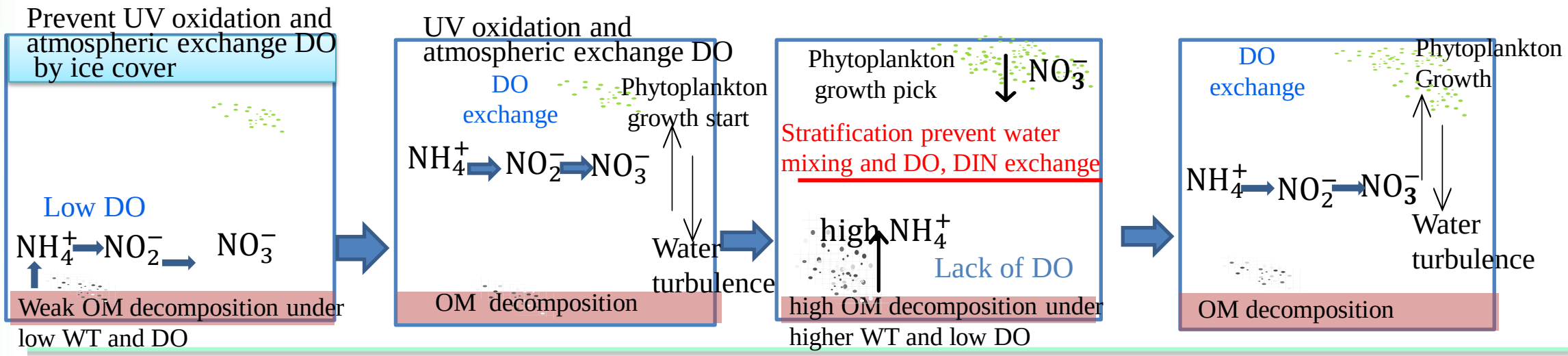


Lake turnover



Source: Univ. of Illinois at Chicago

Factors controlling profile of DIN concentration



Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

Conclusion

Winter profile data of nutrients in small freshwater lakes has not yet been undertaken in Mongolia, which is sensitive to global warming. The following results were obtained.

The concentrations of nutrients ranged widely over four seasons. Higher concentrations of DIN and PO_4^{3-} were observed in January (1.37 ± 0.08 mg N/l, 0.08 ± 0.07 mg P/l) and September (0.72 ± 0.10 mg N/l, 0.02 ± 0.01 mg P/l).

The vertical profiles of DIN concentrations were different in each season.

Spring and autumn: constant with water depth due to vertical mixing of water mass.

Summer: higher concentration of NH_4^+ was observed at the bottom layer.

Winter: higher concentration of NO_3^- and NH_4^+ was observed at the bottom layer. The NO_3^- concentration and its vertical profile were similar to those of NH_4^+, suggesting active metabolism in lake bottom water in winter.

The water stratification was one of the factors controlling nutrient concentration in Lake Bulan. This is reflected the phytoplankton production in spring and autumn in lake, and basic important information to understand and predict the effects of global warming on ecosystem in ice-covered lakes.

Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

Seasonal Variation and Vertical Distribution of Inorganic Nutrients in a Small Artificial Lake, Lake Bulan, in Mongolia

water

MDPI

Article

Seasonal Variation and Vertical Distribution of Inorganic Nutrients in a Small Artificial Lake, Lake Bulan, in Mongolia

Ariunsanaa Baterdene [1,2,3], Seiya Nagao [4,*], Baasanjav Zorigt [2], Altansukh Ochir [2,3], Keisuke Fukushi [4], Davaadorj Davaasuren [5], Baasansuren Gankhurel [6], Enkhuur Munkhsuld [3,7], Solongo Tsetsgee [3] and Ariuntungalag Yunden [2]

1 Division of Material Chemistry, Graduate School of Natural Science and Technology, Kanazawa University, Kanazawa 920-1192, Ishikawa, Japan; ariunsanaa1790@stu.kanazawa-u.ac.jp
2 Department of Environment and Forest Engineering, School of Engineering and Applied Sciences, National University of Mongolia, Ulaanbaatar 14201, Mongolia; baaska8696@gmail.com (B.Z.); altansukh@num.edu.mn (A.O.); ariuna_0924@yahoo.com (A.Y.)
3 Institute for Sustainable Development, National University of Mongolia, Ulaanbaatar 210646, Mongolia; munkhsuld.e.aa@m.titech.ac.jp (E.M.); osko_8888@yahoo.com (S.T.)
4 Institute of Nature and Environmental Technology, Kanazawa University, Kanazawa 920-1192, Ishikawa, Japan; fukushi@staff.kanazawa-u.ac.jp
5 Department of Geography, School of Art and Sciences, National University of Mongolia, Ulaanbaatar 210646, Mongolia; davaadorj@num.edu.mn
6 Division of Global Environmental Science and Engineering, Graduate School of Natural Science and Technology, Kanazawa University, Kanazawa 920-1192, Ishikawa, Japan; gbaasnsrn@stu.kanazawa-u.ac.jp
7 Department of Transdisciplinary Science and Engineering, School of Environment and Society, Tokyo Institute of Technology, Yokohama 226-8502, Kanagawa, Japan
* Correspondence: seiya-nagao@se.kanazawa-u.ac.jp; Tel.: +81-761-51-4440

check for updates

Citation: Baterdene, A.; Nagao, S.; Zorigt, B.; Ochir, A.; Fukushi, K.; Davaasuren, D.; Gankhurel, B.; Munkhsuld, E.; Tsetsgee, S.; Yunden, A. Seasonal Variation and Vertical Distribution of Inorganic Nutrients in a Small Artificial Lake, Lake Bulan, in Mongolia. *Water* **2022**, *14*, 1916. https://doi.org/10.3390/w14121916

Abstract: This is the first seasonal observation study on nutrient dynamics undertaken in a small freshwater lake with eutrophication in Mongolia. The vertical profile and seasonal fluctuation of nutrients are crucial to understanding the biogeochemical cycles in aquatic systems. In this study, field research was carried out at a small and shallow lake, Lake Bulan, in the lower Kharaa River basin. The area has been receiving increased nutrient loads from the water catchment area for the last 20 years. Water samples were collected seasonally from the lake from 2019–2022 and analyzed for nutrients, major cations, trace metals, and dissolved organic carbon. The average concentration of dissolved inorganic nitrogen (DIN) in the surface lake water had a wide seasonal variation from 0.26 ± 0.11 mg N/L in August to 1.44 ± 0.08 mg N/L in January. Seasonal differences were also

Ariunsanaa Baterdene [1,2,3], Seiya Nagao [4,*], Baasanjav Zorigt [2], Altansukh Ochir [2,3], Keisuke Fukushi [4], Davaadorj Davaasuren [5], Baasansuren Gankhurel [6], Enkhuur Munkhsuld [3,7], Solongo Tsetsgee [3] and Ariuntungalag Yunden

Published: 14 June 2022

Urban Resilience and Adaptation for India and Mongolia:
curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP

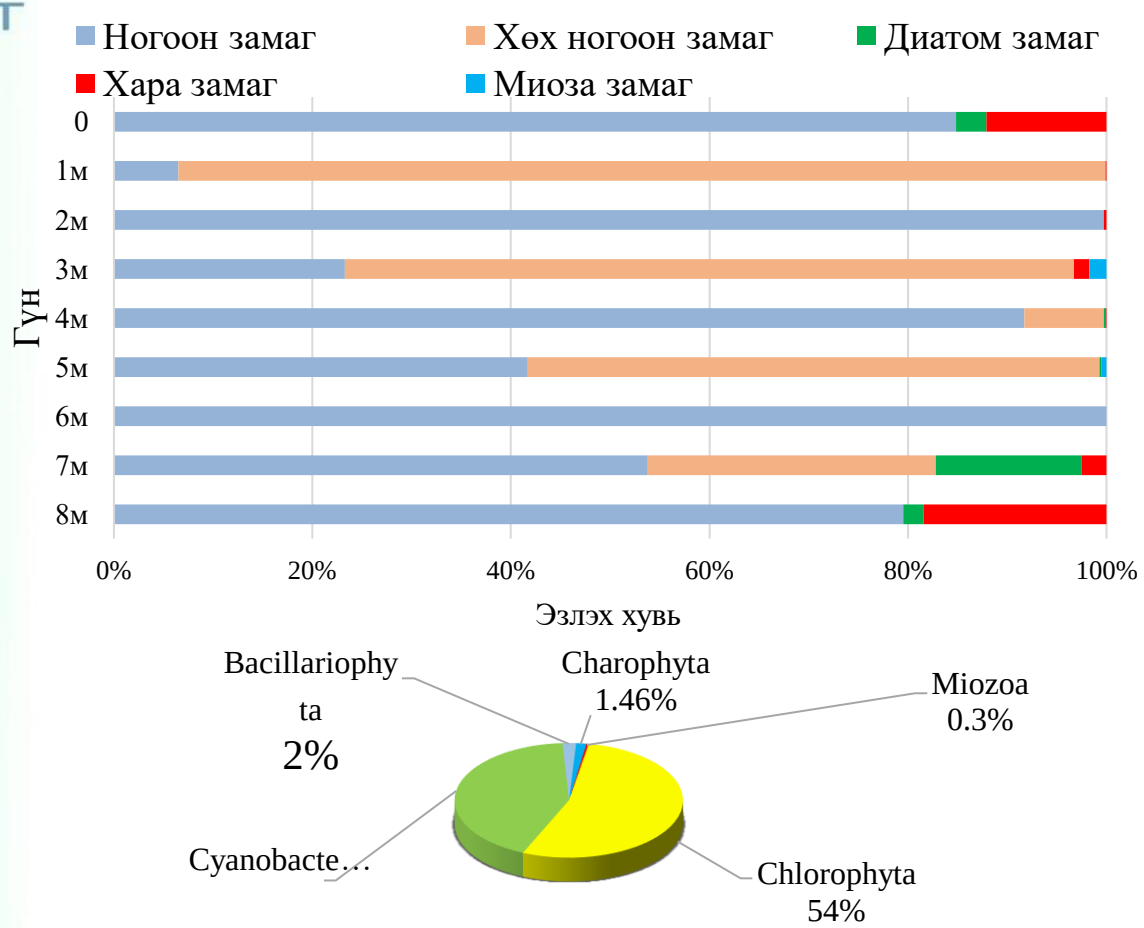
Co-funded by the Erasmus+ Programme of the European Union

THANK YOU FOR YOUR ATTENTION

Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

Судалгааны үр дүн ба хэлэлцүүлэг

Фитопланктоны бүлэг, арви /Б.Ганцоож, Ц.Бөхчулуун, 2023/



Нуурт Chlorophyta, Cyanobacteria хүрээ давамгайлах, ялангуяа энэ хоёр хүрээнд хамаарах *Chlorella, Microcystis* төрлүүд нь их хэмжээтэй байгаа нь усан сан эутрофикацид нөхцөлд байгааг илэрхийлэх[19][20] бол *Chlorella, Scenedesmus, Nizschia, Navicula, Actinastrum, Synedra* төрлүүд тохиолдох нь бохирдолд тэсвэртэй чанарыг илэрхийлдэг.

Баялаг байдал	Хүрээ	Төрөл (sp)	Эзлэх хувь
9	Ногоон замаг (Chlorophyta)	*Chlorella*	35.93
		Microspora	9.07
		Scenedesmus	3.88
		Acutodesmus	3.32
		Acutodesmus (dimorphus)	1.21
		Actinastrum	0.25
		Monoraphidium	0.10
		Parapediastrum	0.01
		Selenastrum	0.002
7	Хөх ногоон замаг (Cyanobacteria)	*Microcystis 1*	27.85
		Anabaenopsis	8.82
		Microcystis 2	2.38
		Gloeobacter	2.09
		Anabaenopsis	1.26
		Merismopedia	0.06
		Gomphosphaeria	0.02
6	Диатом замаг (Bacillariophyta)	*Staurosirella*	1.78
		Amphora	0.10
		Nitzschia	0.01
		Planothidium	0.01
		Synedra	0.004
		Navicula	0.004
3	Хара замаг (Charophyta)	*Klebsormidium*	0.86
		Euastrum	0.47
		Staurastrum	0.12
2	Миоза замаг (Miozoa)	*Ceratium*	0.30
		Gyrodinium	0.002

Олон янз байдлын индексийн үнэлгээ

Гүн, м	Шэннон-Уинерийн индекс	Жигд байдлын индекс	Маргалефийн индекс	Симпсоны индекс
0	1.08	0.78	0.25	0.73
1m	0.75	0.36	0.23	0.87
2m	0.22	0.163	0.07	0.99
3m	1.27	0.58	0.24	0.59
4m	0.30	0.19	0.23	0.84
5m	0.99	0.48	0.23	0.5
6m	0	0	0	1
7m	1.19	0.74	0.24	0.39
8m	0.73	0.45	0.17	0.66

Шаннон, Маргалеф олон янз байдал бага байгаа нь бусад биотик хүчин зүйлсээс гадна антропоген нөлөөллөөс үүдэлтэй байгаль орчны доройтол, төрөл зүйлийн тоо багатай холбоотой байна .

Булан нуурын 7 метр гүнд Шэннон-Уинерийн индекс 1.19 байсан бөгөөд Нюрнбергийн судалгаагаар гүехэн нуурын ёроол хэсэгрүү индекс нэмэгдэх нь уг хэсэгт исэлдэх процесс буурсан ч уусмал фосфорын ялгаралт нь фитопланктоны өсөлт, хөгжлийг дэмжих шим тэжээл болж буйтай холбоотой гэжээ.

Гүн, м	Шэннон-Уинер индекс	Жигд тархац-ын индекс	Маргале-фийн индекс	Симпсо-ны индекс
0	Ядмаг	Тогт	Нөл/Өр	Дан
1	Муу	Стр	Нөл/Өр	Дан
2	Муу	Стр	Нөл/Өр	Дан
3	Ядмаг	Тогт.г	Нөл/Өр	Дунд
4	Муу	Стр	Нөл/Өр	Дан
5	Муу	Стр	Нөл/Өр	Дун
6	Муу	Стр	Нөл/Өр	Дан
7	Ядмаг	Тогт.г	Нөл/Өр	Ол
8	Муу	Стр	Нөл/Өр	Дан

Тайлбар: Тогт- тогтвортой, Стр-стрест өртсөн, Нөл/өр – нөлөөлөлд өртсөн, Дан-дангаар нэг төрөл голчлон тархсан байна. Дунд- төрлүүдийн холилдож тархах нь дундаж хэмжээнд, Ол-харьцангуй олон бүлэг тархсан байна.

Усны чанар буурснаар экосистемийн бүтцэд өөрчлөлт орж, фитопланктоны олон янз байдлыг бууруулдаг ба бохирдсон нуур нь байгалийн нууртай харьцуулахад зүйлийн олон янз байдлын индекс утга бага байдаг.

Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

Булан нуурын эрүүл ахуйн үнэлгээ (биологийн олон янз байдлын түвшин)

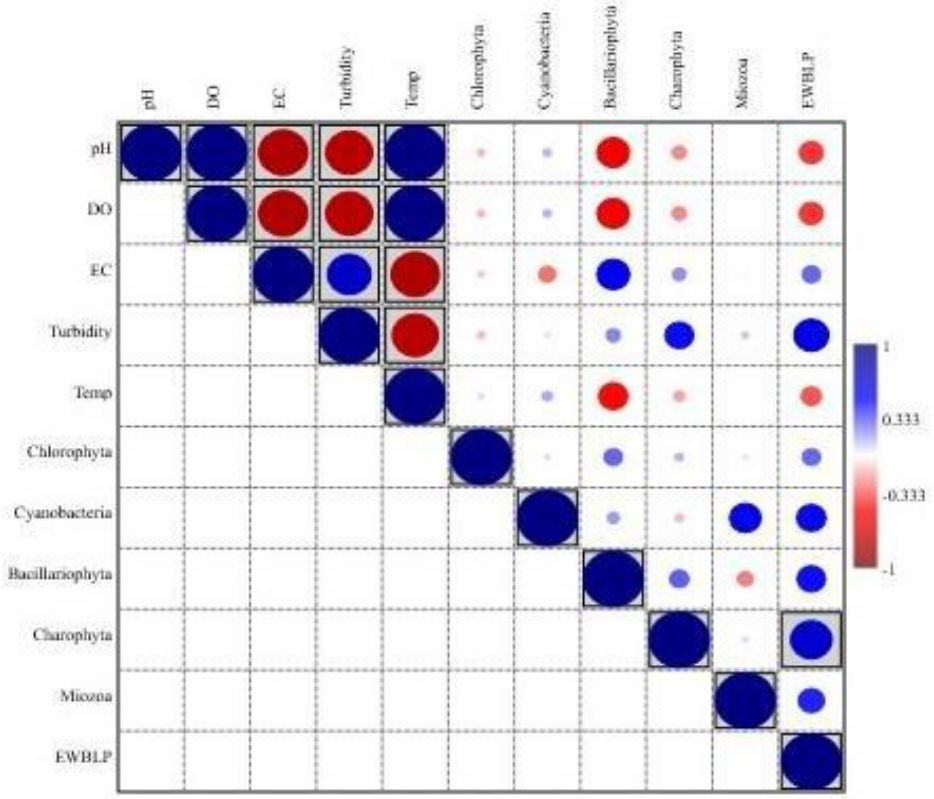
Булан нуур нь үүсмэл нуур тул түүнд бий болсон фитопланктоны төрөл, зүйлийг байгалийн нууртай шууд харьцуулах боломжгүй гэж үзээд Омаио нарын 2019 оны арга зүйгээр нуурын эрүүл ахуй, түүний биологийн олон янз байдлын түвшнийг үнэлсэн.

Гүн, м	Хүрээлэн буй орчны эрүүл ахуй буюу биологийн олон янз байдлын түвшин (EWBLP)
0	44.8
1	49.5
2	48.7
3	57.4
4	47.2
5	54.7
6	29.4
7	68.8
8	50.6±10.7%

Нуурын эрүүл ахуй, биологийн төрөл зүйлийн түвшний дундаж үнэлгээ 50.6±10.7%,

УЧҮ болон нуурын эрүүл ахуйн үнэлгээний үзүүлэлтийн хамаарал

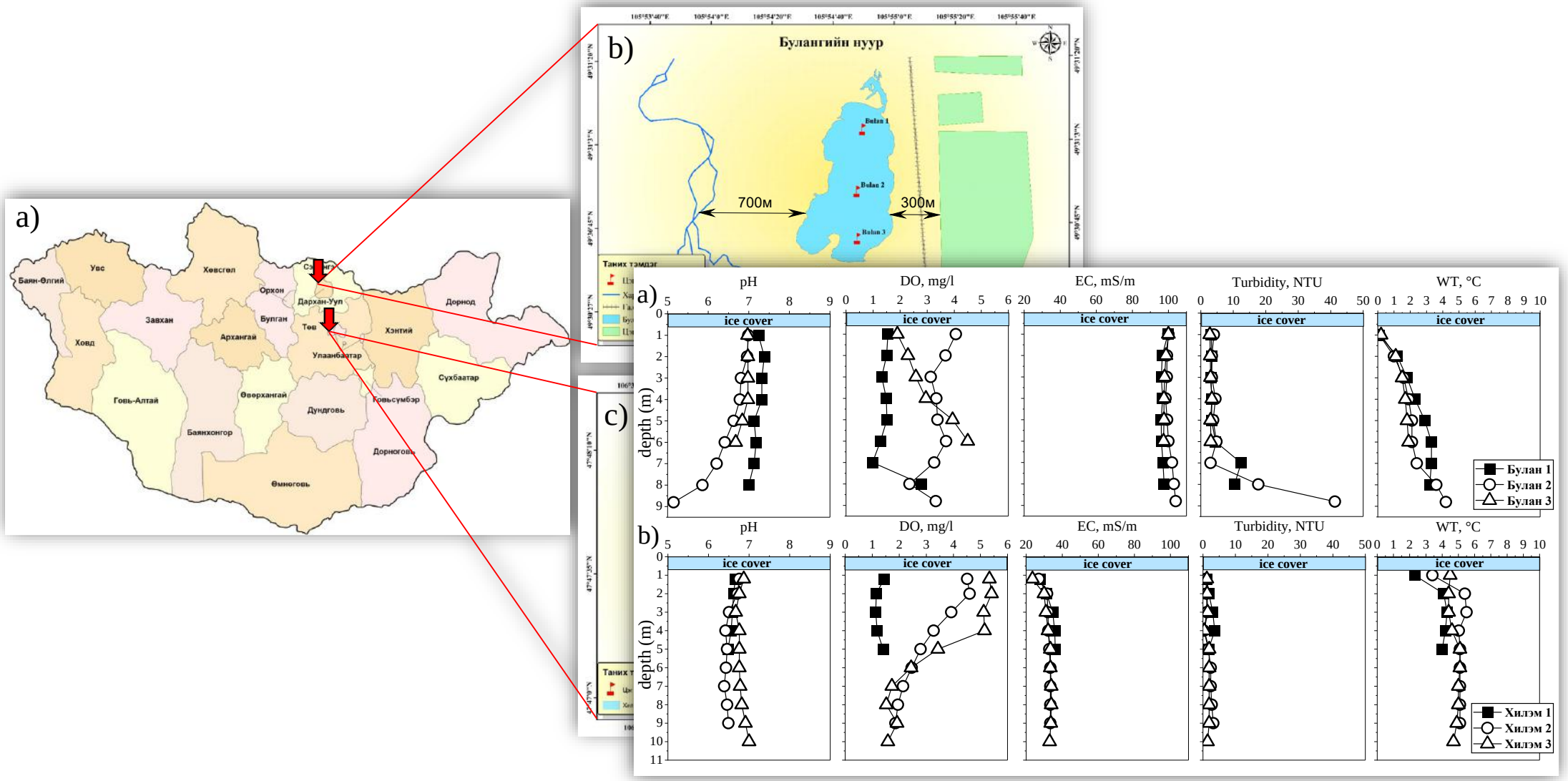
$P < 0.05$



Нуурын эрүүл ахуй, биологийн төрөл зүйлийн түвшний үнэлгээ нь pH, ууссан хүчилтөрөгч, булингартай сөрөг хамааралтай байгаа бол бусад үзүүлэлтүүдтэй эерэг хамааралтай байна.

Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP
Co-funded by the Erasmus+ Programme of the European Union

Ongoing study….



Urban Resilience and Adaptation for India and Mongolia: curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
619050-EPP-1-2020-1-DE-EPPKA2-CBHE-JP

Co-funded by the Erasmus+ Programme of the European Union