Jun 25th, 10:40 AM - 12:00 PM

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iEMSs International Congress on Environmental Modelling and Software

9th International Congress on Environmental Modelling and Software
Fort Collins, Colorado, USA, Mazdak Arabi, Olaf David, Jack Carlson, Daniel P. Ames (Eds.)
https://scholarsarchive.byu.edu/iemssconference/2018/

Is the crowd wise enough to capture systems complexities? An exploration of wisdom of crowds using Fuzzy Cognitive Maps.

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Abstract: Researchers in natural resource management can draw valuable insights from crowds not only by estimating the size and status of natural resources based on crowd-supplied observation data, but also by leveraging the crowd's own ability to directly estimate them. Under specific conditions, researchers can expect that crowds accurately estimate the resource size because over- and under-estimations will cancel each other out when estimates are aggregated statistically. This is known as the wisdom of crowds. However, such data-focused crowdsourcing projects constrain the participants to relatively short tasks that neither require nor encourage creativity or an understanding of a system's dynamics. Moreover, little is known about the wisdom of crowds effect when participants are asked to provide complex system descriptions rather than data points. This study aims to investigate the evidence of wisdom of crowds when the crowd is asked to provide an internal representation of a complex system described by a set of interdependent components. We collected the mental model of 267 participants from four groups (anglers, club managers, water managers, and experts), describing the dynamics of a fishery system as a Fuzzy Cognitive Map. We compared the mental models aggregated at the group levels in terms of cause-and-effect relationships and which socio-ecological concepts they viewed as important. We find that the crowd is more aligned with experts than with any of the individual groups in terms of the structure, the function, and the composition of maps. Finally, we discuss the broader implications of these findings for socio-environmental decision-making..

***Keywords**:* Crowdsourcing; complex systems; Fuzzy Cognitive Maps; sustainability decision-making.