

## C4b: Philosophy of Science and Natural Science Methods

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**Instructors:** Priyadarsanan (Course Coordinator: [priyan@atree.org](mailto:priyan@atree.org)), Aravind Madhyasta, Soubadra Devy, T. Ganesh and R. Ganesan.

**Credits :** 2 credits (32 hours)

**Day:** Wednesdays

### Course description

The first part of this course is designed to familiarize students with the history, evolution and philosophy of science. Students will also be exposed to the formulation of concepts, developing methods and analysis. Each student is expected to write a couple of papers in which they will create their own philosophical arguments to provide a clear and consistent defence on a topic of their interest and its ethical considerations.

The second part of the course is intended to acquaint students with the basic methods commonly employed by natural scientists. The course will begin with lectures on the theoretical concepts underpinning each type of sampling, when to use what followed by a 10 day field component. The course is expected to build the capacity of students to develop design & implement research projects in ecology. The students will develop small research projects, implement in the field and write a paper and present their findings with a clear hypothesis, rationale, sampling design, methodology, analysis, results and conclusion which is of publishing standard.

### Theory

Module No.	Topic	Date	Time	Instructor
1	History Philosophy of Science			
	i) Science, Non- science and nonsense: Defining truth, reality and Science.	13 <sup>th</sup> Jan	11:00 – 11:50	PD
	ii) History and Evolution of Scientific thought: How man invents the Science	20 <sup>th</sup> Jan	11:00 – 11:50	PD
	iii) History and Evolution of Scientific thought: How Science shapes the man	10 <sup>th</sup> Feb	11:00 – 11:50	PD
	iv) The Components of Science	17 <sup>th</sup> Feb	11:00 – 11:50	PD
	v) The epistemology of Science	24 <sup>th</sup> Feb	11:00 – 11:50	PD
	vi) On being a Scientist: the ethical considerations & engaging public	2 <sup>nd</sup> March	11:00 – 11:50	PD
2	Doing ecology in field	9 <sup>th</sup> March	11:00 – 11:50	TG
3	Theory of sampling/Design - I	16 <sup>th</sup> March	11:00 – 11:50	SD
4		23 <sup>rd</sup> March	11:00 – 11:50	SD
5	Sampling population (2 hours)	30 <sup>th</sup> March	11:00 – 12:50	AM
6	Curation of species and data	6 <sup>th</sup> April	11:00 – 11:50	AM
7	Geography for ecology and conservation ( 2 hours)	13 <sup>th</sup> April	11:00 – 12:50	AM
8	Big data and data mining ( 2 hours)	20 <sup>th</sup> April	11:00 – 12:50	AM
9	Social-natural Science integration	27 <sup>th</sup> April	11:00 – 11:50	SD

## Practicing Ecology

Module No.	Topic	Date	Time	Instructor
10	Longterm monitoring	9 <sup>th</sup> March	2:00 – 2:50	RG
	Plot and plotless methods	16 <sup>th</sup> March	2:00 – 2:50	RG
	Migratory birds	23 <sup>rd</sup> March	2:00 – 2:50	TG
	Introduction to insects	30 <sup>th</sup> March	2:00 – 2:50	PD
	Plant-animal interaction	6 <sup>th</sup> April	2:00 – 2:50	SD

Note - PD: Priyadarsanan Dharma Rajan, SD: Soubadra Devy, AM: Aravind Madhyasta, RG: R Ganesan, TG: T Ganesh

## Field course at KMTR

Day	Topic
Day 1	Natural History Day
	Mapping
Day 2	Demo- Field techniques (Camera traps, tress, invertebrates, vertebrates)
Day 3	Canopy climbing
Day 4	Develop problem (Question, hypothesis, methods)
Day 5	Field data collection
Day 6	Field data collection
Day 7	Field data collection
Day 8	Field data collection
Day 9	Analysis
Day 10	Analysis and Presentation

## Assessment

Sl No.	Assessment	Marks
1	Philosophy –(Assignments)	25
2	Mapping and field notes	25
3	Manuscript based on field exercise	40
4	Class participation	10

## Suggested Reading:

### Philosophy of Science

Briggle, Adam and Carl Mitcham. 2012. Ethics and Science: An Introduction (Cambridge Applied Ethics) Cambridge University Press.

Chalmers, A. F. (1999), What is This Thing Called Science? 4th ed. Open University Press.

Forster, Malcolm R. (2000) Hard Problems In The Philosophy of Science: Idealization And Commensurability. In R. Nola and H. Sankey (eds.) After Popper, Kuhn & Feyerabend: Issues in Theories of Scientific Method.

Hitchcock, Christopher (Ed.) 2003. Contemporary Debates in Philosophy of Science Wiley-Blackwell.

IEEE Policy Statement on Self-Plagiarism

([http://www.comsoc.org/pubs/jrnal/transcom/Self\\_Plagiarism.pdf](http://www.comsoc.org/pubs/jrnal/transcom/Self_Plagiarism.pdf))

Kuhn, T. (1998), The Structure of Scientific Revolutions, 3rd Ed., University of Chicago Press.

Ladyman, James (2002): Understanding Philosophy of Science, Routledge.  
National Academy Of Sciences, 1995. "On Being a Scientist: Responsible Conduct in Research";  
National Academy Press, Wash. D.C, 2009 (<http://www.nap.edu/catalog/12192.html> ).  
Resnik, David B. 1998. The Ethics of Science ; An Introduction Pub. Routledge  
Turney Jon (Ed) ENGAGING SCIENCE : Thoughts, deeds, analysis and action. Wellcome  
Trust. [www.wellcome.ac.uk/stellent/groups/corporatesite/.../wtx033010.pdf](http://www.wellcome.ac.uk/stellent/groups/corporatesite/.../wtx033010.pdf)  
Weinberg, Steven (2015) To Explain the World: The Discovery of Modern Science. HarperCollins  
Publishers.

### **Research Methods**

Alpizar-Jara, R. (2006), Advanced Distance Sampling: Estimating Abundance of Biological  
Populations Edited by S. T. Buckland, D. R. Anderson, K. P. Burnham, J. L. Laake, D. L.  
Borchers, and L. Thomas. Biometrics, 62: 940–941. doi: 10.1111/j.1541-  
0420.2006.00588\_1.x

MacKenzie  
Buckland ST, Anderson DR, Burnham KP et al (eds) Advanced distance sampling. Oxford  
University, Oxford

Karban, R., and Huntzinger, M. (2006) How to Do Ecology: A Concise Handbook. Princeton, NJ:  
Princeton University Press

Krebs Charles J. ,1998, Ecological methodology Pub. Benjamin Cummings.

MacKenzie Darry, James Nichols, J. Royle, Kenneth Pollock, Leslie Bailey and James Hines  
Occupancy Estimation and Modeling: Inferring Patterns and Dynamics of Species  
Occurrence, ELSIVIER.

Michael Joseph Ryan,2001. Anuran Communication, Smithsonian Institution Press

Morrison, M. L., Marcot, B. G., & Mannan, R. W. (1998). Wildlife-habitat relationships: concepts  
and applications. Island Press.

Ruxton, G.D. and Colegrave, N. 2003. Experimental design for the life sciences.  
Southwood T. R. E. , Peter A. Henderson 1998. Ecological Methods, 3rd Edition  
Wiley-Blackwell