Title: Identifying Alternative Indicators for the Detection of Abrupt Transitions in Ecosystems

Organizers: Emily Rivest: emily.rivest@lifesci.ucsb.edu;
Xueying (Shirley) Han: xhan@lifesci.ucsb.edu;
Samantha Davis: samantha.davis@lifesci.ucsb.edu

Goal: Our goal is to produce two manuscripts for publication in peer-reviewed journals, such as *Frontiers in Ecology and the Environment*. The first manuscript will be a data-driven case study using data from LTER site (Moorea Coral Reef, MCR) to address key issues that influence the detection of abrupt transitions in ecosystems, including the temporal and spatial scope of data sets. This manuscript will also employ a simulation model parameterized from MCR data (see below). The second manuscript will be a conceptual synthesis of ecosystem processes and transitions at LTER sites, providing general characterizations and a common framework for discussion across sites.

Any derived datasets resulting from our meeting will be archived and recorded in a timely fashion on both the nascent LTER Network Information System (NIS) and the Knowledge Network for Biocomplexity (KNB).

Participants: Our group contains participants from 6 different LTER sites, both terrestrial and marine.

Name of participant	Email	Affiliated LTER site	Rank
Julia Jones	jonesj@geo.oregonstate.edu	AND	Co-PI
Aaron Ellison	aellison@fas.harvard.edu	HFR	Faculty Associate
Nate Pierce	npierce@email.arizona.edu	JRN	PhD Student
Jill Thompson	jiom@ceh.ac.uk	LUQ	Faculty Associate
Emily Rivest	emily.rivest@lifesci.ucsb.edu	MCR	PhD Student
Samantha Davis	samantha.davis@lifesci.ucsb.edu	MCR	PhD Student
Xueying (Shirley) Han	xhan@lifesci.ucsb.edu	MCR	PhD Student
Amy Churchill	Amber.churchill@colorado.edu	NWT	PhD Student
Nick Fabina	nsfabina@ucdavis.edu	N/A	PhD Student
Brandon Bestelmeyer		JRN	

LTER Working Group Meeting #1: May 31- June 2, 2013

The first working group session was hosted by the Andrews Forest LTER (AND) at the Andrews Experimental Forest, Blue River, Oregon. The workshop began with a brief presentation reviewing our proposal and initial meeting at the LTER All Scientists Meeting in September 2012. The organizers (Rivest, Han, Davis) presented results of preliminary data analyses completed during winter and spring 2013. These preliminary analyses used statistical approaches from Bestelmeyer et al. 2011 to examine LTER data compiled from several sites to examine indicators of abrupt ecosystem transitions at these sites. Throughout the weekend, the results of these preliminary analyses were discussed,

and the group identified focal areas for future analyses as well as the manuscript products.

The principal outcomes of this workshop were outlines of two potential manuscripts (see above) relating to the original proposal. The group delegated tasks and developed rough deadlines for each manuscript (~Winter/Spring 2014). Participants also developed a questionnaire for LTER PIs to discuss ecosystem transitions at each site, and will begin compiling these results and developing a conceptual framework during Fall 2013.

LTER Working Group Meeting #2: July 19-24, 2013

A subset of participants (Rivest, Han, Fabina) met at the Hawaii Institute of Marine Biology for some targeted work for both manuscripts. The participants developed a size-structure population dynamics model of two competing coral species with a crown-of-thorns sea star (COTS) predator. They compiled trait and life history values from the literature, which they then used to parameterize the model. Subsequent simulations exposed the coral species to COTS outbreaks and determined how community indicators responded across a range of outbreak intensities. This model will be used to generate data sets for analysis of the utility of alternative indicators in the detection of ecosystem transitions as well as the sensitivity of such analyses to temporal and spatial characteristics of the data sets.

Following a trial survey deployment, a second version of the questionnaire was developed and finalized.

LTER Working Group Meeting #3 (informal): August 2013

Group members Han, Fabina, Bestelmeyer, and Ellison reviewed progress on the population dynamics model and determined that a ecosystem with alternative stable states would be best to analyze for alternative indicators (the working group goal) and that the coral-COTS interaction was not ideal for representing such a system. Therefore, following the recent literature, a new model was proposed. This coral-macroalgae model will be used to create two datasets that describe simulation output for percent cover of coral, macroalgae, turf algae, and free space. The first dataset will have linear responses and no alternative stable state, while the second will have hysteretic responses and alternative stable states. The two datasets will be used to examine ecosystem transitions regarding spatial and temporal variation as well as alternative indicators.