

**Centre d'Analyse et Mathématique Sociales (CAMS)**

*laboratory associated with CNRS and EHESS*

**Ecole des Hautes Etudes en Sciences Sociales (EHESS)**

<http://www.ehess.fr/centres/cams/>

Multidisciplinary team « **Modelling and Complex Systems** »

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*(computer science & social sciences)*

Research Associate at CNRS  
CAMS

## *Tools*

### *Mathematics*

- *nonlinear PDE*
- *reaction-diffusion equations*

### *Computer science*

- *multi-agent approach*

### *Statistical physics*

- *concepts and methods borrowed from the statistical physics of disordered systems*
- *numerical and analytical techniques*

### *Modelling goals*

- *exhibit generic properties, stylized facts*
- *modeling of specific problems, confrontation with empirical data*

## *Some Projects*

### *Biodiversity, sustainable development*

- *Population facing climate change:  
joint influences of Allee effect (for smaller populations,  
the reproduction and survival of individuals decrease)  
and environmental boundary geometry*

### *Making choice under social influence*

- *Large number of agents having to make a binary choice (to buy or not a good; to vote for or against the European constitution...)*
- *Nash equilibria when individual choice depends on other's choice*
- *Market context: optimal strategy for the seller?*
- *Adaptive behavior in case of repeated choices*

### *Modelling crime patterns*

- *Diffusion of illegal behavior*
- *Analysis of crime time series:  
separating global trend and local fluctuations*

*Some Results*

- *Population facing climate change:*

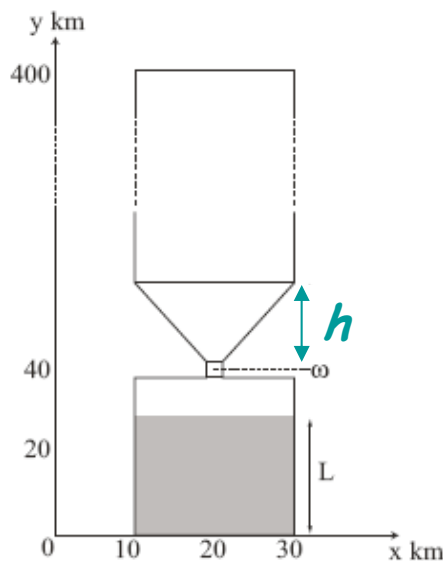
*joint influences of Allee effect (for smaller populations, the reproduction and survival of individuals decrease) and environmental boundary geometry*

L. Roques, A. Roques, H. Berestycki and A. Kretzschmar, 2008, Population Ecology [to appear]

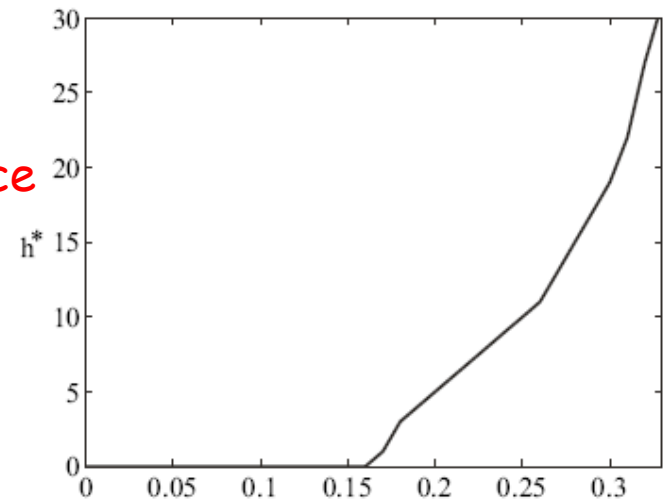
The shaded area corresponds to the « climate envelope » (the environmental conditions under which the population can persist) at  $t=0$ .

The narrow passage  $\omega$  is followed by a trapezoidal region of height  $h$ .

For  $t > 0$ , the climate envelope moves poleward at a constant velocity  $v$ .



Minimal value  $h^*$  of  $h$  required for persistence



Strength of Allee effect

*Some Results*

*Making choice under social influence*

- Large number of agents having to make a binary choice under social influence
- Monopoly market: optimal strategy for the seller?

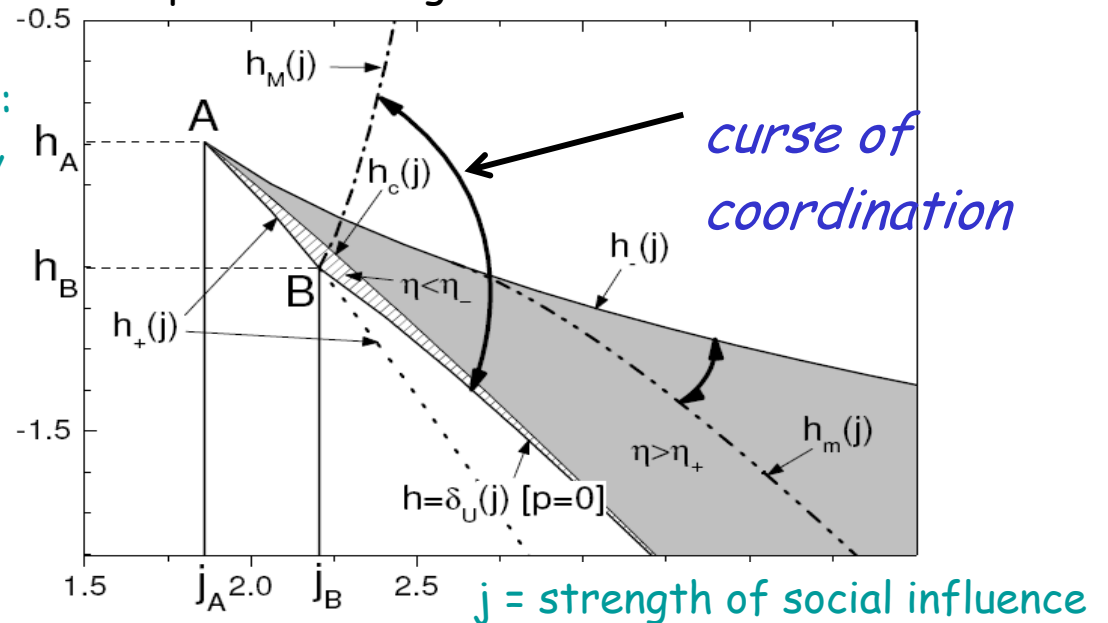
M. B. Gordon, J.-P. Nadal, D. Phan & V. Semeshenko, 2005, 2008

- **seller's dilemma - multiple equilibria** (*non white domain*)  
 sell at high price to a small number of customers  
 or at low price to a large number of customers?

Idiosyncratic preferences:  
 $h$  = mean willingness to pay

- **curse of coordination:**

At the seller's optimal price, the demand may have multiple solutions  
 - if the customers do not coordinate, the seller makes a profit much lower than the expected one.



*Some Results*

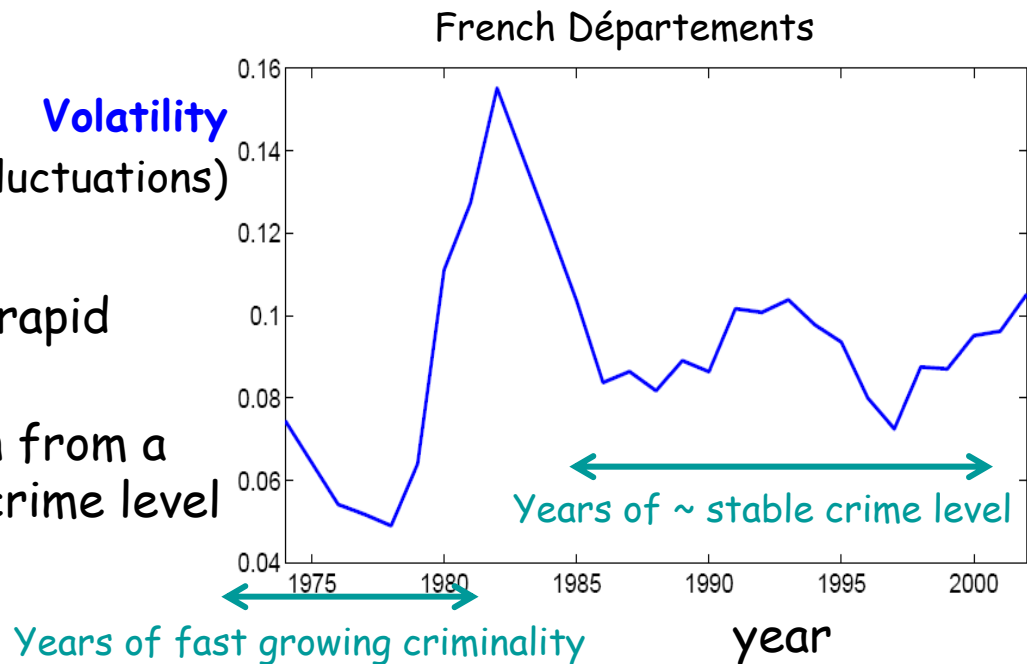
*Temporal crime patterns*

- Analysis of crime time series: separating *global trend* and *local fluctuations*

M. Barthélémy, J.-P. Nadal & H. Berestycki, 2008 [in preparation]

- Data : crime time series for French « Départements » and USA States
- An independent component analysis approach

- low volatility during the years of rapid increase in crime rates
- pick of volatility at the transition from a fast growth to a relatively stable crime level



## *Some references*

<http://www.ehess.fr/centres/cams/>

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