# IPM Innovation Lab Workplan

## Project title

**Biodiversity and climate change**

## PI

Madhav Marathe

## CO PIs

## Collaborating Institutions

University of Virginia, Biocomplexity Institute and Initiative, Charlottesville, VA, USA

Tribhuvan University, Nepal

## Objective 1

## Title

Development of deep learning framework for species distribution from remote sensed data

#### Activity 1

* **Title** Procuring high-resolution images
* **PIs** Abhijin Adiga, Pramod Jha, Krishna Poudel
* **Site/Location** BII
* **Status**
  + Continuing
* **Description**

Areas of interests and periods of interest have been identified. With help from IPMIL, vendors of Digital Globe data have been contacted and quotes have been obtained for images.

* **Expected outcomes**
  + Images will be procured

#### Activity 2

* **Title** Modeling framework development
* **PIs** Abhijin Adiga, Aniruddha Adiga, Madhav Marathe
* **Site/Location** NSSAC, BII, UVA
* **Status**
  + Continuing
* **Description** 
  + Development of a machine-learning (deep-learning)-based classification/ detection of invasive plant species using remote-sensing data. In this training-based scheme, the classification rules are learnt by the algorithm by viewing multilpe remote-sensing images of expert annotated invasive species incidence locations. This classifier, once learnt, is then deployed over the regions-of-interest to obtain a prediction map of the invasive species. In this scheme, we consider one classifier per invasive plant species. One of the main challenges in this work is data limited in both spatial coverage and variability. To a large extent we have addressed these issues by employing techniques used in traditional image classification techniques.

* **Expected outcomes**
  + **Prediction maps for unseen regions.**
  + Code will be documented.

## Objective 2

### Title

## Understanding spatiotemporal dynamics of invasive species spread

#### Activity 1

* **Title** Creation and analysis of species distribution maps
* **PIs** Abhijin Adiga, Aniruddha Adiga, Madhav Marathe, Srinivasan Venkatramanan
* **Site/Location** NSSAC, Biocomplexity Institute and Initiative, UVA
* **Status**
  + continuing
* **Description** 
  + Based on the classifiers described in Activity 2, we intend to obtain prediction maps for a given region over time to determine the time-evolution of the invasive species in the region. One of the main challenges in this activity, in additon to limited spatial data, is the lack of sufficient temporal samples. We intend to make meaningful predictions on evolution of the spread from the undersampled data by using models that consider exogenous variables such as climatic conditions (mean temperature, humidity, etc.), geographic parameters (elevation, slope, etc), people mobility, etc..
* **Expected outcomes**
  + Analysis will be documented.
  + Manuscript will be submitted to a suitable venue.

## Graduate and undergraduate students sponsored by the project

* Ethan Choo, USA, Under graduate student, Department of Computer Science, UVA, 06/01/19 to present, 100% funding, advisor(s) Abhijin Adiga, Assessing threat of *T. absoluta* in South-east Asia.

## Short term training planned

Workshop in India.

## Publications planned

### Article

* Mapping Invasive Plants in a Biodiversity Hotspot Using Remote Sensing Data. Aniruddha Adiga, Ethan Choo, Madhav Marathe, Srinivasan Venkatraman, Pramod Jha, Krishna Poudel, Sandeep Dhakal, Bharat Babu Shreshta, Rangaswamy Muniappan, and Abhijin Adiga.
* Spatiotemporal dynamics of invasive plants using multi-year remote sensing data. Authors TBD.

### Book chapter

None

### Poster

1

### Conference Abstracts

1

### Technical bulletin

None

### Extension bulletin

None

### Other

None