

---

# The centre-periphery hypothesis: new insights from an old biogeographical paradigm

Guillaume Papuga<sup>\*1,2</sup>, Samuel Pironon<sup>3</sup>, Jesús Villellas<sup>4</sup>, Amy L. Angert<sup>5</sup>, María B. García<sup>3</sup>, and John D. Thompson<sup>2</sup>

<sup>1</sup>University of Sassari (UNISS) – via Piandanna, 4, 07100 Sassari, Italy

<sup>2</sup>Centre d'écologie fonctionnelle et évolutive (CEFE) – CNRS : UMR5175, Université Montpellier II - Sciences et techniques, Université Montpellier I, Université Paul Valéry - Montpellier III, École Pratique des Hautes Études [EPHE] – Campus CNRS - 1919 route de Mende - 34293 Montpellier cedex 5, France

<sup>3</sup>Instituto Pirenaico de Ecología (IPE) – Zaragoza, Spain

<sup>4</sup>Duke University Department of Biology – Box 90338, Durham, NC 27708-0338, United States

<sup>5</sup>University of British Columbia, Department of Botany (UBC) – Vancouver, British Columbia, Canada

## Abstract

The "centre-periphery hypothesis" (CPH) is a long-standing paradigm in ecology that states that genetic variation and demographic performance of a species decrease from the center to the periphery of its range. It is assumed that such results are associated with a decrease in environmental suitability towards peripheral populations. The CPH has stimulated much empirical investigation that has brought mixed support for its generality. Indeed, ecology and species history interact across the geographical range, and modify its predictions. In this presentation, we discuss the birth and development of the CPH, and provide the first global assessment of this hypothesis with a review of 248 empirical studies. A decrease in species occurrence toward their range limit was observed in 81% of the tests, while only 51% of tests dealing with the abundance of individuals provided support for the CPH. Studies of genetic diversity, differentiation and inbreeding, also provide support in roughly one out of two studies (47, 45 and 48%), while the analysis of demographic rates provided support for the hypothesis in only 30% of studies. We highlight the impact of important methodological, taxonomic, and biogeographical biases and show that geographical and ecological marginality gradients are not systematically concordant, which calls into question a major underlying tenet of the CPH. Finally, we illustrate why and how variation in demographic performance is better explained by ecological marginality gradients than geographic gradients, and how contemporary and historical factors act conjointly on the spatial organization of genetic variation across the range of a species.

**Keywords:** centre periphery hypothesis, abundant center model, ecological marginality, demography, species distribution, rear leading edge, genetic diversity, range limits

---

\*Speaker