DETAILED FINAL REPORT

ON

HERPETOFAUNAL DIVERSITY AND CONSERVATION IN EASTERN INDIAN AGROECOSYSTEMS

Application ID: 18506-1

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CONTENTS

BACKGROUND OF THE PROJECT

Studies related to herpetofauna in agricultural systems is sparse and far between, particularly in India. The project took place in Odisha, Balasore district, a major rice growing area.

This project was initiated in 2016, March and has achieved good progress in this short tenure.

The main aim of the project was to get an insight into the perceptions of the farming community about herpetofauna and to prepare an inventory of herpetofauna in agricultural landscape comparing low and high agricultural intensification. Though the work has been able meet the primary objectives of the project yet much work needs to be done to establish a strong conclusion through further research.

SUMMARY

Wildlife beyond protected areas require active participation of the community for conservation. This work provides an insight into the perceptions of the farming community of Balasore district, Odisha about herpetofauna. The farmers are inevitably in contact with wildlife through ages particularly in areas that are close to forests. The work has been able to bring out the perception, knowledge of this community about these herpetofauna. We used informal questionnaire to interview the framers regarding different aspects of herpetofauna in and around their crop fields. Ethno-herpetofaunal survey showed a clear difference in knowledge farmers between areas of high and low cropping intensities. The farmers in high crop intensity areas were less knowledgable than farmers of low crop intensity areas. Alongside this, the work also involved preparing an inventory of herpetofauna in the focal agricultural system and also comparred the result between high and low cropping intensity areas. We used passive sampling, active sampling, transect walk, active search and opportunistic encounter for preparing the inventory.

12 species of amphibians belonging to 5 families and 9 species of reptiles belonging to 6 families have been sampled so far. This work will provide a baseline information which could be utilised for future studies in developing and implementing conservation plans in these agricultural areas involving the farming communities.

INTRODUCTION

Agricultural intensification has been implicated as a major driver of biodiversity meltdown, particularly in the tropics. A large proportion of world's biodiversity exists in man-made ecosystems outside the protected areas. Agricultural systems create new ecological niches allowing specific species of farmland birds, insects, mammals, reptiles and weeds to establish themselves. On the other hand, various factors associated with agricultural intensification also affect the sustenance of various biodiversity elements. According to IUCN 2010 report land transformation issues regarding agricultural and forest related activities have endangered 70% of 10,707 terrestrial threatened animal species (Palacios et al., 2013).

Though an integral part of the agricultural landscape, the conservation status of herpetofauna in agro-ecosystems has remained grossly understudied. Extensive literature survey reveals large knowledge gaps regarding the status of herpetofauna and their role in agroecosystems in the world including India. Herpetofauna, a top predator, plays significant role in sustaining agroecosystems delivering valuable ecosystem services e.g., pest control. Meltdown of the herpetofauna diversity could have serious implication on a larger scale across trophic levels operating in the agroecosystems. The ongoing work is a pioneering attempt in studying the status and ecological roles of the herpetofauna in an intensive agroecosystem and would pave the context for initiating a conservation plan for saving the herpetofauna in agroecosystems.

LITERATURE REVIEW

Not much study of herpetofauna is available in agroecosystem. However, for a few decades herpetofauna have been a major topic of concern among the scientists and attempts have been made to delineate the causes of decline in herpetofauna. In the paper *Global amphibian Decline: Sorting the Hypothesis* James P. Collins and Andrew Storfer, 2003 has categorized 6 causes for the amphibian decline in 2 hypotheses. These hypotheses are- 1) alien species, over-exploitation and land use change, 2) global change (including UV radiation and global climate change), 3) contaminants and emerging infectious disease. Gibbons et al., 2000 in the article -*The global decline of reptiles De Javu Amphibians* has identified the same 6 causes for the loss of herpetofauna of which habitat destruction has been given the topmost priority. Several ecotone and gradient based surveys have been done along with the effect of forest edge. In the study by Graeme Gillespie et.al., 2005, herpetofaunal species richness, abundance and diversity have been studied along a gradient of primary forest, secondary forest, natural shade cacao agro-forestry, planted agro-forestry and finally open lands. Much importance is also given towards the association of microhabitats and the herpetofaunal assemblages in several studies by Matthew J. Goode et al., 1995; J. Nicola´s Urbina-Cardona, Mario Olivares-Perez, Victor Hugo Reynosa,2006 and others. Camila P. Palacios, Belen Ageuro, Javier A Simonetti, 2013 in the review paper *Agroforestry systems as habitat for herpetofauna: is there supporting evidence?*, identifies habitat loss as a major threat for herpetofauna and that plantations mostly support generalists. Few studies have focused on the effect of environmental toxicity on heroetofauna (Carlos Davidson et al., 2007) and using herpetofauna as bioindicators to determine the chemical input in the agricultural lands and thus provide information about condition of the environment. The national status of herpetofaunal significance in agroecosystem is still in its pristine stage. Several surveys on herpetofauna have been done in different rainforests as is evident from a few papers- *The Herpetofauna of Nallamala Hills, Eastern Ghats, India: An Annotated Checklist, With Remarks on Nomenclature, Taxonomy, Habitat Use, Adaptive Types and Biogeography* (C. Srinivasulu and Indraneil Das, 2008), *Amphibian assemblages in undisturbed and disturbed areas of Kudremukh National Park, central Western Ghats, India*(S.V. Krisnamurthy,2003), *A case report on Herpetofauna of Gir Protected Area* (Kautilya Bhatt, Raju Vyas and Mahesh Singh,1999) and few others. There are also few studies that focussed on effect of pesticide on these animals e.g., LC 50 of melathione on behavioral and morphological anomalies (M. David, R.M. Kartheek, 2015).

STUDY SITE

The project work was conducted in South-Eastern India, Odisha (20.9517° N, 85.0985° E). Odisha is divided into 10 agroclimatic zones of which Balasore district (field site) falls under the North-Eastern Coastal Plateau.

MAP OF ODISHA SHOWING BALASORE, REMUNA & JALESWAR

Survey of ethnoherpetofauna was conducted in 3 towns of Balasore district Panchalingeswar, Remuna and Jaleswar.

20 VILLAGES FOR SURVEY

LOW INTENSIFICATION ZONE

1. BALIANAL
2. ASHOKNAL
3. BETOKATA
4. GOPAL
5. KERAMARA
6. TORTORI
7. TODOASHOKNAL
8. KHUNKUT
9. BALICHUA

MID INTENSIFICATION ZONE

1. DASIPUR
2. KUDIA
3. UDAYPUR
4. SUTANUTI
5. DUMURIA

HIGH INTENSIFICATION ZONE

1. SEKHSARAI
2. EKTALI
3. GOBORDHAN PUR
4. MALGODIA
5. RAMCHANDRA PUR
6. CHALONTI

Primary data are collected in 11 agricultural lands in Balasore District.

IMAGE SHOWING SAMPLING SITES- WHITE MARKED- LOW INTENSIFICATION SITES : YELLOW MARKED- HIGH INTENSIFICATION SITES.

TIME BUDGET

TIME LINE AS PROPOSED			TIME LINE FOLLOWED	
ETHNO-HERPETOFAUNAL SURVEY	DEC’2015-JAN’2016		ETHNOHERPETOFAUNAL SURVEY	MAR’2016-APRL’2016
		NEW	VALIDATING THE SURVEY WITH 200 FARMERS	APRL’2016-MAY 2016
FIELD SITE SELECTION	JAN’2016-FEB’2016		FIELD SITE SELECTION	APRL’2016-MAY 2016
		NEW	REPEATING THE SURVEY WITH 5 FARMERS IN EACH OF THE 12 FIELD SITES	MAY 2016-JUNE 2016
TRAP CONSTRUCTION & INSTALLATION	JAN’2016-FEB’2016		TRAP CONSTRUCTION & INSTALLATION	APRL’2016-MAY 2016
HERPETOFAUNAL SAMPLING	FEB’2016-JAN’2017		HERPETOFAUNAL SAMPLING	MAY 2016-FEB’2017

		NEW	RESELECTING 6 OF THE SITES UNDER HIGH INTENSIFICATION ZONE	NOV'2016-DEC'2016
PUBLIC AWARENESS	JAN' 2016-JAN'2017(THROUGHOUT THE WORK)		PUBLIC AWARENESS	MAR'2016-MAR'2017

The disparity in following the time- line is because of delay in the approval and the release of grants. Though the project started off 3 months after schedule it has been able to meet the proposed activities and is in accordance with the proposed time period.

ACTIVITIES

Methodology & Results

I.A) Survey method

A questionnaire was prepared that would allow informal interactions with the farmers. Questions were made as simple as possible keeping in mind the poor educational background of these communities. The survey took place in two phases.

Phase I

In each village individually 5 farmers were asked to answer the questionnaire. The interview was conducted individually so that the answers are not influenced by others. **Apart from this, survey was also conducted in 12 more villages in low intensification zone i,e in Panchalingeswar of which 8 has been selected for gathering the primary data**.

Though not proposed in the project we decided to undertake a second phase of the survey owing to the reticent nature of the farmers so that we can further validate the data and can put the data in some analysis.

A total of 160 farmers participated in this phase of the survey

Phase II

For phase II of the work we selected 10 farmers from each of the 20 villages mentioned above and put them in 2 groups of 5 each. Each group was treated as 1 and were asked the same questionnaire. Each group was asked to come up with a consensus answer. This was done to cross validate the answers that we got from the first phase of the survey.
A total of 200 farmers participated in this phase.

I B) SURVEY PICTURES

Farmers throughout 32 villages were engaged in informal interaction. Apart from questionnaires about herpetofauna, the advantage and disadvantage of co-existing with them were also discussed. This was done to prepare grounds for undertaking conservation campaigns in the following year so that they participate willingly in such campaigns. Piquing their interest was the first aim of such programme which would result in their positive and enthusiastic participation in conservation in future and this would prove the fruitfulness of our ethno-herpetofaunal survey programme.

Initially farmers were very reluctant to participate because of their inherent reticent nature, inadequate knowledge and ignorance which made the initial phases of the work very difficult. But as the work progressed and we started sampling in the area there was sharp change in interest among the villagers about our work and the results that we are expecting. This was quite a success for the effort that we took to make them interested in these animals because no conservation is possible without the co-operation of people co-existing with them.

II) FIELD SITE SELECTION

12 field sites were selected by Google Earth Imagery. To build up interaction and co-operation with the farmers of the respective sites we did the same herpetofaunal survey with 5 farmers each, a total of 60 farmers. Each site is minimum 5 km apart with a total area of 4.9 hectres each. We selected sites that are away from human settlements or any factory to avoid anthropogenic effects.

III) TRAP CONSTRUCTION

A biggest challenge for initiating the work was constructing traps for the sampling part. Because of the place being very interior transport facilities are very poor. Therefore I had to construct traps for my own and from very basic equipment that could be made available in this place.

TRAP CONSTRUCTION IMAGES

MAKING OF DOUBLE-ENDED FUNNEL AND PITFALL TRAPS

IV) METHOD FOR SAMPLING

Herpetofauna being very reticent in nature I had to take resort to more than 1 sampling techniques.

All together 5 different methods were used for sampling them.

1. Passive Trapping
   Passive trapping manipulates the behaviour of these creatures. They move along a straight path and when obstructed they do not change their path rather follow the new way.
   In case of passive trapping this obstruction is created by drift fences that deviate their route, which finally lead them to traps. Traps used in this case are pitfall traps and double ended funnel.

   Different designs of traps can be installed for proper and satisfactory results.
   Trap design used for my study is a cross-shape, where drift fences of 7m are arranged in a "X". Pitfall traps are buried at the ends of each arm and at the centre of the trap array. 2 double ended funnels are placed on either side of the drift fence arms.

   Night sampling is not possible in these places because of large distance of the sites and unavailability of transport. Therefore passive trapping proved to be the best sampling technique for me.

A.

B.

Fig: A. TRAP INSTALLATION, B. ONE TRAP ARRAY

A.TRAP FIXING, B.TRAP CARRAIGE, C.DRIFT FENCE WITH A PITFALL AT AN END, D.DRIFT FENCE WITH DOUBLE-ENDED FUNNEL AT BOTH SIDES

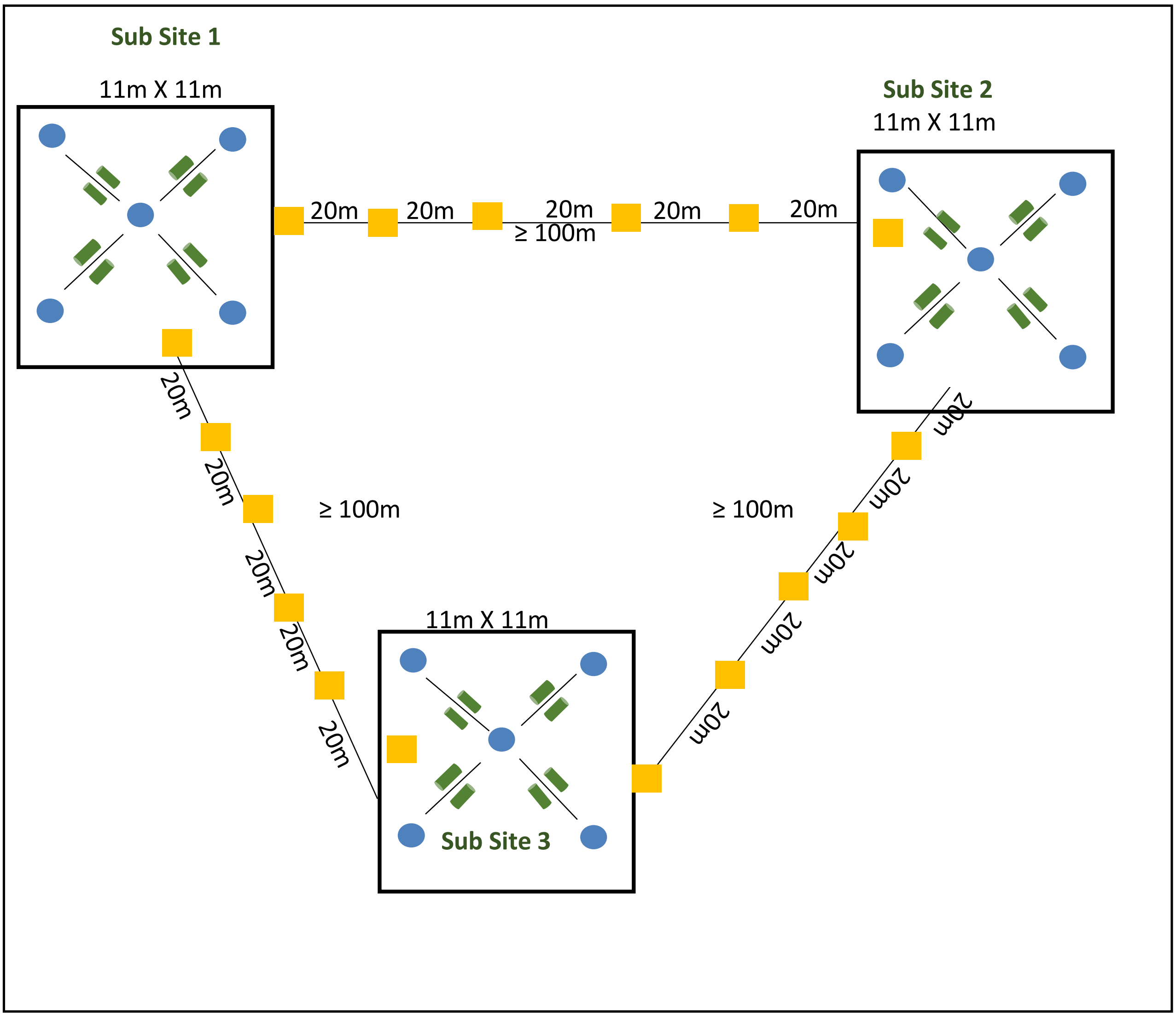
ACTIVE SAMPLING

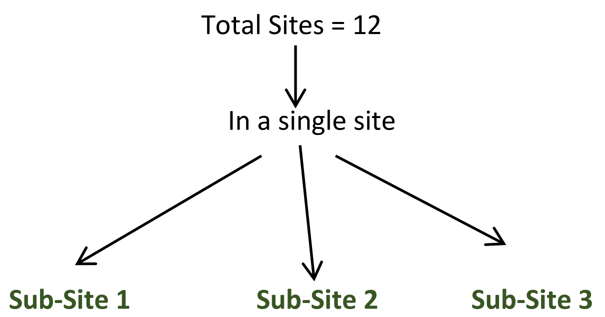
Herpetofauna, being reticent in nature utilize rock crevices, burrows, tree barks, litters and other objects for taking shelter. Active sampling exploit this behaviour and provide artificial shelter to these animals that they use for taking refuge. Surveyor can sample these animals without trapping them.

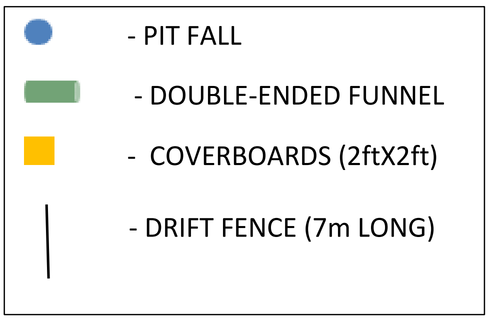
I have used this sampling method to increase the efficiency of sampling. Coverboards made of polythene sheets and Saal tree leaves of 2 X 2 ft dimensions are placed at a regular interval along the 100m distance between the trap arrays.

COVERBOARDS LAID IN SAMPLING AREA

DESIGN


Sub Site 1
11m X 11m
Sub Site 2
11m X 11m
20m
20m
20m
≥ 100m
20m
20m
≥ 100m
≥ 100m
11m X 11m
Sub Site 3


Total Sites = 12
In a single site
Sub-Site 1
Sub-Site 2
Sub-Site 3


- PIT FALL
- DOUBLE-ENDED FUNNEL
- COVERBOARDS (2ftX2ft)
- DRIFT FENCE (7m LONG)

TRANSECT WALKING

Sampling also involved transect walk for a distance of 250 m. Transect walking is performed by 3 persons walking in a straight line with 2 m distance between each other at a similar pace.

TRANSECT WALK

ACTIVE SEARCH

Another method that I applied for effective sampling is active search. Active searching is performed by 2 or 3 persons covering an area of 4.9 hectare in 3 consecutive days.

Active search was also performed in 10 X 10 m quadrats when trap installation was not possible.




A, B, D.-ACTIVE SEARCH FOR HERPETOFAUNA: C, E. ACTIVE SEARCH FOR A LIZARD: F. SEARCHING FOR SKINK.

OPPORTUNISTIC ENCOUNTER

Another method that we use is the opportunistic encounter of sample within the sampling area

TIME OF SAMPLING

Traps are installed in day 1 and is left open till day 4 morning i,e traps remain open for 3 nights.

V) PROCESSING SPECIMEN

Samples obtained from sampling were temporarily kept in Zip-lock pouches. Since we did not get the permission for capturing animals we took the SVL-length of the reptiles and amphibians and their body weight. We also did a photo documentation of the animals. We took a dorsal view a ventral and 2 lateral side profile photographs for later identification and for maintaining a photographic library of the specimens obtained.

To avoid recounting the same individuals we carried them in zip-lock pouches and released them approximately 10 km away from their site of capture in a suitable agricultural habitat with water bodies nearby to reduce any stress.

PICTURES OF SPECIMEN PROCESSING

A. MEASURING

B. WEIGHING

C.PHOTO-DOCUMENTATION

VI) VEGETATION DATA

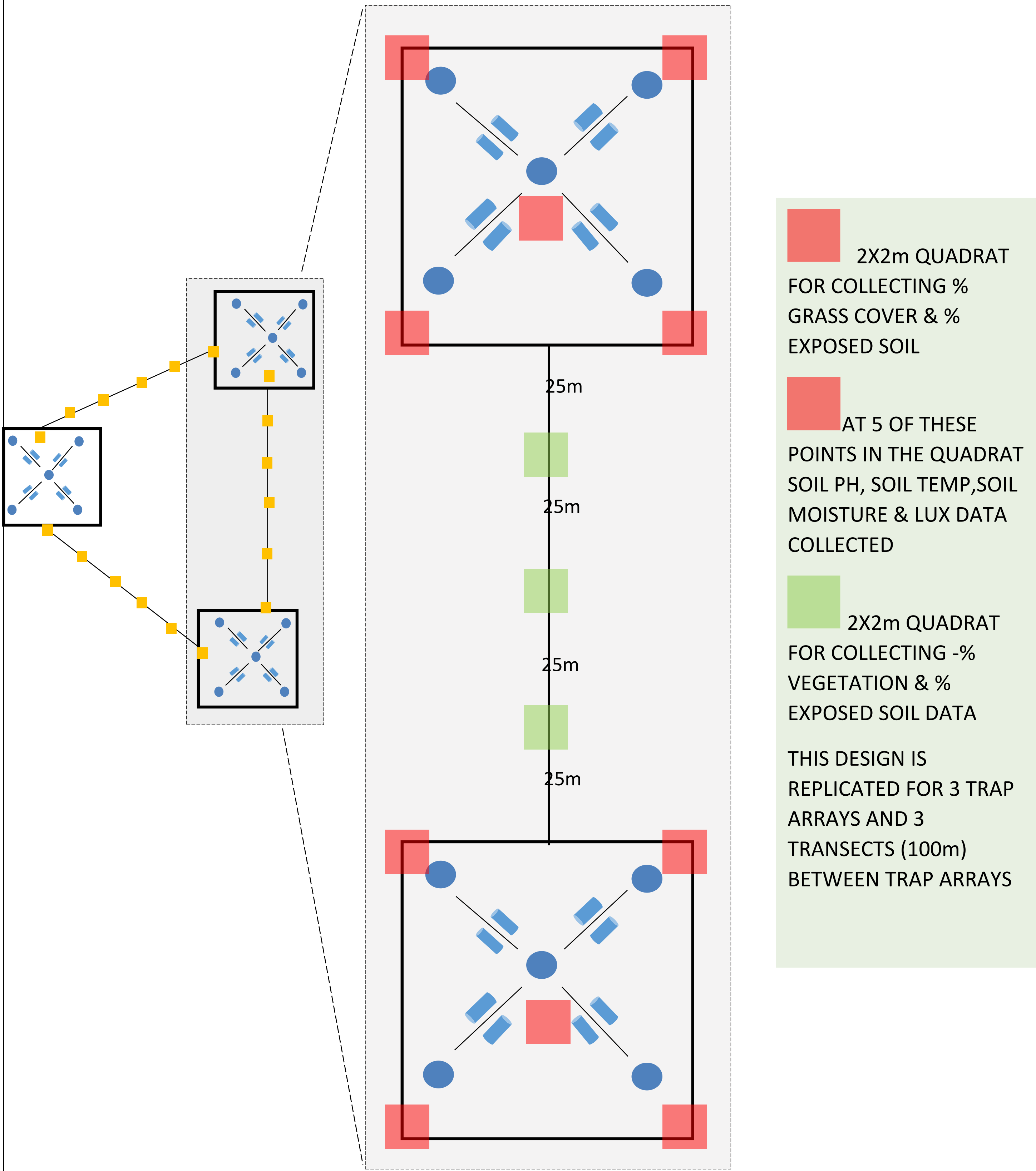
We collected the vegetation data around each trap array in 2 X 2 m quadrat at the end of each arm and at the centre. We took data for percent of bare ground and percent of grass. We also counted the numbers of any herbs present within the quadrat.

We also collected vegetation data in a 2 X 2 m quadrat along the 100 m distances within the trap arrays at an interval of 25m.

ENVIRONMENTAL DATA

We collected environmental data about pH, soil moisture, soil humidity and lux at the end of each arm and at the centre of the trap array.

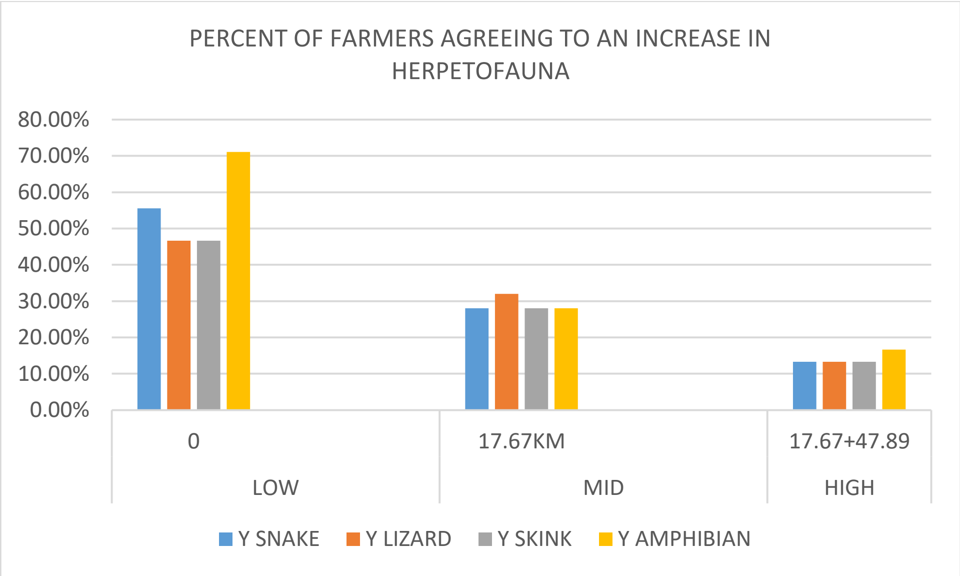
DIAGRAMMATIC REPRESENTATION OF VEGETATION AND ENVIRONMENTAL DATA COLLECTION



RESULTS

I) FARMERS' SURVEY PHASE I

I. HERPETOFAUNA STATUS OVER YEARS



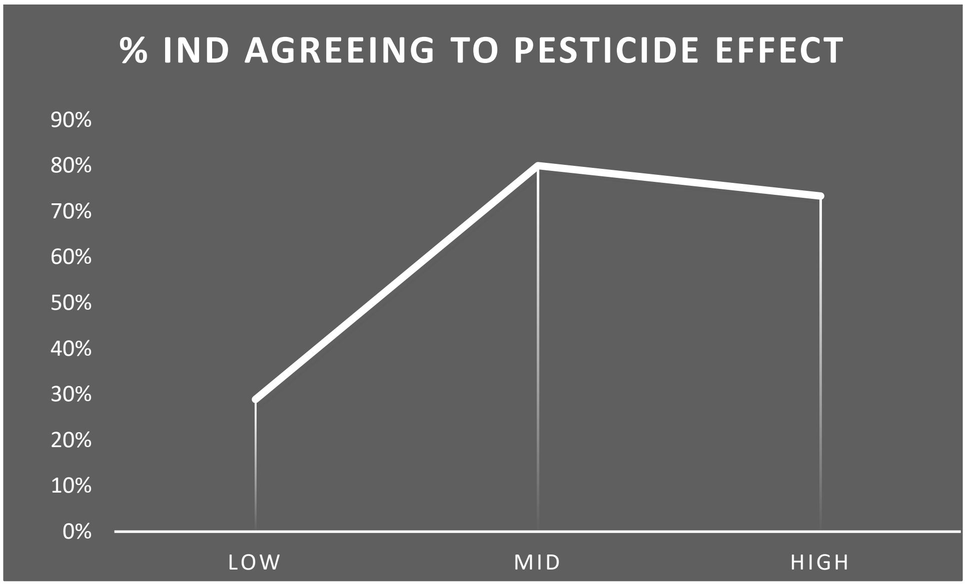
We investigated whether there is any change in herpetofauna over time. We asked the farmers of their opinion on whether there is any decrease or increase in herpetofauna in and around their fields. The graph shows a decrease in sighting of all the herpetofaunal groups from low to mid and finally to high.

Thus there is a clear decrease of herpetofaunal sighting over ages along the gradient which again could be a result of decrease in natural cover percentage and an increase in agricultural intensification.

II. IMPACT OF AGRICULTURAL INTENSIFICATION

We asked the farmers about their opinion of why there has been a decrease in herpetofauna over ages. The answers were mostly in 4 groups- 1. Due to deforestation 2. Due to climate changes and Environmental pollution 3. Due to killing and 4. Due to the effect of pesticide. As pesticide could be an indication for intensification if agriculture we selected pesticide for the further analysis. We plotted the percentage of people addressing pesticide across the gradient.

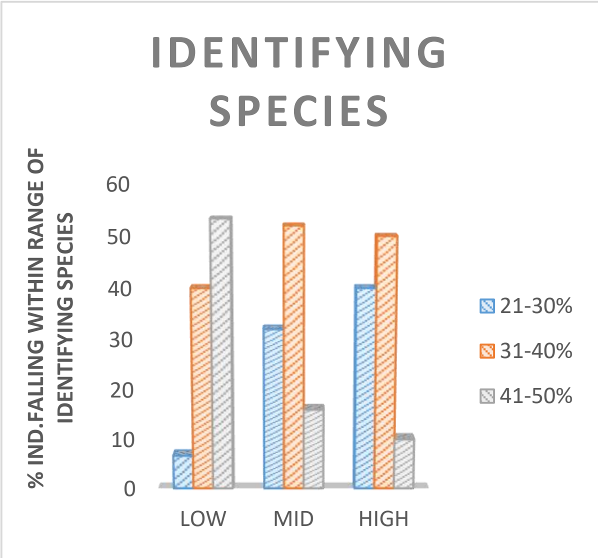
The result showed a clear indication of increase in agricultural intensification with respect to pesticide input.



III. <u>SPECIES IDENTIFYING ABILITY</u>

We wanted to investigate if there is any change in species availability across the gradient. Since there is a decrease in percentage of natural vegetation from low, mid and high and also an increase in agricultural intensification we hypothesised that there should be a decrease in species richness across the gradient.

We prepared a checklist of herpetofauna from the available field guides and emphasized specifically on those species that could be found in agricultural fields rather than in forests.

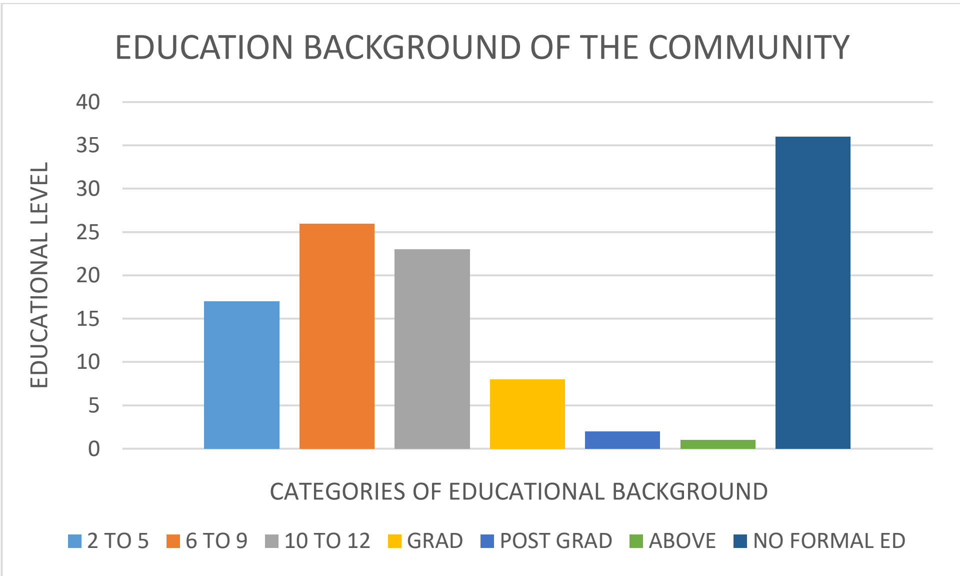


A sample of checklist is provided at the end of this report.

Farmers were also interviewed about which species of herpetofauna could they identify of having seen and divided the identification along 4 ranges- 1. Identifying 20-30 species, 2. Identifying 31-40, 3. Identifying from 41-52 species.

The results when plotted clearly indicate a significant decrease in percent of people identifying species in the high range along the gradient.

IV. STATUS OF FORMAL EDUCATION



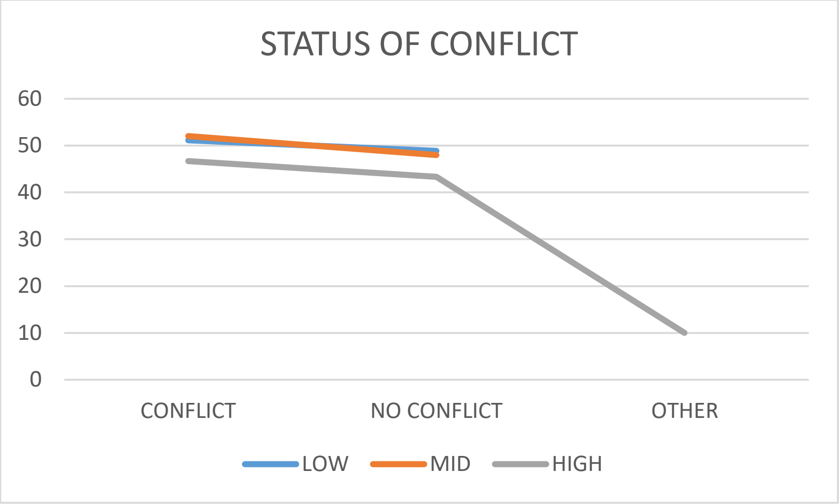
This identification abilities could be dependent on their educational background. To get a status of their educational qualification we plotted the number of individuals belonging to the specified levels of education.

As the graph shows, most of the farmers fall under “no formal education” category. This identification thus could depend more on the farming experience. But analyses of results indicate no effect of farming experience and thus this identification could be dependent only on the availability of species across gradient thus indicating the loss of habitat by deforestation, increase in agricultural intensification and also the status of conflict.

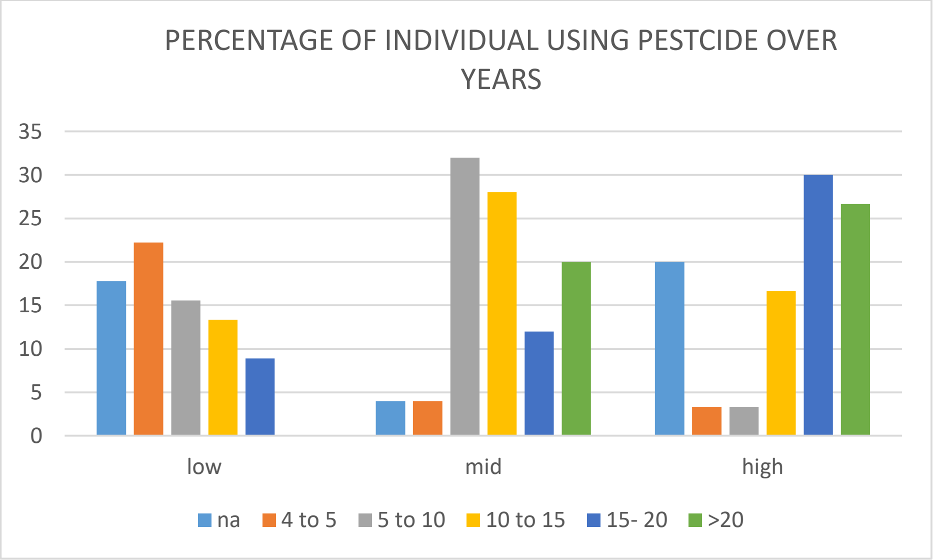
V. STATUS OF CONFLICT

We tried to evaluate how are herpetofauna threatened due to anthropogenic factors. We put up questions related to their reaction to a snake and ploted the percentage of people who would say 1. They would directly kill a snake at first sight irrespective of venomous or nonvenomous which we categorised as CONFLICT, 2. They would kill only those snakes who would harm or are venomous which e categorises a NO CONFLICT and 3. Where farmers would not answer the question or would talk about about money making by capturing and selling the animals.

The status of conflict is very similar when it comes to the low intensification and mid intensification zones whereas the status is slightly low for high intensification zones.



VI. <u>TIME SINCE PESTICIDE INPUT</u>



We tried to get an over view of the usage of pesticide across the area under repeated cultivation. We asked the individual farmers of the time period for which they have been using pesticide. We categorised the time period as 1. No application, 2. For 4-5 years, 3. For 5-10 years, 4. For 10-15 years, 5. For 15-20 years and 6. For more than 20 years.

We plotted the percentage of people from each intensification zone fitting in the assigned category. The graph clearly shows that usage of pesticide is quite new in low intensification zone where most of the farmers have started using pesticide 4 to 5 years ago and 185 of the farmers do not use it at all owing to the fertility of soil in the areas near forest. There is a gradual drop in pesticide usage with the increase in years in low intensification zone whereas in mid intensification area farmers using pesticide for 5-10 years, 10-15 years, 15-20 years and more than 20 years is high than in low intensification zones. Similarly in high intensification zone percentage of people using pesticide for 15-20 years and more than 20 years is high intensification zone.

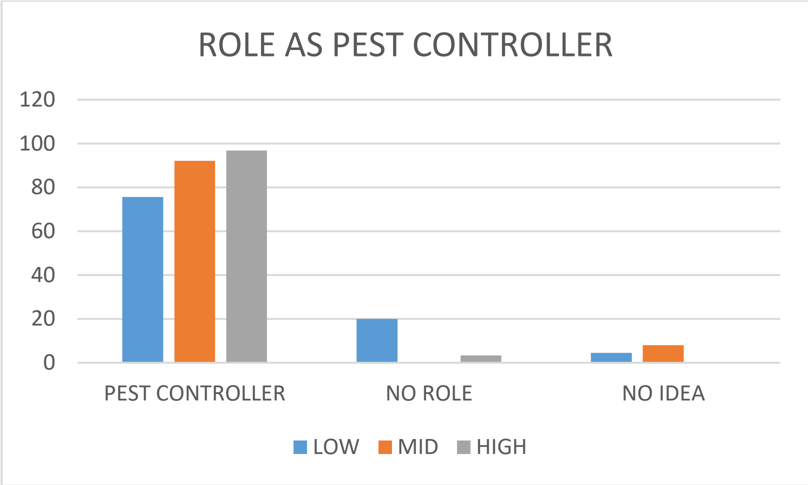
Thus the graph shows that pesticide usage is comparatively old and is being used for a longer period of time in mid and high intensification zones than in low intensification areas.

VII. HERPETOFAUNA AS PEST CONTROL AGENT

We tried to understand the knowledge base of the farmers regarding the utility of these animals in their agricultural field. This we did so that they get some informal information about their utility as this will help to pique their interest in these animals and they might be motivated to take active step in conserving them.

We plotted the percentage of farmers who would accept that herpetofauna help them by feeding on pests i,e they act as pest controller.

Results show that more percentage of farmers from high intensification zone acknowledge the utility of herpatofauna in their fields rather than mid and least percentage of farmers find herpetofaunal role in pest control in the low intensification zone.



II) PHASE II

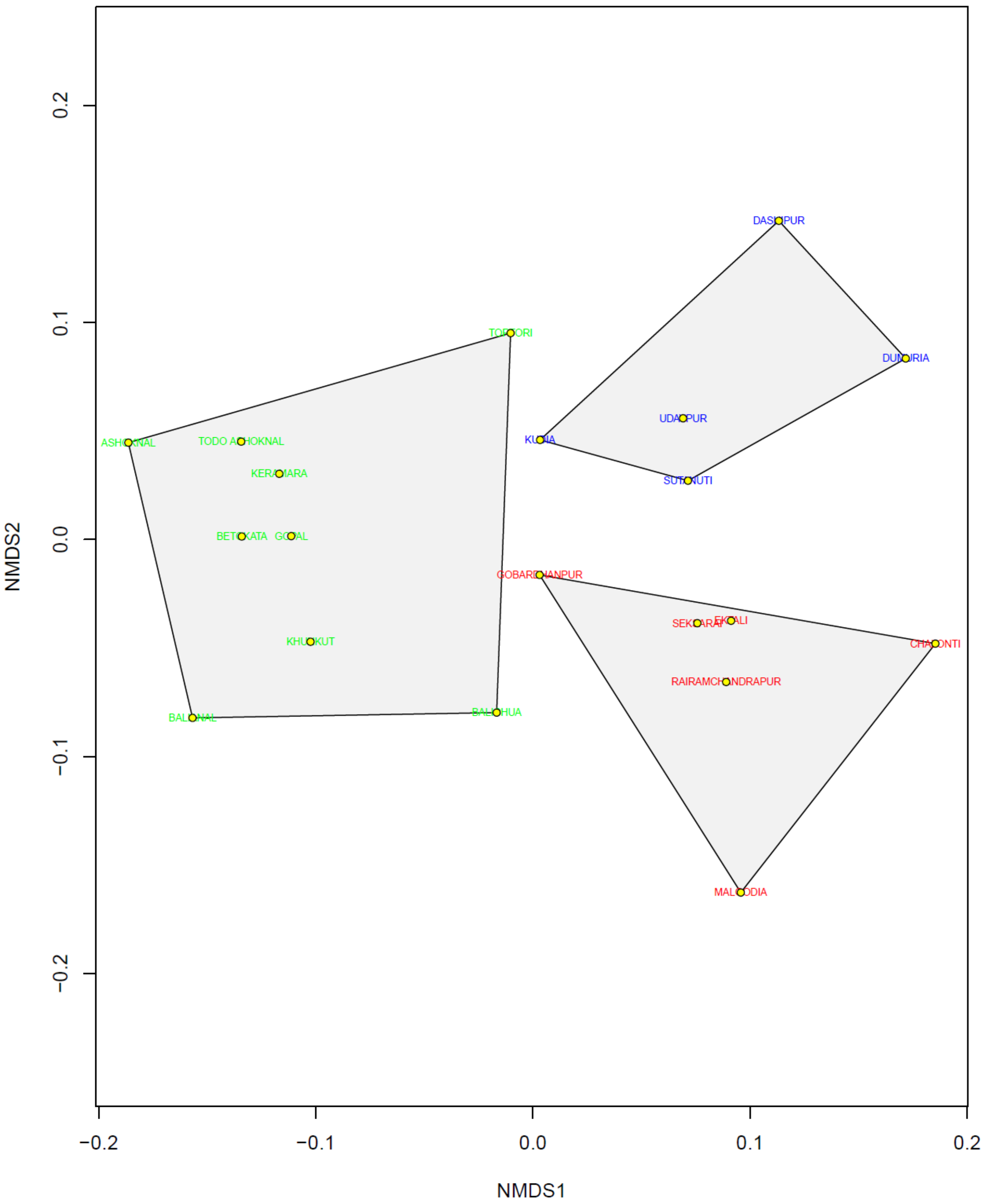
HOW CLOSE ARE THE COMMUNITIES ON THE BASIS OF THEIR REPORT ON SPECIES COMPOSITION DURING SURVEY

We performed an ANOSIM to compare sampling sites on the basis of species composition. We used presence/absence data that we got from our checklist and performed Jaccard similarity matrix. The results from the similarity matrix is plotted in an NMDS (Stress value=0.1059932**) to visualise the data.**

The results show three distinct cluster for low, mid and high intensification zones.

9 sites marked in green fall under the low intensification zone, 5 sites marked with blue indicate sites under mid intensification zone and the polygon with sites in red fall under high intensification zone.

This distinct clustering gives an indication of the similarity in habitat on the basis of species composition which could be used to design the nature of conservation strategies in these areas.


NMDS2
0.2
0.1
0.0
−0.1
−0.2
−0.2
−0.1
0.0
0.1
0.2
NMDS1

III) RESULTS FROM PRIMARY DATA

Sites

We could sample 11 sites instead of 12. The first 8 are considered low and the remaining 3 sites under high zone. The inequality in gradient selection is due to unforeseen problems of working in the field which led to reselection of the sites.

Sites under Low intensification

GUR 21° 24.279'N: 86° 43.307'E
GOB 21° 21.255'N: 86° 40.838'E
HATI 21° 23.875'N: 86° 40.226'E
VAL 21° 28.586'N: 86° 41.406'E
BUD 21° 28.321'N: 86° 38.034'E
JOD 21° 32.528'N: 86° 44.417'E
MAT 21° 33.675'N: 86° 42.893'E
KAK 21° 31.085'N: 86° 39.377'E

Sites under high intensification

SAN 21° 34.670'N: 86° 46.246'E
BAT 21° 33.679'N: 86° 49.903'E
MAN 21° 35.735'N: 86° 49.122'E

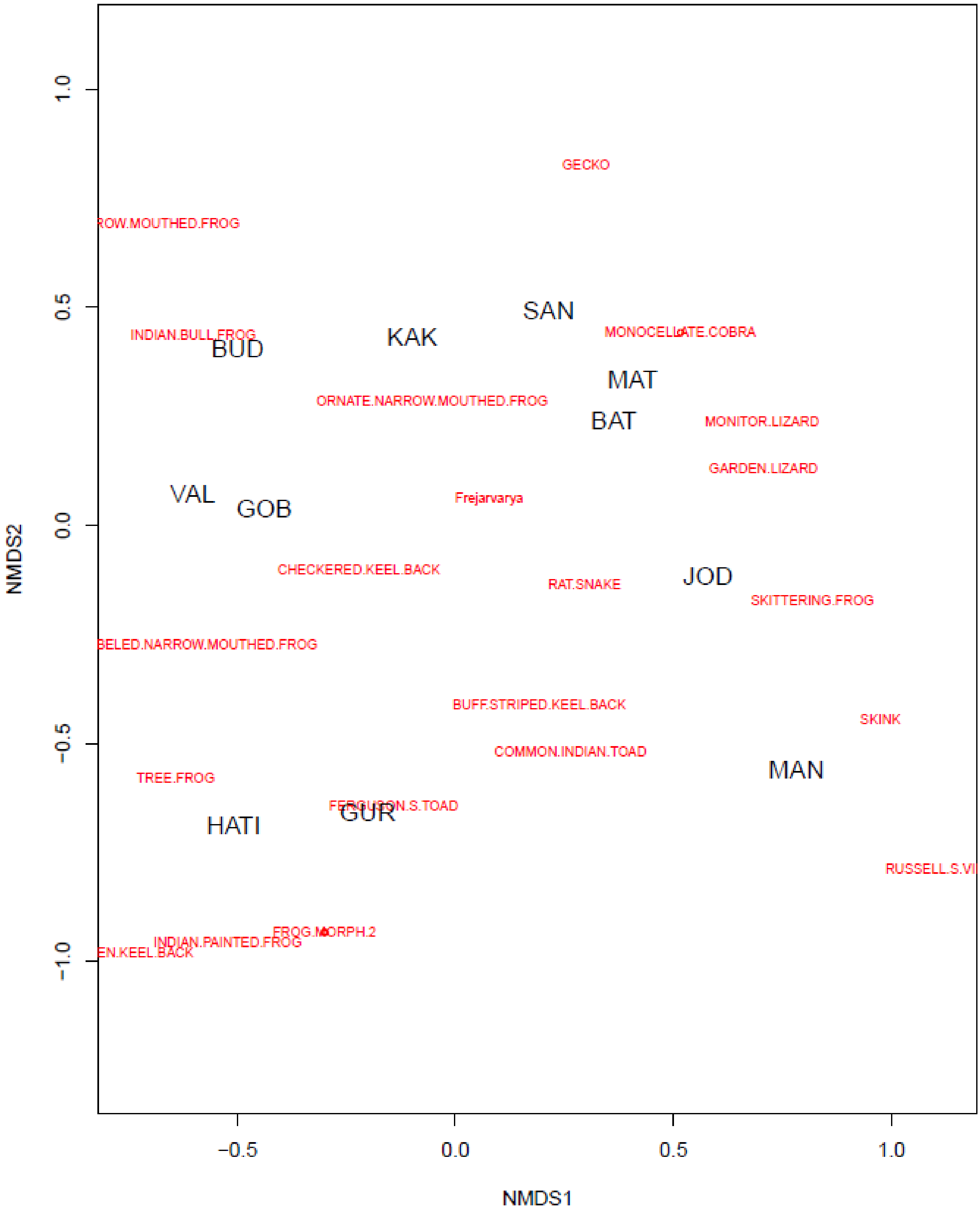
A) SPECIES LIST

SL NO.	AMPHIBIANS		FAMILY
1	COMMON INDIAN TOAD	*Duttaphrynus melanastictus*	Bufonidae
2	FERGUSON'S TOAD	*Duttaphrynus scaber*	Bufonidae
3	MARBLED NARROW-MOUTHED FROG	*Ramanella variegata*	Microhylidae
4	GREATER BALLOON FROG	*Uperodon globulosus*	Microhylidae
5	INDIAN PAINTED FROG	*Kalaula taprobanica*	Microhylidae
6	ORNATE NARROW-MOUTHED FROG	*Microhyla ornata*	Microhylidae
7	BURROWING FROG	*Sphaerotheca sp.1*	Dicroglossidae
8	FROG MORPHOSPECIES	*Sphaerotheca sp.2*	Dicroglossidae

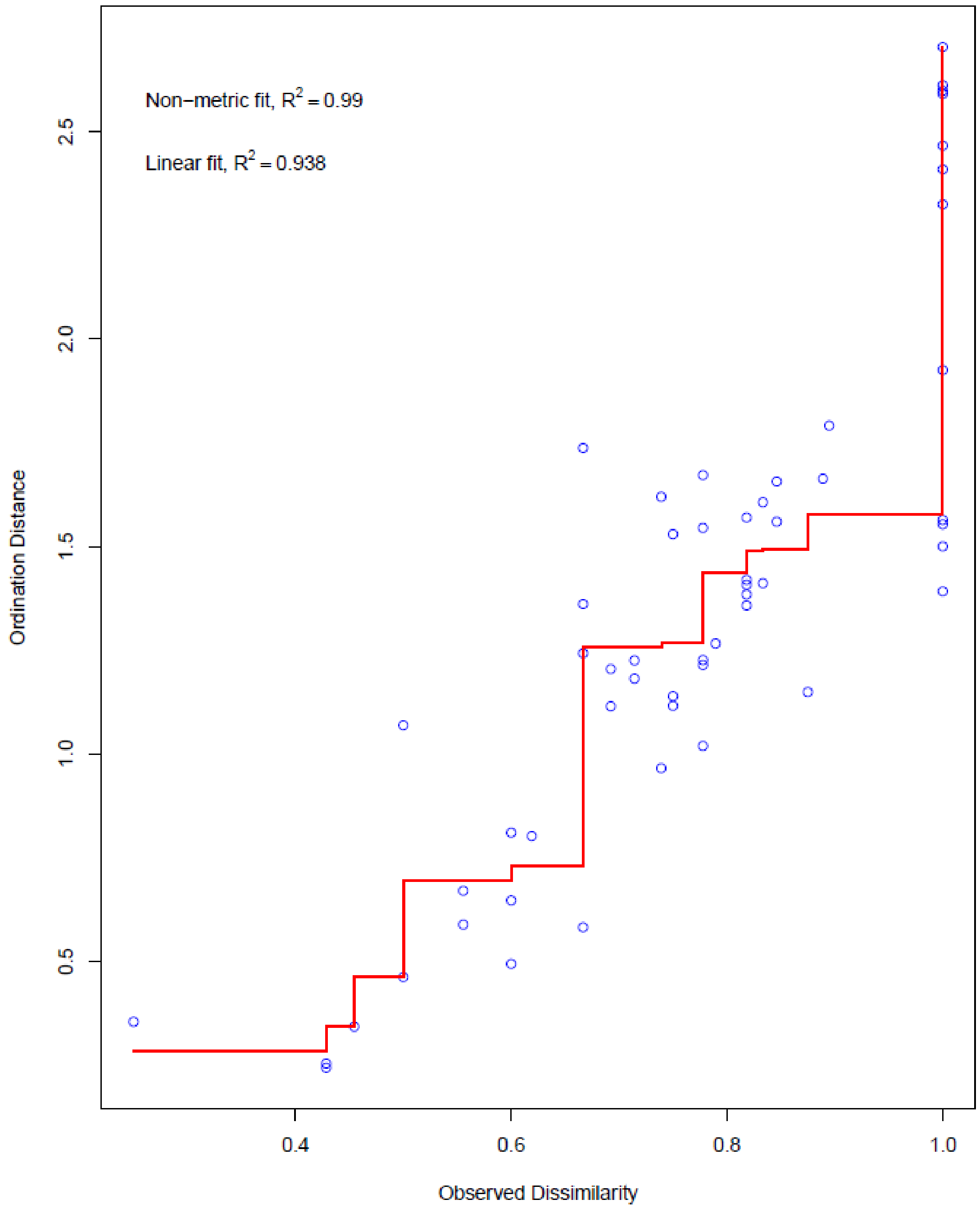
9	**TREE FROG**	***Polypedates maculatus***	**Rhcophoridae**
10	**INDIAN BULL FROG**	***Haplobatrachus tigerinus***	**Ranidae**
11	**WHITE STRIPED FROG**	***Rana taipehensis***	**Ranidae**
12	**SKIPPER FROG**	***Euphlyctis cyanophlyctis***	**Ranidae**
13	**Frejarvarya sp.**		**Ranidae**
14	**Frejarvarya 1**		**Ranidae**
15	**Frejarvarya 2**		**Ranidae**
16	**Frejarvarya 3**		**Ranidae**
17	**Frejarvarya 4**		**Ranidae**
18	**Frejarvarya 5**		**Ranidae**
19	**Frejarvarya 6**		**Ranidae**
20	**Frejarvarya 7**		**Ranidae**
21	**Frejarvarya 8**		**Ranidae**
22	**RED NARROW-MOUTHED FROG**	***Microhyla rubra***	**Microhylidae**

SL NO.	REPTILES		FAMILY
1	**GARDEN LIZARD**	***Calotes versicolor***	**Agamidae**
2	**SKINK**	***Eutropis macularia***	**Scincidae**
3	**GECKO**	***Hemidactylus flaviviridis***	**Gekkonidae**
4	**RAT SNAKE**	***Ptyas mucosa***	**Colubridae**
5	**CHECKERED KEEL BACK**	***Xenochropis piscator***	**Colubridae**
6	**BUFF-STRIPPED KEEL BACK**	***Amphiesma stolatum***	***Colubridae***
7	**GREEN KEEL BACK**	***Macropisthodon plumbicolor***	***Colubridae***
8	**MONOCELLATE COBRA**	***Naja kaouthia***	***Elapidae***
9	**SPECTACLED COBRA**	***Naja naja***	***Elapidae***
10	**RUSSELL'S VIPER**	***Daboia russelii***	***Viperidae***
11	**MONITOR LIZARD**	***Varanus salvator***	***Varanidae***

B) We tried to plot the sampling data to get an overview of the result by using Jaccard similarity index and then plotting the result in an NMDS.

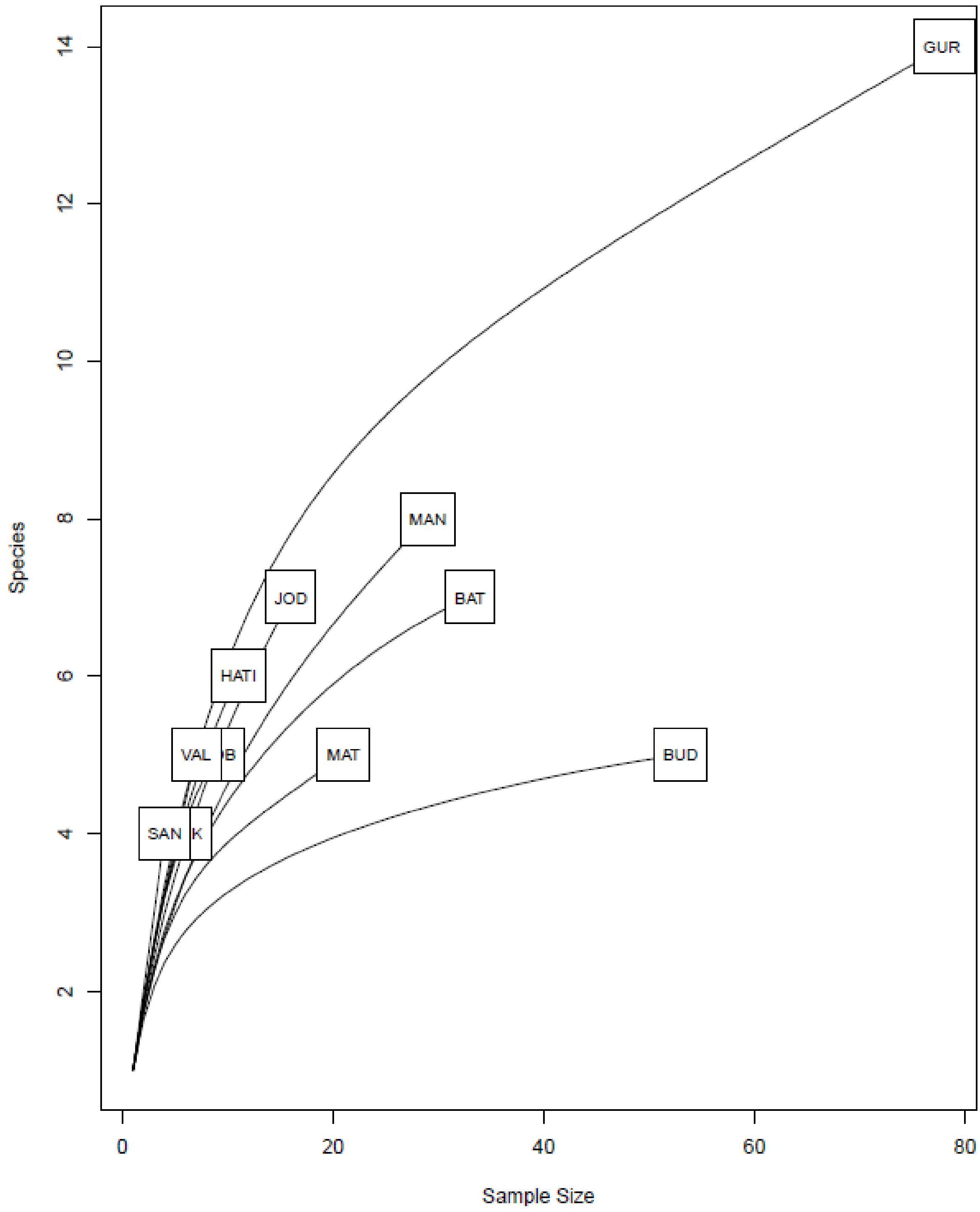


Stress plot



The plot gives a stress value of 0.0466418 which is a very good representation of the data.

C) RAREFACTION



We plotted a rarefaction curve to show how species availability changes with sample size for 11 of the sites.

CONCLUSION

Our work has made fairly good progress in the tenure that we have proposed from March 2016 to March 2017. Yet the work needs more time before any strong conclusion can be reached. We are planning to continue this sampling for the last 12^{th} site and then proceed with the next part of the project in the coming year.

There has been some unforeseen situations because of which we could do only 11 sites, 8 under low intensification zone and 3 under high intensification zone.

We were not allowed to sample in August, November and December as it was time for sowing and growth phases of paddy respectively. All information provided in this report are preliminary and baseline data that need further work in future for designing any strong conservation policies involving the farmers of these areas.

SPECIMEN PHOTO

COMMON INDIAN TOAD

FERGUSON'S TOAD

MARBLED NARROW-MOUTHED FROG

GREATER BALLOON FROG

INDIAN PAINTED FROG

ORNATE NARROW-MOUTHED FROG

RED NARROW-MOUTHED FROG

BULL-FROG

COMMON TREE FROG

SKIPPER FROG

BURROWING FROG 1

Frog Morphospecies 2

WHITE-STRIPED FROG

Frejarvarya sp.

Frejarvarya sp.2

Frejarvarya sp. 3

Frejarvarya sp.4

Frejarvarya sp. 5

Frejarvarya sp. 6

Frejarvarya sp. 7

Frejarvarys sp. 8

Frejarvarya sp. 9

Frejarvarya sp. 10

Frejarvarya sp. 11

Frejarvarya sp. 12

Frejarvarys is a species complex. The identification is based on different morphological characters.

REPTLES

SPECTACLED COBRA

INDIAN RAT SNAKE

BUFF-STRIPED KEEL BACK

GREEN KEELBACK JUVENILE

CHECKERED KEEL BACK

RUSSELL'S VIPER

GARDEN LIZARD

COMMON BRONZE BACK GRASS SKINK

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Snakes
1. Worm Snake
2. Common Sand Boa
3. Red Sand Boa
4. Copper-Headed Trinket Snake
5. Common Trinket Snake
6. Indian Rat Snake
7. Banded Racer
8. Russell's Kukri Snake
9. Common Kukri Snake
10. Python
11. Russel's Viper
12. Chekered Keel Back
13. Striped Keel Back
14. Vine Snake
15. Brown Vine Snake
16. Common Wolfsnake
17. Common Bronze Back Tree Snake
18. Ornate Flying Snake
19. Monocellate Cobra
20. Spectakled Cobra
21. King Cobra
22. Common Krait
23. Banded Krait
24. Common Cat Snake
25. Forsten's Cat Snake
26. Green Keel Back
27. Bamboo Pit Viper
28. Saw Scaled Viper

Amphibians
32. Common Indian Toad
33. Common Tree Frog
34. Indian Bull Frog
35. Indian Bull Frog (Variant)
36. Indin Skippping Frog
37. Pierre's Cricket Frog
38. Hylarana Taipehensis
39. Paddy Field Frog
40. Balloon Frog
41. Indian Painted Frog

Lizards
42. Indian Garden Lizard
43. Spotted Flying Lizard
44. Brook's House Gecko
45. Flat-Tailed Gecko
46. Clouded Ground Gecko
47. South Indian Rock Agama
48. Chaemeleon
49. Water Monitor Salvator
50. Bengal Monitor
51. Tortoise
52. Turtle*

Skinks
29. Bronze Grass Skink
30. White-Spotted Supple Skink
31. Spotted Litter Skink

SAMPLE OF CHECKLIST

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