Complementary network models to assess social-ecological fit: A case of flood planning in the Wolastoq

Keywords: Collaboration; Social-ecological fit; Flood Planning; Social network analysis; Exponential Random Graph Model

Extended Abstract

Decades of scholarship about environmental related decision-making have called for governance systems to be more responsive to complex adaptive social-ecological systems (1–3). Governance refers to the actions and interactions within the system of institutions, organizations, and networks involved with addressing social concerns and opportunities (4). Environmental governance literature has also emphasized the need for the decision-making systems to "fit" with the problems it is addressing to enhance performance (1,5). This involves aligning the structure and function of the governance systems to different dimensions of the focal problem , such as the biophysical characteristics of the environmental challenge (6) as well as the collective action problem (7).

Network methods allow insight into 1) the structure of the governance system, illuminating insights into governance function; 2) the fit to the biophysical challenge; and 3) fit to the collective action challenge. We demonstrate the utility of complementary network models to assess the social-ecological fit of a governance system through a case study of flood planning in the Walostoq River basin, Canada (8). We conceptualize the multilevel networks as involving a social network connecting organizations, an ecological network connecting spatially defined watershed areas, and a task network connecting interconnecting flood-planning activities. We analysed the system through three different multilevel models: an exponential random graph model, an auto-logistic actor attribute model, and a network autocorrelation model. Both overall effectiveness and task effectiveness were supported when organizations collaborated with another effective organization and on a shared task. Structures that supported task effectiveness differed when considering organizations that work in the same watershed areas versus connected watershed areas. The compilation of multiple statistical social network models in a focal system provides a broader understanding of how current collaboration matches the environmental issue and illustrates the complementary nature of different modelling procedures.

This research received ethics clearance from the Brock University Research Ethics Board. Given the potential for network diagrams to reveal sensitive power dynamics and hierarchical relationships, labelled network visualizations were restricted to an invite-only participant webinar. This approach balanced transparency by allowing participants to understand their network positions as well protection from potential reputational or relational harm. The research was conducted as a component of a transdisciplinary project specifically designed in partnership with environmental non-governmental organizations within the Wolastoq to address community-identified priorities. Research findings and project outcomes were disseminated back to the Wolastoq community through multiple accessible formats, including webinars, infographics, and presentations at local conferences.

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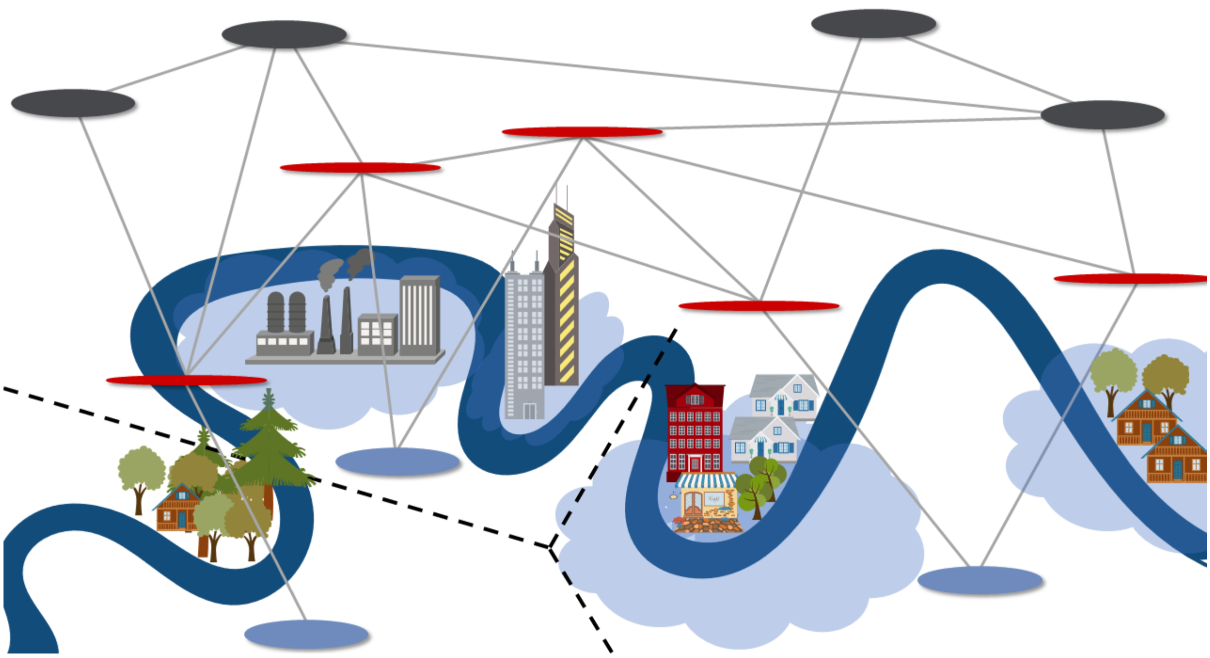

Figure 1. **Flood planning as networks.** A conceptualization of the flood planning system, where red nodes indicate organizations, blue nodes indicate watershed delineations, and grey nodes indicate flood planning tasks.