IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	**Climate resilience of ecosystem networks**	
Project Number	**IMURA1153**	
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IITB Department:	Climate Studies	

Research Clusters:

Research Themes:

Highlight which of the Academy's CLUSTERS this project will address? *(Please nominate JUST **one.** For more information, see www.iitbmonash.org)*		**Highlight which of the Academy's Theme(s) this project will address?** *(Feel free to nominate more than one. For more information, see www.iitbmonash.org)*	
1	*Material Science/Engineering (including Nano, Metallurgy)*	***1***	*Artificial Intelligence and Advanced Computational Modelling*
2	*Energy, Green Chem, Chemistry, Catalysis, Reaction Eng*	2	*Circular Economy*
3	*Math, CFD, Modelling, Manufacturing*	3	*Clean Energy*
4	*CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control*	4	*Health Sciences*
5	*Earth Sciences and Civil Engineering (Geo, Water, Climate)*	5	*Smart Materials*
6	*Bio, Stem Cells, Bio Chem, Pharma, Food*	6	*Sustainable Societies*
7	*Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng*	7	*Infrastructure*
8	*HSS, Design, Management*		

The research problem

Global warming has resulted in an increase in climate extremes, which includes meteorological drought, wildfire, floods and other shocks. Human activities also introduce new shocks by moving species around the world, including pests, pathogens, invasive animals and invasive plants. These shocks have significant impacts on terrestrial vegetation and the pollinators that both depend on them for resources, and provide them with the capability to reproduce by distributing pollen. Cascading effects from shocks can result in a reduction in vegetation productivity, loss of species viability in their current range, loss of reproductive stability, and a host of other impacts. Not all impacts of all climate shocks are negative for all species however. Some shocks can favour some species, for instance invasive species can occupy expanded ranges and may outcompete native species. In general, it is unclear how a particular shock impacts the vegetation and pollinators of an ecosystem and how these species may recover after the extreme event. Such understanding needs analysis of vegetation / plant / pollinator ecosystem networks that considers also their meteorological components. Understanding such processes also helps to derive the trajectory of terrestrial ecosystems in a changing climate under warming and Carbon fertilization. The dynamics of ecosystem and pollinator networks and interactions with meteorological factors can be analyzed and visualized by complex networks and network models. The project proposes to develop such a complex network model of vegetation and pollinator ecosystems to understand its behavior during climate shock and recovery periods. This will be a test bed to explore different hypotheses associated with carbon fertilization, the relative role of soil moisture & vapor pressure deficit, and limits of adaptability for plant - pollinator networks, especially by reference to the existence of their tipping points.

Project aims

The aims of the project are:

1. *Development of complex network to understand ecosystem climate and pollinator interactions*
2. *The dynamics of the network of graph under climate shock and recovery*
3. *Understand possible adaptation strategies of vegetation and insect pollinators*
4. *Explore the limits of adaptability of vegetation and pollinators to climate change*

What is expected of the student when at IITB and when at Monash?

The student will develop expertise in ecohydroclimatology during his/her stay at IITB and in ecosystem and plant-pollinator networks during his/ her stay at Monash University.

Expected outcomes

The expected outcome is to reveal the unclear processes of ecosystem and plant-pollinator climate interactions and their dynamics under stress.

How will the project address the Goals of the above Themes?

The project with use data science and is directly related to Sustainability

Potential RPCs from IITB and Monash

From IITB: Prof. Subhankar Karmakar

Capabilities and Degrees Required

Masters in Data Science/ Computer Science/ Ecology/ Water Resources

Interest and past engagement with the ecological applications of computer science highly recommended.

Necessary Courses

We will decide after looking at the expertise and background of selected student.

Potential Collaborators

Collaborator: Prof. Anshuman Modak

Select up to **(4)** keywords from the Academy's approved keyword list **(available at http://www.iitbmonash.org/becoming-a-research-supervisor/)** relating to this project to make it easier for the students to apply.

Climate, Sustainability, Ecosystem, Resilience