Infra-estruturas ecológicas e protecção biológica das culturas

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Serviços de um ecossistema

Daily, G.C., 1997. Nature's Services: Societal Dependence on Natural Ecosystems. Island Press, Washington, D.C.

Aprovisionamento

- **Bens produzidos ou fornecidos pelos ecossistemas,**
  - e.g., alimentos, fibras, recursos genéticos

Suporte

- **Serviços necessários à produção de outros serviços do ecossistema,**
  - e.g., formação do solo, ciclo de nutrientes, produção primária

Regulação

- **Benefícios resultantes dos processos dos ecossistemas**
  - e.g., regulação do clima, das populações de inimigos das culturas, das cheias

Culturais

- **Bens não materiais dos ecossistemas,**
  - e.g., valores espirituais, estéticos, recreativos, educacionais

Biodiversidade funcional

Parte da biosfera que fornece os serviços do ecossistema

Moonen A-C, Bàrberi P (2008) Functional biodiversity: an agroecosystem approach. Agriculture, Ecosystems and Environment 127: 7–21

Infra-estrutura ecológica

Qualquer infra-estrutura, existente na exploração ou num raio de cerca de 150 m, que tenha valor ecológico para a exploração e cuja utilização judiciosa aumente a sua biodiversidade funcional.

regras OILB srop
Produção inegrada da vinha

Recomendam o fomento da biodiversidade, por ser considerada elemento importante da sustentabilidade da viticultura

Infra-estruturas ecológicas devem ocupar, pelo menos, **5% da área da exploração***, excluindo a superfície florestal, para manter adequada biodiversidade funcional

Malavolta & Boller 2009. IOBC wprs Bulletin 46:1-11

* óptimo = 10%

Artrópodes auxiliares

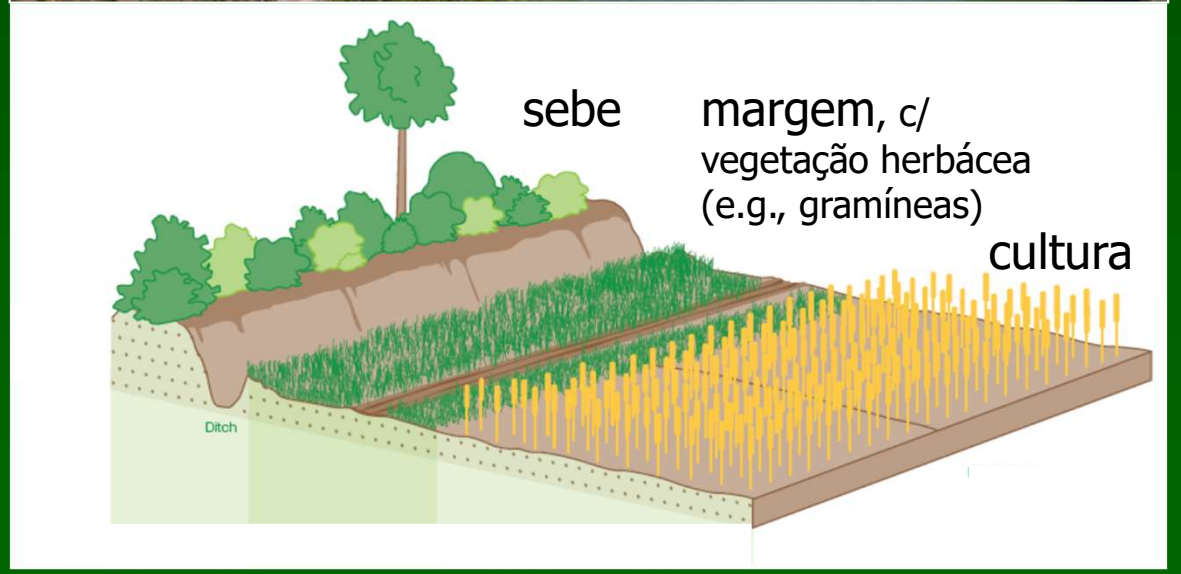
- **Recursos/habitats necessários no ecossistema agrário**:
  - Refúgios
  - Locais de hibernação
  - Hospedeiros/presas alternativas
  - Fontes de alimento, e.g., néctar, pólen, melada
  - Locais de reprodução
  - Habitats para dispersão (e.g., muitos artrópodes auxiliares têm fraca mobilidade)

Exemplo de infra-estruturas ecológicas constituídas por plantas

Enrelvamento

Revestimento dos taludes

Sebes + margens herbáceas



OPERA & ELO (2010) Multifunctional landscapes: why good field margin management is important and how it can be achieved? http://www.europeanlandowners.org/files/pdf/multifunctionallandscapes.pdf

Árvores velhas

aves

insectívoras

Pica-pau malhado grande

de rapina

Mocho-galego

morcegos

Morcego arborícola pequeno

Outras infra-estruturas ecológicas

Amontoados de lenha ou pedra

aves

anfíbios

mamíferos

carriça

sapo comum

ouriço-caixeiro

Muros de pedra solta

aves

Pisco de peito ruivo

répteis

sardão

mamíferos

musaranhos

Ninhos/abrigos artificiais

California Agriculture 62(4):131-132.

http://essps.pt/01_ESSPS_PORTAL_WEB/_NOVO/ARQUIVO/2009_2010/chapim_escola_secundaria_sps/chapim_escola_secundaria_sps-.htm#ESCOLA_

Rede de infra-estruturas ecológicas

- Três elementos básicos, com diferentes funções:
  - 1) **Habitats permanentes**, de grande dimensão
  - 2) **Habitats temporários**, de pequena dimensão
  - 3) **Corredores ecológicos**, de estrutura mais ou menos linear, que favorecem a dispersão das espécies animais entre os habitats permanentes e temporários

Habitats permanentes

Exemplos:

floresta

pomares tradicionais

Áreas ruderais

Prados e pastagens pouco intensivas

Habitats temporários

Exemplos:

bosquetes

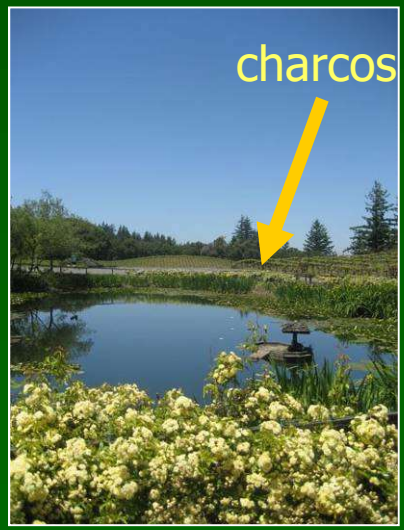
amontoados de pedra

manchas de arbustos e árvores

amontoados de lenha

muros de pedra

charcos



Corredores ecológicos

Exemplos:

sebes

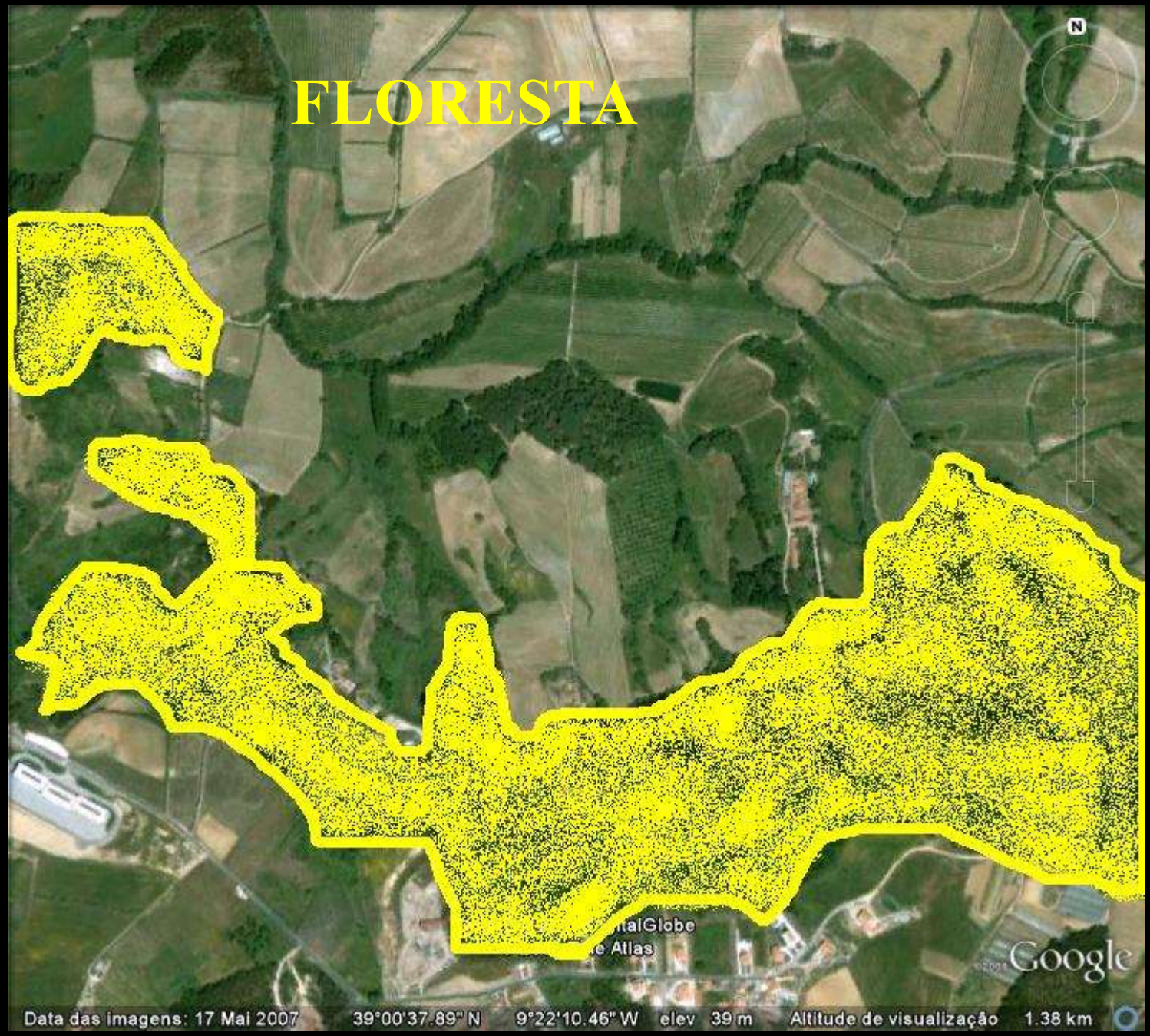
linhas de água

caminhos rurais

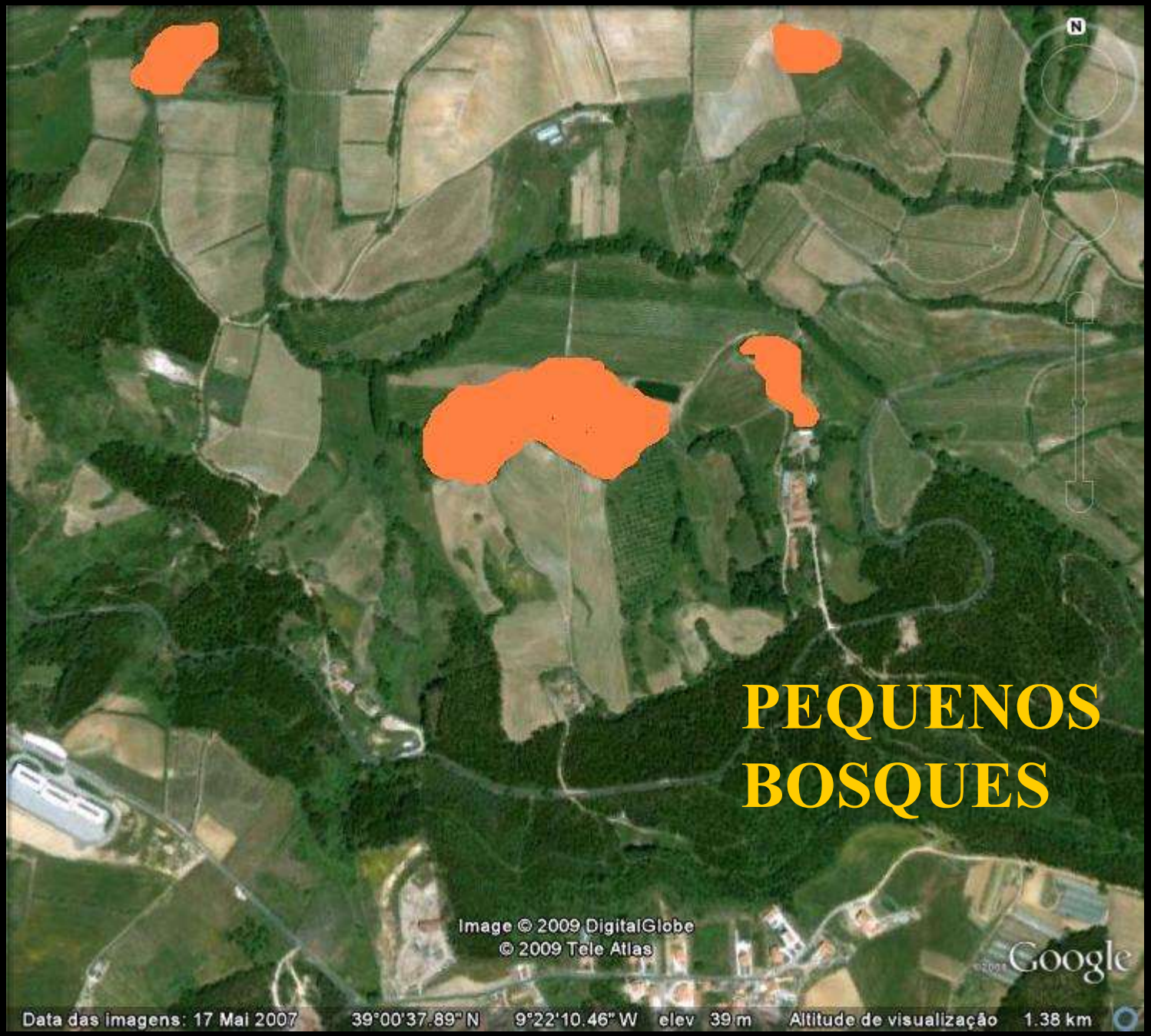
enrelvamento


N
Image © 2009 DigitalGlobe
© 2009 Tele Atlas
Google
Data das imagens: 17 Mai 2007
39°00'37.89" N
9°22'10.46" W
elev 39 m
Altitude de visualização 1.38 km

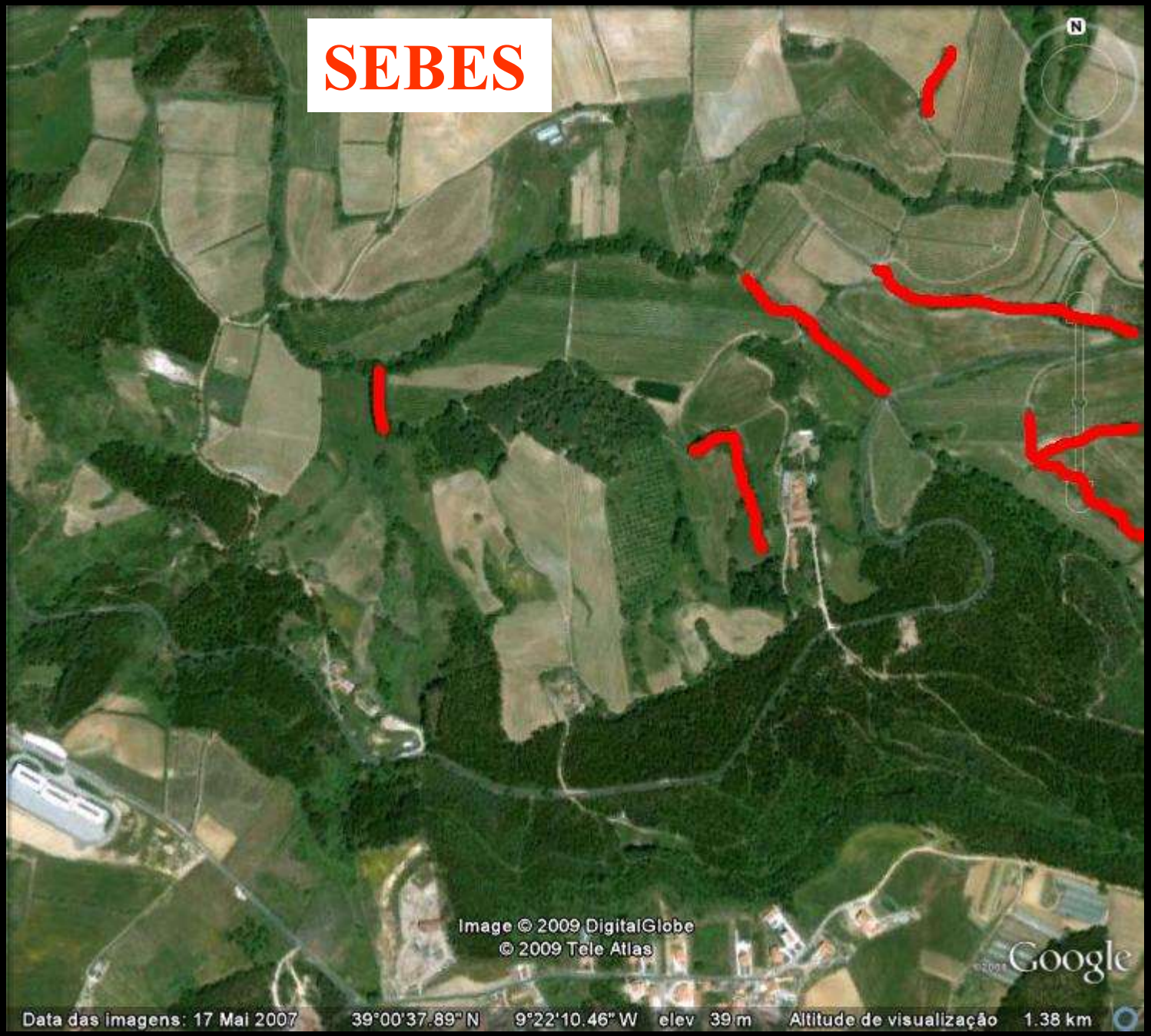
HABITATS PERMANENTES



HABITATS TEMPORÁRIOS



CORREDORES ECOLÓGICOS



CORREDORES ECOLÓGICOS

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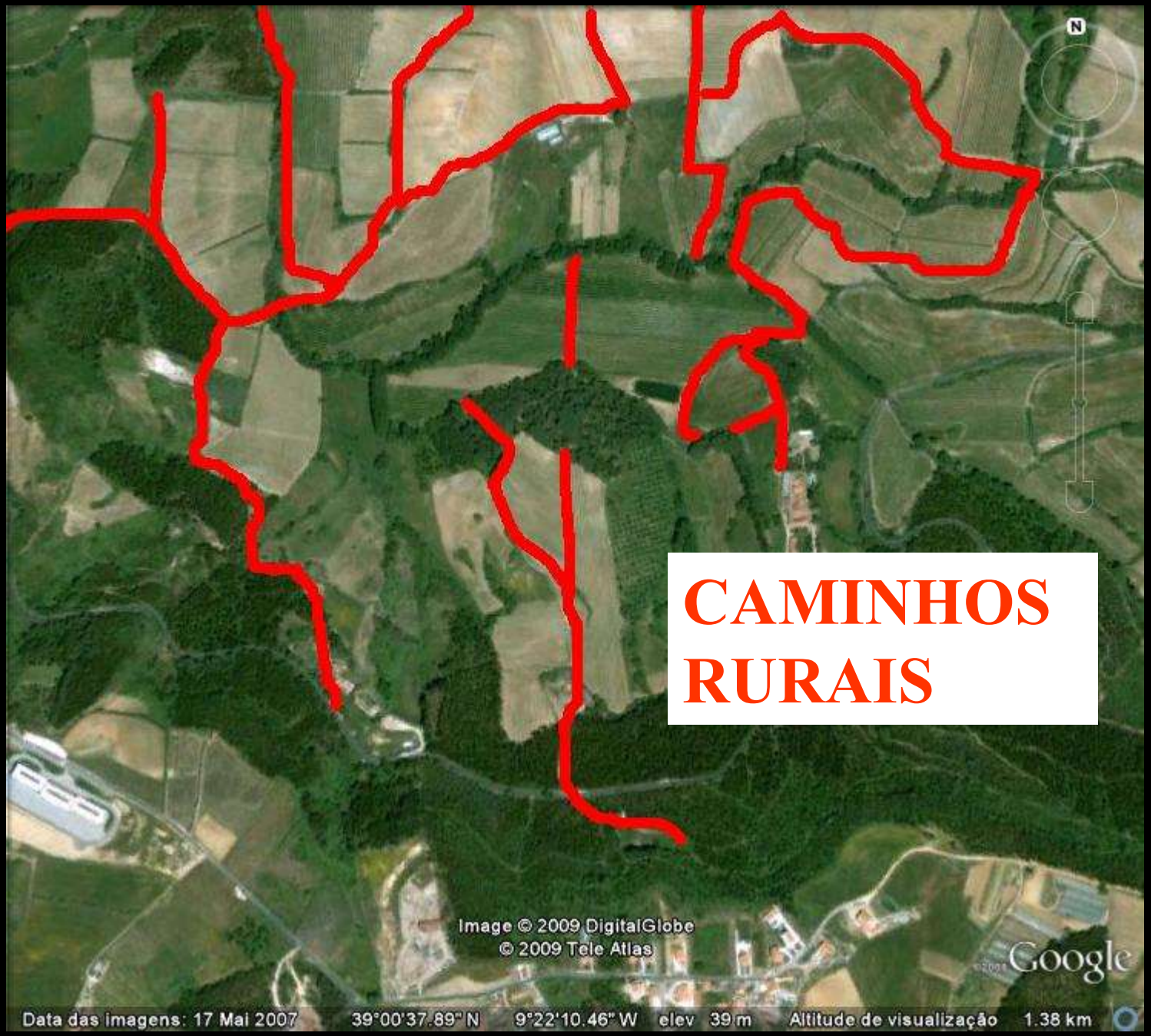
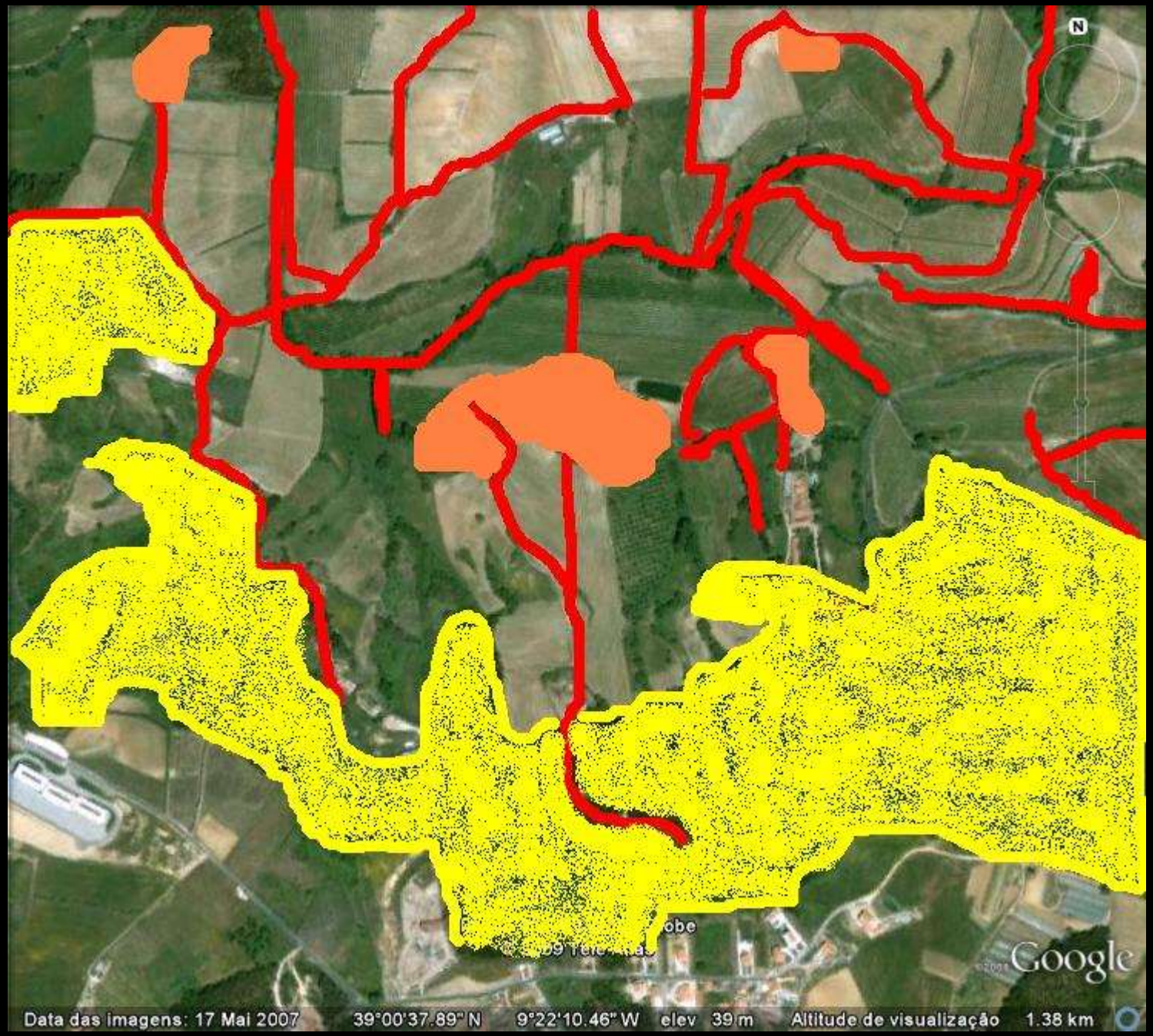


REDE INFR. ECOLÓGICAS



Os organismos animais têm capacidade de dispersão limitada:

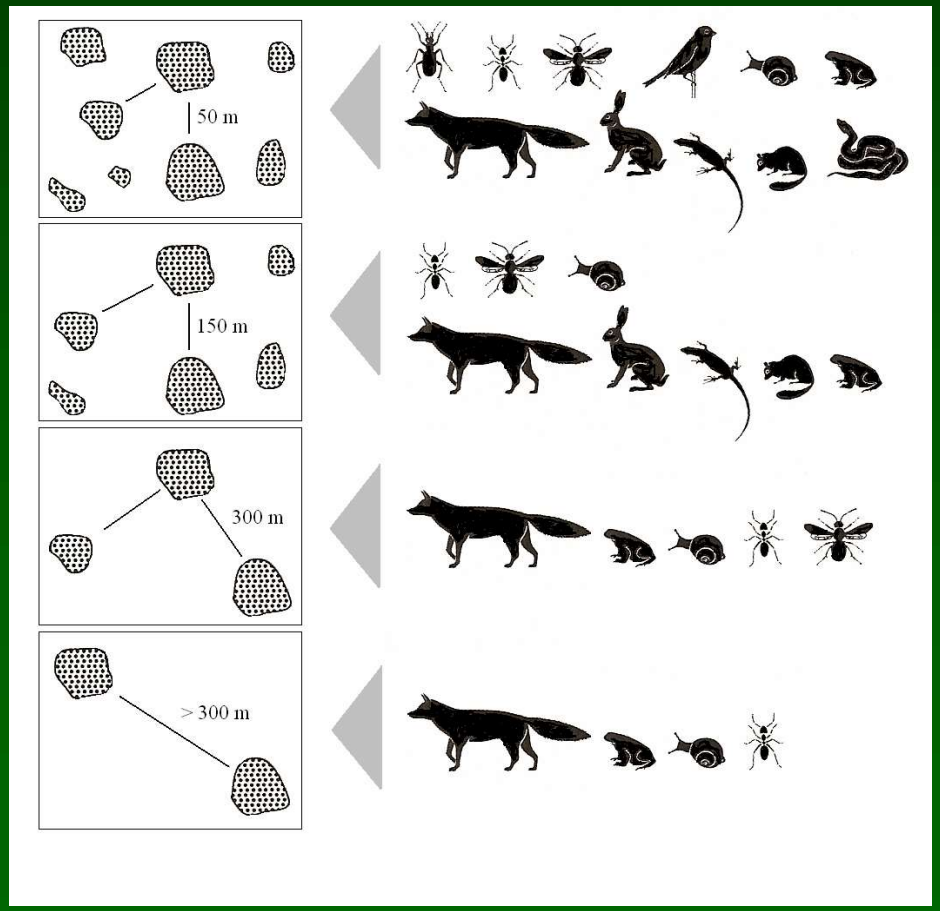
distância média entre infra-estruturas ecológicas

50 m

150 m

300 m

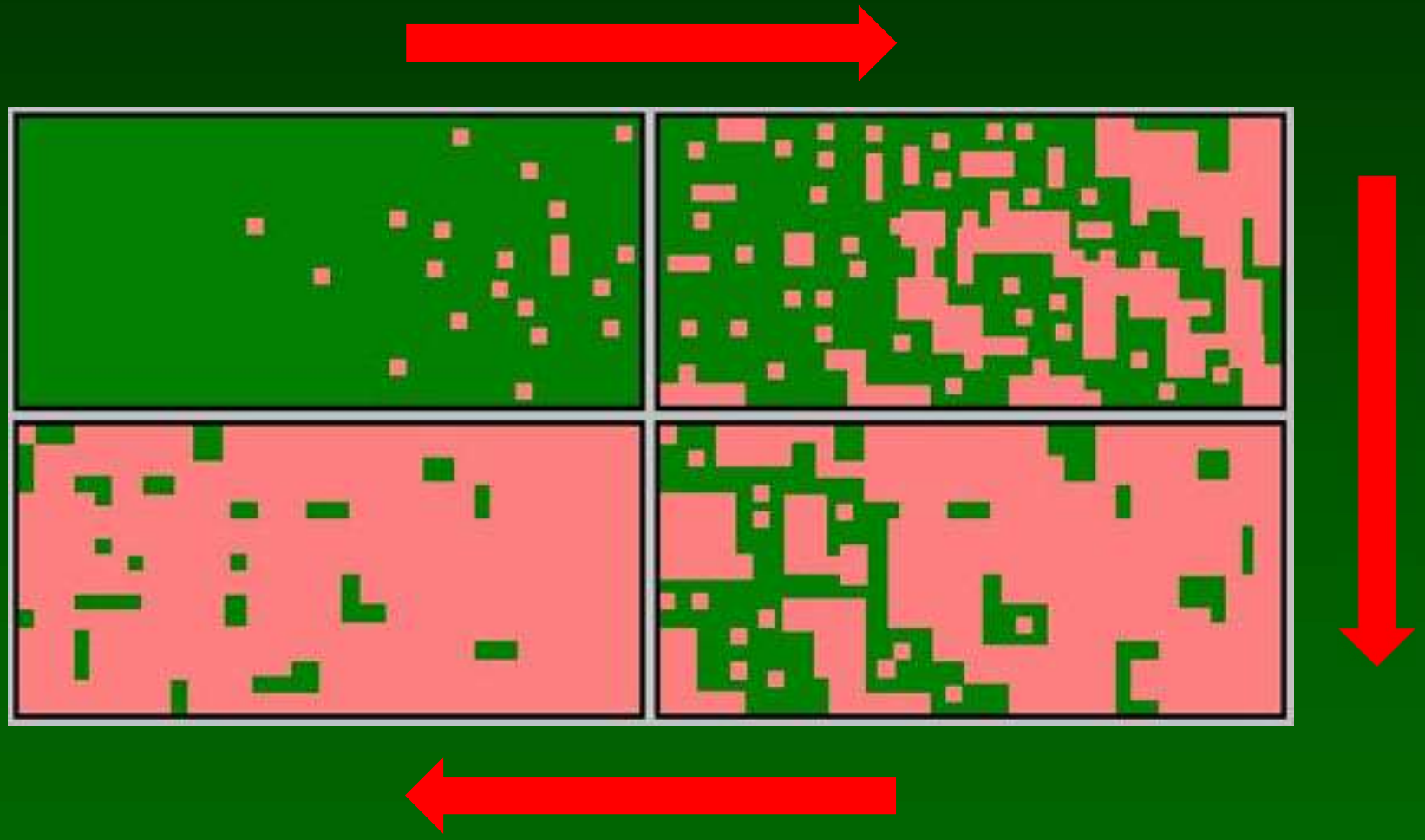
> 300 m



maioria organismos auxiliares

"Stepping-stones"

Fragmentação da paisagem agrícola



Vegetação natural /floresta

Culturas agrícolas

Estrutura e composição da paisagem: fragmentação de habitats naturais

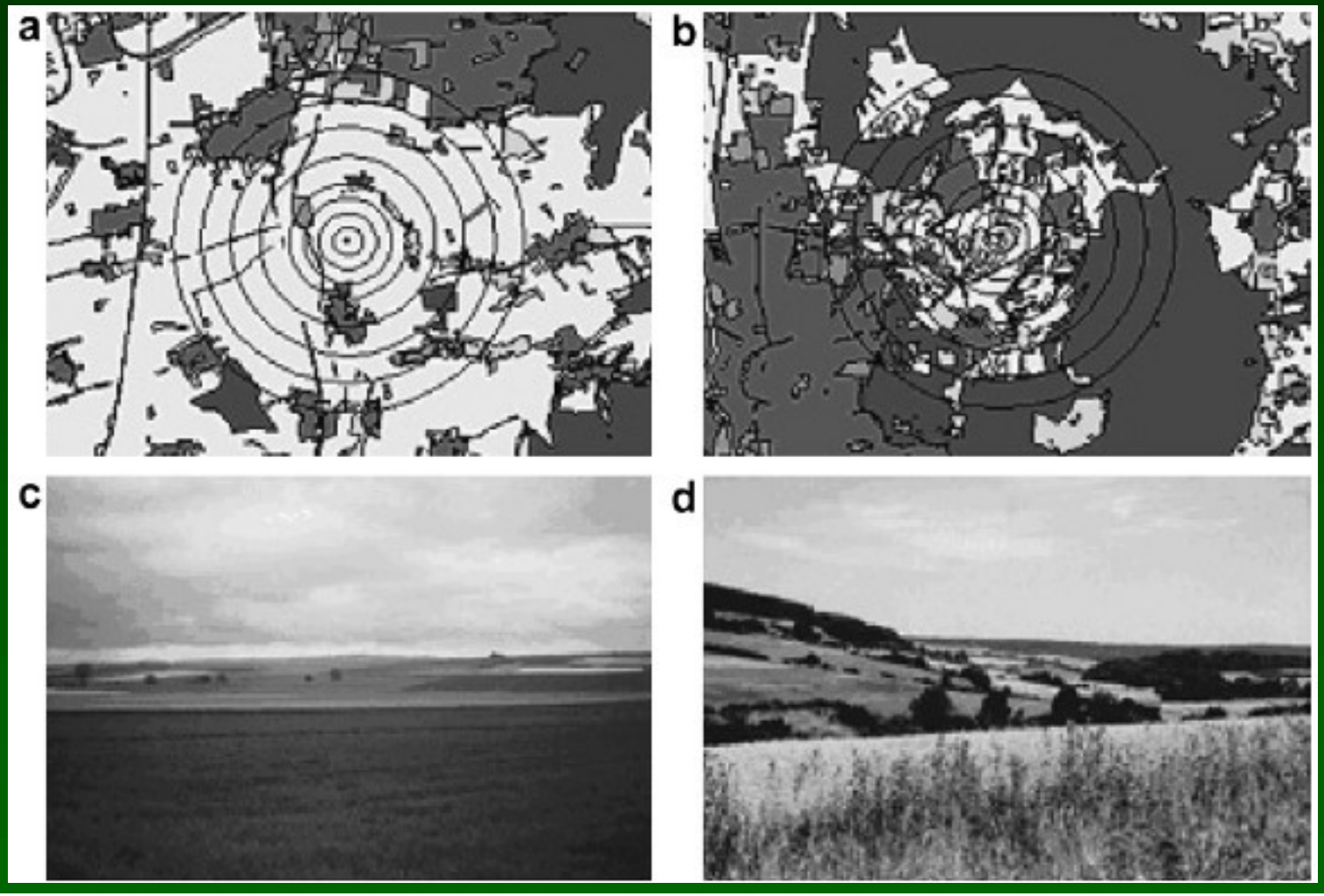


Fig. 1. Structurally simple (a and c) and complex (b and d) landscapes (near the city of Göttingen, Germany) showing the great contrasts in landscape composition with corresponding differences in natural-habitat fragmentation and landscape-wide species pools (see text for more details). (a–b) GIS data (white, arable crop area; the rest is noncrop area) with circles of different diameters indicating different and species-specific spatial scales experienced by the dispersing organisms. (c–d) Photos.

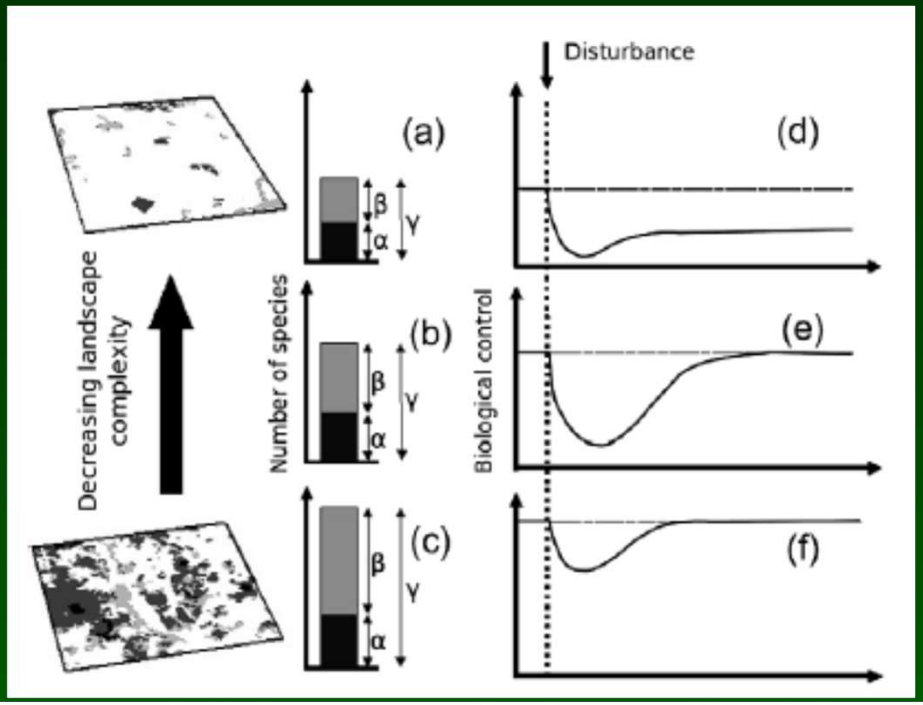


Fig. 5. Hypothesized response to disturbance on biological control by native natural enemies (conservation biological control) in different landscapes, showing how beta diversity (a–c) and recover of biological control after disturbance (d–f) change with landscape heterogeneity. (a and d) Intensely used monotonous landscape with a small available species pool, giving a low general level of biological control, a greater dip in biological control after a disturbance and an ecosystem that is unable to recover. (b and e) Intermediate landscape harbouring slightly higher species richness, rendering deeper dip and slower return from a somewhat lower maximum level of biological control after a disturbance. (c and f) Heterogeneous landscape with large species richness, mainly due to the higher beta diversity, rendering high maximum level of biological control, and low dip and quick return in biological control after a disturbance. Modified after Bengtsson et al. (2003).

Gestão do habitat em pomares

- **Infra-estruturas ecológicas**
  - Cobertura vegetal do solo ou enrelvamento
    - Vegetação residente
    - Sementeira
  - Sebes/cortinas de abrigo




Projecto nº 29 do PO AGRO-Medida 8.1-DE&D

"Gestão da flora adventícia e envolvente do pomar de citrinos com vista ao fomento da limitação natural dos inimigos da cultura"

- ISA
- DRAALG
- Frutoeste
  - Consultoria: Estação Agronómica Nacional

O Projecto nº 29 PO AGRO-Medida 8.1-DE&D

- **Objectivo principal:**
  - **mostrar que a gestão da cobertura vegetal do solo e a selecção adequada de sebes ou cortinas de abrigo podem contribuir para fomentar a limitação natural dos inimigos da cultura.**

três modalidades de gestão de cobertura do solo, ao nível da entrelinha

- sementeira de espécies seleccionadas

- **Mafra:**
  - *Lolium multiflorum* (5 kg/ha),
  - *Lolium perenne* (5 kg/ha)
  - *Medicago polymorpha* (3 kg/ha)
  - *Trifolium resupinatum* (3kg/ha)
  - *Trifolium fragiferum* (3kg/ha)
  - *Trifolium incarnutum* (3kg/ha)

- **Tavira:**
  - *Lolium multiflorum* (10 kg/ha),
  - *Medicago polymorpha* (3 kg/ha)
  - *Medicago truncatula* (9 kg/ha)
  - *Medicago scudellata* (4 kg/ha)
  - *Trifolium resupinatum* (4 kg/ha)


três modalidades de gestão de cobertura do solo, ao nível da entrelinha
aplicação de herbicida (prática comum na região): diurão+glifosato+terbutilazina

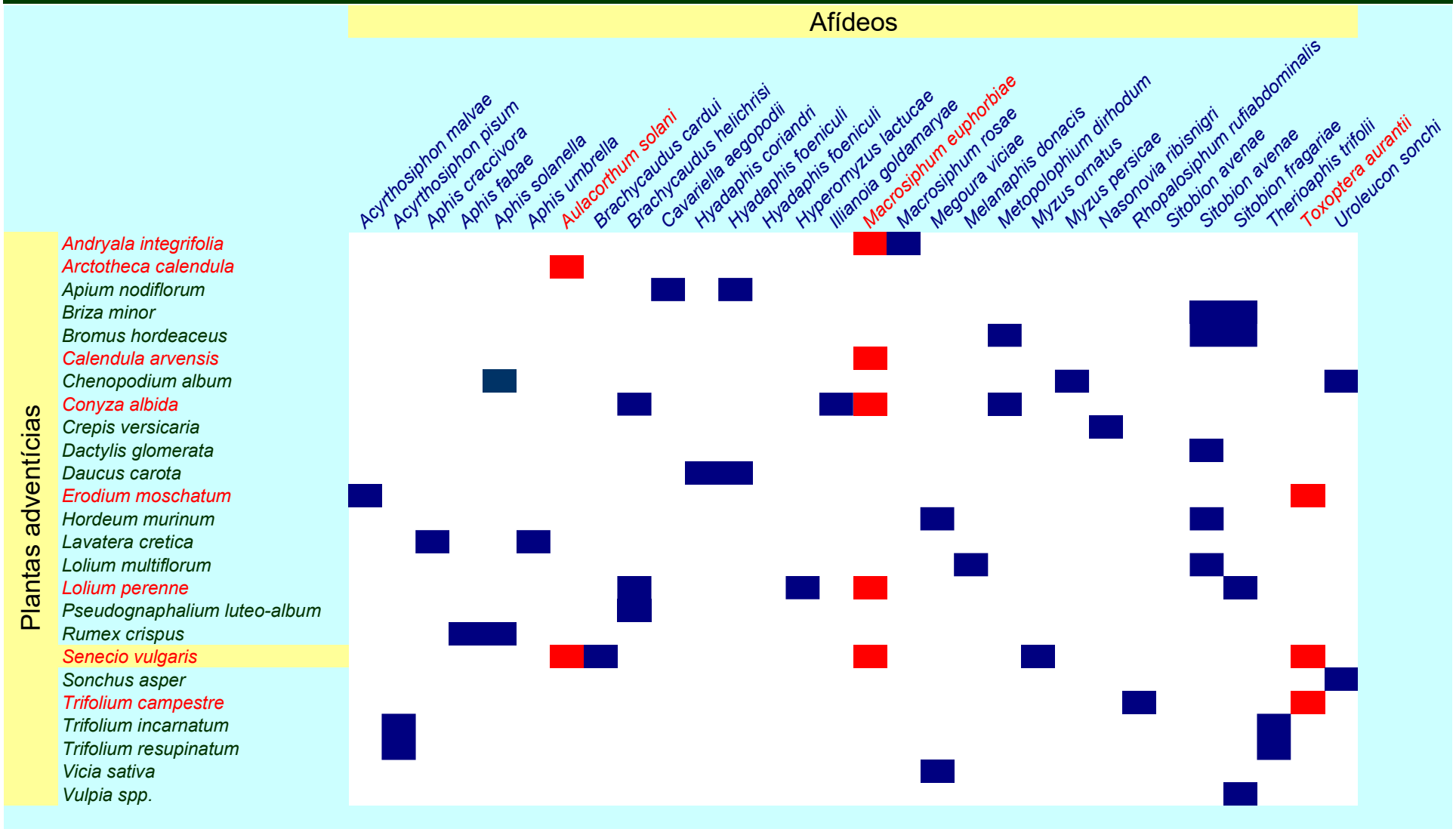
Sebes/cortinas de abrigo

- Considerou-se, também, a presença e natureza das sebes/cortinas de abrigo:
  - ciprestes
  - incenso
  - canas

Sebes e flora adventícia como hospedeiros de fitófagos

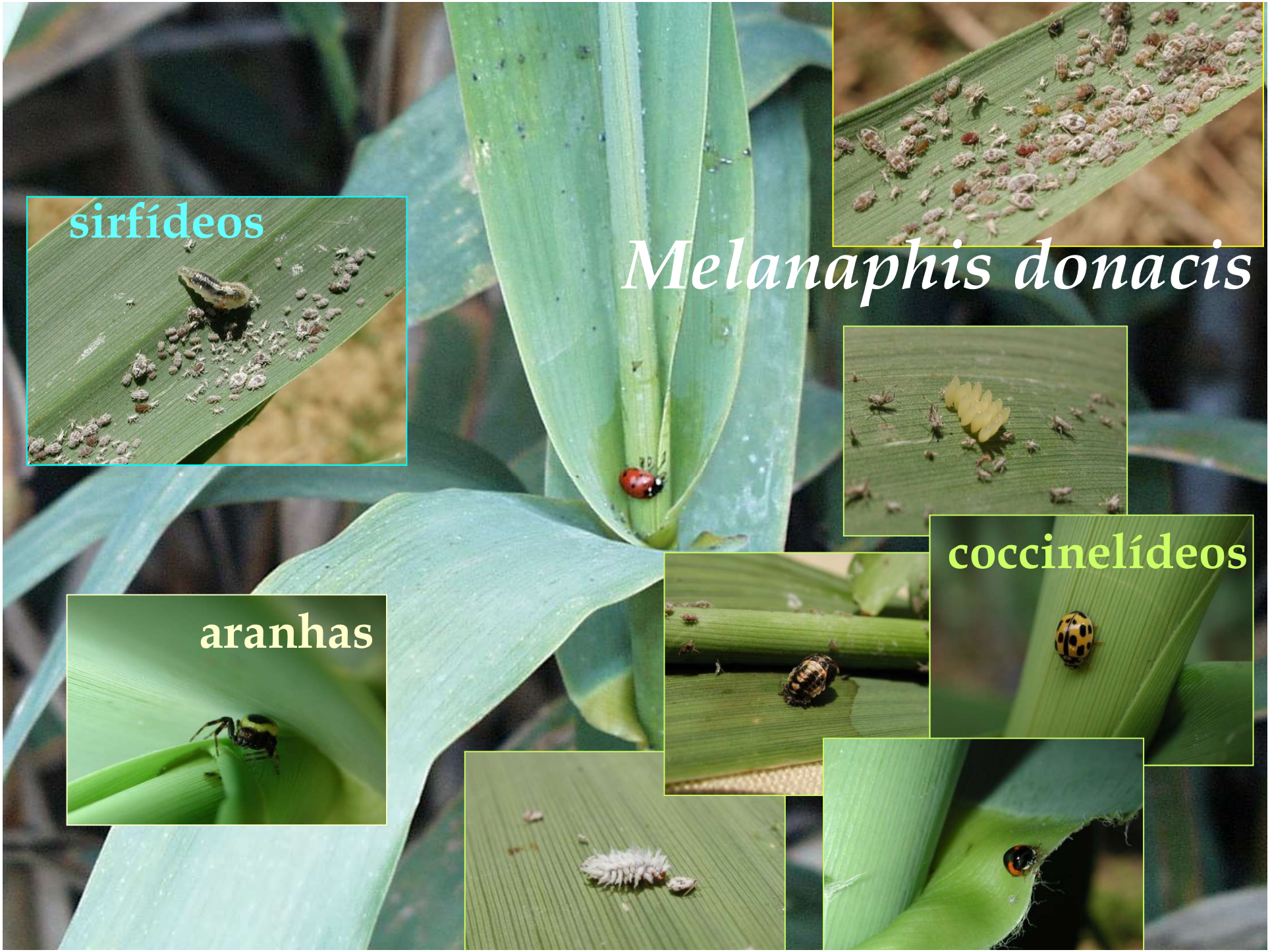
Fitófagos: pragas ou auxiliares?

Afídeos identificados em plantas adventícias

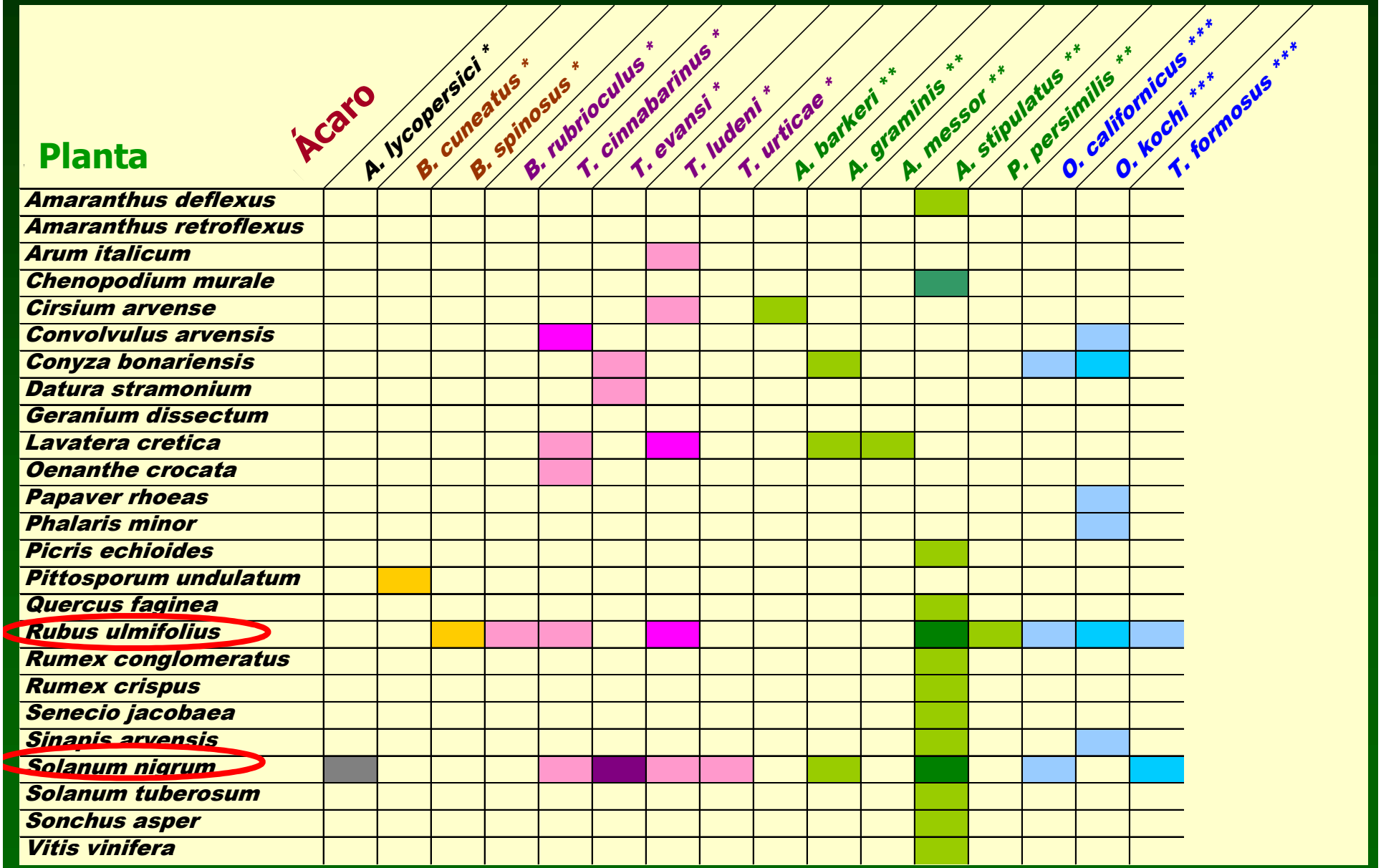


Afídeos identificados em sebes

Espécie	Cortinas de abrigo																				
	Canas							Pitósporo							Ciprestes						
	I	II	III	IV	V	VI	VII	I	II	III	IV	V	VI	VII	I	II	III	IV	V	VI	VII
Acyrthosiphon pisum																					
Amphorophora rubi																					
Anoecia corni																					
Aphis arbuti																					
Aphis fabae																					
Aphis solanella																					
Aphis spiraecola																					
Atheroides serrulatus																					
Aulacorthum solani																					
Brachycaudus helichrysi																					
Capitophorus elaeagni																					
Cinara cupressi																					
Dysaphis spp.																					
Hyperomyzus lactucae																					
Illinoia goldamarie																					
Illinoia morrinsoni																					
Lipaphis erysimi																					
Macrosiphum euphorbiae																					
Megoura viciae																					
Melanaphis donacis																					
Metopolophium dirhodum																					
Myzus ornatus																					
Myzus persicae																					
Protaphis terricola																					
Rhopalosiphum padi																					
Rhopalosiphum rufiabdominalis																					
Sitobion avenae																					
Sitobion fragariae																					
Therioaphis trifolii																					
Tetraneura caerulescens																					
Toxoptera aurantii																					
Uroleucon jaceae																					
Uroleucon mierae																					
Uroleucon sonchi																					
Total	42	103	379	5	14	8	1	5	7	13	1	0	0	0	8	11	81	6	4	4	1


sirfídeos
Melanaphis donacis
coccinelídeos
aranhas

Ácaros identificados em plantas adventícias



Efeito do enrelvamento
na
abundância e diversidade
de
predadores e parasitóides

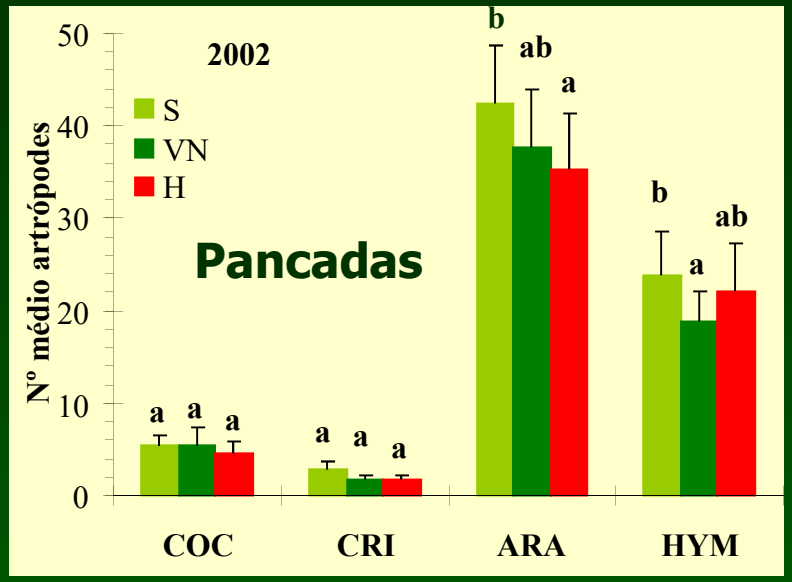
Efeito na abundância de auxiliares

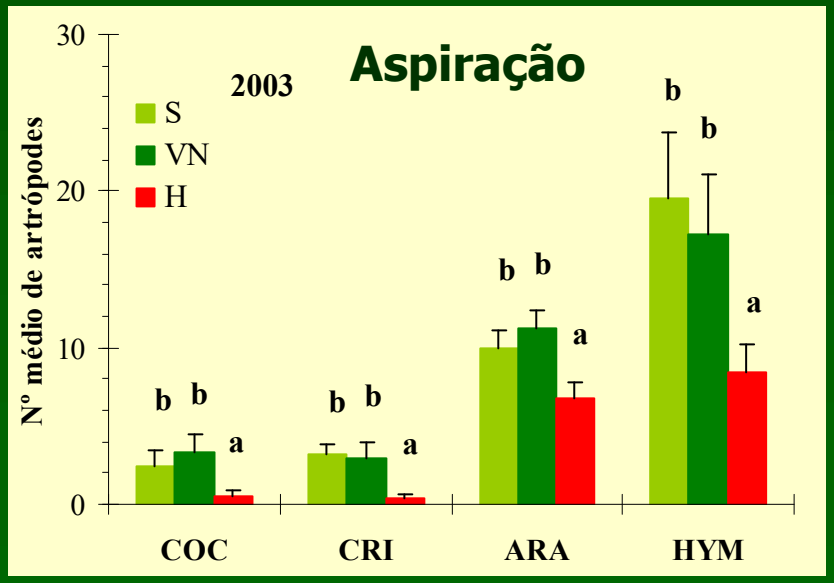
Himenópteros parasitóides

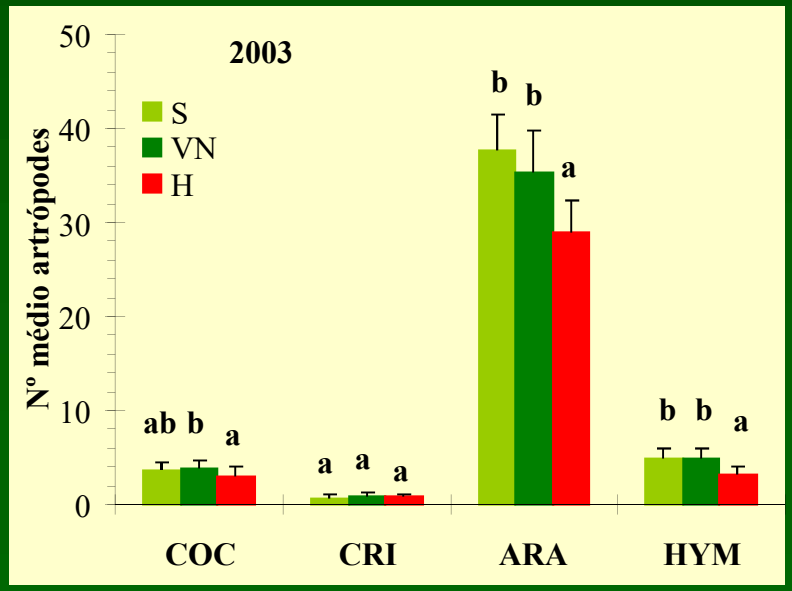
coccinelídeos

crisopídeos

aranhas

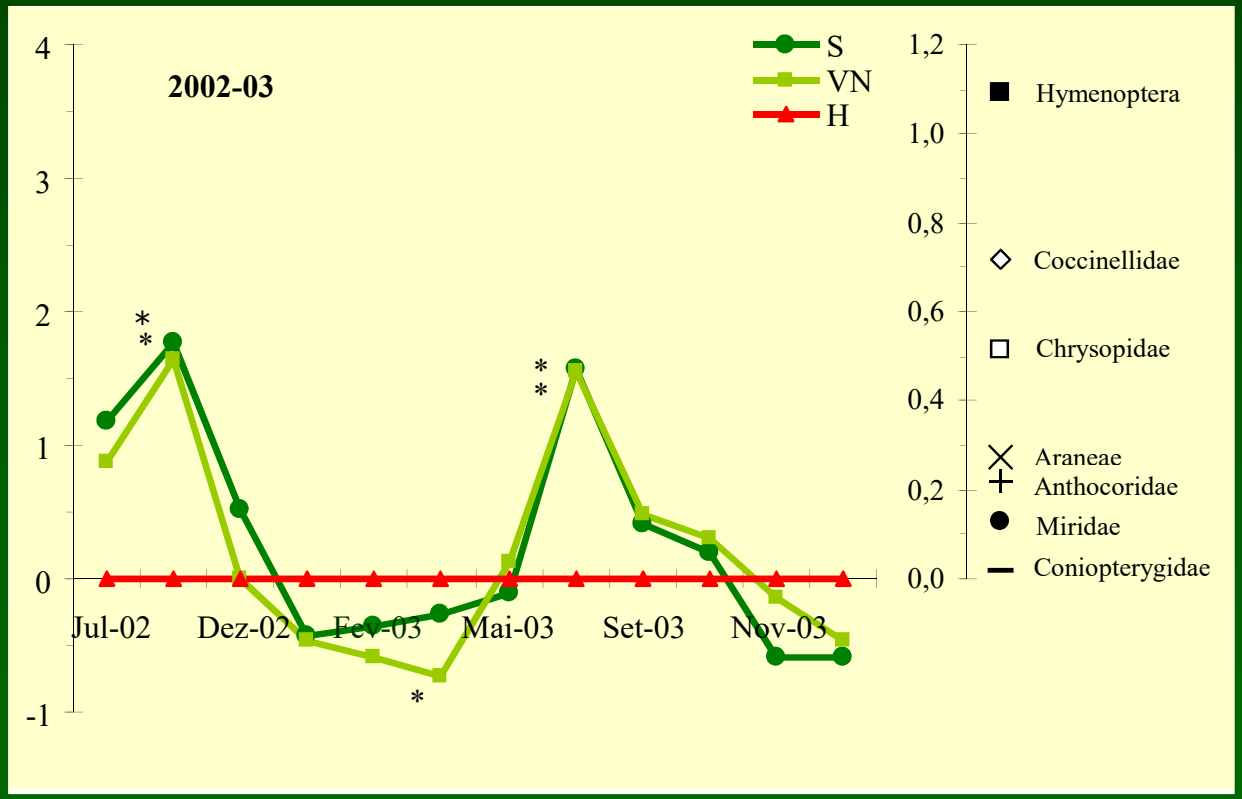






Influência da cobertura vegetal do solo na dinâmica dos artrópodes auxiliares

- **"Principal Response Curves (PRC)" (téc. pancadas)**



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Effect of ground cover vegetation on the abundance and diversity of beneficial arthropods in citrus orchards

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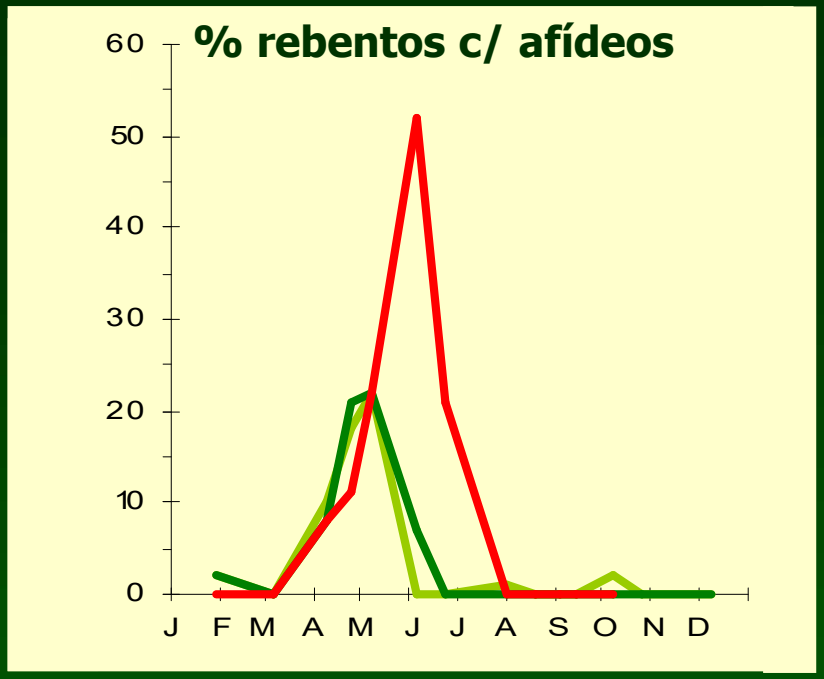
Abstract

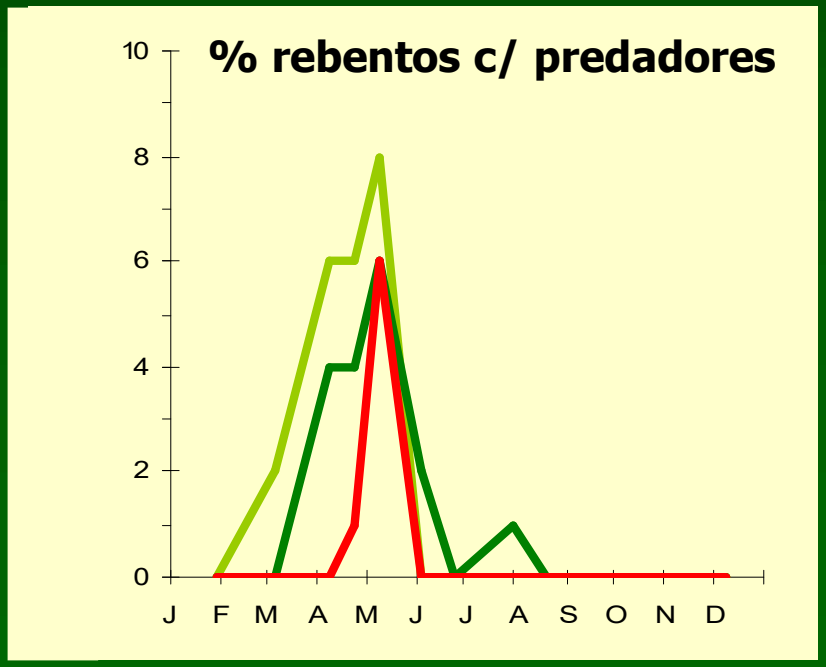
The effect of ground cover upon the communities of beneficial arthropods established in the canopy of lemon trees was investigated, by comparing three ground-cover management treatments applied: RV, resident vegetation; S, sowed selected species; and BS, bare soil by controlling weeds with herbicide. Over two consecutive years, arthropod communities in the tree canopy were sampled periodically by beating and suction techniques. Significantly higher numbers of beneficial arthropods were found in the RV and S treatments in comparison with bare soil. Spiders and parasitoid wasps were the two most common groups, representing, respectively, 70% and 19% of all catches in beating samples and 33% and 53% in suction samples. For the RV and S treatments, significant seasonal deviations from the bare soil treatment were observed using principal response curves. Similar seasonal patterns were observed over the two years. The RV and S treatments showed significant positive deviations from the BS treatment in late spring and summer, accounted for the higher numbers of parasitoid wasps, coccinelids and lacewings present. By contrast, the seasonal deviations observed for the spider community differed from those of the remaining arthropods. During late winter and early spring, the RV and S treatments presented a higher abundance of spiders in the tree canopy, in comparison with bare soil, whereas in the summer significantly more spiders were found in the bare soil treatment. Spider movements between tree canopy and ground vegetation layers may justify this result.

Keywords: cover crop, habitat management, parasitoids, predators, Principal Response Curves

- O enrelvamento aumentou a abundância de artrópodes auxiliares na cultura
- Não se registou efeito significativo na diversidade de aranhas e coccinelídeos



Antecipação da colonização da cultura pelos inimigos naturais



Será que o aumento da diversidade de auxiliares se traduz numa limitação natural mais efectiva dos inimigos das culturas?

Available online at www.sciencedirect.com
ScienceDirect
Biological Control 45 (2008) 225–237
Biological Control
www.elsevier.com/locate/ybcon

Are the conservation of natural enemy biodiversity and biological control compatible goals?

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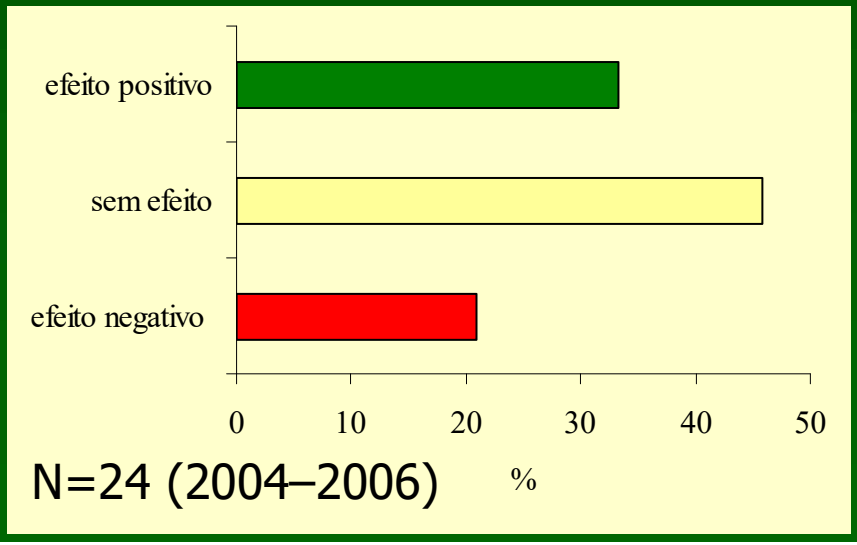
[b] Department of Entomology, Washington State University, Pullman, WA 99164, USA
[c] Division of Plant Sciences, University of Missouri-Columbia, Columbia, MO 65211

Efeito da diversidade de auxiliares na supressão de pragas



N=24 (2004–2006)

Conclusão:

O efeito depende do contexto

sustainability

MDPI

Article

Ecological Infrastructures May Enhance Lepidopterans Predation in Irrigated Mediterranean Farmland, Depending on Their Typology and the Predator Guild

José Carlos Franco, Manuela Branco, Sofia Conde, André Garcia, Maria Rosário Fernandes, José Lima Santos, Tainan Messina, Gonçalo Duarte, André Fonseca, Vera Zina * and Maria Teresa Ferreira

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* Correspondence: verazina@isa.ulisboa.pt

Abstract: Ecological infrastructures (EIs) are considered relevant components in agricultural landscapes to support biodiversity and ecosystem services. We used the predatory attacks on lepidopteran dummies as a proxy to assess predation rates in the agricultural matrix and different EIs types according to their location and vegetation structure. We aimed at comparing the effect of different types of EI on the predation intensity in two intensively irrigated agricultural areas located in the Sorraia and Tagus river valleys in central Portugal. We hypothesized that: (1) the predation rate would be higher near EIs compared with the agricultural matrix, (2) the positive effect of EIs on predation rate would differ with their typologies, and (3) the EIs' proximity and proportion in the surrounding landscape would have a positive effect on the predation rate in agricultural fields. The EI typologies influenced differently the predator groups and the overall predation rate. Major differences were observed for bird predation, being higher in woody EIs. A positive correlation between predation rate and EIs area of the surrounding landscape, as well as a negative correlation with the distance to the nearest riparian and woody EIs, was observed for birds. The observed dissimilarities in the predators' response may be related to habitat differences and its functional connectivity. The overall monthly low predation rates are possibly related to the intensive agricultural system and the small area occupied by EIs.

Keywords: artificial sentinel prey; dummy caterpillars; ecosystem services; greening; predators

check for updates

Citation: Franco, J.C.; Branco, M.; Conde, S.; Garcia, A.; Fernandes, M.R.; Lima Santos, J.; Messina, T.; Duarte, G.; Fonseca, A.; Zina, V.; et al. Ecological Infrastructures May Enhance Lepidopterans Predation in Irrigated Mediterranean Farmland, Depending on Their Typology and the Predator Guild. *Sustainability* **2022**, *14*, 3874. https://doi.org/10.3390/su14073874

Academic Editor: Helvi Heinonen-Tanski

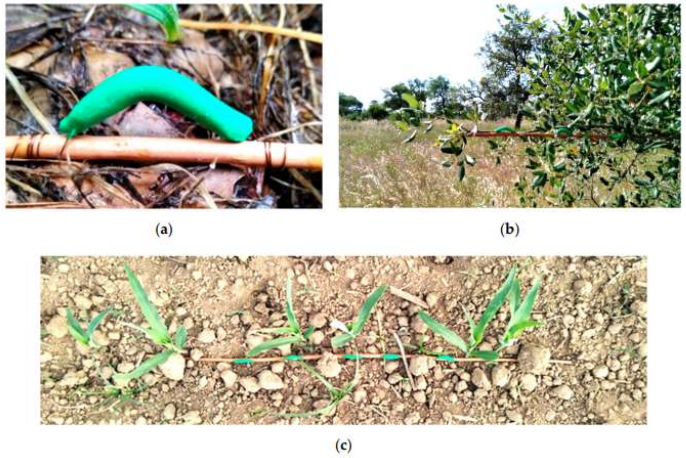


Figure 3. Setup of dummy caterpillars in the field: (**a**) close-up view; (**b**) placement on tree branches in an ecological infrastructure; (**c**) placement on the ground, in the agricultural matrix.

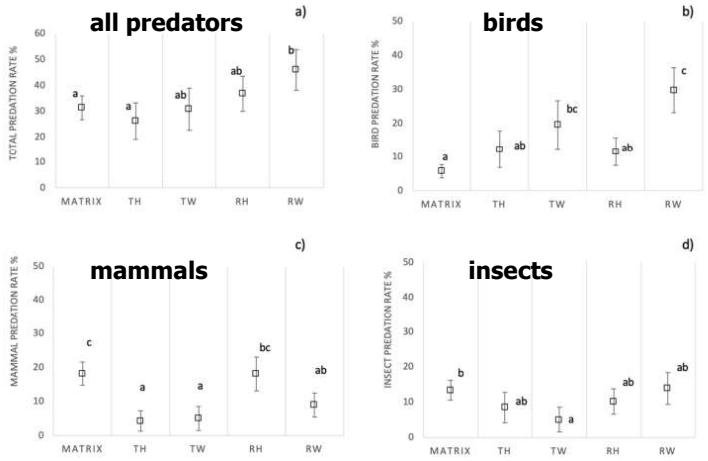
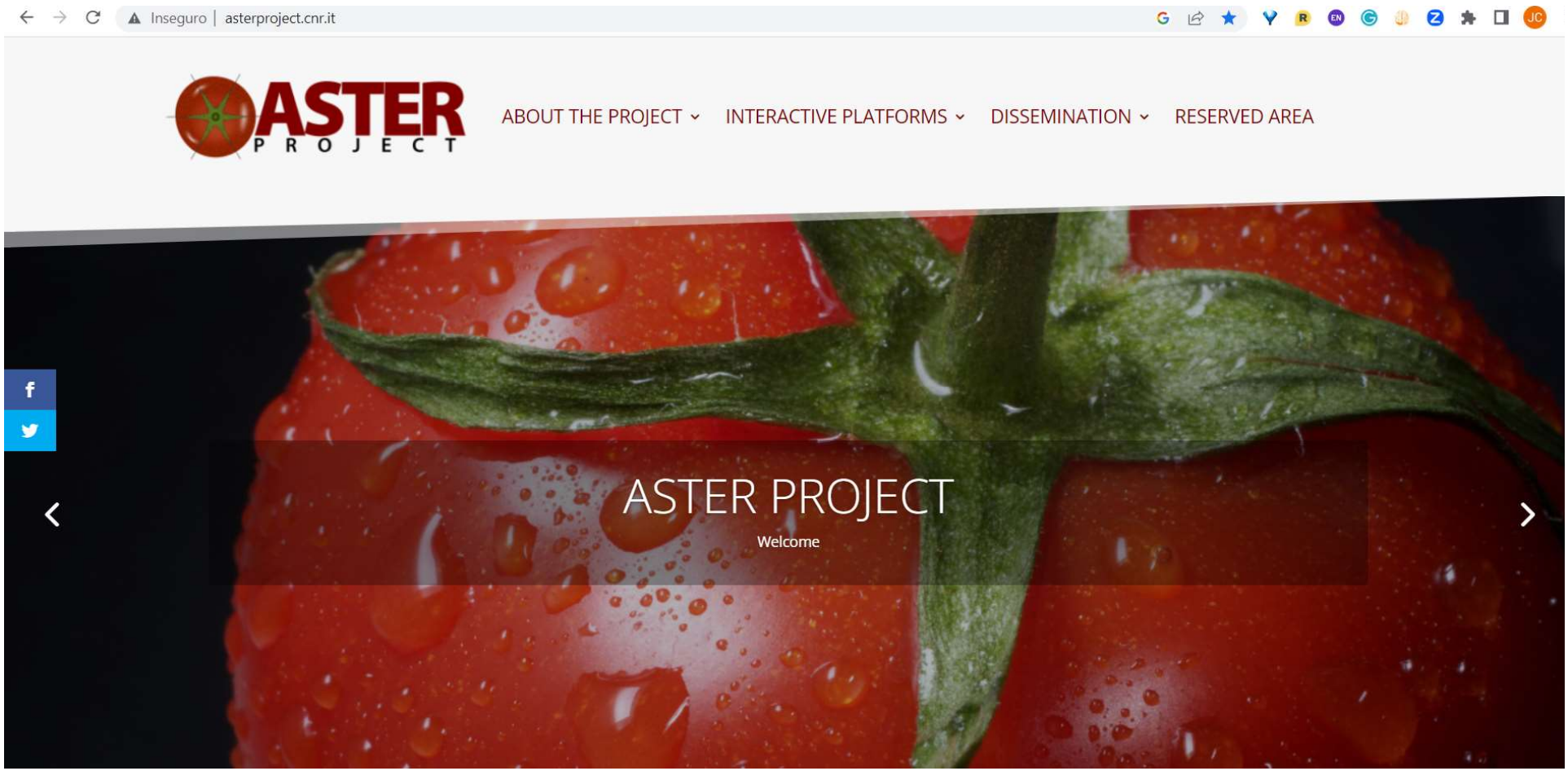


Figure 5. Mean (± SE) predation rate (percentage of dummies attacked) for a 30-day period of exposure registered in the matrix and EIs and produced by: (**a**) all predators, (**b**) birds, (**c**) mammals, and (**d**) insects. TH (terrestrial herbaceous), TW (terrestrial woody), RH (riparian herbaceous), and RW (riparian woody). Mean values with different letters are significantly different ($\alpha = 0.05$).



Agroecology-inspired Strategies and Tools to Enhance Resilience and ecosystem services in tomato crop

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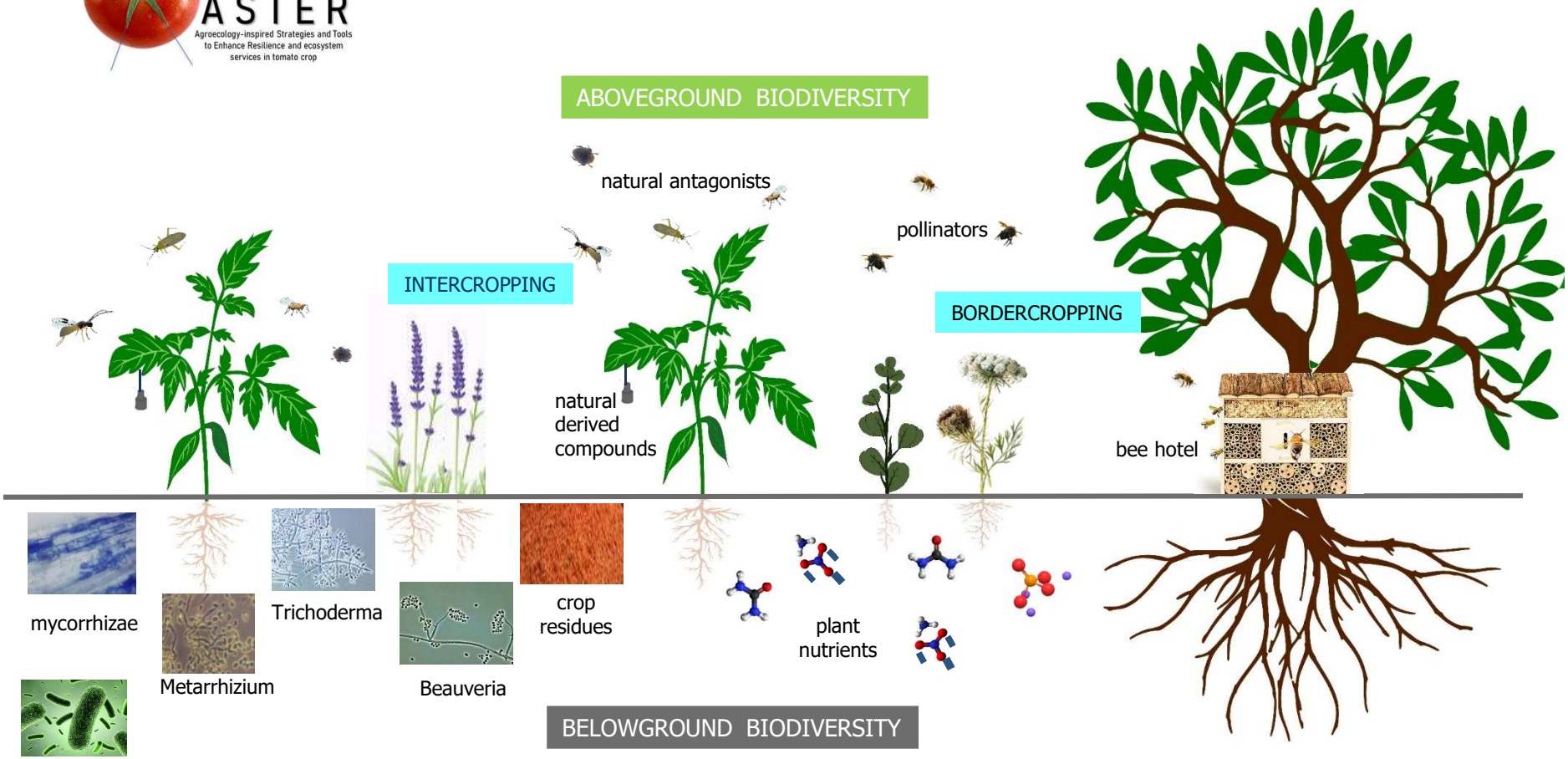


Thanks !