

Using a systematic grid of pheromone traps for the early detection of the Pine Wood Nematode in new infested areas

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***Monochamus galloprovincialis*, insect vector of the PWN**



ORIGINAL CONTRIBUTION

Combining pheromone and kairomones for effective trapping of the pine sawyer beetle *Monochamus galloprovincialis*

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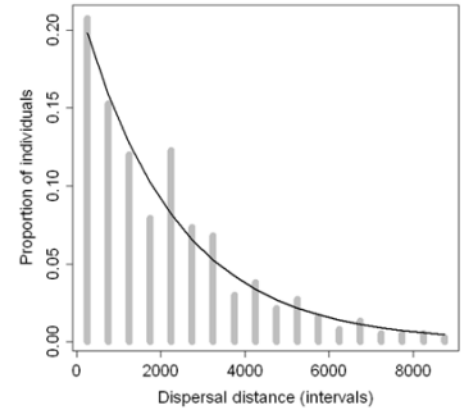


Individual based-model to simulate insect vector dispersal

- beetles are aged from 1 to 120 days (life expectancy)
- beetles are immature until 20 days
- the daily probability of flying is 0.45
- each day they can change the direction and distance of flight
- the flight distance is taken randomly within a kernel distribution (mean daily flight 2 km)
- the direction of flight is taken randomly within a uniform distribution

- after 12 days of starvation (within CCZ) they die
- they fly every second day (or feed)

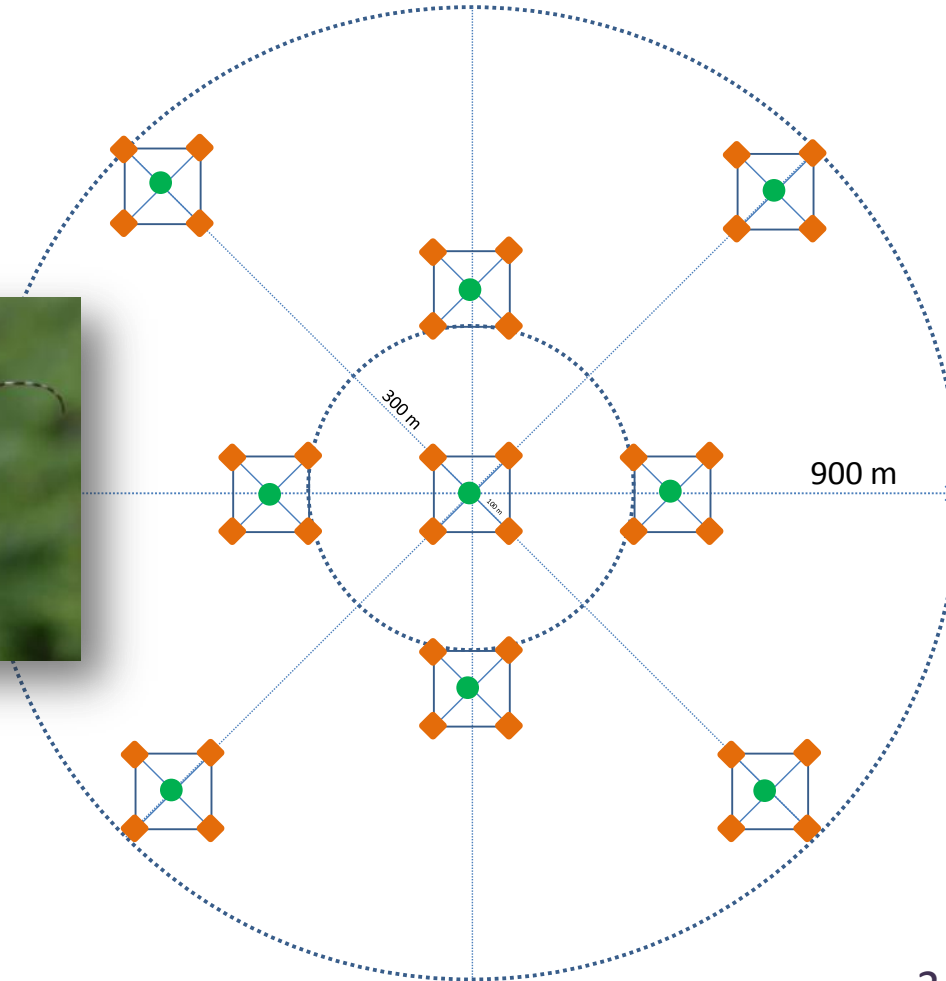
- Simulations were made in a theoretical landscape of non fragmented maritime pine plantations



Calibration of the model to simulate insect vector dispersal

Mark-Release-Recapture

- ◆ Trap
- Release point

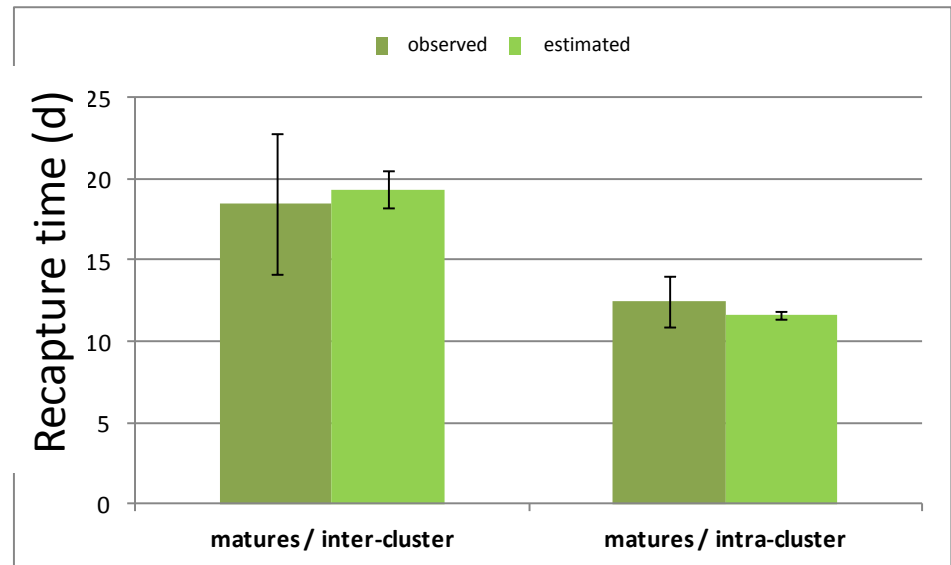
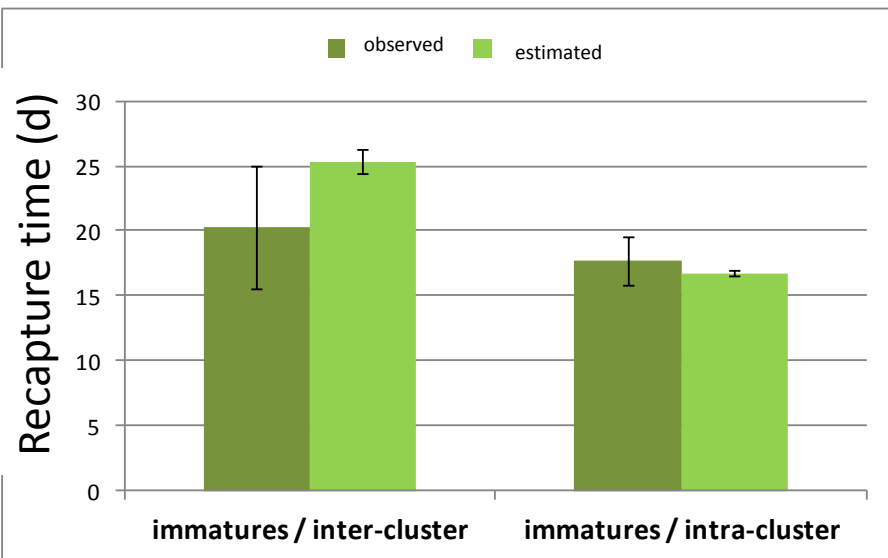
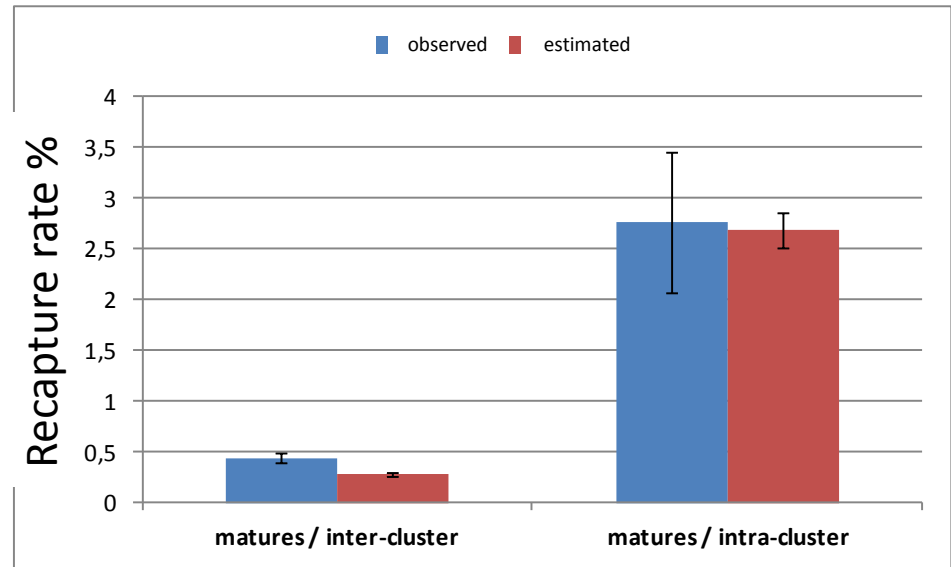
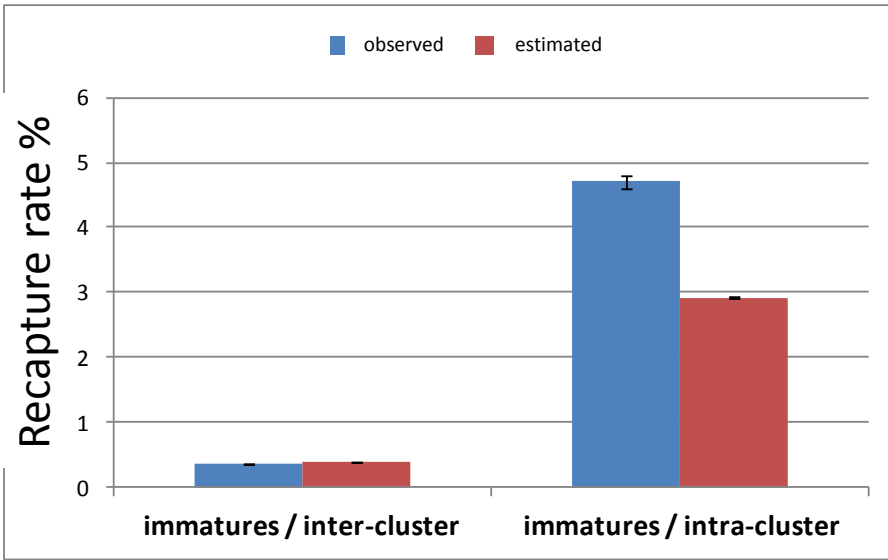


36 pheromone traps



- 2 MRR experiments:
- 500 immature beetles
 - 3000 mature beetles

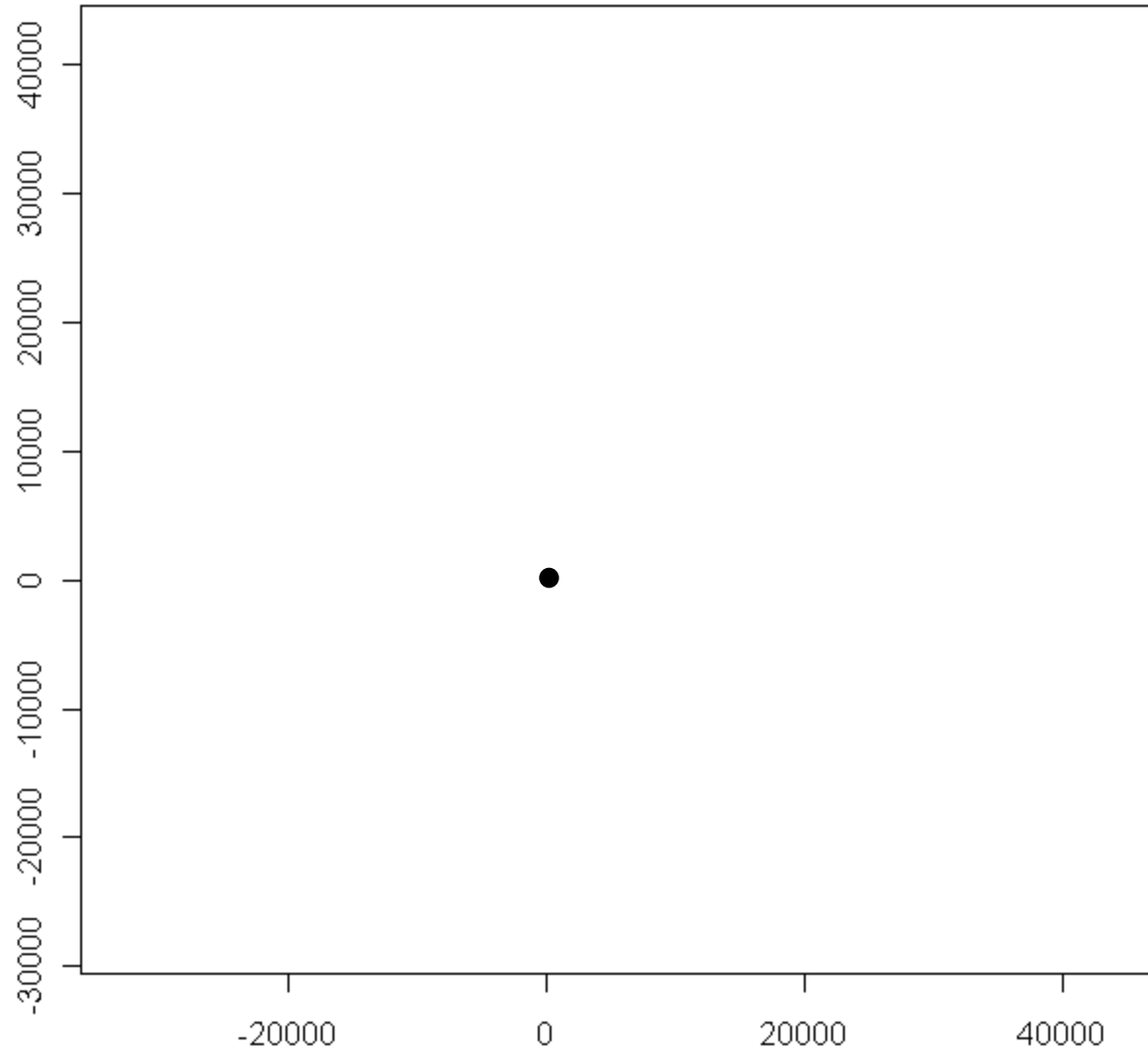
Calibration of the model to simulate insect vector dispersal



Stochastic dispersal simulation

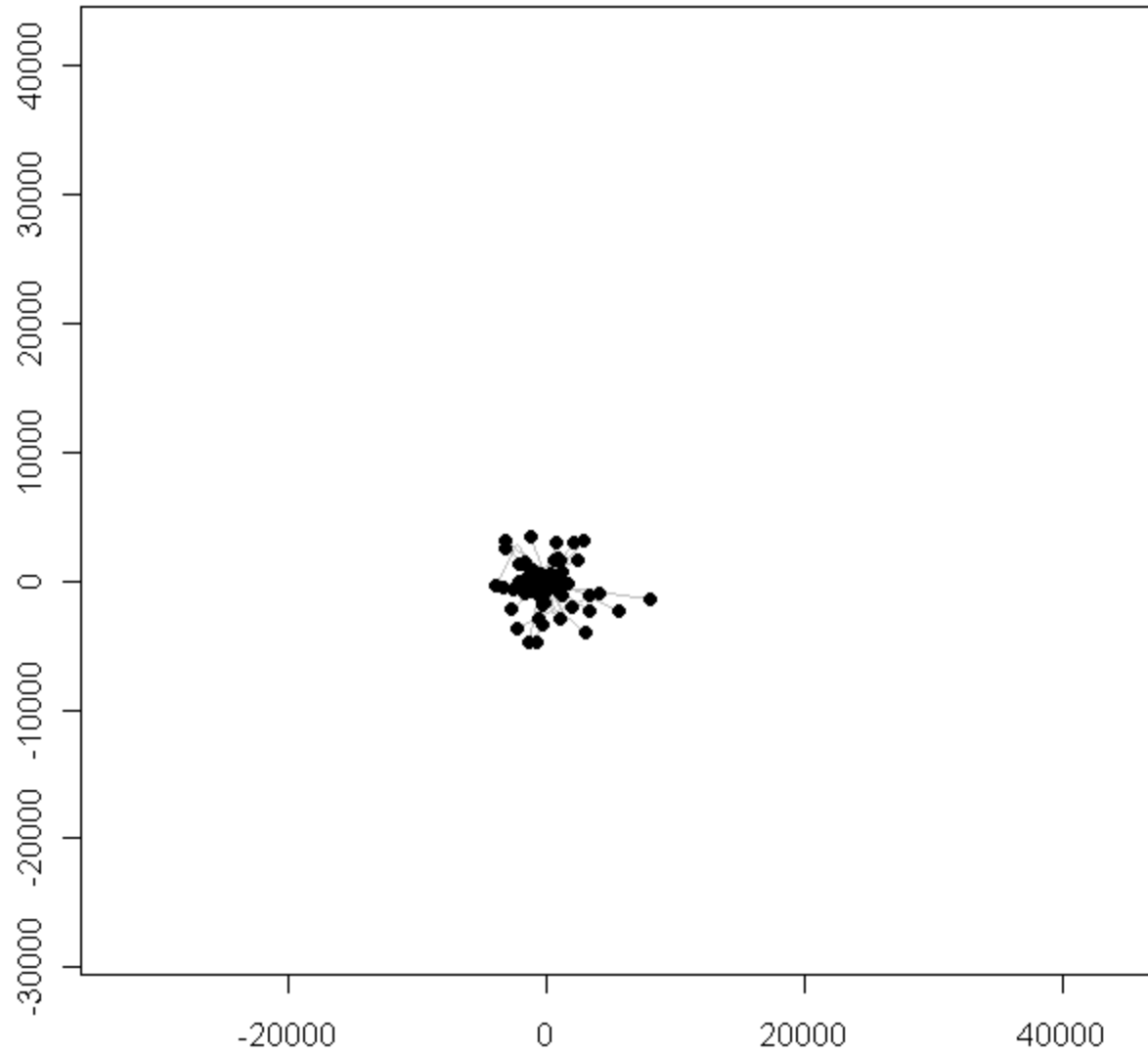
Day 0

- insect
- trajectory



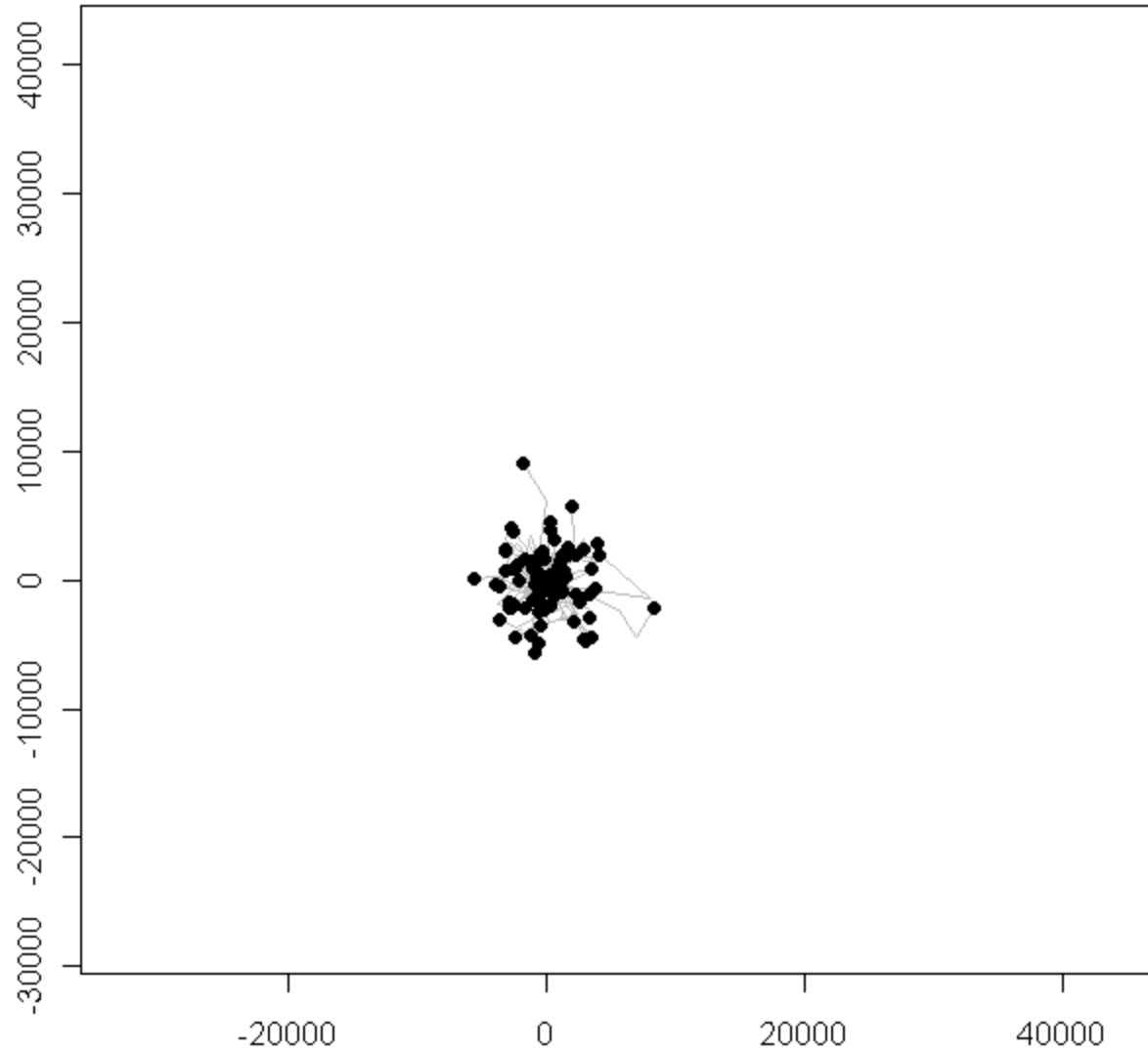
Stochastic dispersal simulation

Day 2



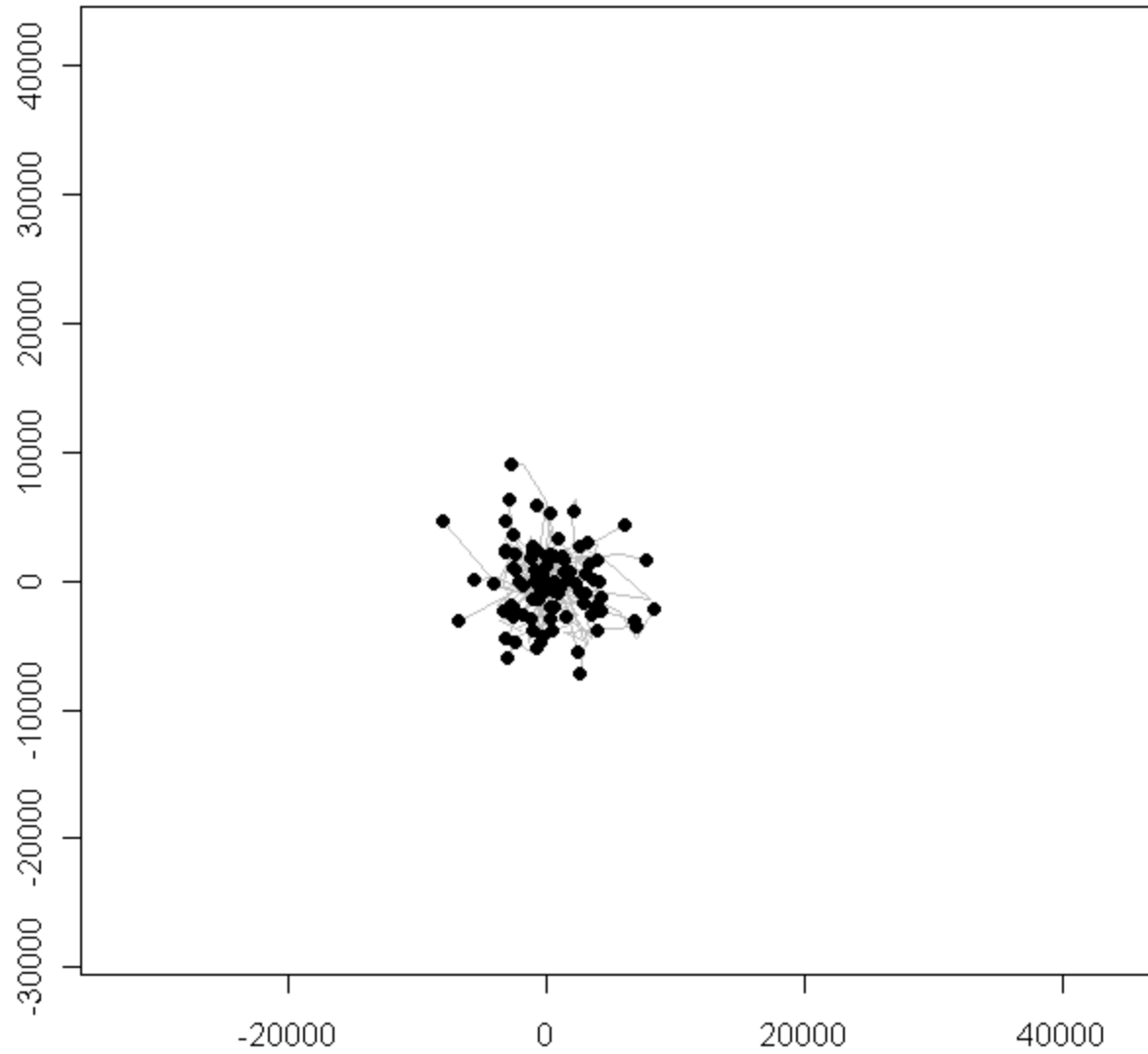
Stochastic dispersal simulation

Day 4



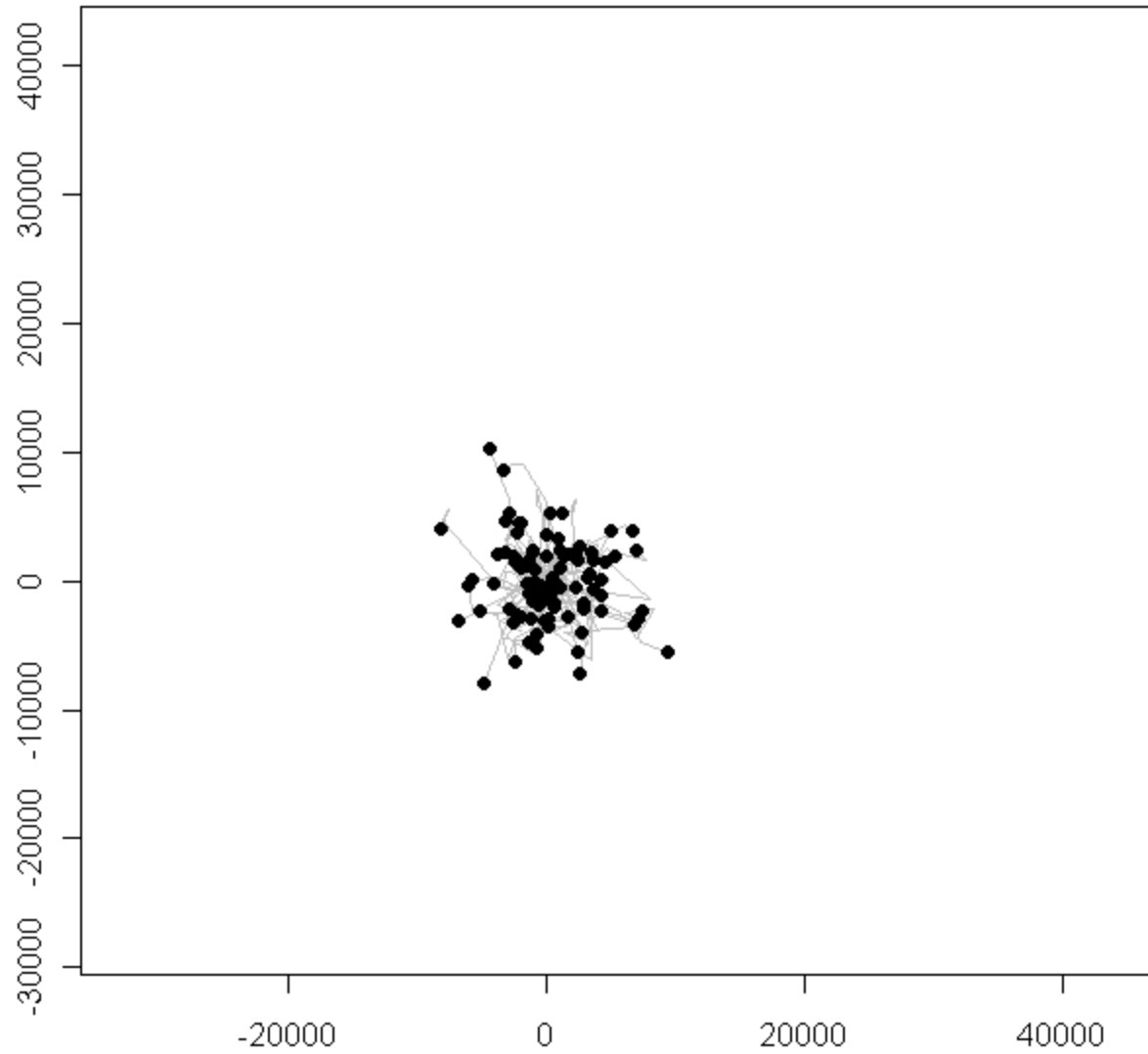
Stochastic dispersal simulation

Day 6



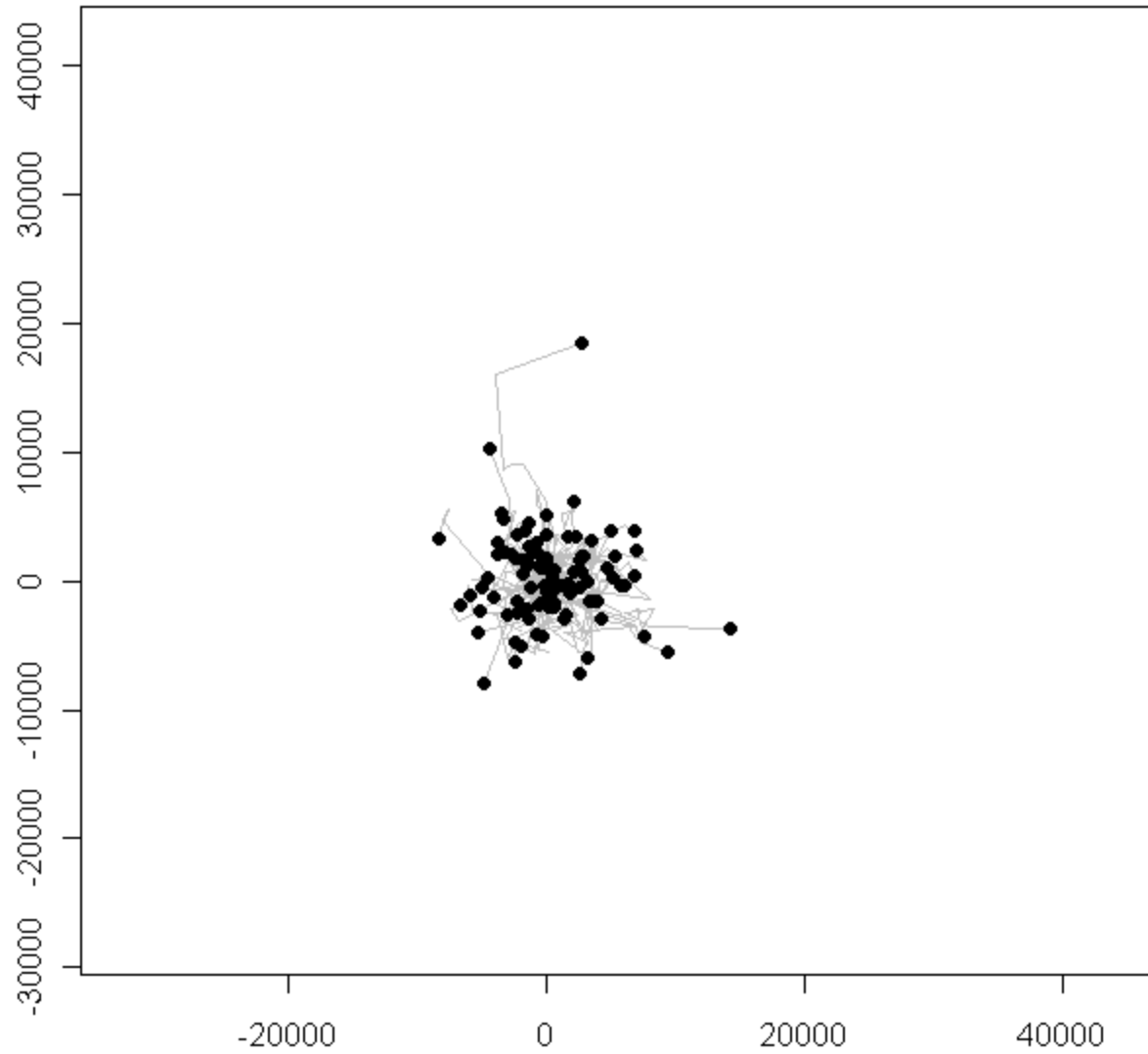
Stochastic dispersal simulation

Day 8



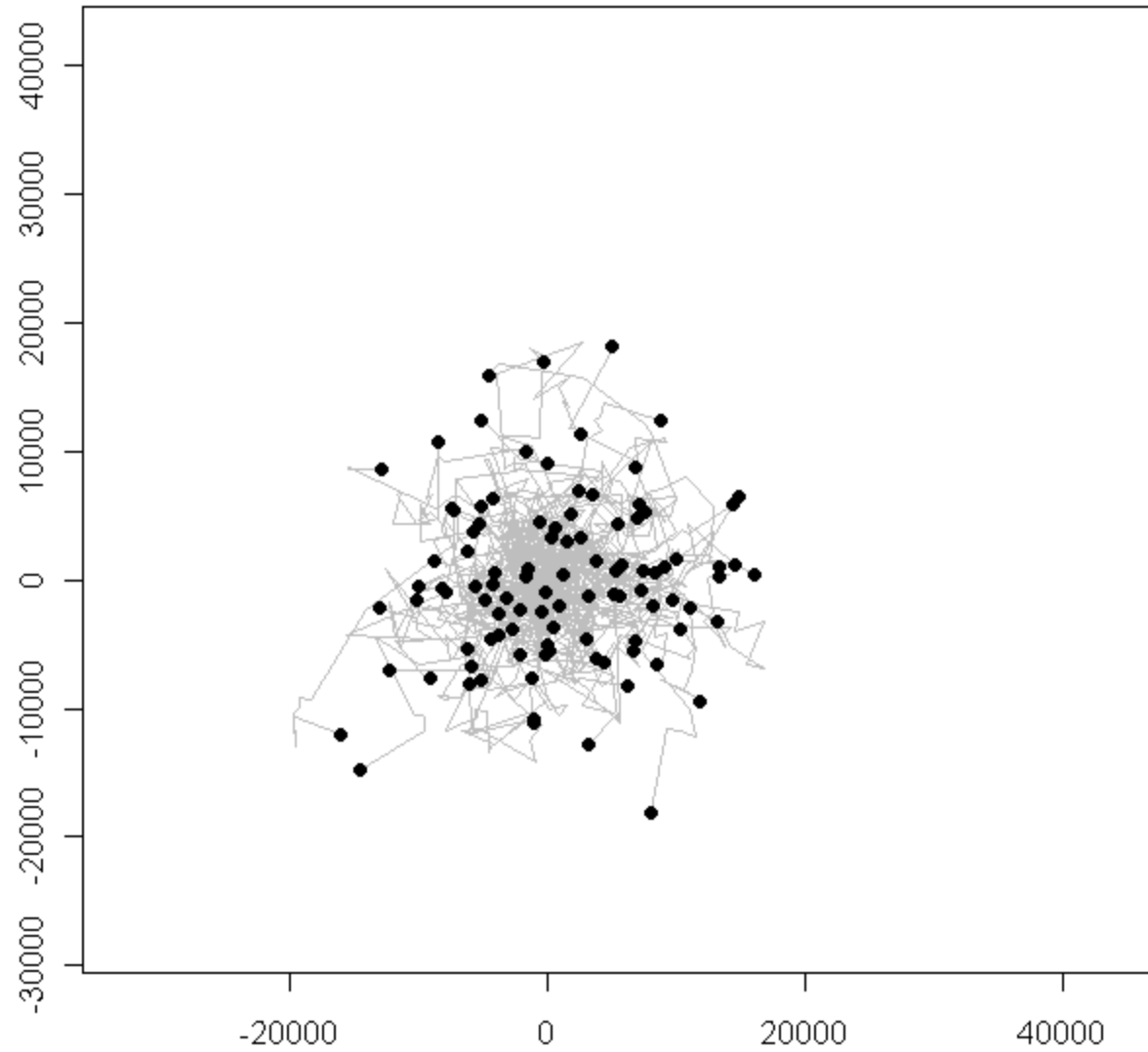
Stochastic dispersal simulation

Day 10



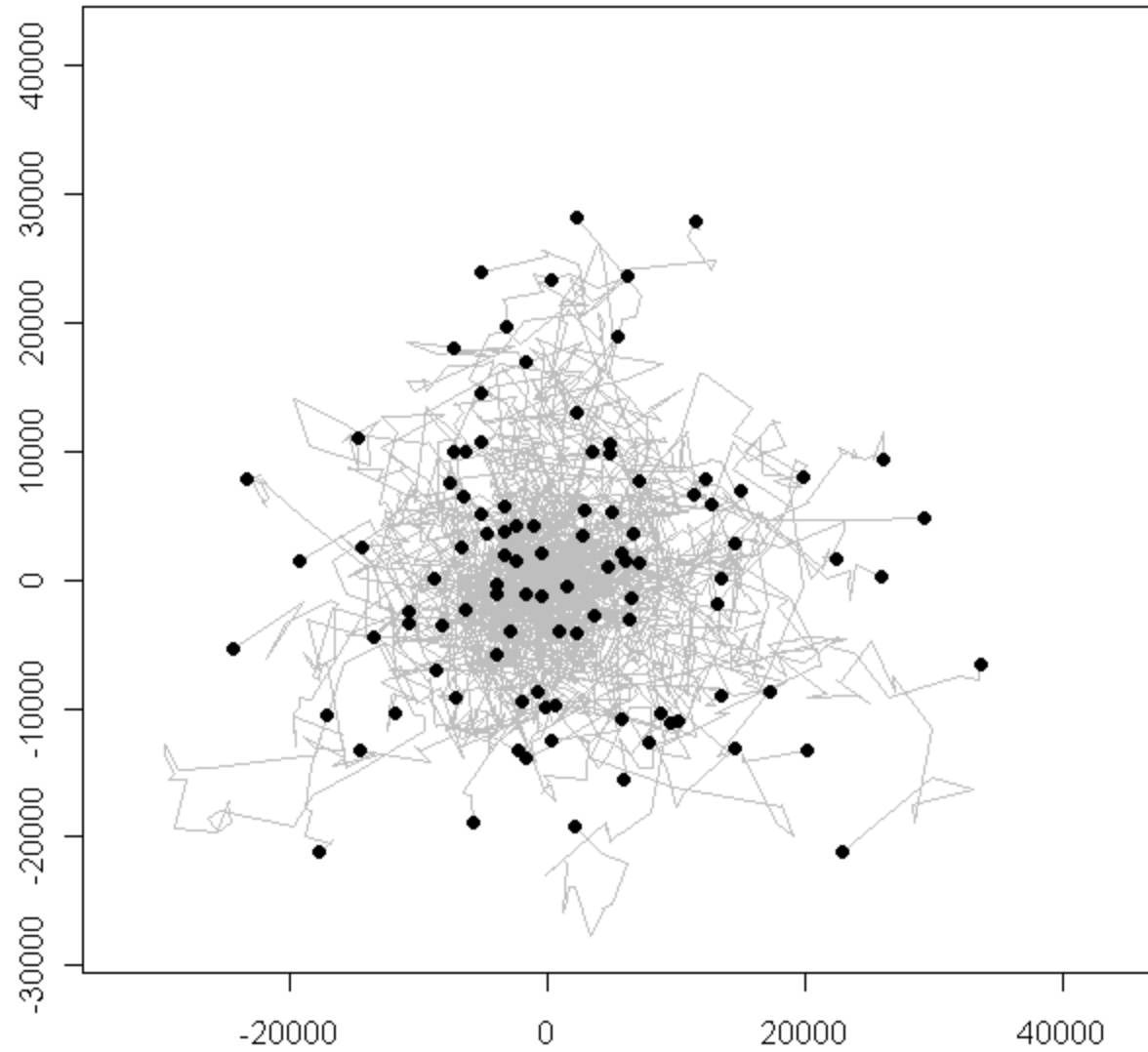
Stochastic dispersal simulation

Day 30



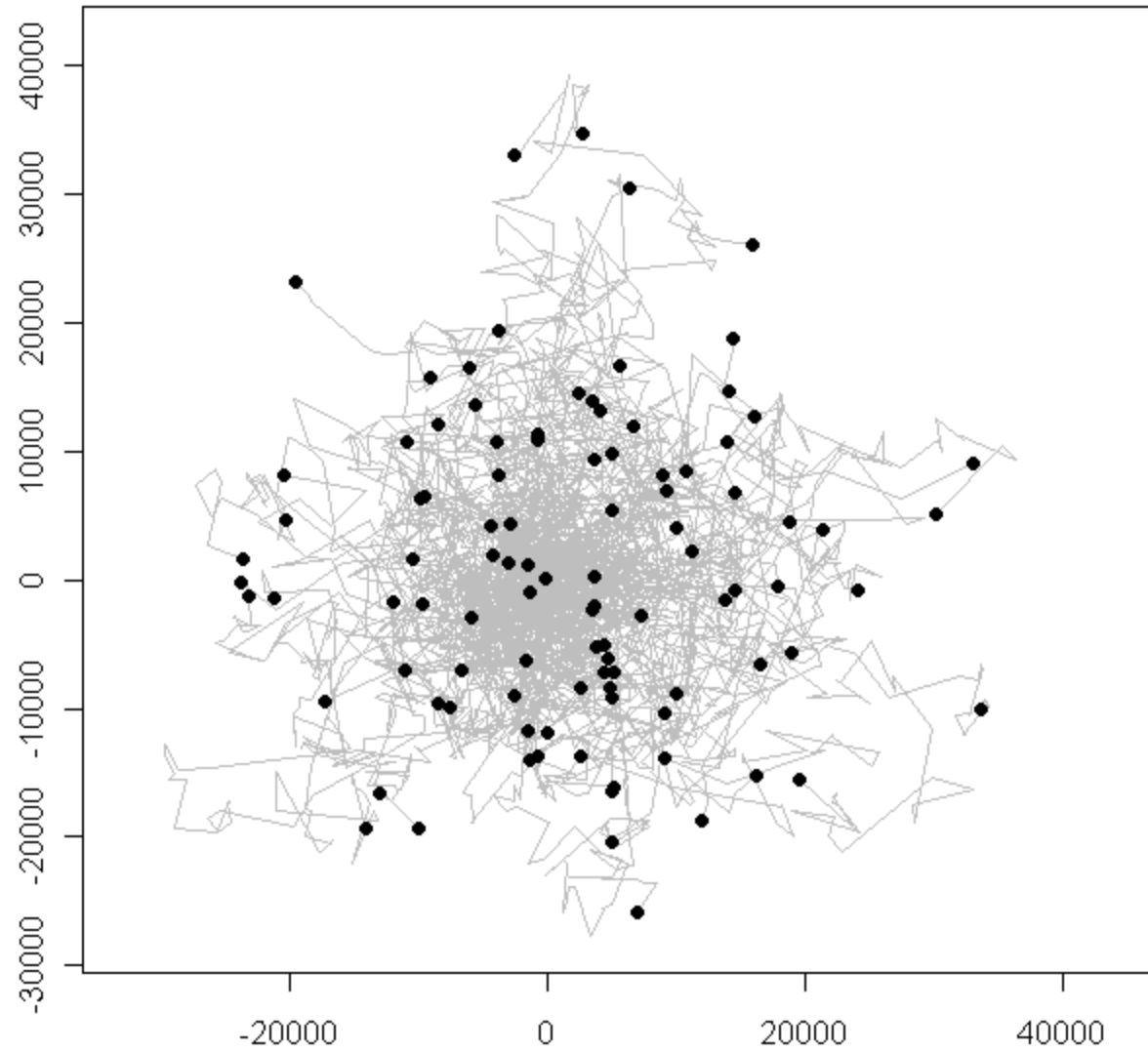
Stochastic dispersal simulation

day 60



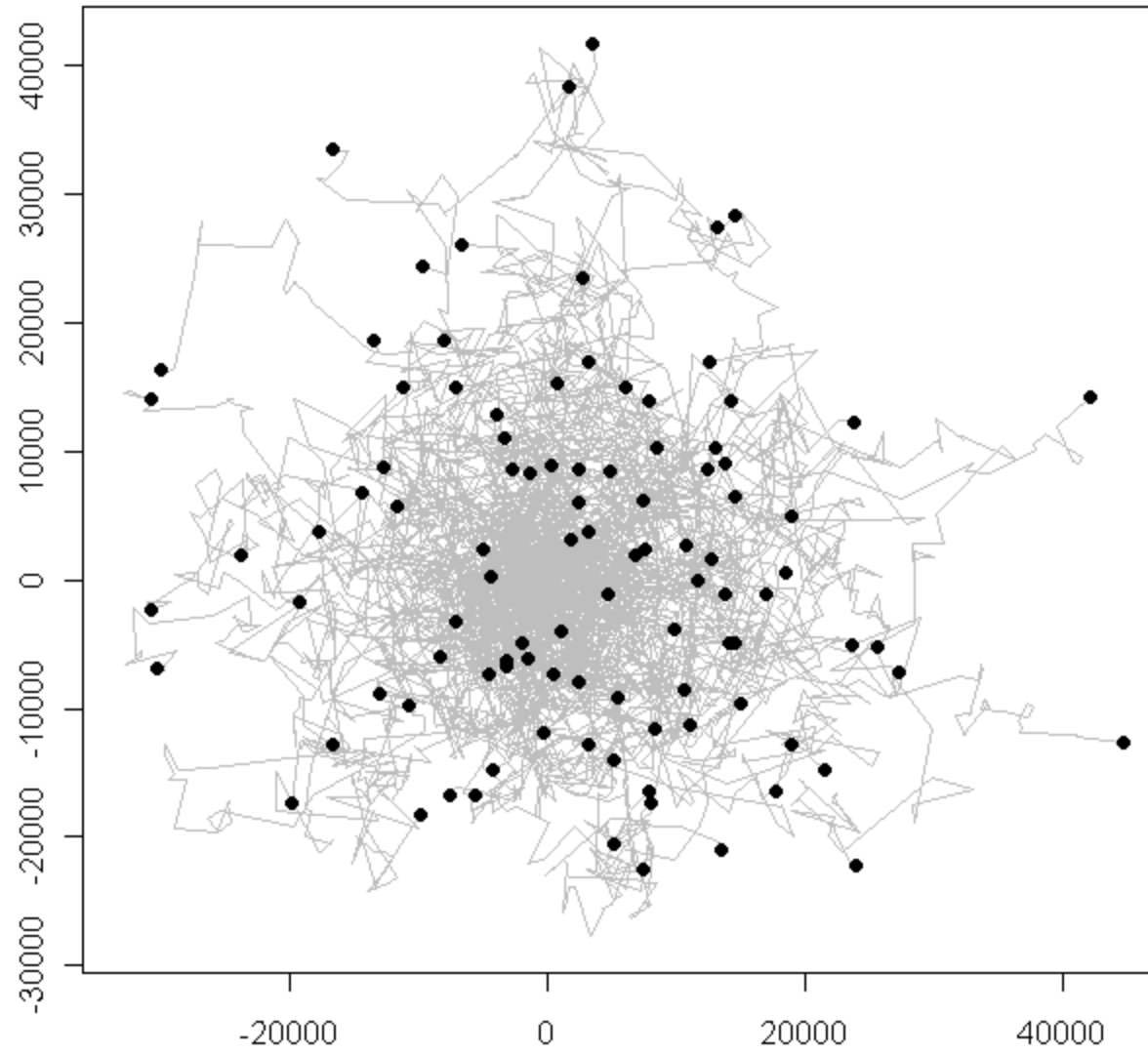
Stochastic dispersal simulation

Day 80



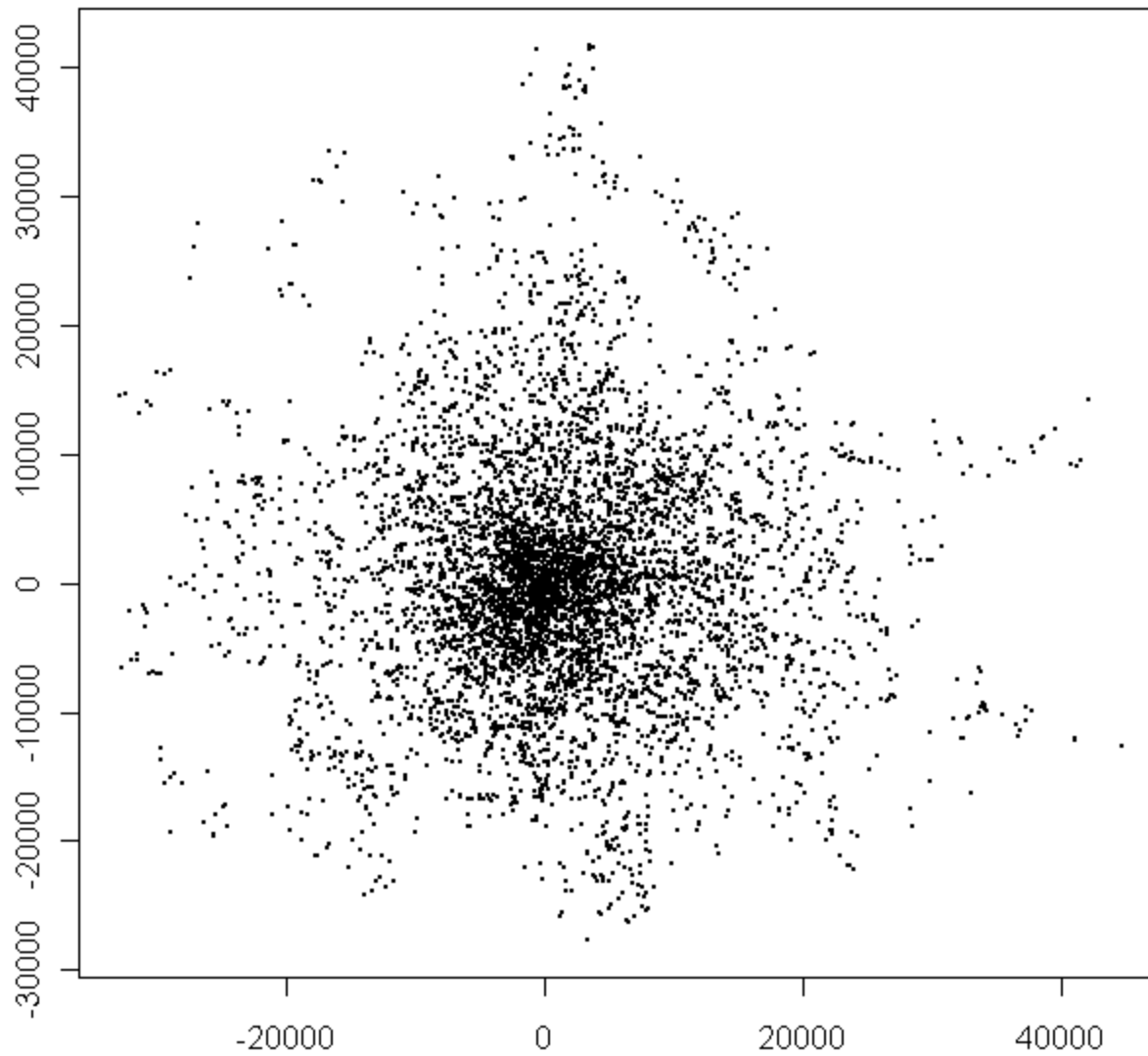
Stochastic dispersal simulation

Day 120



Day 120

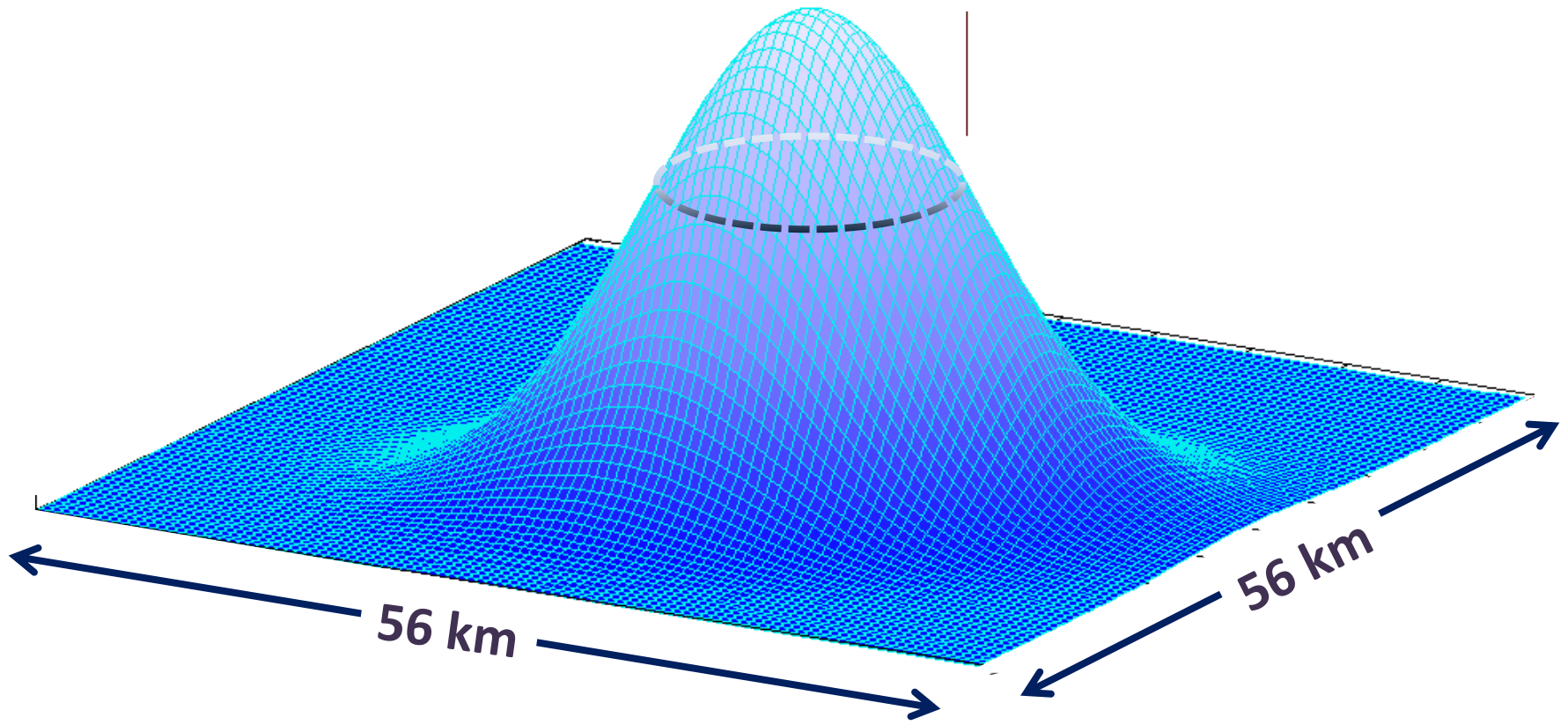
All stops

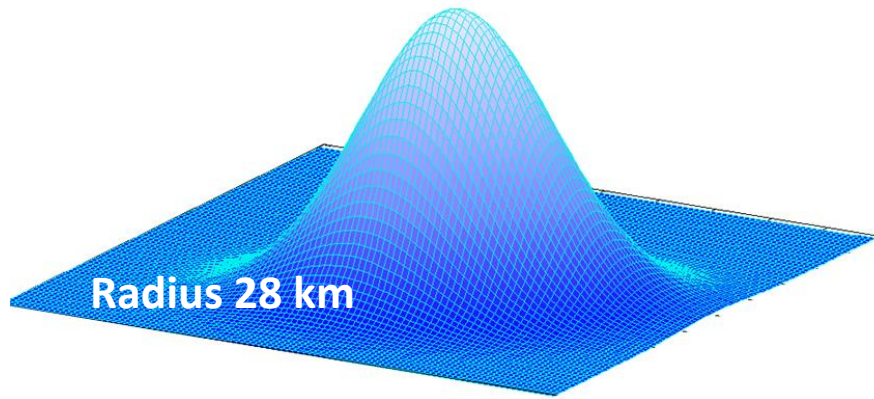


Distribution of dispersal probabilities

~ 300 000 ha
potentially covered

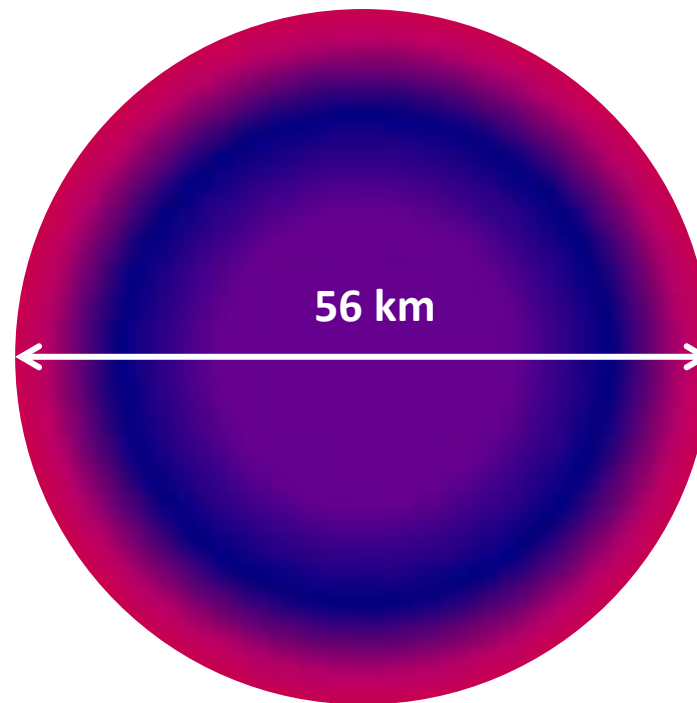
50% of insects
can fly at least
10 km = 10 000 ha



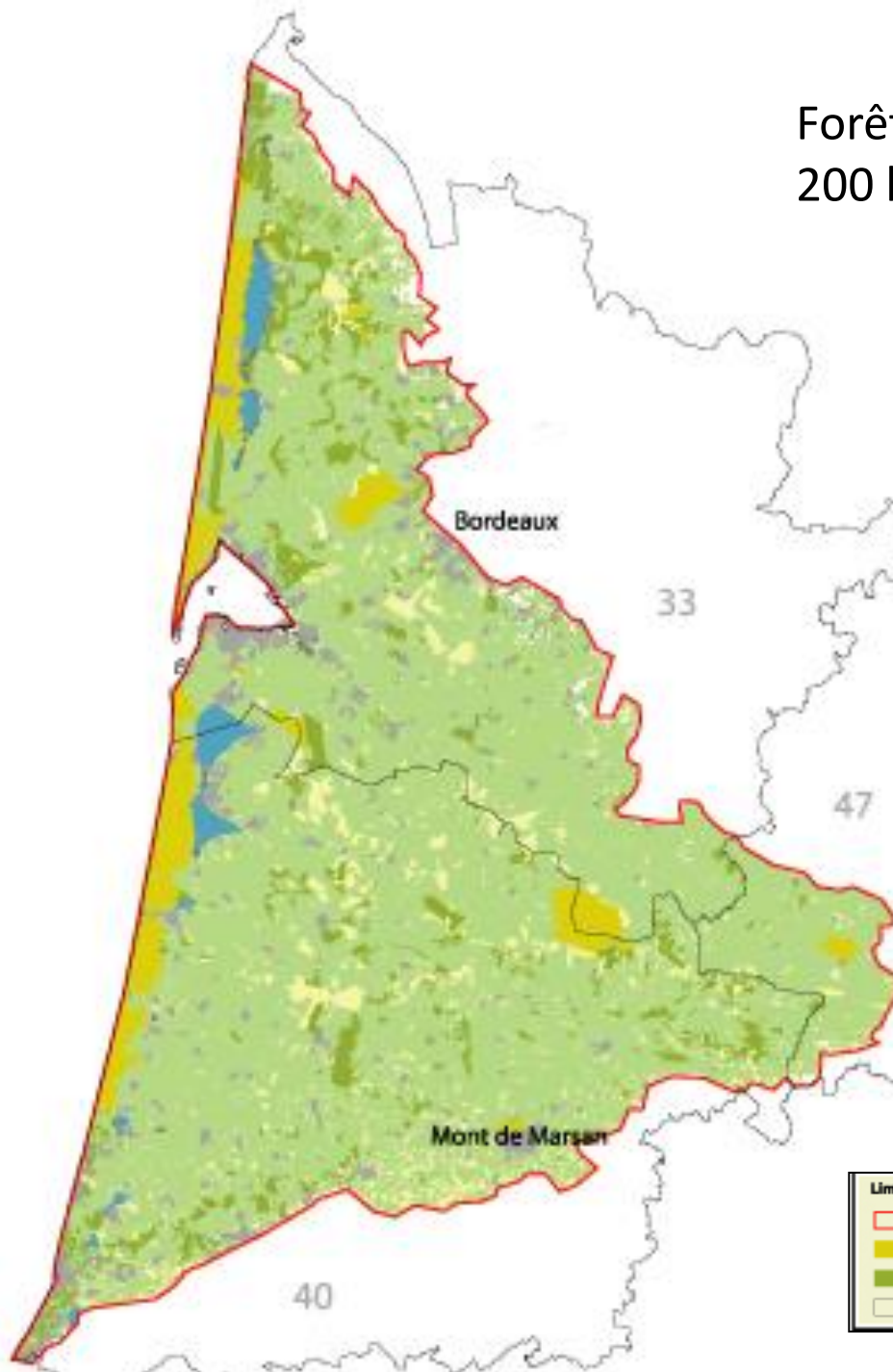


3D representation of frequency distribution of flying distances from the contaminated area

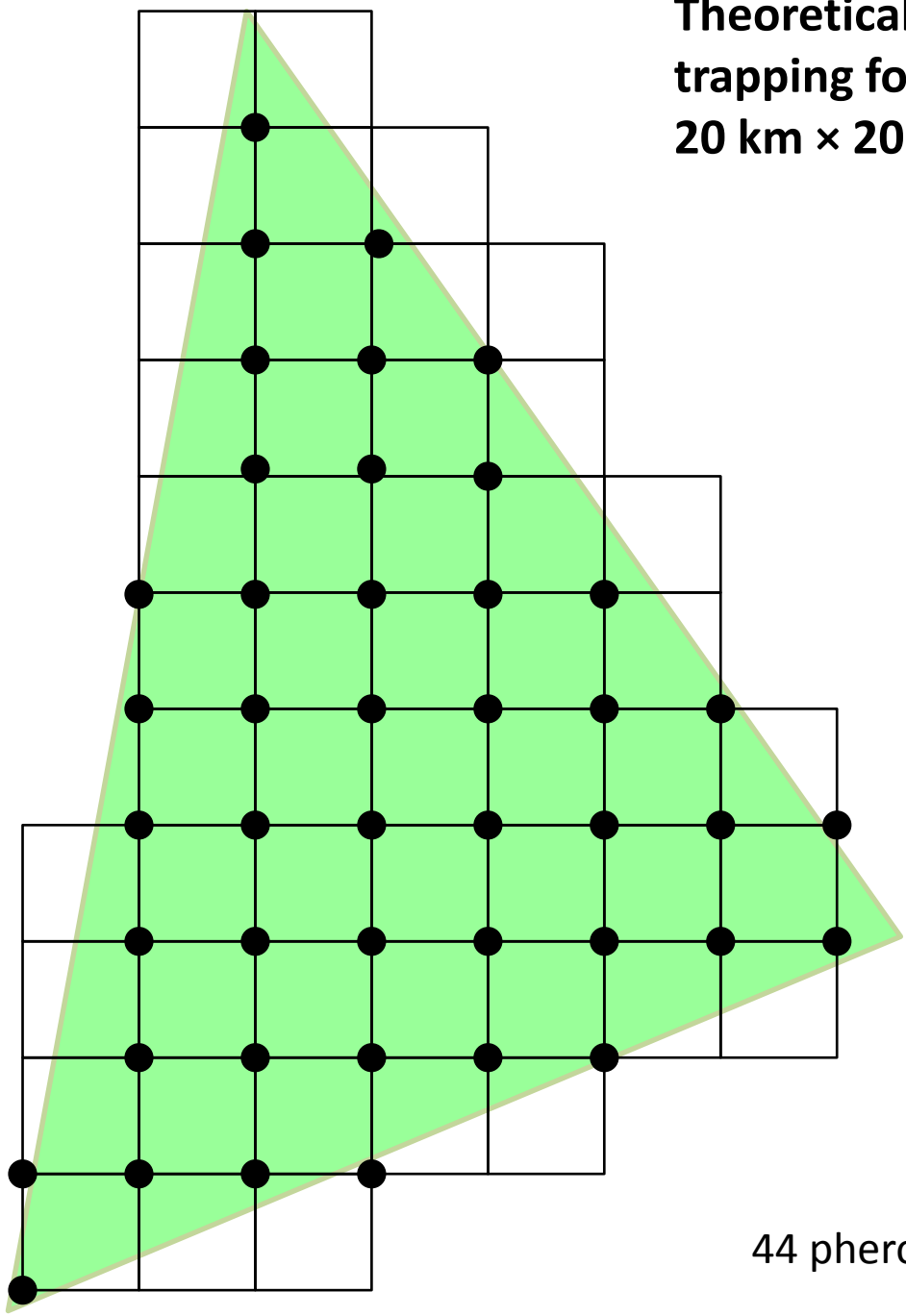
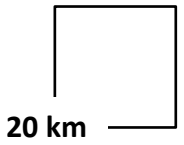
2D representation of frequency distribution of flying distances from the contaminated area



Forêt des Landes de Gascogne 200 km NS – 120 km EO



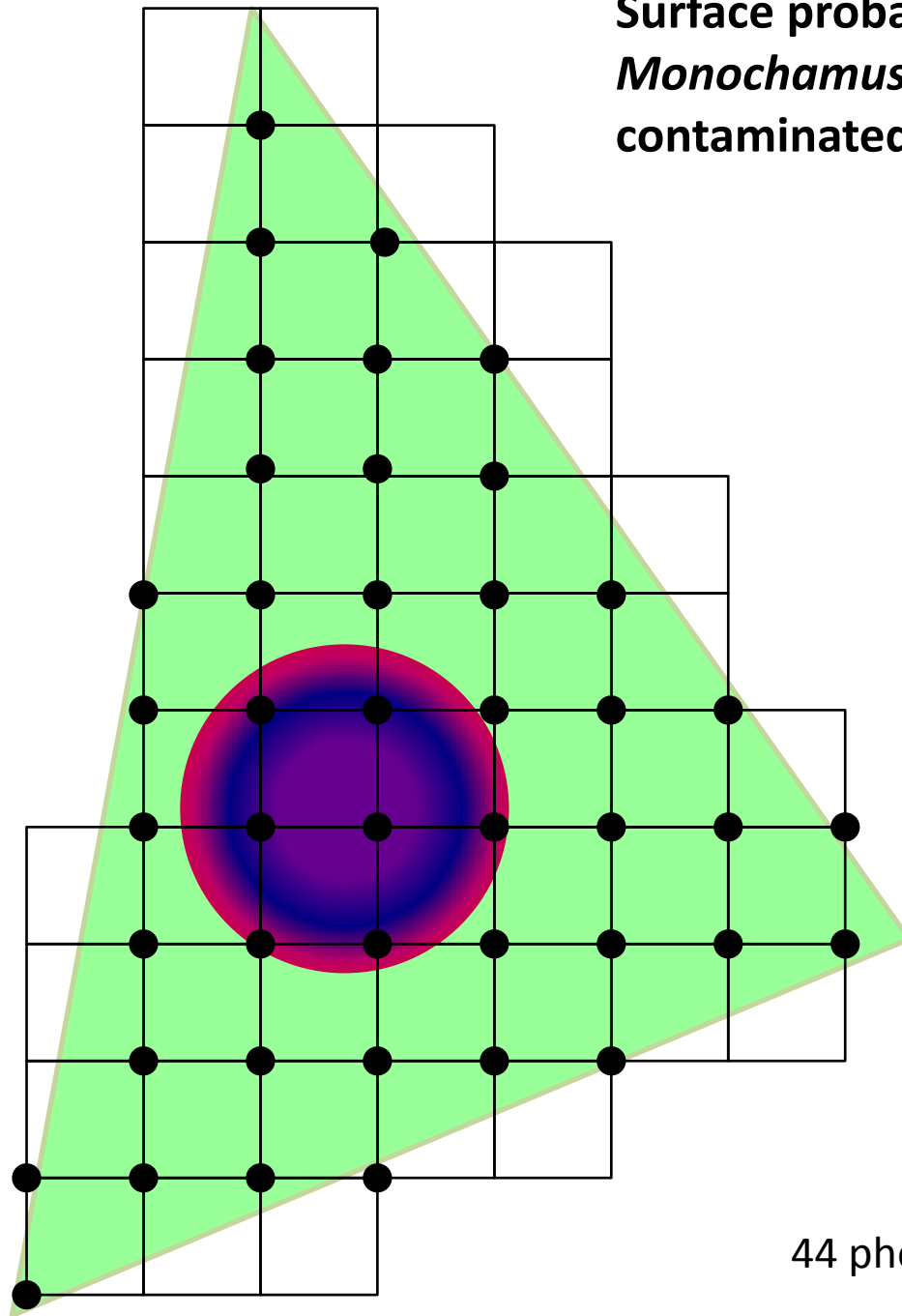
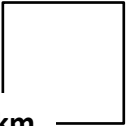
Theoretical grid of pheromone trapping for *Monochamus*
20 km × 20 km



●
44 pheromone traps

Surface probability of presence of *Monochamus* dispersing from the contaminated stand

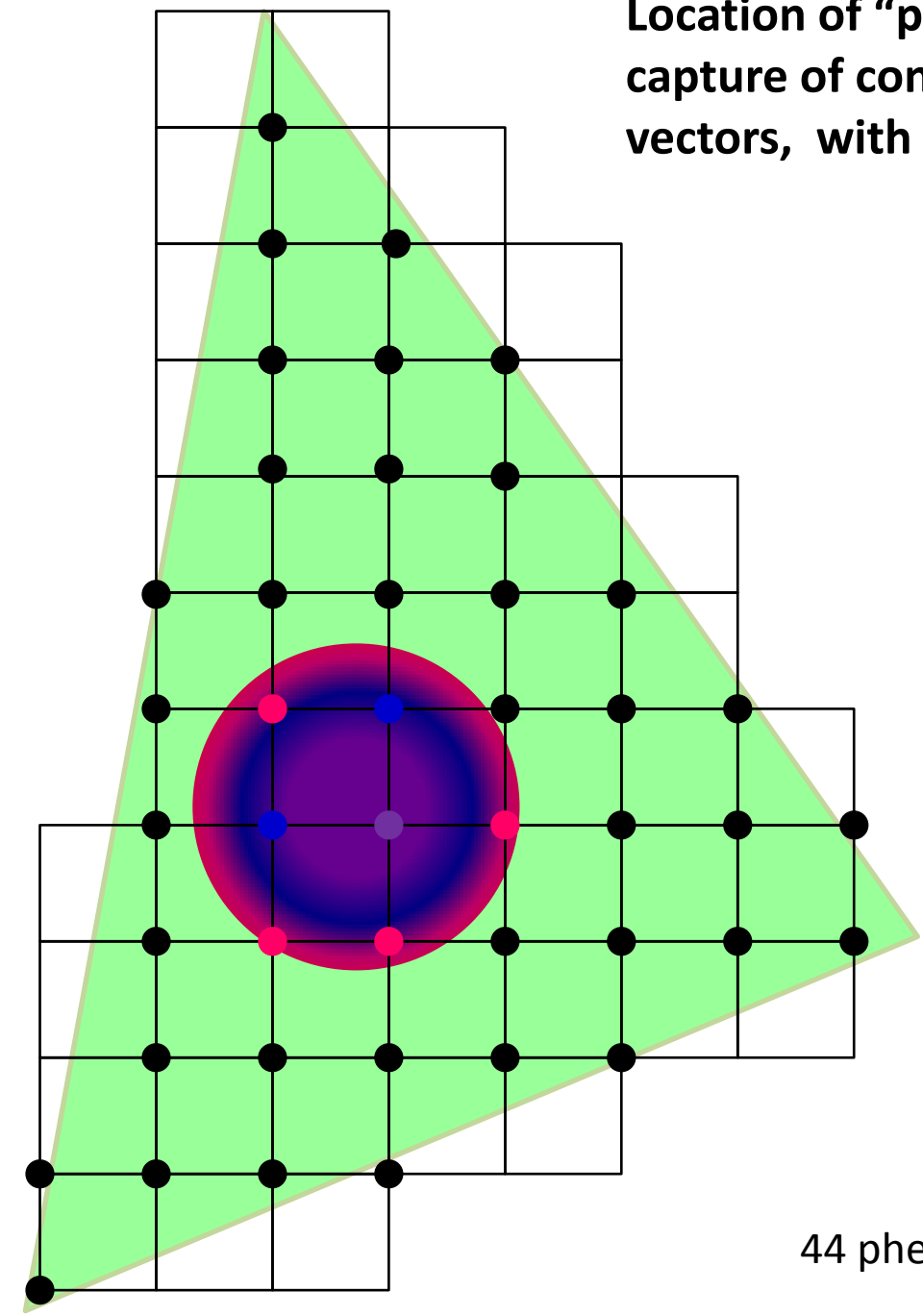
20 km



●
44 pheromone traps

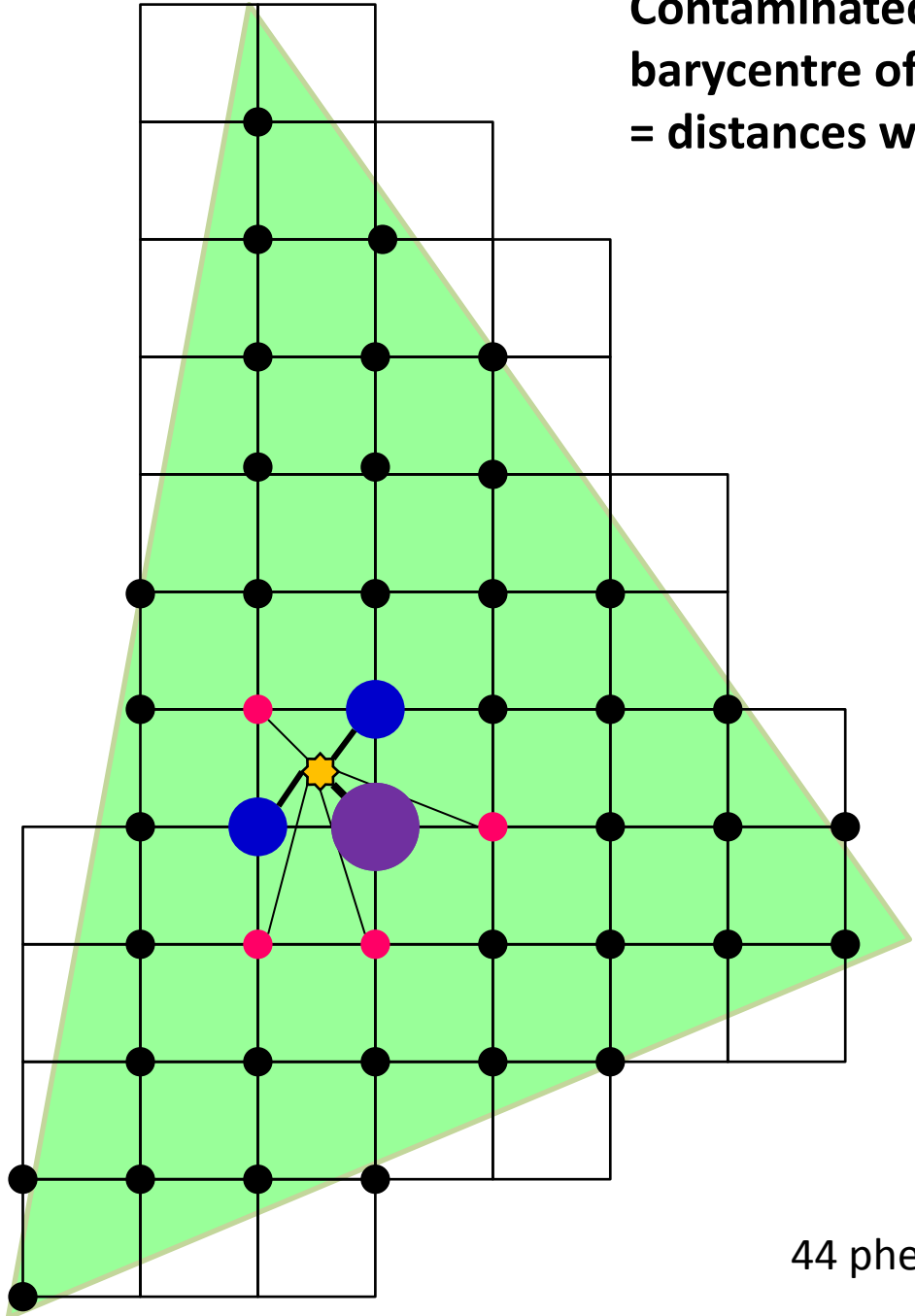
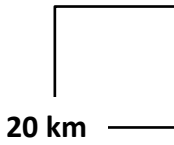
Location of "positive traps" = with capture of contaminated insect vectors, with levels of capture

20 km



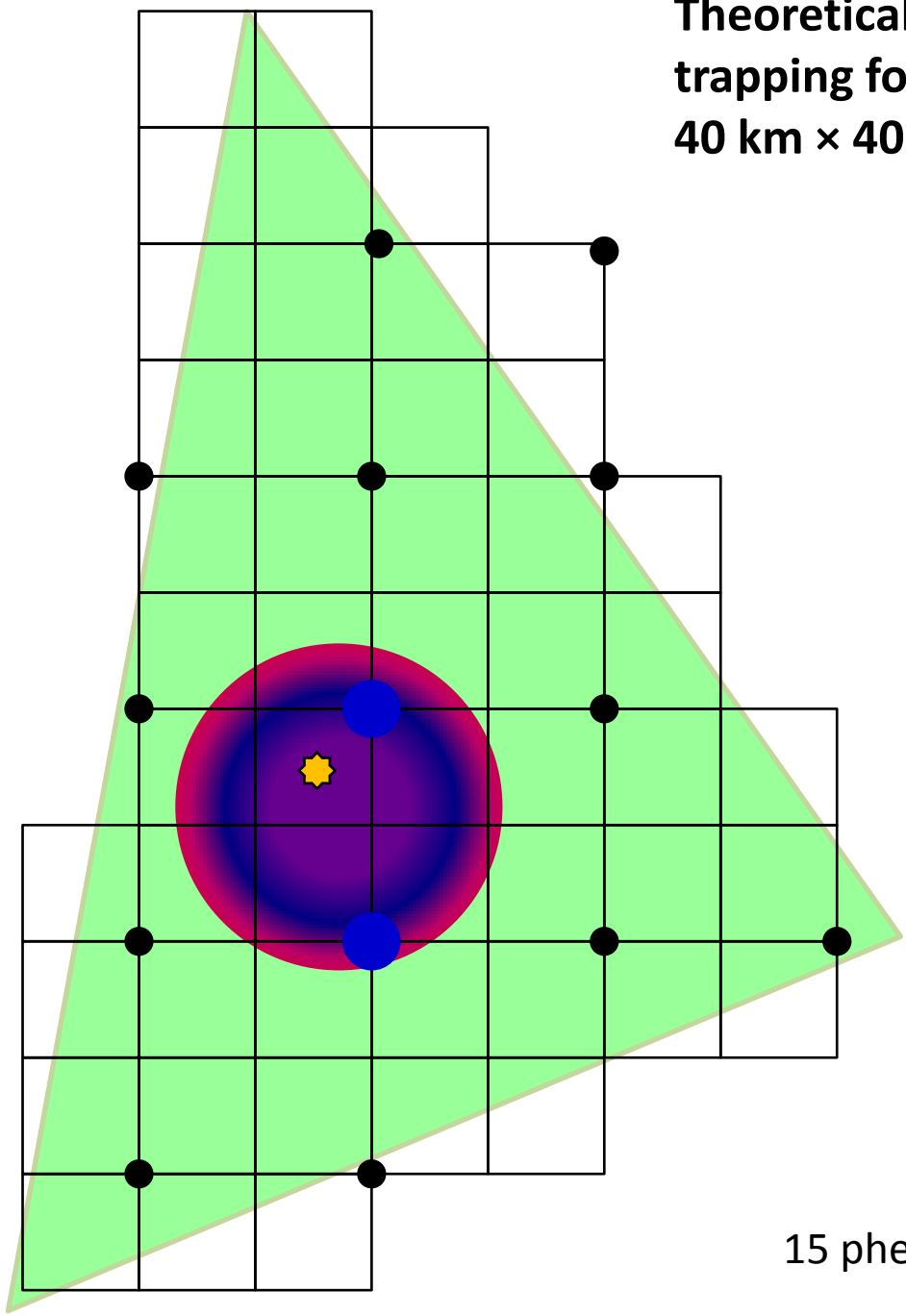
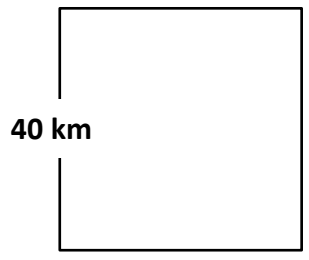
●
44 pheromone traps

**Contaminated area at the
barycentre of « positive traps »
= distances weighted by capture**



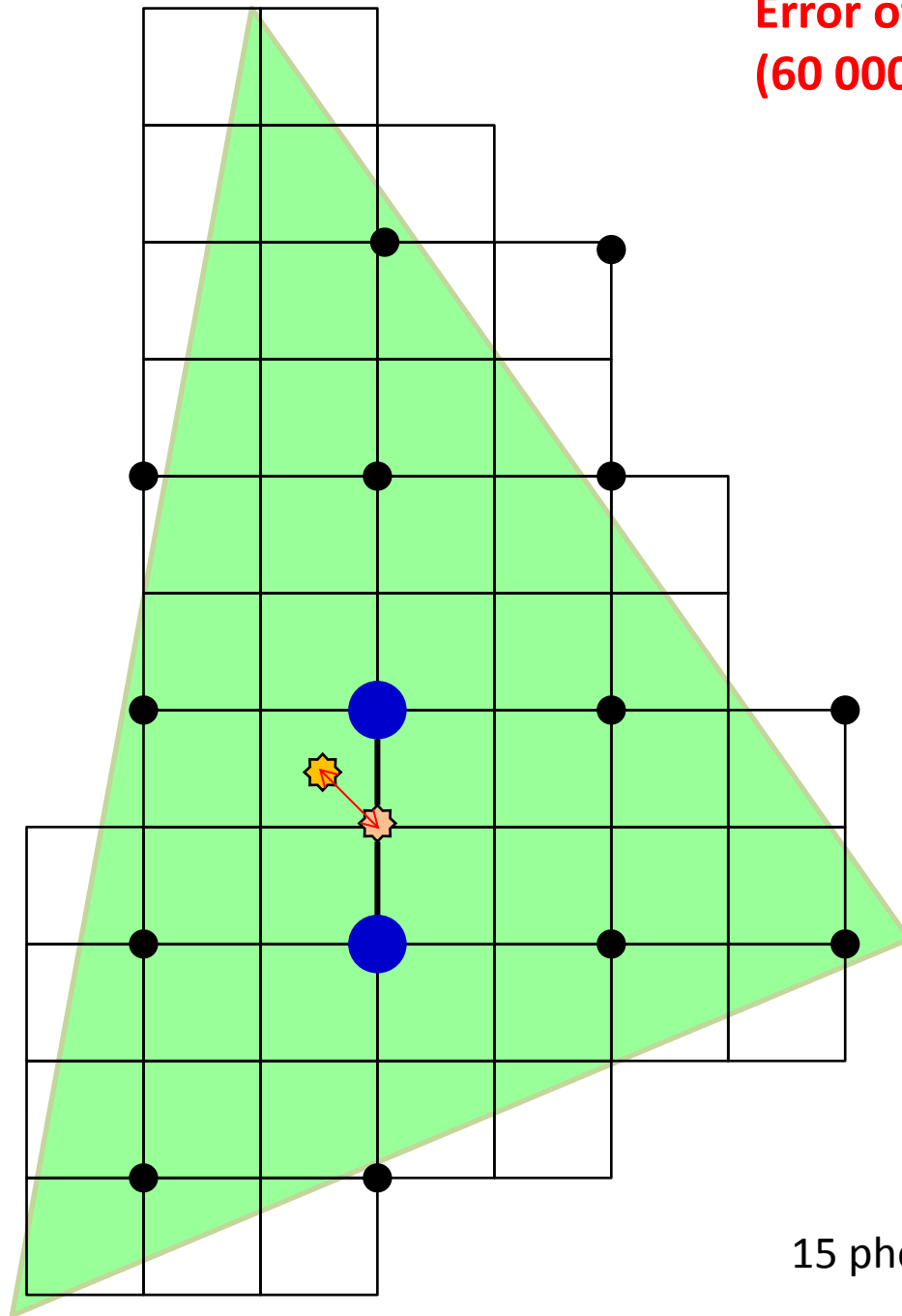
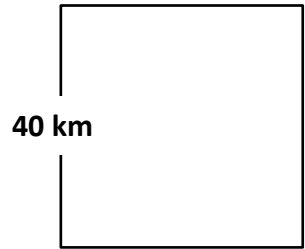
●
44 pheromone traps

Theoretical grid of pheromone trapping for *Monochamus*
40 km × 40 km



●
15 pheromone traps

**Error of positioning : 14 km
(60 000ha)**



●
15 pheromone traps

Surface probability of presence of *Monochamus* dispersing from the contaminated stand, according to landscape heterogeneity

