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AGROECOSYSTEM HEALTH IN THE GREAT LAKES BASIN : RELATIONSHIPS BETWEEN LIVESTOCK INTENSITY AND INDICATORS OF STREAM HEALTH AND FARM FINANCIAL HEALTH

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La recherche a pour but de décrire et de mesurer les associations entre l'intensité de l'élevage du bétail (densité de bestiaux, usage de fumier, aire des pâturages) et les indices de santé aquatique des petits cours d'eau (abondance relative de poissons et d'invertébrés, qualité de l'habitat), ainsi que l'effet des indices de santé fiscale de la ferme (revenu net, capitaux propres et le rapport du passif à l'actif) sur les associations décrites ci-dessus. Le tout se situe dans un cadre holisitique de santé d'agroécosystème, que l'on définit en termes d'intégrité (présence des parties nécessaires au fonctionnement du système) et d'efficacité (atteinte de buts prédéterminés, tels la pureté de l'eau, le rendement de l'investissement, l'esthétique, etc). Les sous-bassins hydrologiques de la région des Grands Lacs seront dessinés grâce à un système d'informations géographiques, et l'analyse sera à base de données de sources secondaires (recensement, surveillance écologique).

THE PROBLEM

Livestock agriculture is a major part of the Great Lakes Basin's rural economy. Since there are also major wildlife populations and urban settlements in the Basin, concerns have arisen about the sustainability of agriculture itself, and conflicts have arisen between those with competing goals for water and wildlife conservation. The conflict between agriculture and environment, traditionally witnessed at the scale of the farm, is often at an impasse. We suggest that a different perspective is required to find approaches to such conflicts. The following is a research proposal to describe and measure the relationships between the intensity of livestock production and indicators of stream health and farm financial health in the Great Lakes Basin using a holistic agroecosystem health framework.

AGROECOSYSTEM HEALTH FRAMEWORK

Agroecosystems are bounded ecological systems that are intentionally altered, often intensively managed, for the purposes of providing food, fiber and other agricultural commodities; hence they inherently have socio-economic, and biophysical dimensions, and they occur over a number of different time and spatial scales, in a nested hierarchy or holarchy. This study is using subwatersheds as the scale of interest. Agroecosystem health is measured by indicators of integrity (presence of all working parts) and effectiveness in achieving goals (maintenance of biodiversity, provision of clean water for other uses, recreation, aesthetic, etc). A hypothetical model is described in which livestock both contribute to and detract from agroecosystem health as reflected by indicators of stream health and farm financial health. More specifically, we model the effect of livestock intensity indicators on indicators of stream health, and the effect of farm financial indicators on the livestock-stream health associations.

INDICATORS

The health indicators used in this study are borrowed from aquatic biology and agricultural economics. Livestock intensity is measured by livestock species density, frequency and magnitude of manure use as fertilizer, and area in pasture. Stream health is measured by the relative abundance of fish and invertebrates, and the quality of riparian habitat. Farm financial health is measured by net income, farm equity and debt to assets ratio.

METHODS

Data are from secondary sources (federal census, provincial and state agencies). Livestock and financial data are aggregate in nature, but each subwatershed will have multiple stream health data. The data will be re-aggregated into subwatersheds and mapped using a geographic information system (GIS). The livestock-stream health associations, and the effects of farm financial indicators, will be analysed using multiple regression at the scales of the subwatershed, subwatershed nested within ecodistrict, and ecodistrict. GIS will be used to perform spatial analyses such as spatial heterogeneity. This analysis will be supplemented with statistical spatial analyses (e.g. Moran's I). Dynamic modeling methods will be applied to help identify key indicators for agricultural and environmental policy. The research will result in the development of informative models of the interactions between livestock, stream health and farm finances and contribute to our understanding of regional agroecosystems.

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