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Gene drives and the consequences of over-suppression

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Suppression gene drives (SGDs) spread a deleterious genetic cargo through a population by biasing their own inheritance. This technology offers a promising solution to the burden posed by crop pests and vectors of important human diseases. Presently, theoretical and experimental studies favor SGD constructs that quickly eradicate a population. If drive killing occurs faster than drive spreading, however, the target species can be locally eradicated. In the presence of migration from a non-controlled region, local eradication risks the re-invasion of wild-type immigrants, consequently undermining or even reversing suppression efforts. How might we balance drive lethality with target population permanence in the presence of bidirectional migration? In this work, we seek to answer this question for select SGDs. We use a patch-based model to account for heterogeneity in population density across a landscape. Bidirectional migration is considered between a target and non-target population. SGD performance is studied as migration levels vary, and we seek to establish under what conditions the drive persists in a suppressed target population while remaining robust to migration.