



In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy **Sechindra Vallury**

Will defend his prospectus

Institutions for Provision of Shared Infrastructure: Insights from Irrigation Systems in India

Abstract

The world is filled with cases of complex social-ecological systems (SES) in which resources are actively shared, managed, and used to support livelihoods of rural populations. In these systems, humans access the resources through physical infrastructures. Examples of such infrastructures include canals, boats, etc. Many challenging problems we face in modern societies concern the provision (or maintenance) of shared physical infrastructures.

The broad research question motivating my research is: how do formal and informal institutions affect the provision of shared infrastructures in SESs facing environmental risks? In my dissertation, I present three studies that examine dilemmas integral to the provision of shared irrigation infrastructure in India.

The first study examines how the presence of different technologies may result in decline of shared infrastructure in farmer-managed irrigation systems in South India. Using a replicator dynamic model, I examine whether formal institutions (such as Pigouvian taxes) may avoid underprovision of shared tanks (surface reservoirs) in irrigation systems with private groundwater pumps. The second study examines the effect of informal institutions (such as caste-based inequalities) on evolution of governance regimes in a canal irrigation system. Using an evolutionary game theoretic model, I examine the conditions under which different political regimes will persist and facilitate provision of shared canals in the Kuhl irrigation systems in North India. The third study examines how political factors affect provision of shared infrastructure in irrigation systems. Using a two-stage game theoretic model, I examine how bureaucratic and political corruption affects maintenance of canals in a government-managed irrigation system in South India.

The mathematical models I develop to operationalize my research are based on case-study data and fieldwork. Though predominantly based on the empirical work of

sociologists, my models capture the fundamental dynamics of natural resources and the provisioning challenges associated with decisions of individuals, thus making them useful tools for informing irrigation policies beyond the specific case study contexts. These models can also generate testable hypotheses for future empirical research.

Wednesday, April 18, 2018

9:00 a.m.

WGHL 481

Faculty, students, and the public are invited.

Supervisory Committee:

Dr. John M Anderies (Co-chair)

Dr. Joshua K Abbott (Co-chair)

Dr. Bryan Leonard (Member)

Dr. Hallie C Eakin (Member)