Rodent communities in a changing environment:
implications for human health in the Alps - the project ROCOALPS

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Project's framework at an international level and within the hosting research organism

Understanding the impact of human-related environmental changes on biodiversity are of a particularly high priority in ecological research. Climate and land-use changes may alter species diversity, and associated changes in the distribution of parasites and pathogens may also result in the (re)emergence and spread of zoonoses. As rodents are reservoirs and vectors of several important diseases in Europe, the project "**Rodent communities in a changing environment: implications for human health in the Alps**" (ROCOALPS) tests if and how rodent biodiversity changes in environments disturbed by human activity, and how these changes affect rodent behaviour, and in turn, the dynamics of their parasites and pathogens. In order to control various parameters, we use a model system: that includes rodents, their ectoparasites (ticks), their endoparasites (helminths), and a rodent-borne virus transmissible to humans.

ROCOALPS is being carried out at the Department of Biodiversity and Molecular Ecology of Fondazione E. Mach, whose institutional goals include the study of the impact of global environmental changes in natural and agricultural ecosystems.

Apodemus flavicollis

Myodes glareolus

Microtus multiplex

Objectives of the project

The general aim of the project is to model host-parasite interactions and disease dynamics using empirical data on small mammal communities, environmental variables and parasite/pathogen distribution in beech forests of the Autonomous Province of Trento.

OBJECTIVE 1: to determine **rodent community** composition

OBJECTIVE 2: to determine the **social network** of rodent communities

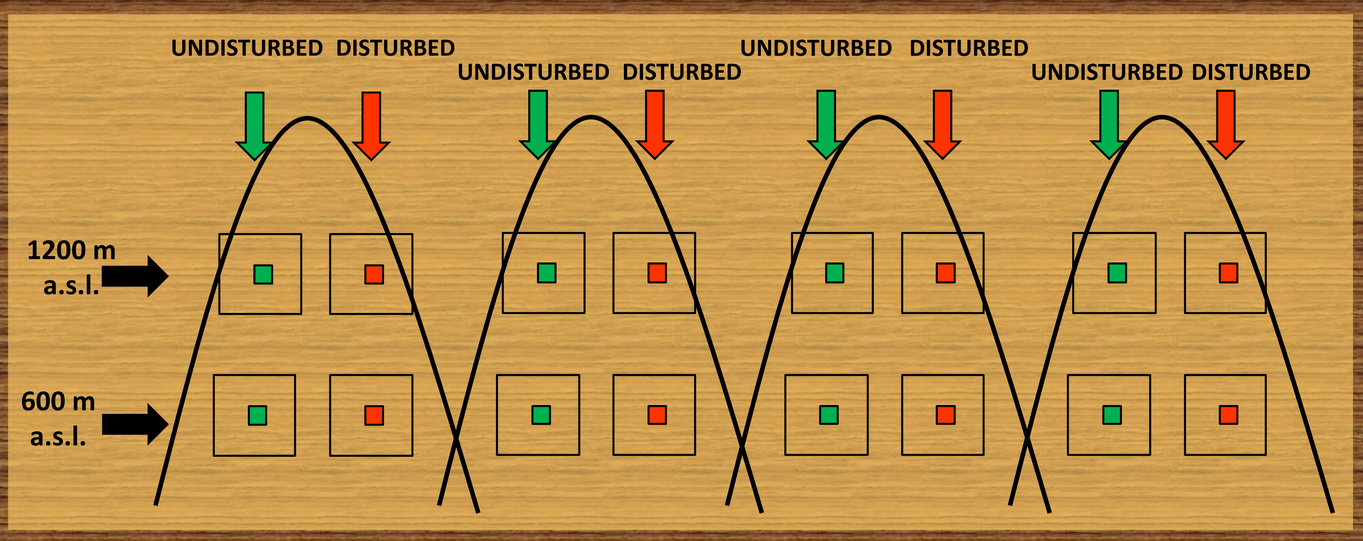
OBJECTIVE 3: to analyse the **parasite/pathogens of rodents**

OBJECTIVE 4: to **model parasite and disease transmission** using empirical data from Objectives 1, 2, and 3.

Sampling design

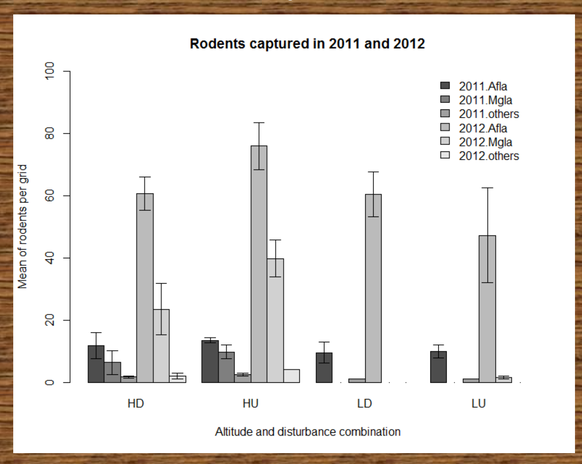
- 2 seasons (2011 and 2012):
- 16 trapping grids of 8x8 multicapture Ugglan livetraps (10m intertrap distance)
- one session of two consecutive nights per month (April – October)
- 8 grids in high (1200 m) and 8 in low (600 m) altitudes
- 8 grids in undisturbed beech forest (harvested more than seven years ago)
- 8 grids in disturbed beech forest (harvested less than four years ago)

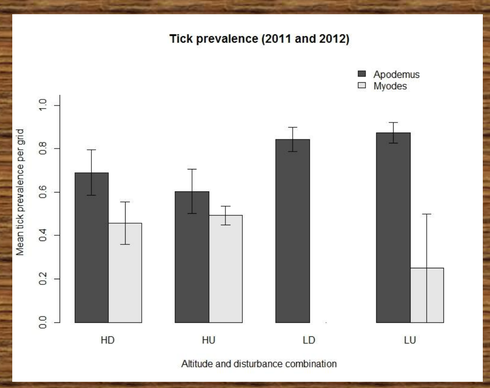
or 14336 trap-nights per season!



RODENT COMMUNITIES

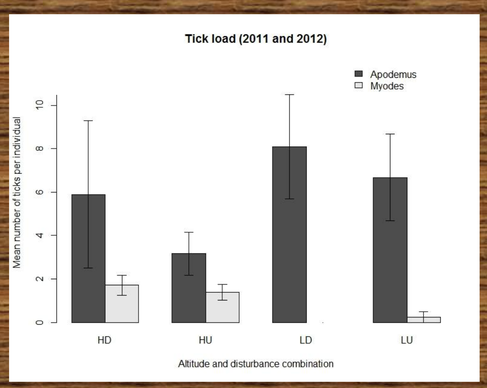
In total 1492 rodents of five species were captured during seasons 2011 (250 individuals) and 2012 (1242 individuals): 1154 *Apodemus flavicollis*, 314 *Myodes glareolus*, 12 *Microtus multiplex*, 8 *Apodemus sylvaticus* and 4 *Muscardinus avellanarius*. *M. glareolus* and *M. multiplex* were found almost uniquely at high altitudes indicating that rodent communities of high-altitude forests are significantly more diverse; and also more abundant.

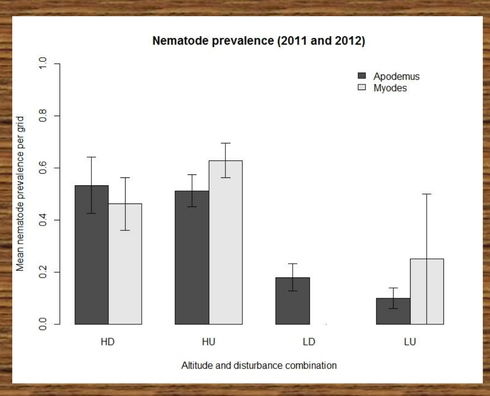




TICKS

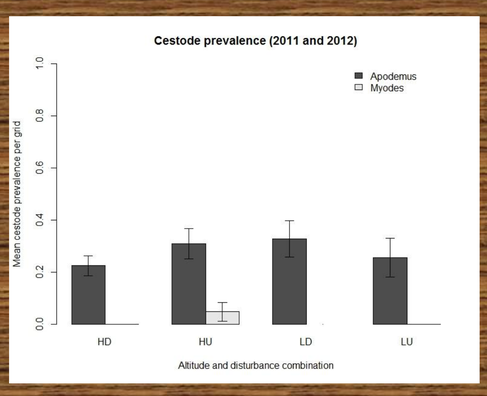
Prevalence (Fig. 1) and load (Fig. 2) of ticks (*Ixodes ricinus*) were higher at low-altitude than high-altitude forests and higher in *Apodemus* sp. than in *Myodes* sp. (no difference between disturbed and undisturbed forests).





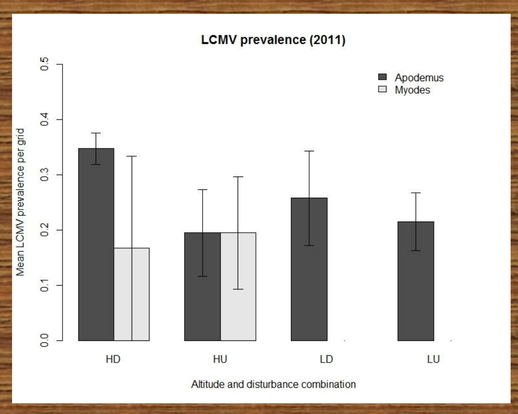
INTESTINAL HELMINTHS

Data on helminth prevalence obtained using standard floatation method on faeces.
Nematodes (*Heligmosomoides* sp., Strongylida) were more common in high-altitude forests. Cestodes (*Hymenolepis* sp., Cyclophyllidea) were present almost exclusively in *Apodemus* sp. In all forests.



LYMPHOCYTIC CHORIOMENINGITIS VIRUS (LCMV)

Seroprevalence data only available at this time for 2011 (obtained from sera screened at Niv. Helsinkki, Finland).
22% of all rodents tested were positive at first capture: 25% *A. flavicollis* (n=170), 11% *M. glareolus* (n=54) and 50% *A. sylvaticus* (n=4).
Positive animals found in all sampled grids with the highest seroprevalence in high-altitude disturbed forests.



Future outlook

The first two years of the project were dedicated to collecting empirical data on rodent communities of forests at different altitudes and disturbance levels, counting their ticks, and helminths, and screening for LCMV. In the 3rd year, LCMv sero-positive samples (both for 2011 and 2012) will be confirmed by PCR. The social network of the rodents will be determined using the CMR data. Then the entire dataset will be used to test models of parasite/pathogen transmission dynamics together with environmental variables. The PI will spend six months at Cardiff University (UK) dedicated to the modelling and publishing of results thus completing Objectives 2 and 4.

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Funding period: **October 2010 – September 2013**
Institute: **Research and Innovation Centre, Fondazione E.Mach,**
San Michele all'Adige (TN), Italy
Funded by: **Autonomous Province of Trento, Marie Curie Action - COFUND Post Doc 2009 Incoming**

Acknowledgments

The PI is thankful to V. Tagliapietra, D. Arnoldi, Z. Hiadlovská, E. Pascoe, S. Maffei, F. Rizzolli, G.Stefani, G. Recinella, L. Sykes, E. Gillingham, M. Collini, I. Baráková, A. Venturi, M. Ferretti and S. Agostini for help in the field; to Z. Hiadlovská, E. Pascoe and E. Gillingham for help in screening for helminths; L. Voutilainen and H. Henttonen for LCMV sero-screening; C. Rossi and M. Girardi for help in molecular species confirmation; M. Scholz, R. Rosà and S. Perkins for help with statistical analyses; and H.C. Hauffe and A. Rizzoli for their leadership. For funding and logistics we thank the Autonomous Province of Trento, the European Union, and the Fondazione E. Mach.