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Oral presentation at SFE² GfÖ EEF joint meeting 2022 (Metz, France): A call for mixed surveillance strategies for containing the invasion of the Japanese Beetle in Europe

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Leyli Borner, Davide Martinetti, Sylvain Poggi. Oral presentation at SFE² GfÖ EEF joint meeting 2022 (Metz, France): A call for mixed surveillance strategies for containing the invasion of the Japanese Beetle in Europe. International conference in Ecology & Evolution - SFE²-GfÖ-EEF - Metz 2022, Nov 2022, Metz, France. ⟨hal-03875819⟩

HAL Id: hal-03875819

<https://hal.science/hal-03875819v1>

Submitted on 28 Nov 2022

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A call for mixed surveillance strategies for containing the invasion of the Japanese Beetle in Europe

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The conquest of the world by the Japanese beetle

Biological invasions are successful introduction and establishment of species outside of their native range.

Biological invasions can impact ecosystems, food security and economic balances.

Biological invasions have been greatly facilitated by globalization.

The Japanese beetle successfully reached and established outside its native range through human-mediated transports.



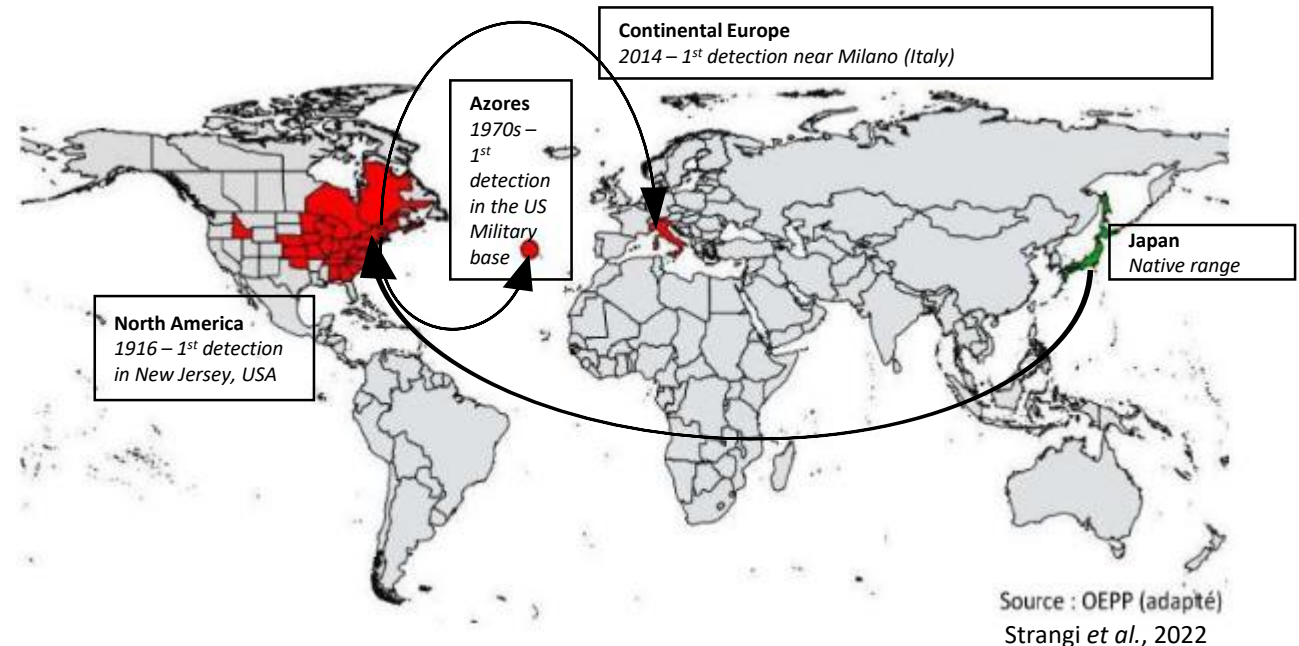
Japanese beetle

Popillia japonica

Native to Japan

Current distribution:

- Japan,
- North America,
- the Azores archipelago,
- Continental Europe










Biology and behavior of the Japanese beetle





Piedmont region, Italy - July 2021
© INRAE, Leyli Borner

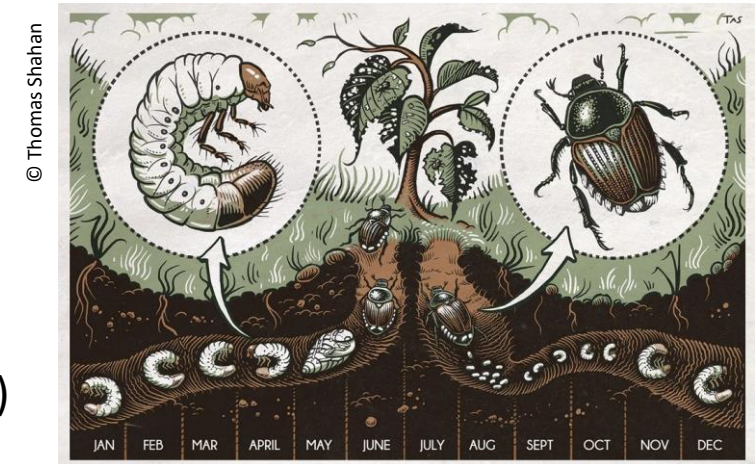
 adult stage  larval stages

Life cycle

-   Life cycle: 1-year (sometimes 2-years)
-  Emergence: between May and July
-  Life span: ~ 4-6 weeks
-   Egg-laying in grasslands (late summer): 40-60 eggs/female
-  Three larval stages, buried >15cm deep: December

Damages in larval and adult stages

-  Grass roots (grass, lawns, pastures)
-  Fruits, flowers and foliage of host plants (> 400 plant species)

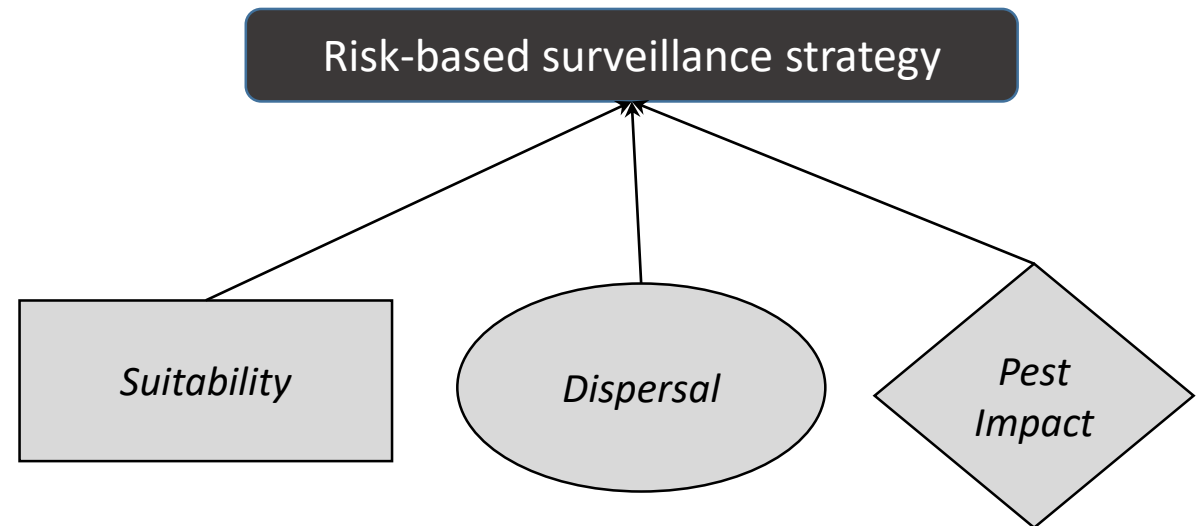
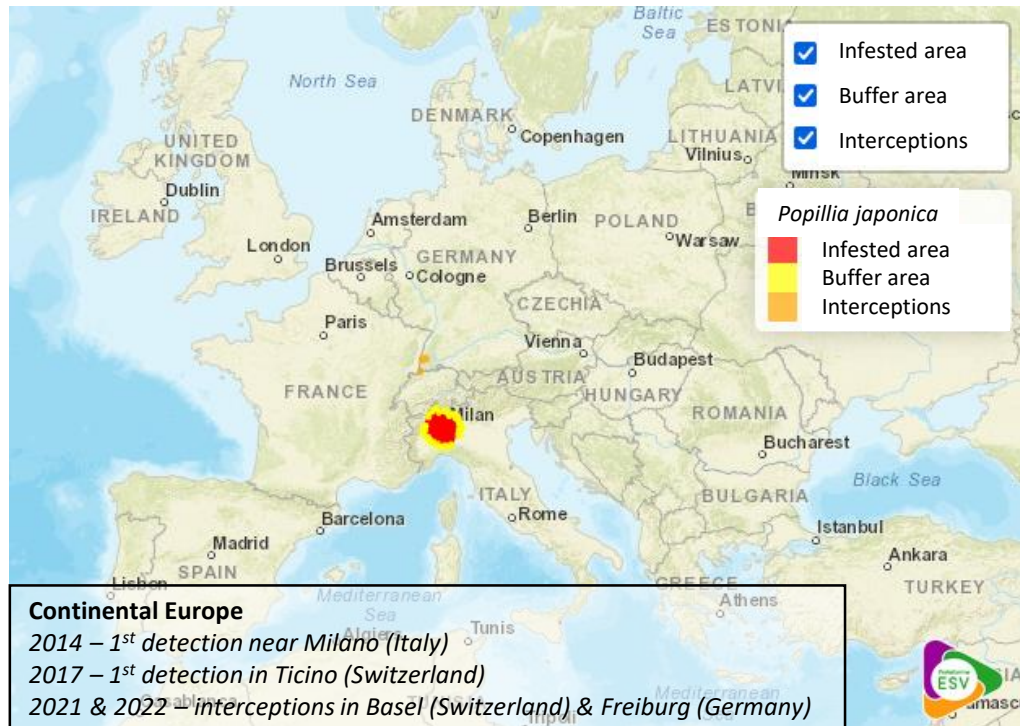


Surveillance to restrict the spread of the Japanese beetle

Assessment based on environmental, social and economic impacts

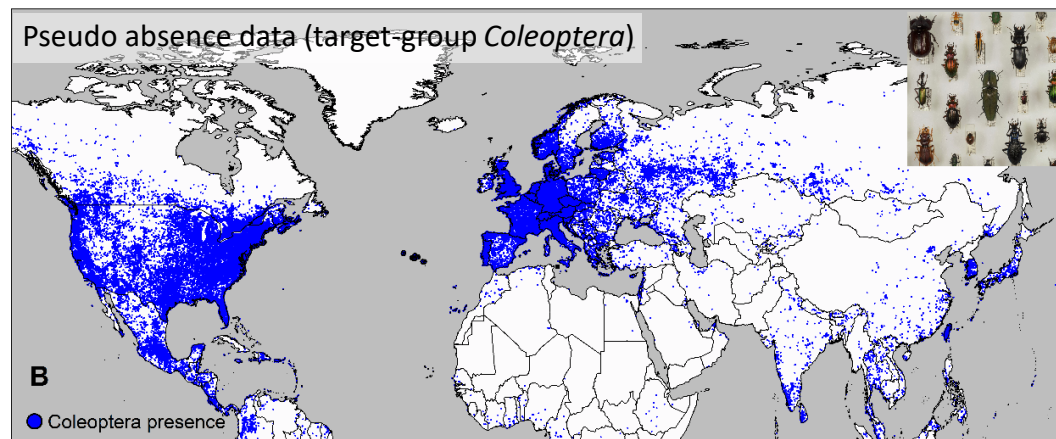
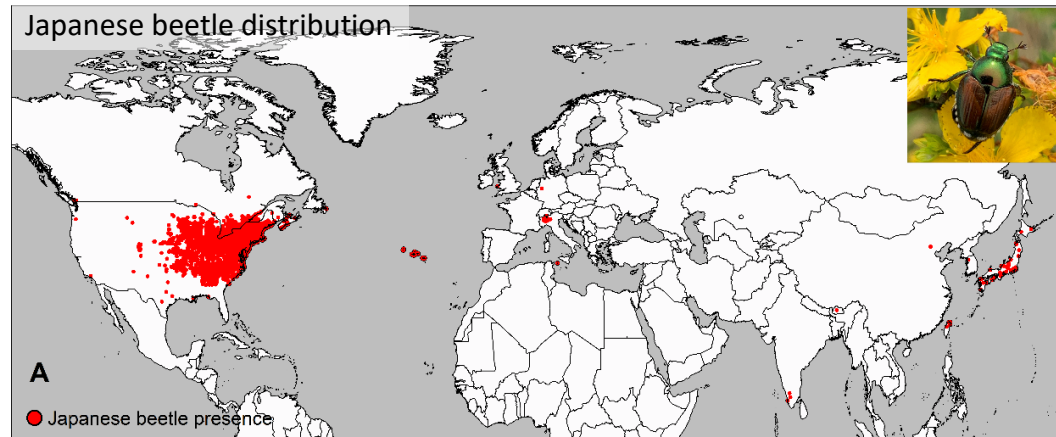
- European plant health agencies classified the Japanese beetle as a high priority quarantine pest (EFSA, 2019)

Goal: **Design surveillance to restrict the spread of the Japanese beetle**

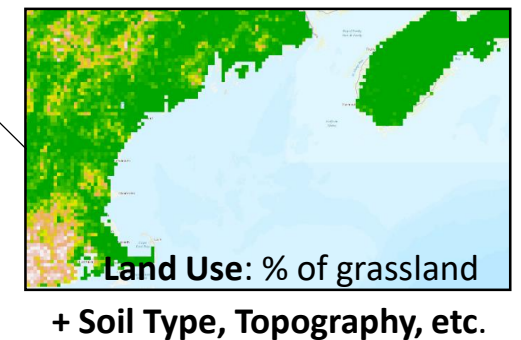
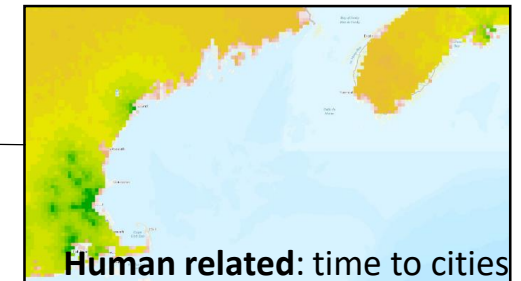
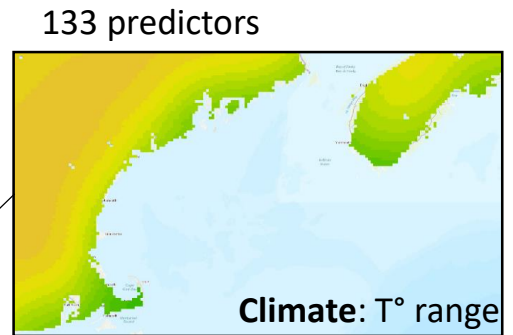


Learning from long-infested areas to predict environmental suitability in Europe

Species Distribution Model, at 4km spatial resolution,
 Model trained on native and long-infested areas & projected on Europe
 Citizen-science distribution data & large set of predictor variables

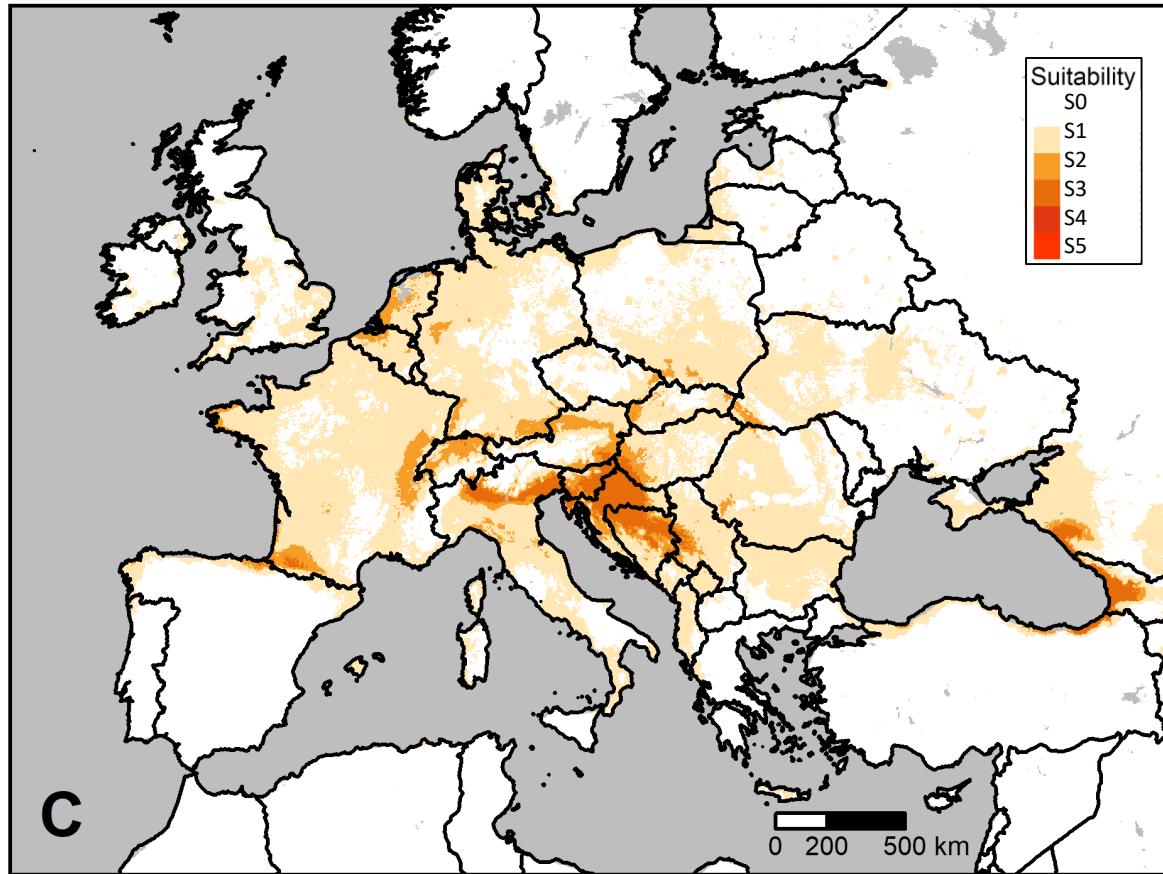


Random Forest Model



- Outputs
- Suitability map
 - Ranking of variable importance
 - Effects of variables on suitability

Distribution of suitability calls for a mixed surveillance strategy



Continuum of suitable land across the continent and embedded clusters of **moderate** and **high** suitability. **Foothills of the Alps (North and South) and Northern Balkans & Eastern shores of the Black Sea.** **Southwestern France, close to the Pyrenees, in Brittany, Germany, & the Low Lands (coastal Belgium and Netherlands).**

- Highly suitable area would reflect high infestation levels
- 1% of highly suitable areas are currently occupied
- All clusters of high suitability are connected through moderate and low suitability areas

⇒ Mixed surveillance: tracking the front of invasion & early detection in neighbouring non-infested areas

⇒ Need to include human-mediated dispersal in risk-based surveillance strategy (connectivity by planes, trains, and trucks)

Combining suitability, dispersal, and pest impact to build a surveillance strategy





Thank you all for your attention

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Ecology & Evolution: New perspectives
and societal challenges

H2020 IPM Popillia project

www.popillia.eu



IPM Popillia

Integrated Pest Management of Japanese Beetle



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Suitability publication

Borner, Leyli, Davide Martinetti, and Sylvain Poggi. « A new chapter of the Japanese beetle invasion saga: predicting suitability from long-infested areas to inform surveillance strategies in Europe ». *bioRxiv*, 2022.

<https://doi.org/10.1101/2022.11.14.515960>.

References

- Borner, L., Martinetti, D. and Poggi, S. (2022) 'A new chapter of the Japanese beetle invasion saga: predicting suitability from long-infested areas to inform surveillance strategies in Europe', *bioRxiv* [Preprint]. Available at: <https://doi.org/10.1101/2022.11.14.515960>.
- Borner, L., Martinetti, D. and Poggi, S. (2022) 'Data for "A new chapter of the Japanese beetle invasion saga: predicting suitability from long-infested areas to inform surveillance strategies in Europe"'. Recherche Data Gouv. Available at: <https://doi.org/10.57745/GM2YVL>.
- EFSA (European Food Safety Authority) *et al.* (2019) 'Pest survey card on *Popillia japonica*', *EFSA Supporting Publications*, 16(3), p. 1568E. Available at: <https://doi.org/10.2903/sp.efsa.2019.EN-1568>.
- Kistner-Thomas, E.J. (2019) 'The Potential Global Distribution and Voltinism of the Japanese Beetle (Coleoptera: Scarabaeidae) Under Current and Future Climates', *Journal of Insect Science*, 19(2), p. 16. Available at: <https://doi.org/10.1093/jisesa/iez023>.
- Strangi, A. *et al.* (2022) 'Tracing the dispersal route of the invasive Japanese beetle *Popillia japonica*'. Available at: <https://doi.org/10.21203/rs.3.rs-1497043/v1>.
- Straubinger, F.B. *et al.* (2022) 'The economic importance of early pest control: new insights from potential *Popillia japonica* infestation in Europe.', *agriRxiv*, 2022, p. 20220316785. Available at: <https://doi.org/10.31220/agriRxiv.2022.00151>.
- Zhu, G., Li, H. and Zhao, L. (2017) 'Incorporating anthropogenic variables into ecological niche modeling to predict areas of invasion of *Popillia japonica*', *Journal of Pest Science*, 90(1), pp. 151–160. Available at: <https://doi.org/10.1007/s10340-016-0780-5>.