

UNIVERSITY GRANTS COMMISSION

BAHADUR SHAH ZAFAR MARG

NEW DELHI-110 002

Annual/Final Report of the work done on the Major Research Project

1. Project report no. : Final
2. UGC Reference No.F. : 41-1119/2012 (SR)
3. Period of report : from 2012 to 2016
4. Title of research project: Distribution and enrichment of heavy metals among sediments, water and aquatic plants and modeling its ecological impact on wetland ecosystem of the Brahmaputra Valley.
5. (a) Name of the Principal Investigator: Prof. Kali Prasad Sarma
(b) Deptt: Environmental Science
(c) University/ College where work has progressed: Tezpur University
6. Effective date of starting of the project: 01 July 2012
7. Grant approved and expenditure incurred during the period of the report
 - (a) Approved allocation: Rs 832800/-
 - (b) Grant received: Rs 676316/-
 - (c) Total interest earned: Rs 10667/-
 - (d) Total expenditure: Rs 686983/-
8. c. Report of the work done: (Please attach a separate sheet)
 - i. Brief objective of the project: Page 8
 - ii. Work done so far and results achieved and publications: Page 9&10.
 - iii. Has the progress been according to original plan of work and towards achieving the objective? If not, state reasons: Yes
 - iv. Please indicate the difficulties, if any, experienced in implementing the project: Did not receive the full fellowship allocated to the project fellow.

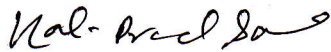


Finance Officer
Tezpur University

v. If project has not been completed, please indicate the approximate time by which it is likely to be completed. A summary of the work done for the period (Annual basis) may please be sent to the Commission on a separate sheet.

vi. If the project has been completed, please enclose a summary of the findings of the study. One bound copy of the final report of work done may also be sent to University Grants Commission.

vii. Any other information which would help in evaluation of work done on the project. At the completion of the project, the first report should indicate the output, such as (a) Manpower trained (b) Ph. D. awarded (c) Publication of results (d) other impact, if any



**SIGNATURE OF THE PRINCIPAL
INVESTIGATOR**



**Finance Officer
Tezpur University**



REGISTRAR/PRINCIPAL
Registrar
Tezpur University
(Seal)



SIGNATURE OF THE CO-INVESTIGATOR

Tezpur University
Finance Officer

UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI – 110 002

**PROFORMA FOR SUBMISSION OF INFORMATION AT THE TIME OF SENDING
THE FINAL REPORT OF THE WORK DONE ON THE PROJECT**

1. Title of the Project: Distribution and enrichment of heavy metals among sediments, water and aquatic plants and modeling its ecological impact on wetland ecosystem of the Brahmaputra Valley.
2. NAME AND ADDRESS OF THE PRINCIPAL INVESTIGATOR: Prof. Kali Prasad Sarma, Deptt. Of Environmental Science, Tezpur University.
3. NAME AND ADDRESS OF THE INSTITUTION: Deptt. Of Environmental Science, Tezpur University, Napaam, Tezpur 784001.
4. UGC APPROVAL LETTER NO. AND DATE: F.No.41-1119/2012 (SR), 26th July, 2012
5. DATE OF IMPLEMENTATION: 24 December, 2012
6. TENURE OF THE PROJECT: 3 years
7. APPROVED ALLOCATION: Rs 832800/- (rupees eight lakh thirty two thousand eight hundred only)
8. GRANT RECEIVED: Rs 676316/- (rupees six lakh seventy six thousand three hundred sixteen only).
9. INTEREST EARNED: Rs 10667/- (rupees ten thousand six hundred sixty seven only)
10. FINAL EXPENDITURE: Rs 686983/- (rupees six lakh eighty six thousand nine hundred eighty three only).
10. TITLE OF THE PROJECT : Distribution and enrichment of heavy metals among sediments, water and aquatic plants and modeling its ecological impact on wetland ecosystem of the Brahmaputra Valley.
11. OBJECTIVES OF THE PROJECT:
 1. To determine the concentrations of some heavy metals (Pb, Cd, Hg, Cu , Cr, Zn, Mn etc) in water, bed sediment and in different parts of the aquatic macrophytes collected from different wetlands system of the Brahmaputra valley.
 2. To study of physico-chemical characteristics of water and sediments in terms of pH, total alkalinity, dissolved solids, Chloride , nitrate, phosphate, organic carbon etc to

collect baseline information on ecological conditions during pre and post monsoon seasons

3. To determine the potential for metal accumulation of different naturally growing wetland plants collected from metal contaminated sites.
4. To evaluate the significant difference in the concentration of different studied metals with respect to different wetlands using statistical tools.
5. To assess the relationship and interdependency of heavy metals (Cu, Zn, As, Pb, Cr Mn, Cd) in macrophytes , sediment, and water samples, during pre and post monsoon seasons.
6. To see the enrichment, bioavailability and pollution level of heavy metals in sediments.
7. To propose an ecological model to relates the transport, distribution and speciation of heavy metals and their toxicity, and the effect of environmental variability on metal toxicity.

12. WHETHER OBJECTIVES WERE ACHIEVED: Yes

13. ACHIEVEMENTS FROM THE PROJECT: Pollution status of the wetlands of different districts of the Brahmaputra valley of Assam with respect to heavy metals were detected.

14. SUMMARY OF THE FINDINGS (IN 500 WORDS): The water of the wetlands of the Brahmaputra valley ranged from neutral to slightly alkaline. Alkalinity, hardness, nitrate and phosphate ranged from low to moderate range. Metals like Cd, Cr, Pb and Zn were found to exceed the USEPA limits in some of the wetlands like DEEPOR BEEL and wetlands of KNP. The contribution of the trace metals in the water and sediments of the wetlands were found to be from natural, anthropogenic and mixed sources. There is a significant difference among trace metal concentrations between water and sediments of the beel ($F = 94.03$, $P < 0.001$) (Table 13). The effects of interaction among trace metals between water and sediments shows significant variations ($F = 94.02$, $P < 0.001$), signifying maximum mobility of trace metals in the wetland sediments. Sediments of all wetlands are acidic in nature. The average values of soil organic carbon indicated that the wetlands of the Brahmaputra Valley are medium to highly productive in respect of soil organic matter. Available soil N and P was found rather poor in most of the beels of Brahmaputra Valley, indicating low productivity. Metals like Cd, Pb and Zn were found to exceed the SQG-TEC, crustal abundance and shale values in some of the wetlands studied.

Enrichment Factor of the metals shows significant enrichment of Cd in Deepor Beel and KNPw, and moderate enrichment in all other wetlands. Deepor Beel and KNP show a moderate enrichment of Zn, Pb and As. A moderate enrichment of Zn is also shown by Maguri, Sareswar, Pobitora, Laokhoa and Saran beel. In all the sampling sites, the Pollution load index (PLI) values were less than 1, thus indicating that none of the wetlands were highly polluted. In Deepor Beel, Cd poses considerable Potential ecological risk (RI), while in KNP, Maguri and Pobitora, it poses moderate potential ecological risk. All other metals fall under low potential ecological risk to the wetlands. Cd showed a very strong positive correlation (0.988) indicating maximum mobility among all the metals studied, Co showed good correlation (0.786) respectively between the labile and immobile fractions. It indicates that the metals were released from immobile fractions to labile fractions which could be due to acidic nature of soils. On the other hand, Cr, Fe, Pb, Cu and Zn showed a weak correlation between the labile and immobile fractions (0.574, 0.404, 0.226, 0.303 and 0.259) indicating a stable nature for these metals. This could be due to abundance of these metals in residual and reducible fractions.

The SEM equipped with EDX revealed the accumulation of metals in the tissues and the cell walls. Macrophytes *E.crassipes* and *T.natans* was found to have a better combination of accumulation and translocation efficiency with regard to the metals studied. Moreover, these two plant species were commonly found in the wetlands, thus helping the aquatic systems for metal clean-up in a natural way. There is a highly significant interaction (P-value: 0.0001) of trace metals between water, sediments and macrophytes in all the wetlands. F: 5.317662 > F crit: 2.23948

This indicates existence of a dynamic equilibrium of trace metals among the water, sediments and aquatic plants in the wetland ecosystem.

15. CONTRIBUTION TO THE SOCIETY:

16. WHETHER ANY PH.D. ENROLLED/PRODUCED OUT OF THE PROJECT: Yes, thesis submitted.

17. NO. OF PUBLICATIONS OUT OF THE PROJECT: 3

1. **Sanghita Dutta**, R.R.Gogoi, L. Khanikar, R.S.Bose and K.P. Sarma. Assessment of hydro geochemistry and water quality index (WQI) in some wetlands of the Brahmaputra valley, Assam, India *Desalination and Water Treatment*. 1–13, 2016. (In Press)


2. **Sanghita Dutta**, R. Sah and K. P. Sarma, An Assessment of Water, Soil Quality And Biotic

Communities Of The Floodplain Wetlands Of The Brahmaputra And Barak Valley Of Assam,

India- A Review. *Journal of Bioresources* .3(1): 61-70 (2016).

3. **Sanghita Dutta**, Upasona Devi, Phani Dutta and Kali Prasad Sarma, Assessment of heavy metals in water, sediments and water hyacinth in some stagnant water bodies of Guwahati, Assam, India, *Desalination and Water Treatment* , 2016 (Accepted)


(PRINCIPAL INVESTIGATOR)


(CO-INVESTIGATOR)


(REGISTRAR/PRINCIPAL)

(Seal)
Registrar
Tezpur University

UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002

STATEMENT OF EXPENDITURE IN RESPECT OF MAJOR RESEARCH PROJECT

1. Name of Principal Investigator: Prof. Kali Prasad Sarma

2. Deptt. Of Principal Investigator: Environmental Science

University/College: Tezpur University

3. UGC approval Letter No. and Date: F.No.41-1119/2012 (SR), 26th July, 2012.

4. Title of the Research Project: Distribution and enrichment of heavy metals among sediments, water and aquatic plants and modeling its ecological impact on wetland ecosystem of the Brahmaputra valley.

5. Effective date of starting the project: 01 July-2012.

6. a. Period of Expenditure: From 2012 to 2016

b. Details of Expenditure:

| S.N | Item | Amount received (Rs) | | Total | Expenditure Incurred (Rs) | | | | Total | Balance |
|-----------------|--------------------------|----------------------|-----------|----------|---------------------------|-----------|-----------|-----------|----------|----------|
| | | 2012-2013 | 2015-2016 | | 2012-2013 | 2013-2014 | 2014-2015 | 2015-2016 | | |
| i | Books and journals | 30000/- | | 30000/- | | 29988/- | | | 29988/- | 12/- |
| ii | Equipment | | | | | | | | | |
| iii | Contingency | 30000/- | | | | 15000/- | | 12000/- | 27000/- | 3000/- |
| iv | Field work/Travel | 90000/- | | | | 44561/- | 5000/- | 36210/- | 85771/- | 4229/- |
| v | Hiring services | | | | | | | | | |
| vi | Chemicals and glasswares | 90000/- | | | | 44985/- | | 36014/- | 80999/- | 900/- |
| vii | Overhead | 41390/- | 23410/- | 64800/- | | 48600/- | 11579/- | 10636/- | 70815/- | |
| viii | Manpower | 392410/- | 189106/- | 581516/- | 31613/- | 182000/- | 50136/- | 128661/- | 392410/- | |
| Total | | 463800/- | 212516/- | 676316/- | 31613/- | 365134/- | 66715/- | 223521/- | 686983/- | -10667/- |
| Interest earned | | | | | | | | | | 10667/- |
| Total | | | | | | | | | | NIL |

For SURAJIT CHAKRABORTY & CO.
CHARTERED ACCOUNTANTS

CA. SURAJIT CHAKRABORTY
(Proprietor)

Membership No.- 305054

[Signature]
23/07/18
Finance Officer
Tezpur University

c. Date of Appointment: 24th December, 2012.

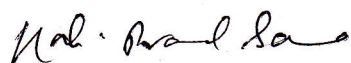
| S.No | Items | From | To | Amount approved (Rs) | Expenditure incurred (Rs) |
|------|--|------|------|----------------------|---------------------------|
| 1. | Honorarium to PI | | | | |
| 2 | Project fellow i) NET/GATE qualified- Rs 16000/-p.m. for initial 2years and Rs 18000/- p.m. for the third year ii) Non-GATE/Non-NET- Rs.14000/-p.m. for initial 2 years and Rs.16,000/- p.m. for the third year. | 2012 | 2015 | 392516.00 | 392410.00 |

1. It is certified that the appointment(s) have been made in accordance with the terms and conditions laid down by the Commission.

2. If as a result of check or audit objection some irregularly is noticed at a later date, action will be taken to refund, adjust or regularize the objected amounts.

3. Payment @ revised rates shall be made with arrears on the availability of additional funds.

4. It is certified that the grant of Rs 676316.00 ((Rupees Six lakhs seventy six thousand three hundred sixteen only) received during 2012-2015 from the University Grants Commission under the scheme of support for Major Research Project entitled 'Distribution and enrichment of heavy metals among sediments, water and aquatic plants and modeling its ecological impact on wetland ecosystem of the Brahmaputra valley'. vide UGC letter No.F.41-1119/2012(SR) dated 26th July 2012 and interest earned Rs. 10667/-. The total grant received plus interest is equal to Rs. 686983 (rupees six lakh eighty six thousand nine hundred eighty three only). has been fully utilized for the purpose for which it was sanctioned and in accordance with the terms and conditions laid down by the University Grants Commission. Balance of the Project is nil.



SIGNATURE OF PRINCIPAL INVESTIGATOR



SIGNATURE OF THE CO-INVESTIGATOR



23/12/18
Finance Officer
Tezpur University



REGISTRAR/PRINCIPAL
Registrar
Tezpur University

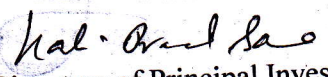
UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002

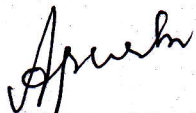
STATEMENT OF EXPENDITURE INCURRED ON FIELD WORK


Name of the Principal Investigator

| Name of Place visited | Duration of the visit | | Mode of journey | Expenditure incurred (Rs) |
|--|-----------------------|------|-----------------|---------------------------|
| | From | To | | |
| Deepor beel, Kaziranga National park, Pobitora, | 2012 | 2015 | Hired Taxi | 81,000.00 |

Certified that the above expenditure is in accordance with the UGC norms for Major Research Projects.


Signature of Principal Investigator


Signature of the Co-Investigator


Registrar/Principal
Registrar
(Seal)
Tezpur University

UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002

Utilization certificate

Certified that the grant of Rs 676316.00 (Rupees Six lakhs seventy six thousand three hundred sixteen only) received during 2012-2015 from the University Grants Commission under the scheme of support for Major Research Project entitled 'Distribution and enrichment of heavy metals among sediments, water and aquatic plants and modeling its ecological impact on wetland ecosystem of the Brahmaputra valley'. vide UGC letter No.F.41-1119/2012(SR) dated 26th July 2012 and interest earned Rs. 10667/-. The total grant received plus interest is equal to Rs. 686983 (rupees six lakh eighty six thousand nine hundred eighty three only) has been fully utilized for the purpose for which it was sanctioned and in accordance with the terms and conditions laid down by the University Grants Commission. Balance of the Project is nil.

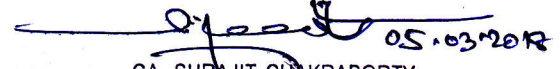

SIGNATURE OF

PRINCIPAL INVESTIGATOR




REGISTRAR/PRINCIPAL
Registrar
Tezpur University

For SURAJIT CHAKRABORTY & CO.
CHARTERED ACCOUNTANTS


CA, SURAJIT CHAKRABORTY
(Proprietor)
Membership No.- 305054

STATUTORY
AUDITOR

(Seal)


SIGNATURE OF CO- INVESTIGATOR

Month-wise and Year-wise detailed statement of Expenditure towards Salary of Staff appointed under the project

| Duration | Amount (Rupees) |
|--|-----------------|
| 24 th Dec to 31 st Dec 2012 | 3613 |
| Jan 2013 | 14000 |
| Feb2013 | 14000 |
| Mar2013 | 14000 |
| Apr2013 | 14000 |
| May2013 | 14000 |
| June2013 | 14000 |
| July2013 | 14000 |
| Aug2013 | 14000 |
| Sept2013 | 14000 |
| Oct2013 | 14000 |
| Nov2013 | 14000 |
| Dec2013 | 14000 |
| Jan 2014 | 14000 |
| Feb2014 | 14000 |
| Mar2014 | 14000 |
| Apr2014 | 14000 |
| May2014 | 14000 |
| June2014 | 14000 |
| 1 st to 18 th July, 2014 | 8136 |
| 19 th July 2014 to 9 th April 2015 | 128661 |
| Grand total | 392410 |

Kal-Brandha
Signature of PI

[Signature]
28/1/18
Finance Officer
Tezpur University

[Signature]
Signature of Registrar
Registrar
Tezpur University

[Signature]