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## Crop diversity in the landscape favors bats and biological control of some pests

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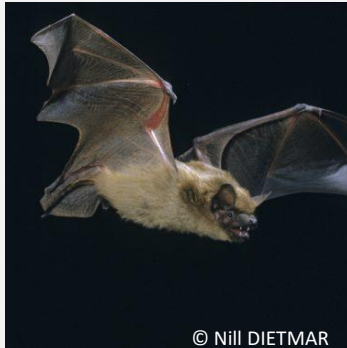
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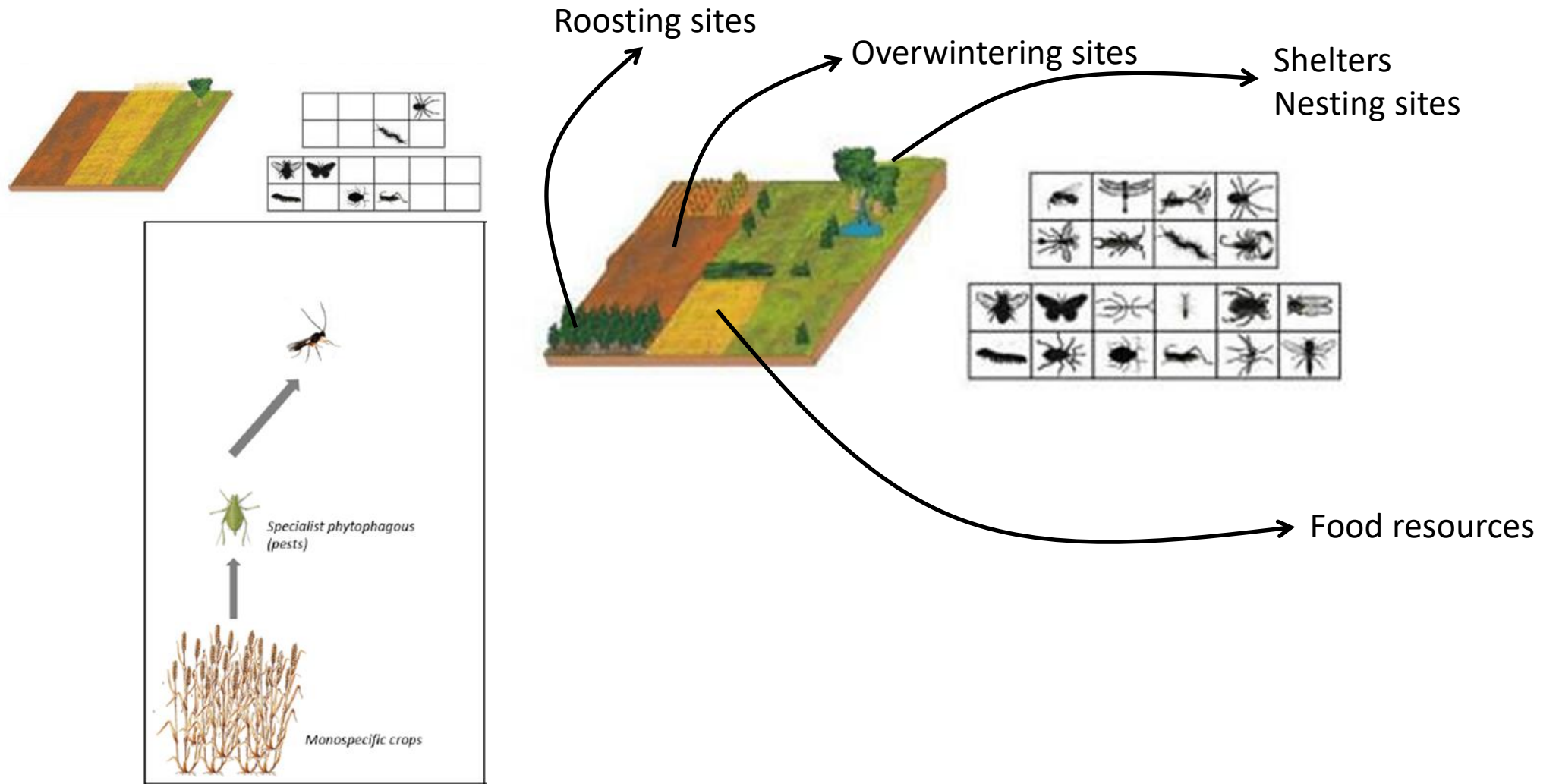
# Crop diversity in the landscape favors bats and biological control of some pests

Axelle Tortosa\*, Brice Giffard, Luc Barbaro, Jérémy Froidevaux, Sylvie Ladet, Jeanne Delhommel, Aude Vialatte



\*Contact mail: [axelle.tortosa@inrae.fr](mailto:axelle.tortosa@inrae.fr)

# ➤ Crop diversity favors natural enemies' diversity and biological pest control



(Damien, 2018; Hutchinson, 1959; Nesme et al. 2016, Root, 1973)

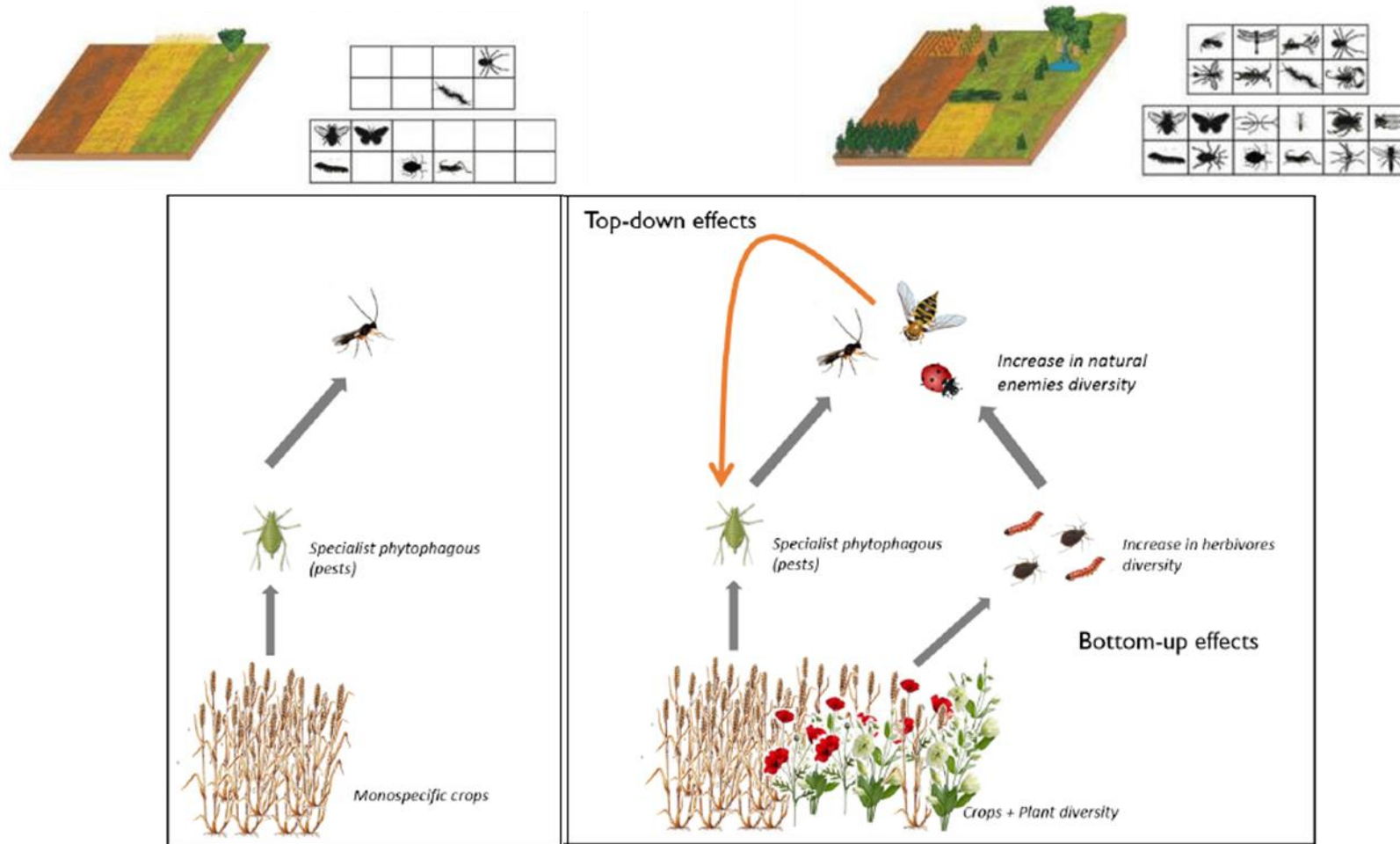


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# ➤ Crop diversity favors natural enemies' diversity and biological pest control



(Damien, 2018; Hutchinson, 1959; Nesme et al. 2016, Root, 1973)

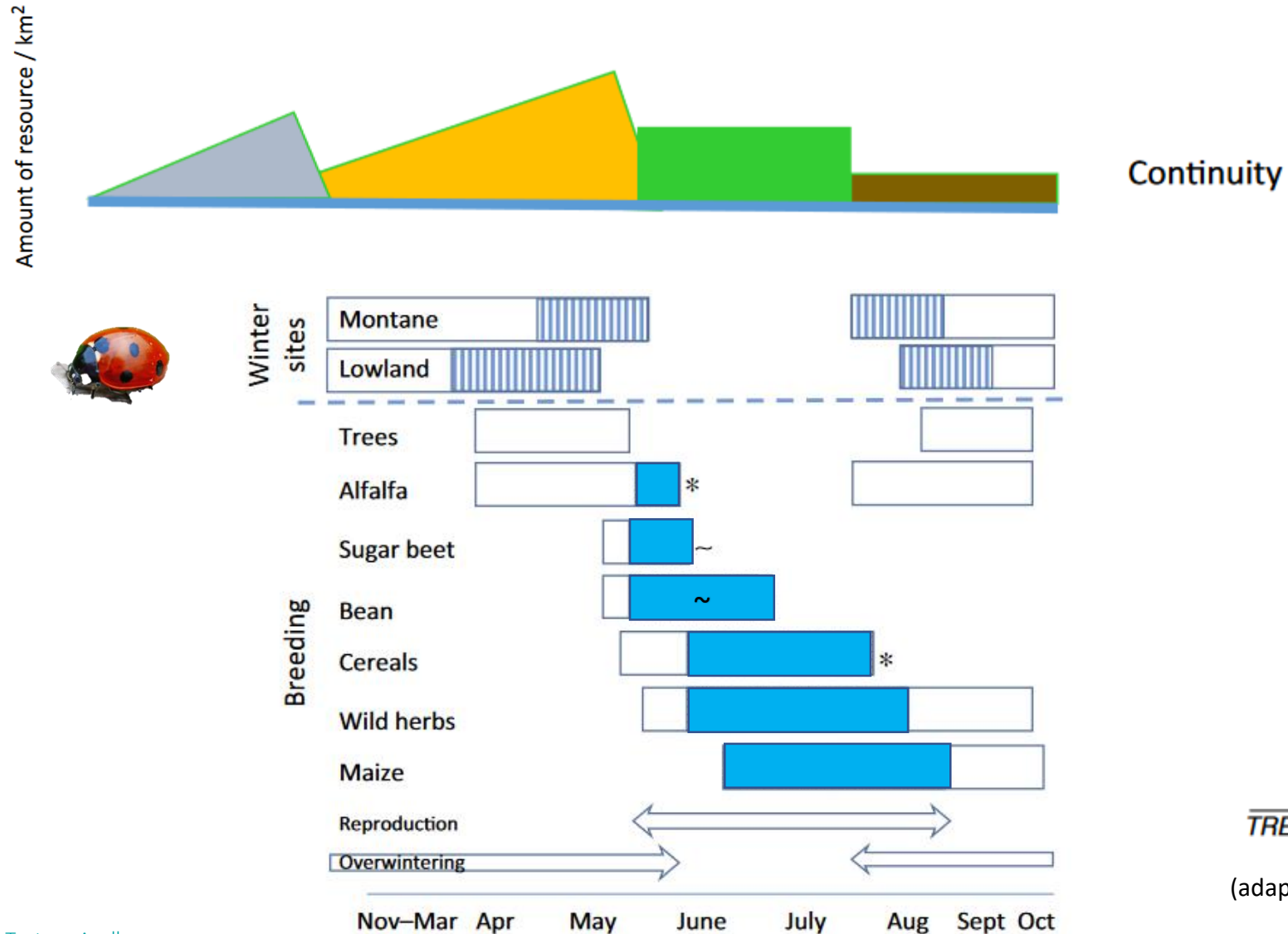


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# ➤ Resources continuity within agricultural landscapes

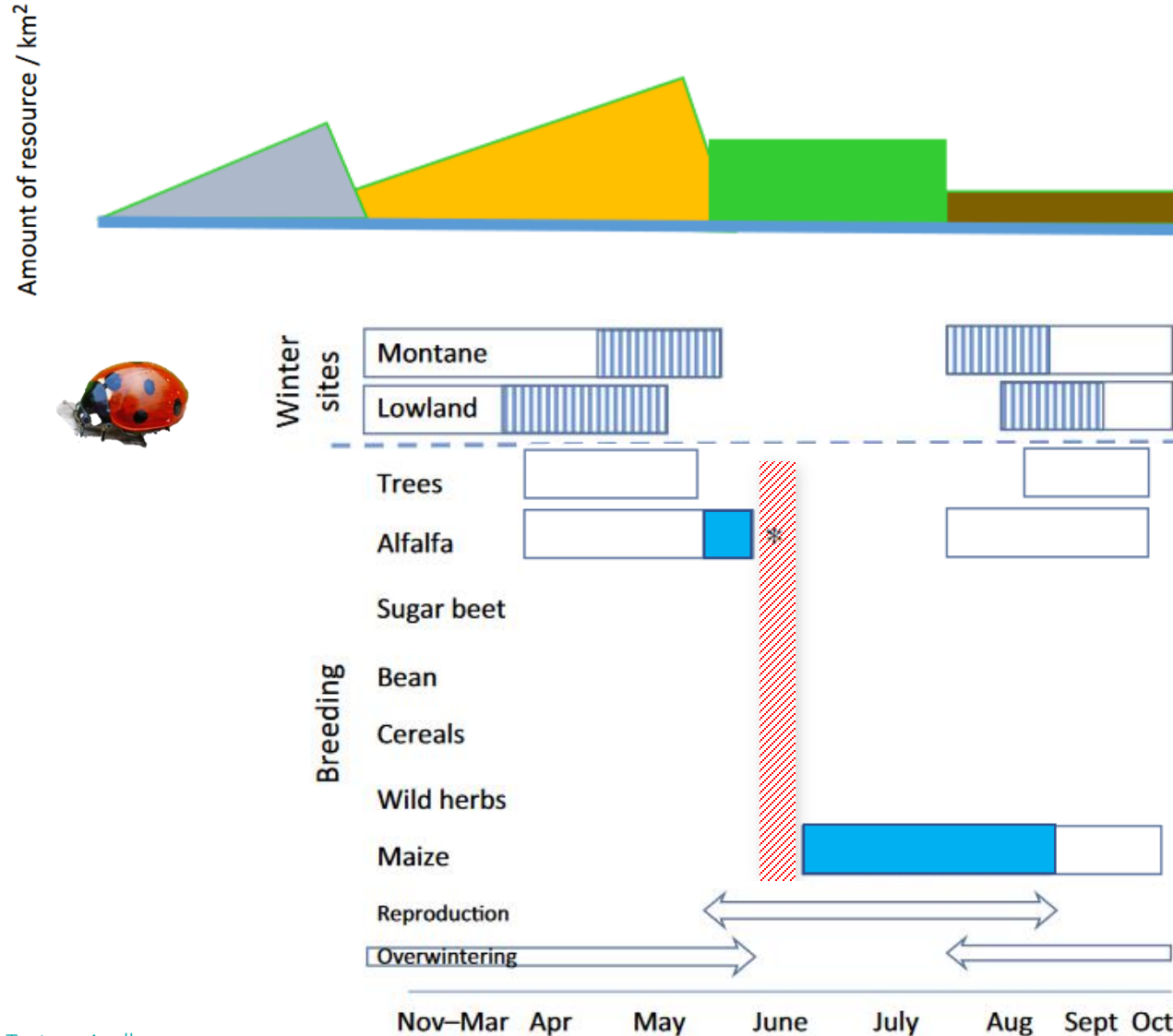


*TRENDS in Ecology & Evolution*

(adapted from Schellhorn et al., 2015)



# ➤ Resources continuity within agricultural landscapes



Continuity

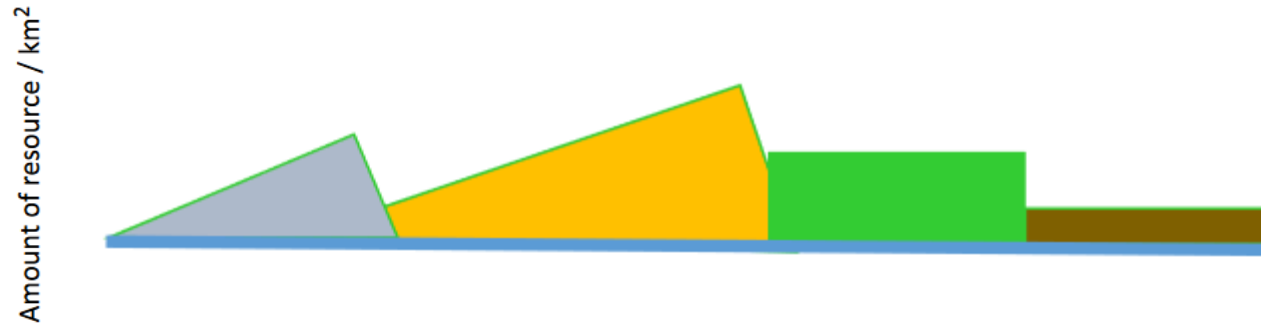
Agricultural landscape dominated by maize and alfalfa

*TRENDS in Ecology & Evolution*

(adapted from Schellhorn et al., 2015)



# ➤ Resources continuity within agricultural landscapes



Continuity

*TRENDS in Ecology & Evolution*

(adapted from Schellhorn et al., 2015)



Lepidopteran pests

Vineyards



Maize



Pine plantations



Nov–Mar Apr May June July Aug Sept Oct

Agricultural landscape with  
vineyards, maize fields  
and pine plantations



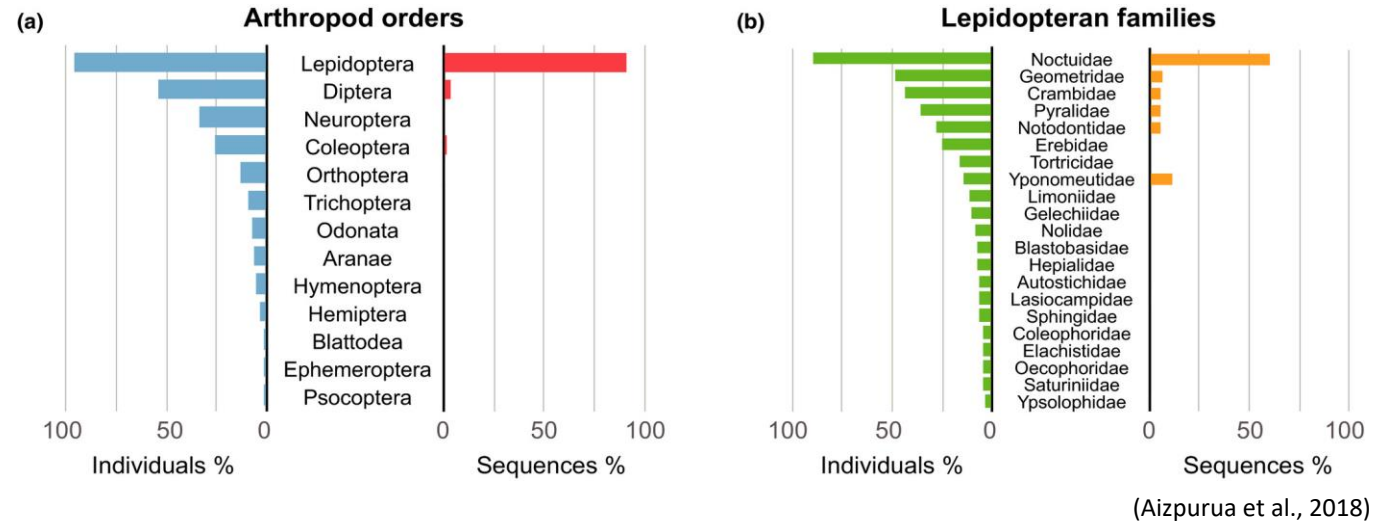
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(Aizpurua et al., 2018; Charbonnier et al., 2014; Charbonnier et al. 2021; Garin et al. 2019)

# ➤ Bats as generalist predators of agricultural and forest pests



➔ Lepidopteran pests are valuable food resources for bats

(Mata et al, 2021; Tournayre et al., 2020)

➔ Bats may be considered as bioindicators through their activity

(Alleva et al., 2006; Jones et al., 2009; Stahlschmidt & Brühl, 2012; Russo et al., 2021)



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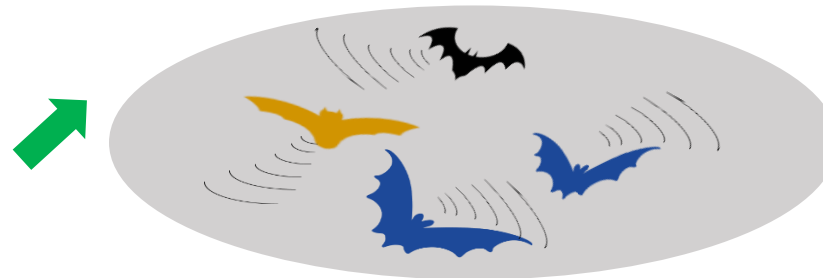


➤ Is the mixture of these **three crops** at the landscape scale **favorable to bats** and does it **favor biological control of pests** ?

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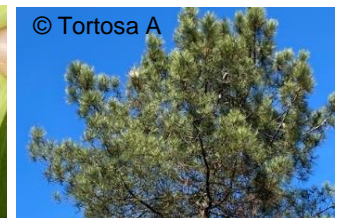
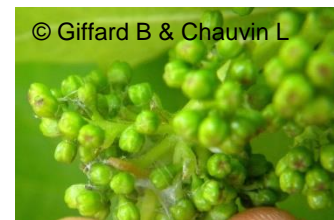
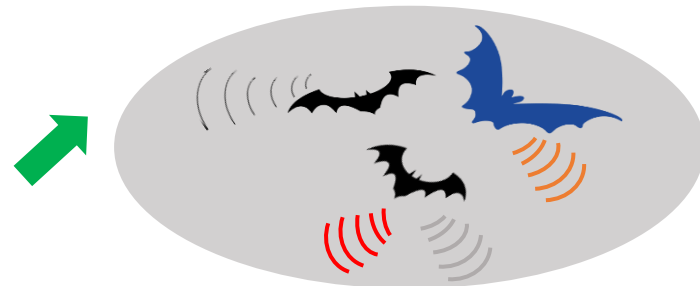
- Higher species richness and activity



➤ Is the mixture of these three crops at the landscape scale favorable to bats and does it favor biological control of pests ?

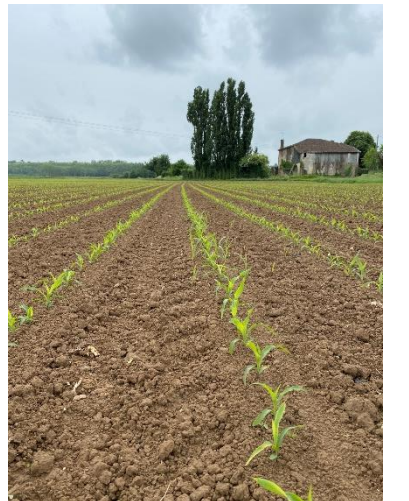
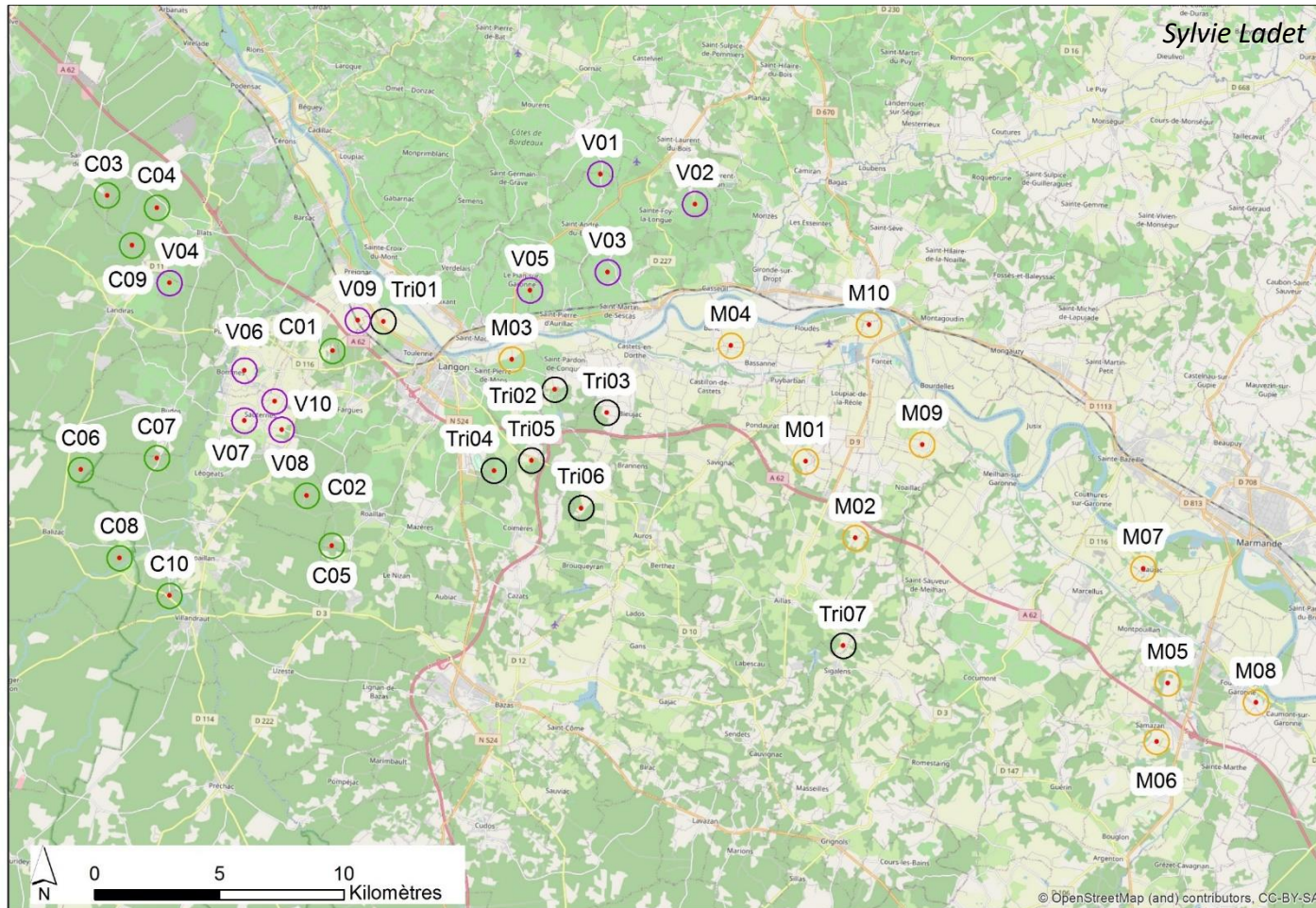


- Higher foraging activity and less crop damage



# ➤ Material and methods

Données à valeur ajoutée traitées par le CNES pour le pôle de données Theia [www.theia.land.fr](http://www.theia.land.fr) à partir de données Copernicus. Les traitements utilisent les algorithmes développés par les Centres d'Expertise Scientifique de Theia.



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## ➤ Material and methods



X 10



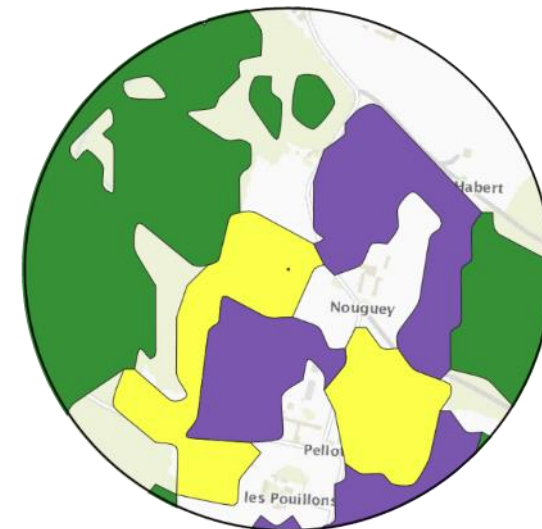
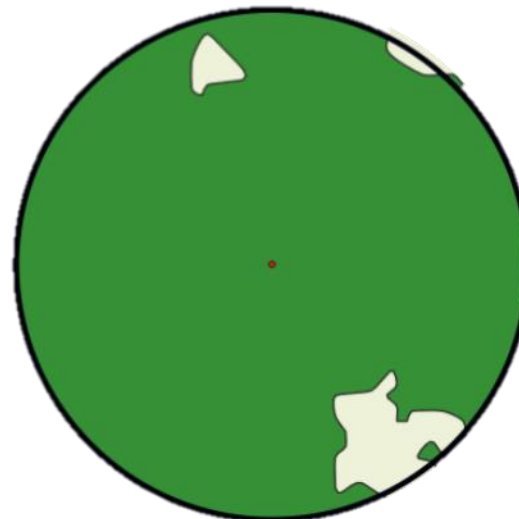
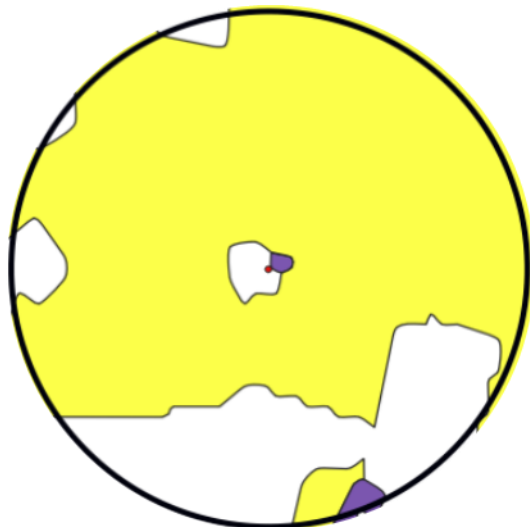
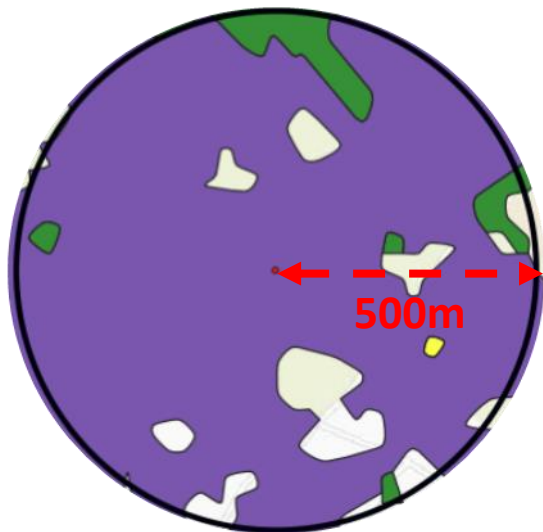
X 10



X 10



X 7



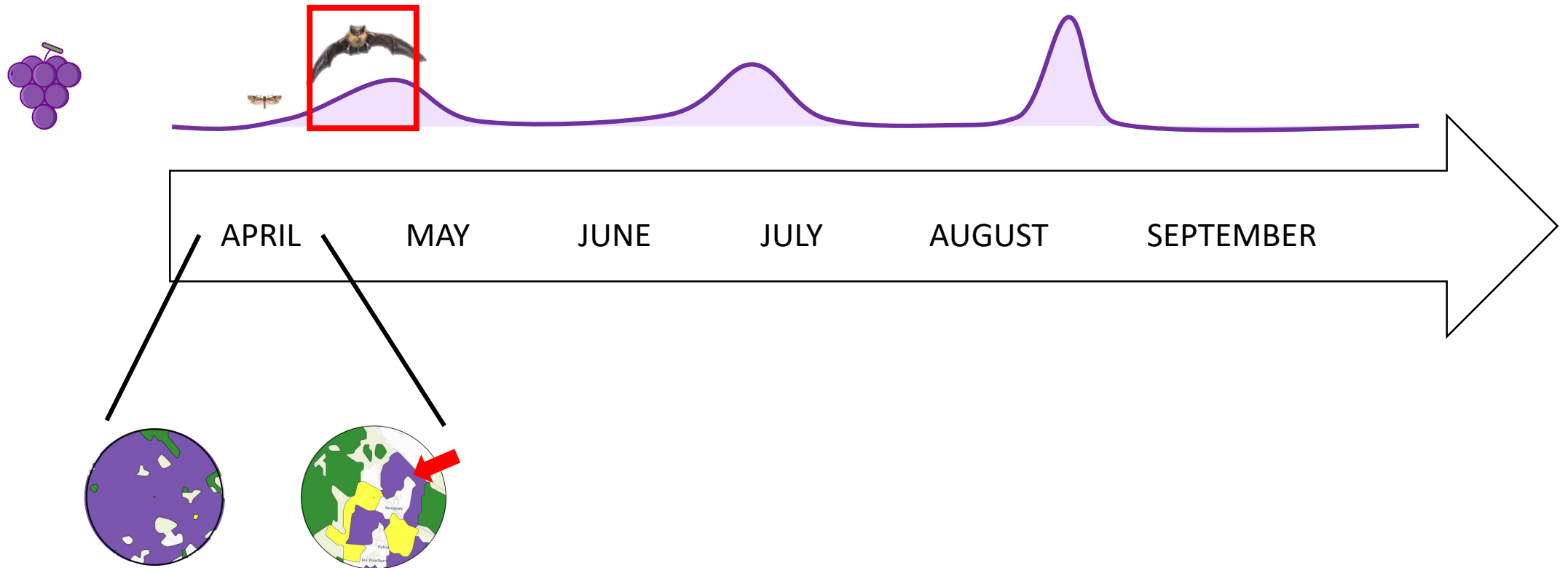
**Crop-dominated landscapes**

**N = 3 x10**

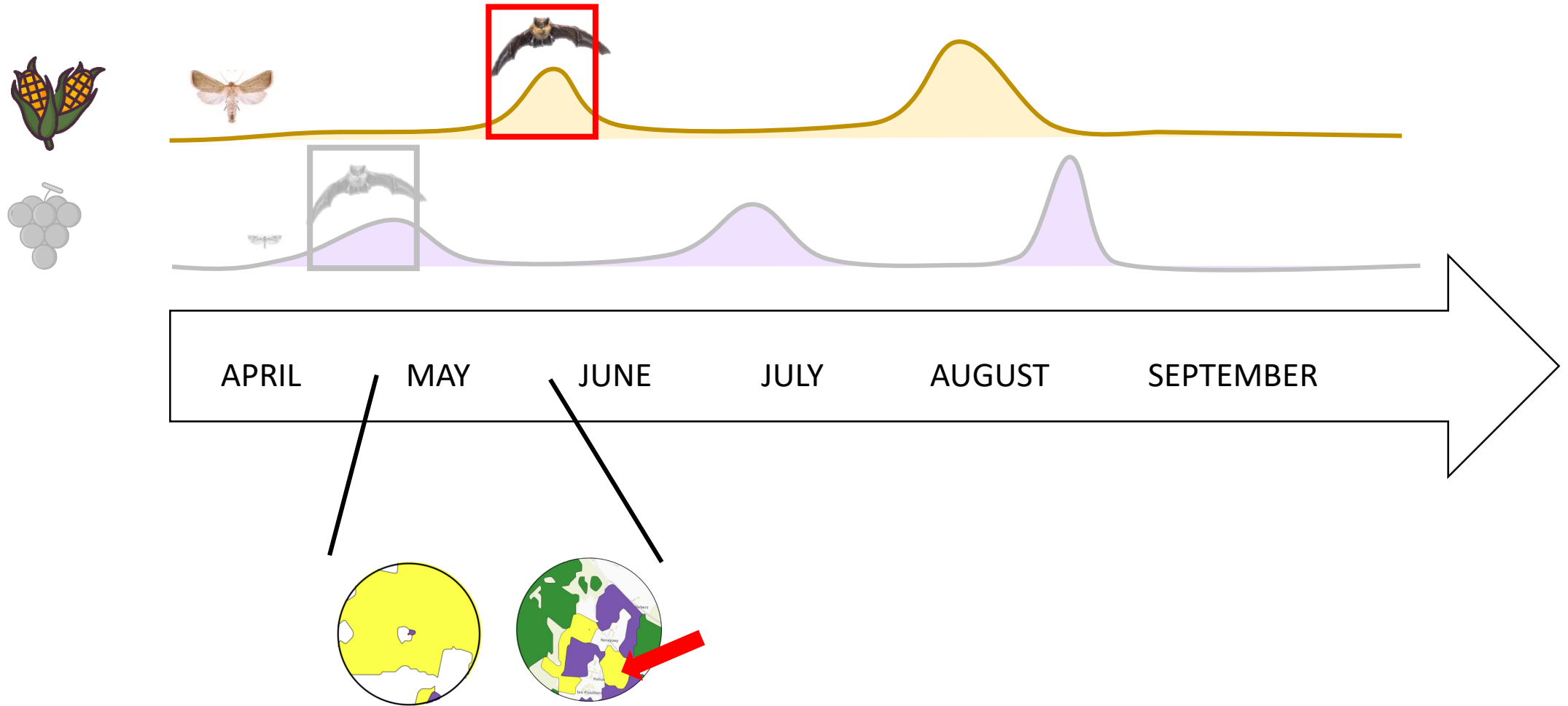
**Diverse landscapes**

**N = 7**

## ➤ Material and methods



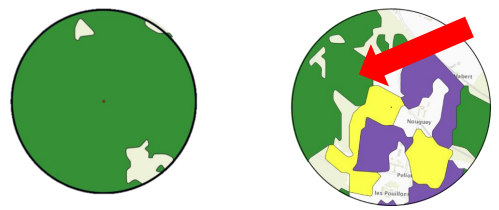
# ➤ Material and methods



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APRIL      MAY      JUNE      JULY      AUGUST      SEPTEMBER



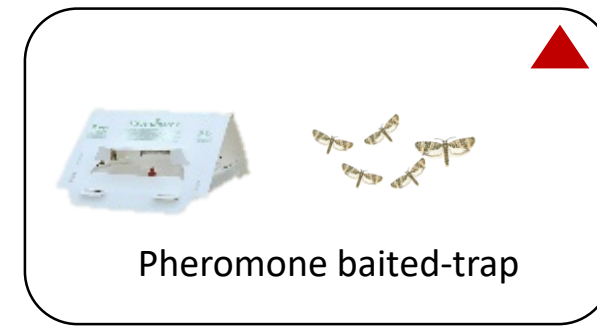
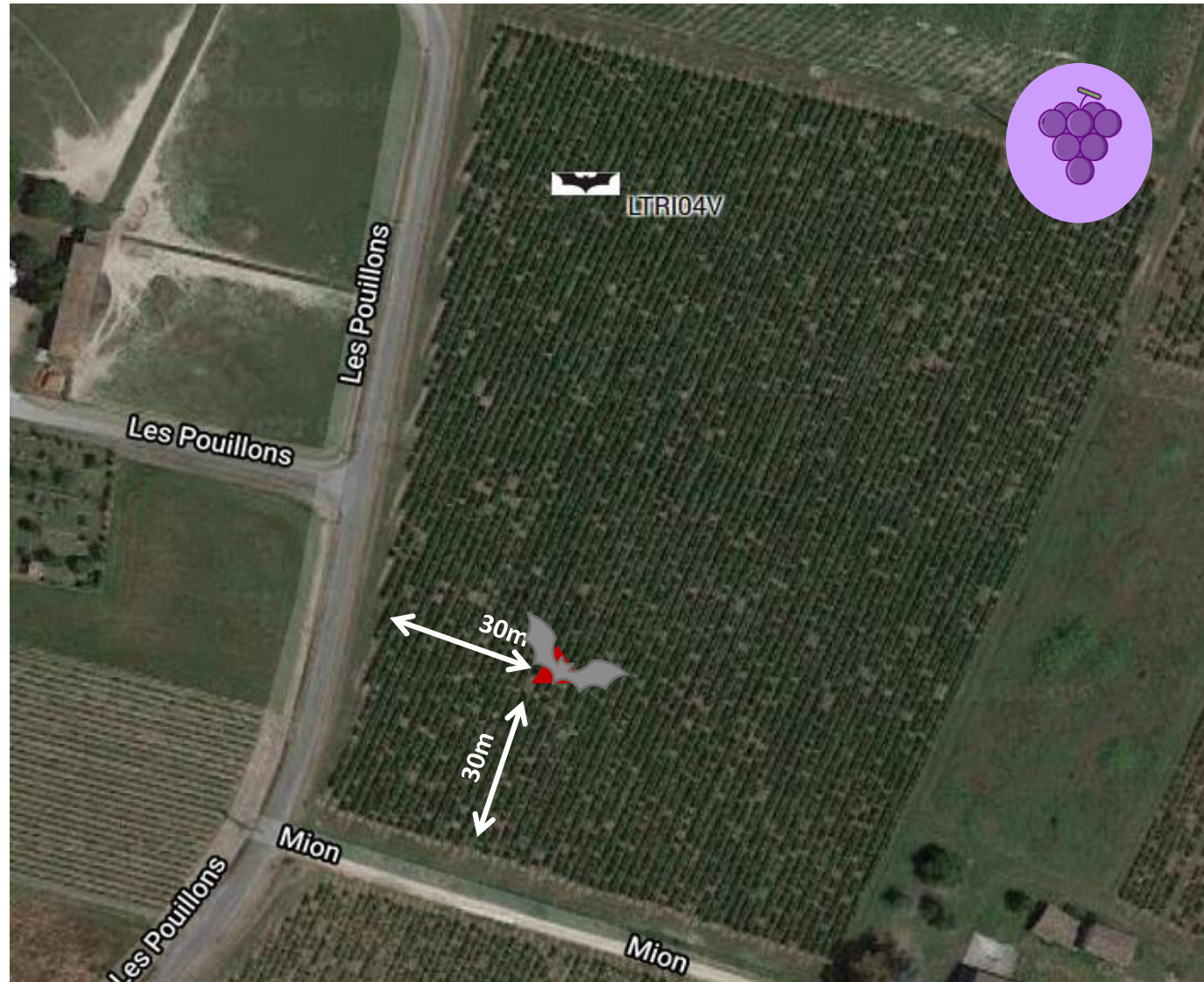
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## ➤ Material and methods



Pheromone baited-trap

+ 7 nights



Batloggers A/A+

+ 2 nights

TADARIDA

VIGIECHIRO

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(<https://github.com/YvesBas/Tadarida-C/>; Bas et al., 2017)

## ➤ Material and methods

### Damage

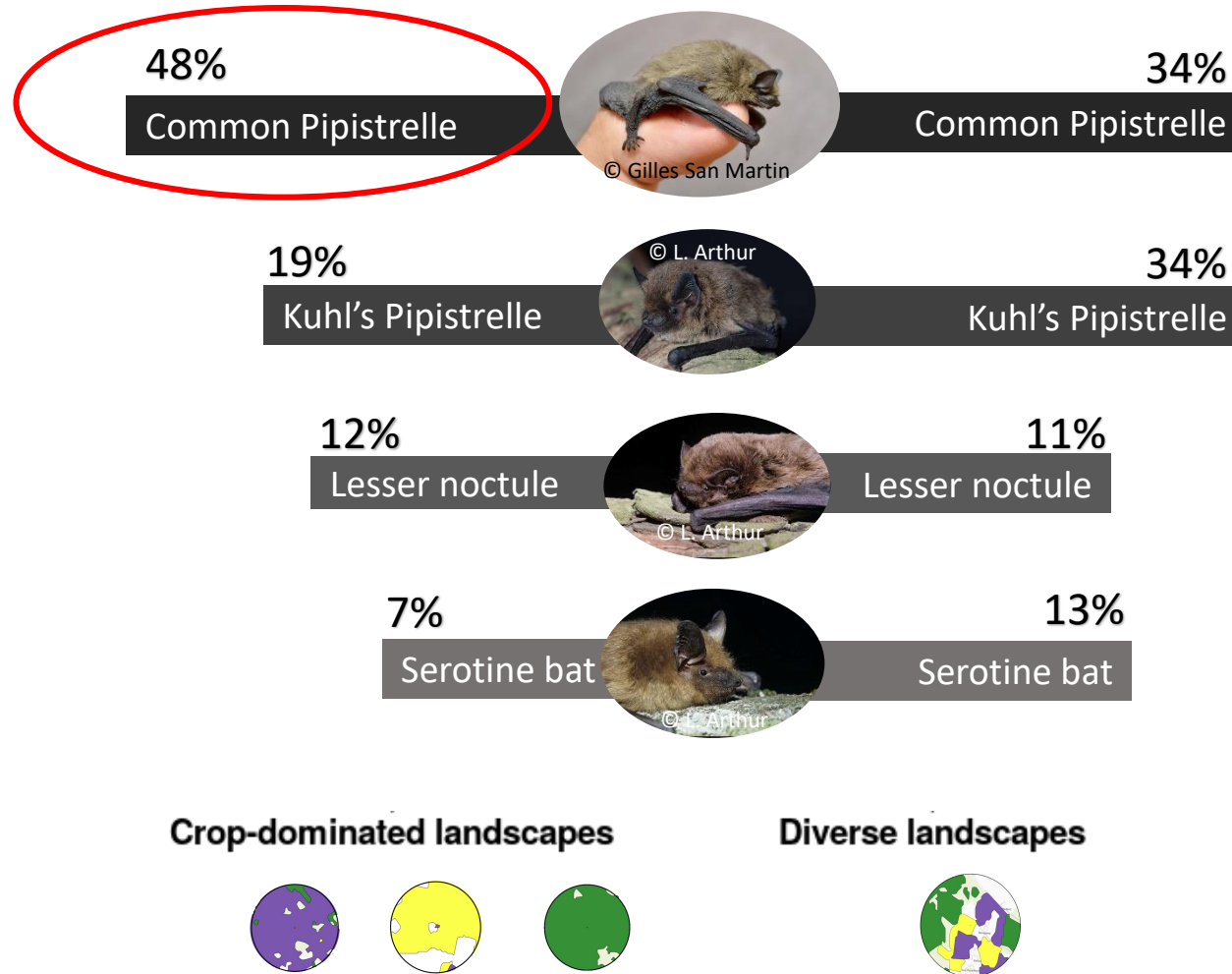




➤ Results  
*Is the mixture of the three crops favorable to bats?*

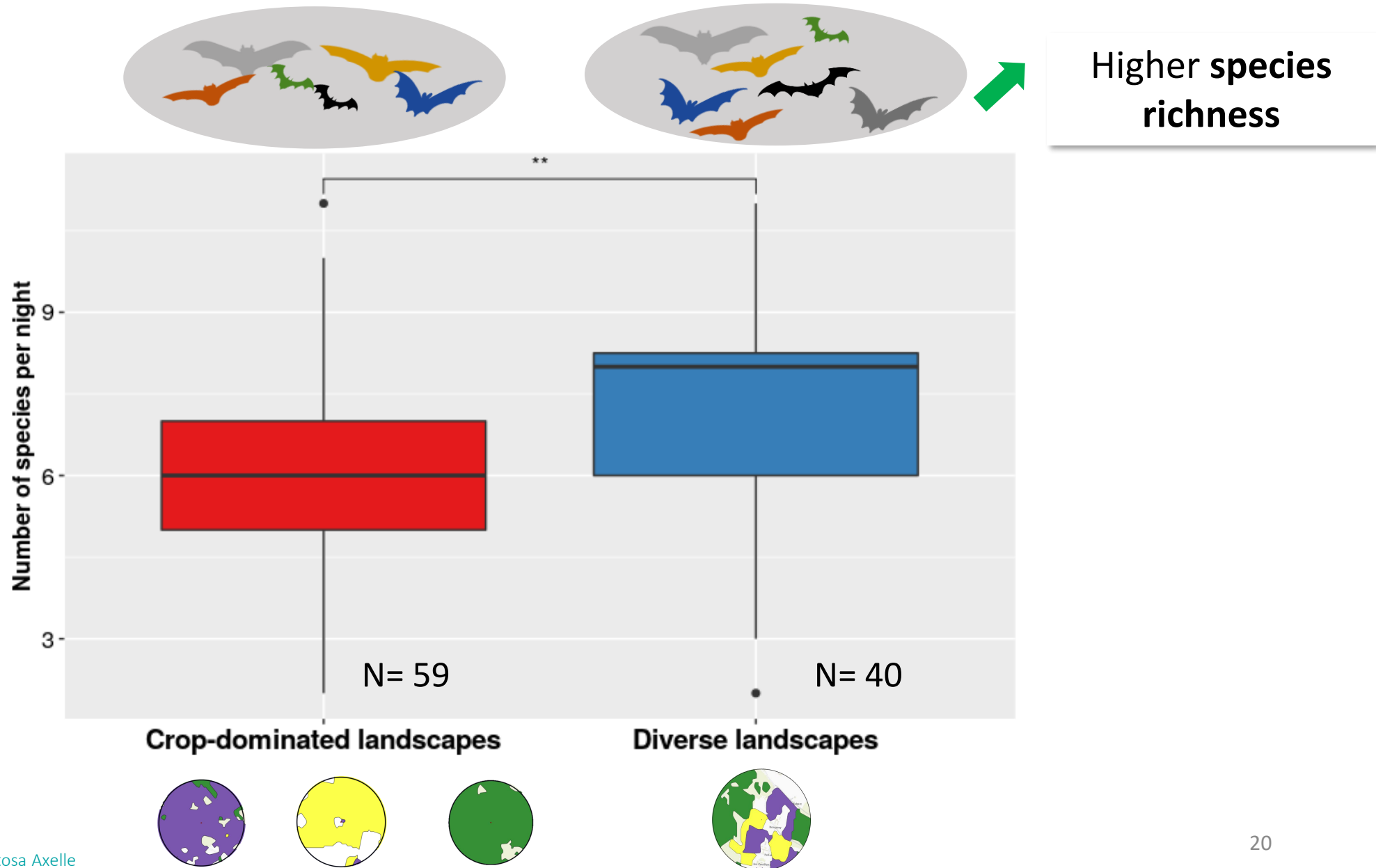
## ➤ Results

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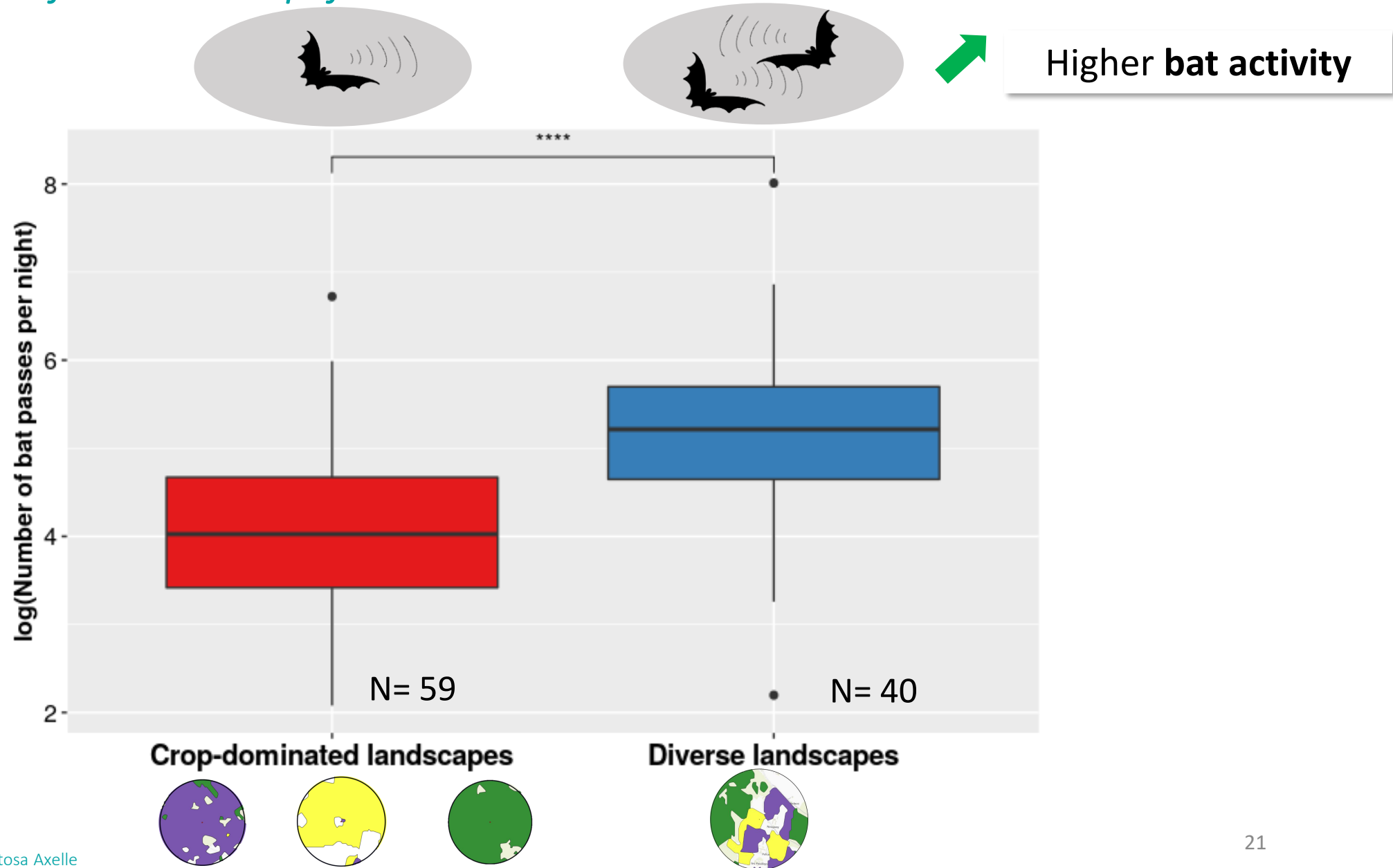
➤ Results

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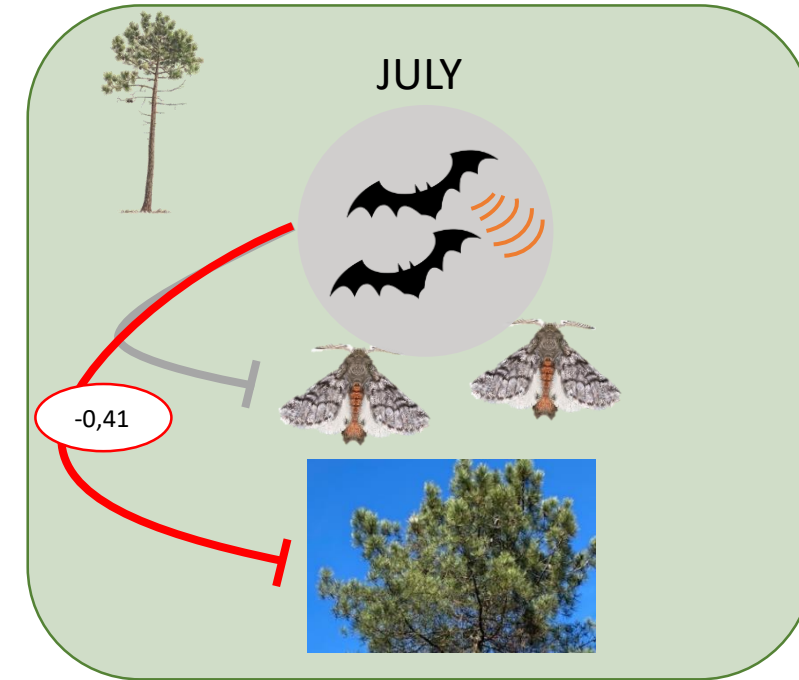
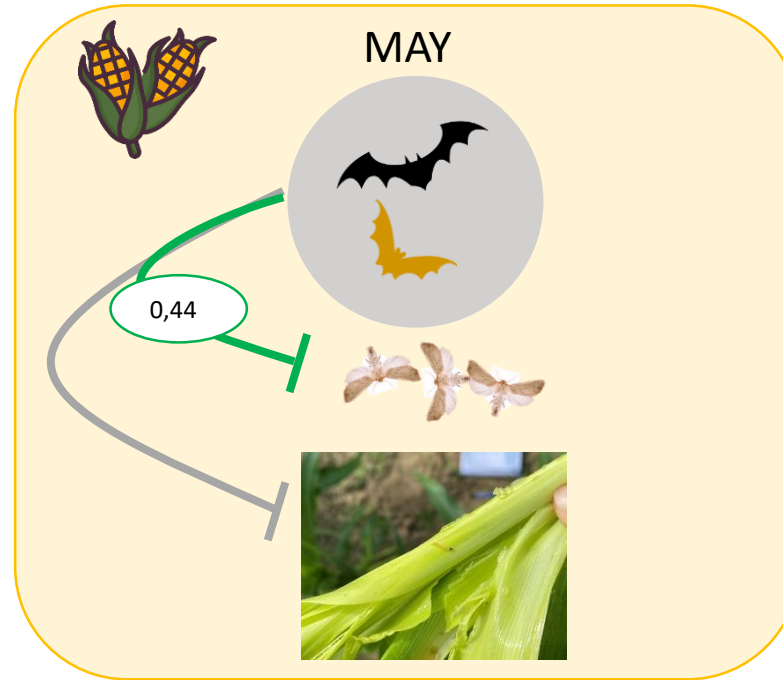
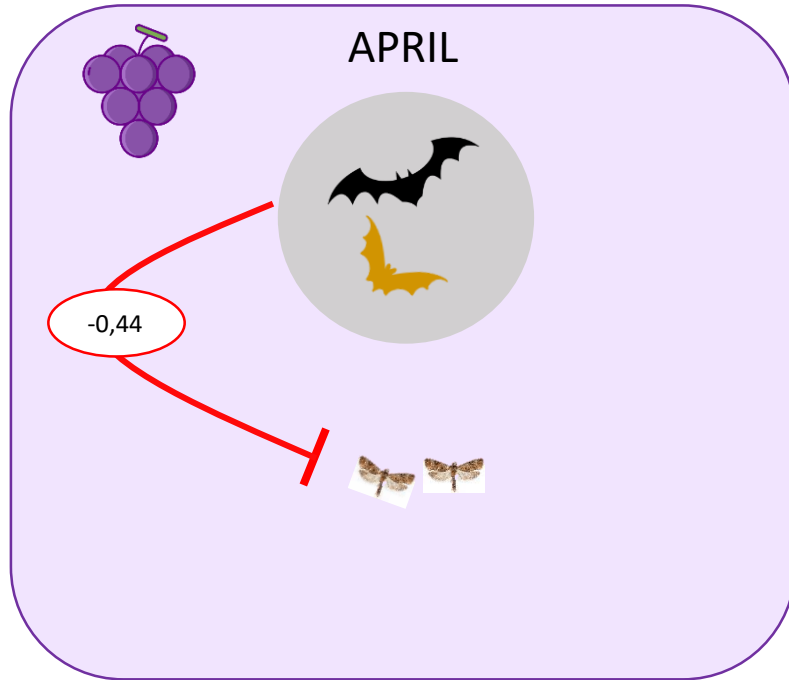


➤ Results

*What are the implications for biological control of lepidoteran pests ?*

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*What are the implications for biological control of lepidoteran pests ?*



➔ Indicator of potential biological control

➔ The abundance of moths seems to attract bats, the associated predator-prey dynamics do not allow for biological control

➔ Bats were efficient biological pest control agent for the pine processionary moth



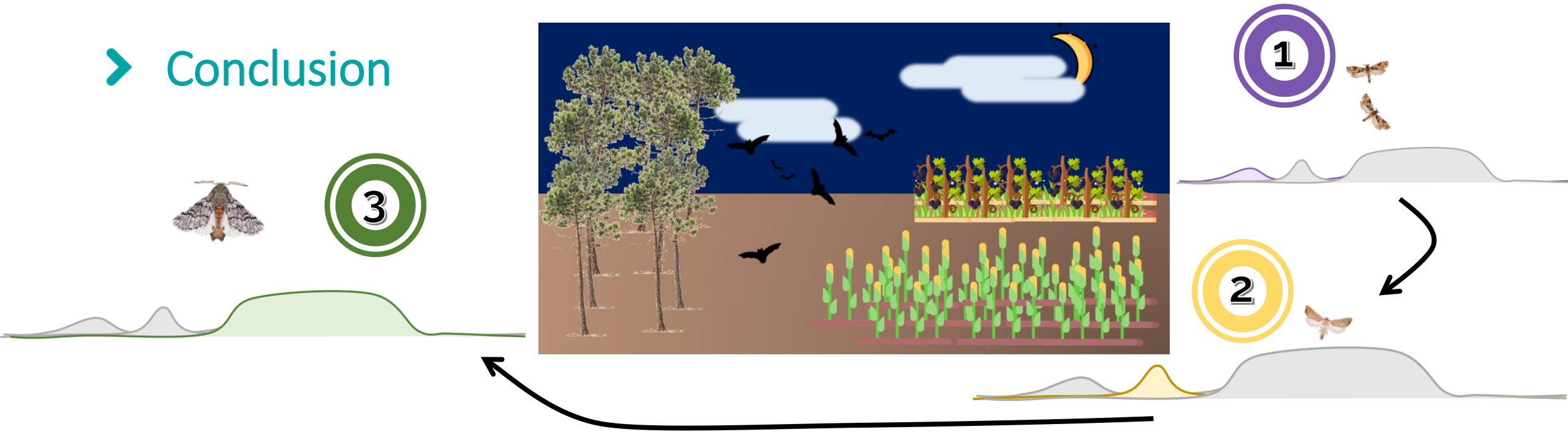
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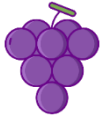


# ➤ Conclusion



**Biodiversity**

**Biological pest control**



**WIN**

Neutral



**WIN**

Neutral



**WIN**

**WIN**



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**Thank you for your attention !**

