Geophysical Research Abstracts
Vol. 18, EGU2016-10852-1, 2016
EGU General Assembly 2016

Sustainability of socio-hydro system with changing value and preference to an uncertain future climate and economic conditions.

Mahendran Roobavannan (1), Jaya Kandasamy (1), Saravanamuththu Vigneswaran (1), Murugesu Sivapalan (2,3)

(1) University of Technology Sydney, School of civil and environmental engineering, NSW, Australia (roobavannan@yahoo.com), (2) Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, Urbana IL 61801, USA, (3) Department of Geography and Geographic Information Science, University of Illinois at Urbana-Champaign, Champaign IL 61820, USA

Water-human systems are coupled and display co-evolutionary dynamics influenced by society's values and preference. This has been observed in the Murrumbidgee basin, Australia where water usage initially focused on agriculture production and until mid-1990's favoured agriculture. This turned around as society became more concerned about the degradation of ecosystems and ultimately water was reallocated back towards the environment. This new water management adversely impacted the agriculture sector and created economic stress in the basin. The basin communities were able to transform and cope with water allocation favouring the environment through sectoral transformation facilitated by movement of capital in a free economy, supported by appropriate strategies and funding. This was helped by the adaptive capacity of people through reemployment in other economic sectors of the basin economy, unemployment for a period of time and migration out of the basin, and crop diversification. This study looks to the future and focuses on how water managers could be informed and prepare for un-foreseen issues coming out of societies changing values and preferences and emerging as different systems in the basin interact with each other at different times and speed. The issues of this type that concern the Murray Darling Basin Authority include a renewed focus and priority on food production due to food scarcity; increased impact and frequency of natural disasters (eg. climate change); regional economic diversification due to the growth of peri-urban development in the basin; institutional capacity for water reform due to new political paradigms (eg. new water sharing plans); and improvement in science and technology (eg. farm practices, water efficiency, water reuse). To undertake this, the study uses a coupled socio-hydrological dynamical system that model the major drivers of changing economic conditions, society values and preference, climatic condition and science and technology. The dynamical system is represented by a suite of differential equations that can evolve with time. The mathematical property (Eigen values and vectors) of complex dynamical system is used to understand the system dynamics and look for signs of system collapse. Bifurcation analysis of the dynamical system defines the limits of different model parameters (safe zone) where system collapse is avoided and to maintain a sustainable society. The safe zone is interpreted in a manner that allows water managers to understand the possible ways of influencing the water-human system and understanding the consequences.
Keywords: socio-hydrology, value and preference, dynamical system modelling, water management.