Reaction-diffusion equations, population and gender dynamics

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Reaction-diffusion models have been widely used to study fundamental questions in population dynamics. This type of partial differential equations provide a way to translate local assumptions regarding the movement, growth and interactions of the individuals of a species, into global features of the population giving us a theoretical framework for questions such as the persistence of a species, invasions, coexistence of competing populations. Different mathematical tools from nonlinear analysis and dynamical systems can be used to study the consequences of varying different population characteristics have in the long term dynamics.

In this talk we will study competitive reaction-diffusion systems of the form:

$$\begin{cases} \dfrac{\partial u}{\partial t} = Lu + u(m(x) - u - bv) \ \text{ in } \Omega,\ t > 0, \\ \dfrac{\partial u}{\partial t} = Mv + v(m(x) - cu - v) \ \text{ in } \Omega,\ t > 0, \\ \nabla \dfrac{u}{m} \cdot \hat{n} = \nabla v \cdot \hat{n} = 0 \ \text{ on } \partial\Omega,\ t > 0, \end{cases}$$

with u, v representing the densities of two competing populations in an isolated habitat Ω, $a(x)$ the space dependent per-capita growth rate, $b, c > 0$ accounting for competition coefficients, and L and M elliptic operators accounting for the dispersal strategies of each species. In particular, we will discuss how the relationship between population dispersal and competition affects the persistence, dispersal and coexistence of the species.

In this talk we will also explore some issues related to the persistence and dispersal of women in STEM in an environment where they account for less than 17% of the population. I will share how

we have been able to significantly grow and thrive through the formation and strengthening of networks and alliances. In particular, we will discuss the process that led to the creation of the Direction for Diversity and Gender, the first in a Faculty of Sciences, Math, and Engineering in Chile, which I currently lead.