

AMBROSIA AND OPHRAELLA AS A MODEL FOR DISCUSSING REGULATORY ISSUES



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■

Müller-Schärer Heinz and the SMARTER[®] network

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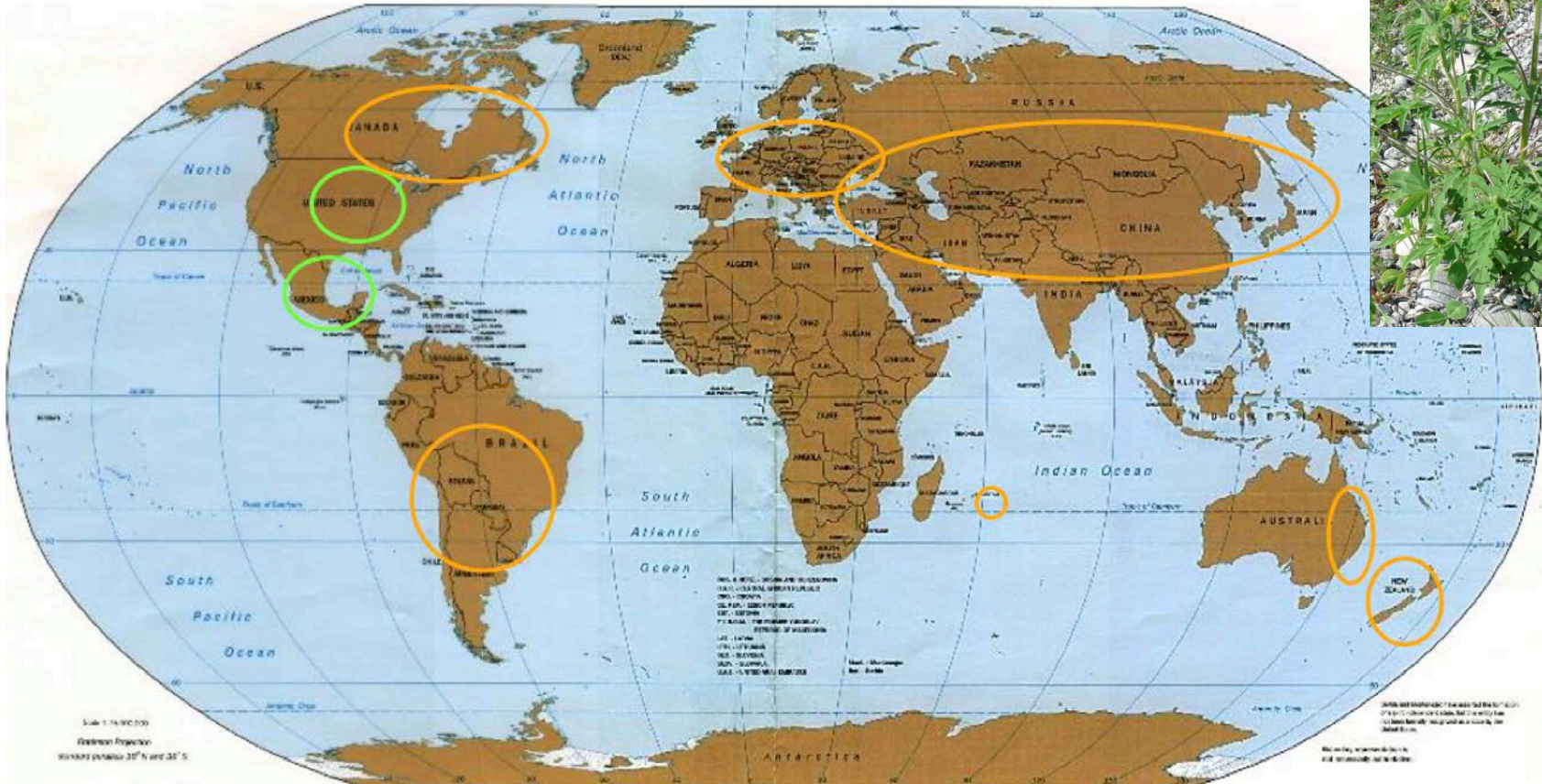
 **cost**
EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY



**Joint EPPO / COST-SMARTER Workshop on the Evaluation and
Regulation of the use of Biological Control Agents in the EPPO Region
Budapest, Hungary, 23 6 24 November 2015**

The study system

Ambrosia artemisiifolia: worldwide distribution



○ native range → ○ invasive range

The problem

Pollen → human health

Seed (plant) → agriculture



Ruderal sites and linear infrastructure: the main surface and routes of spread in Europe

although an annual, it is
most difficult to control by
cutting and herbicides

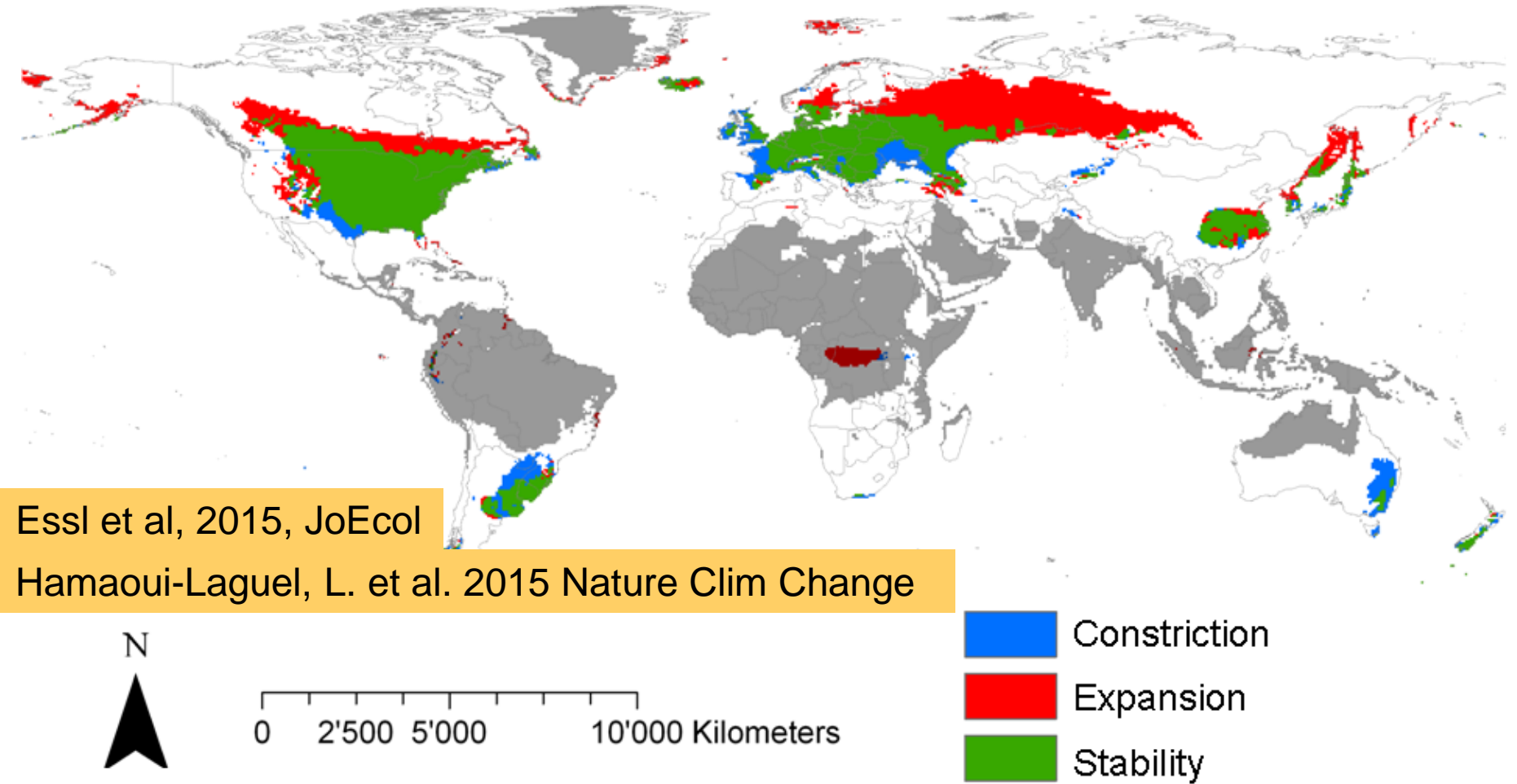


Foto: Chr. Bohren



Lack of measures to control pollen emission and population spread

The potential distribution of *A. artemisiifolia* under current and future (A1b in 2100) climate



In Europe: Great potential to further expand north and east, with airborne ragweed pollen concentrations to increase c. 4x by 2050

SMARTER

Sustainable management of *Ambrosia artemisiifolia* in Europe 2013-2017

Food and Agriculture - COST Action FA1203



2013: Accidental introduction to Europe with massive impact and fast spread of *O. communa*

new solutions

Competitive vegetation

Uprooting by hand

Mechanical harrowing

Mowing roadsides

Insects and a fungus living from *Ambrosia*

Fallen feeder
Trigonarhinus tomentosus
Coleoptera



Seed feeder
Smicronyx perpusillus
Coleoptera



Defoliator
Ophraella slobodkini
Coleoptera



Seed feeder
Euaresita bella
Diptera



Defoliator
Zygogramma disrupta
Coleoptera



Defoliator
Tarachidia confedacta
Lepidoptera



O. communa



(1) Reduce ragweed

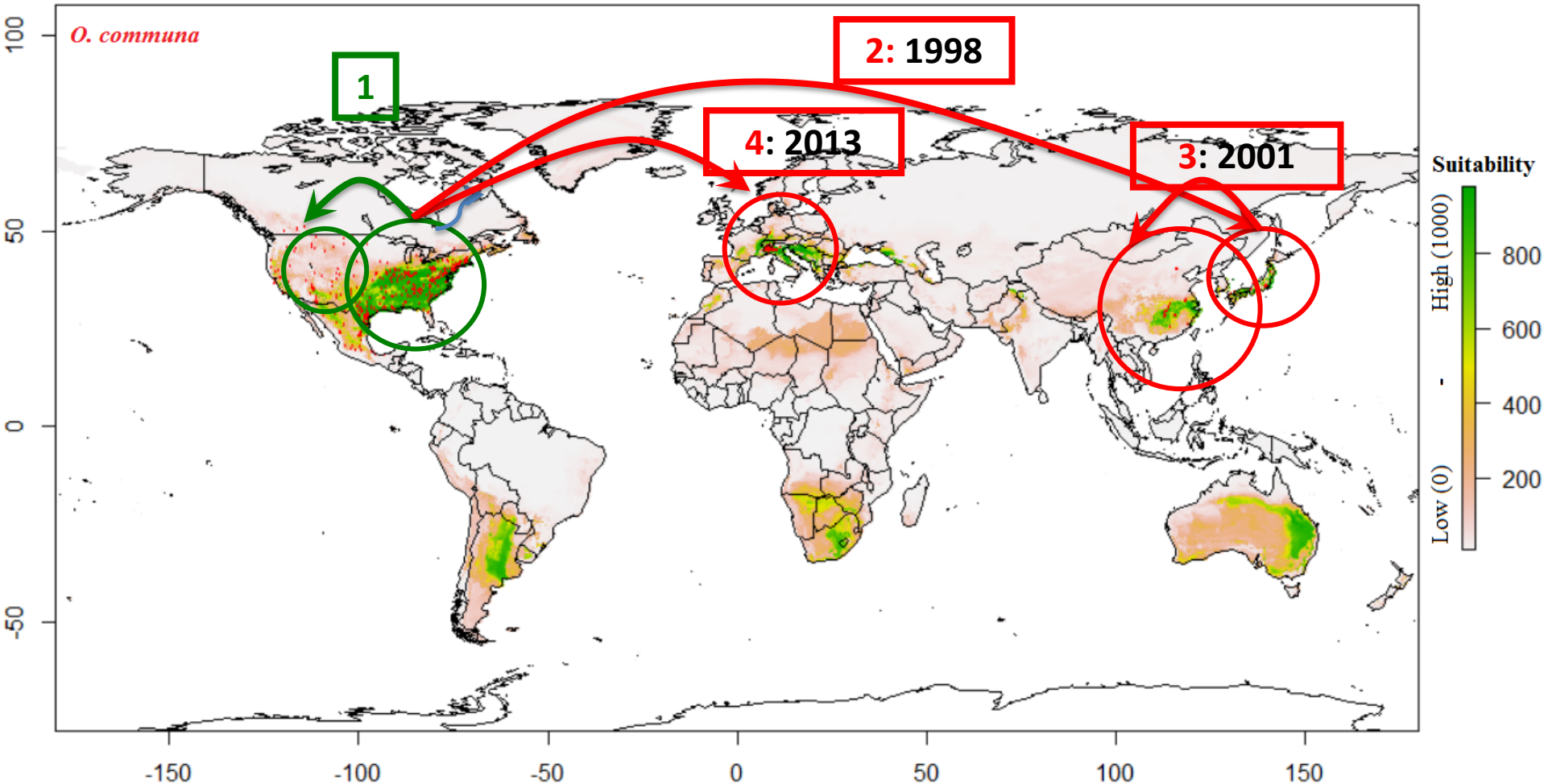
(2) serve as a template for sustainable control of IAS in Europe

Present participation

> 200 researchers from 33 COST/EU countries, plus USA, AUS, CAN & China

Ophraella communa world-wide occurrences and predicted range

○ native range ○ Introduced range



Ophraella communa, the ragweed leaf beetle has already been used successful elsewhere

1998 Japan, 2000 Korea
2001 China: succ. biocontrol



At the CAAS Research Station near Beijing, 2-5 Aug. 2013



June 12 2008



July 28 2008

Guo Jian-Ying, CAAS

Ambrosia

Sunflower



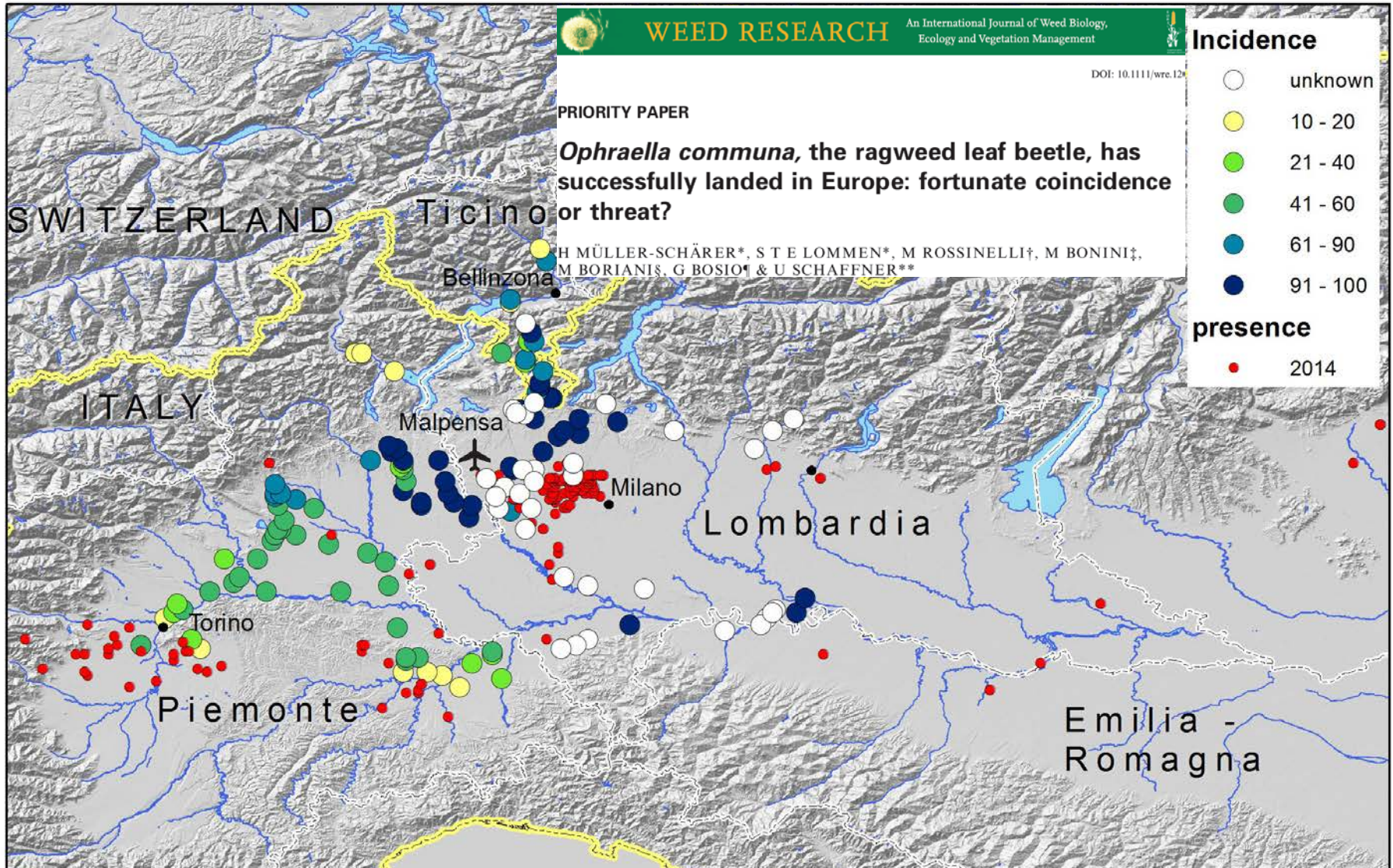


SMARTER is an international and interdisciplinary research initiative on the “Sustainable management of *Ambrosia artemisiifolia* in Europe”, (COST Action FA1203; 2012-2016) with more than 200 participants from 33 countries.

COST SMARTER responded to the accidental introduction of *O. communa*^a by launching The Task Force *Ophraella* to coordinate and conduct data collections to quantify the potential benefits as well as the risks of this beetle for Europe.

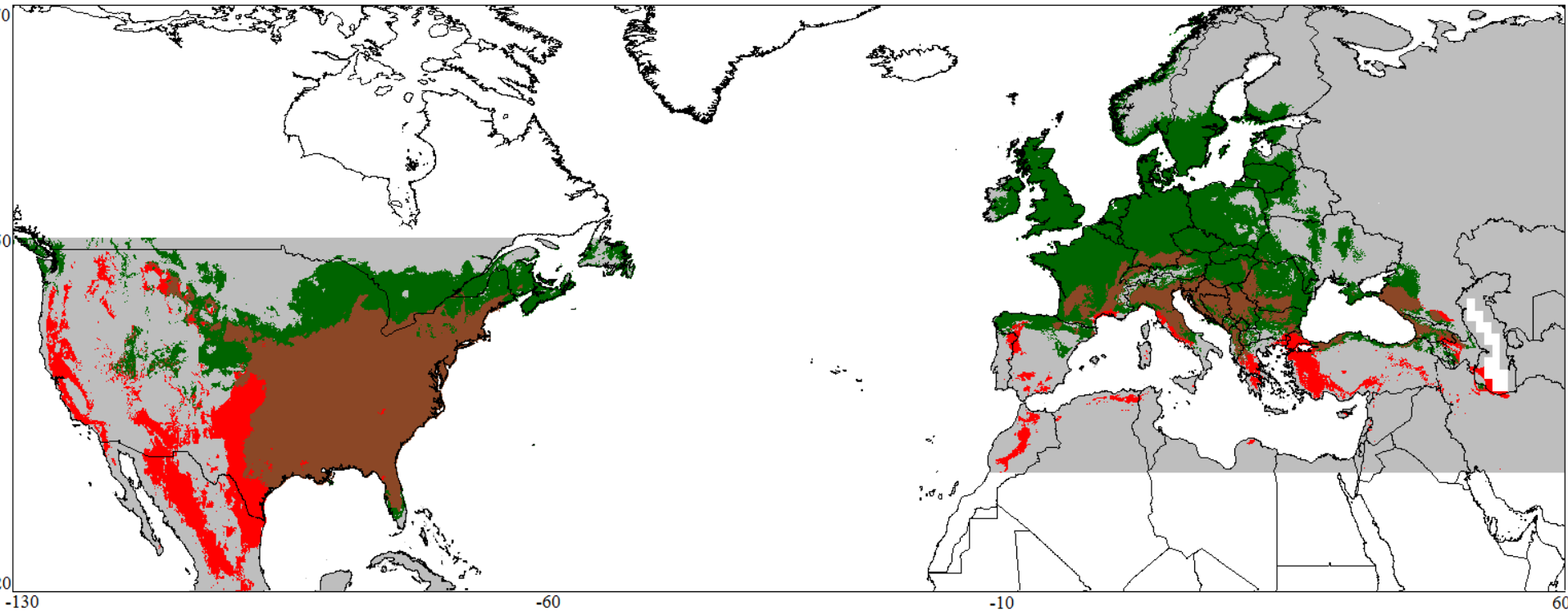
Benefits

Accidental introduction of the ragweed leaf beetle: fast spread in 2013, 2014 and 2015



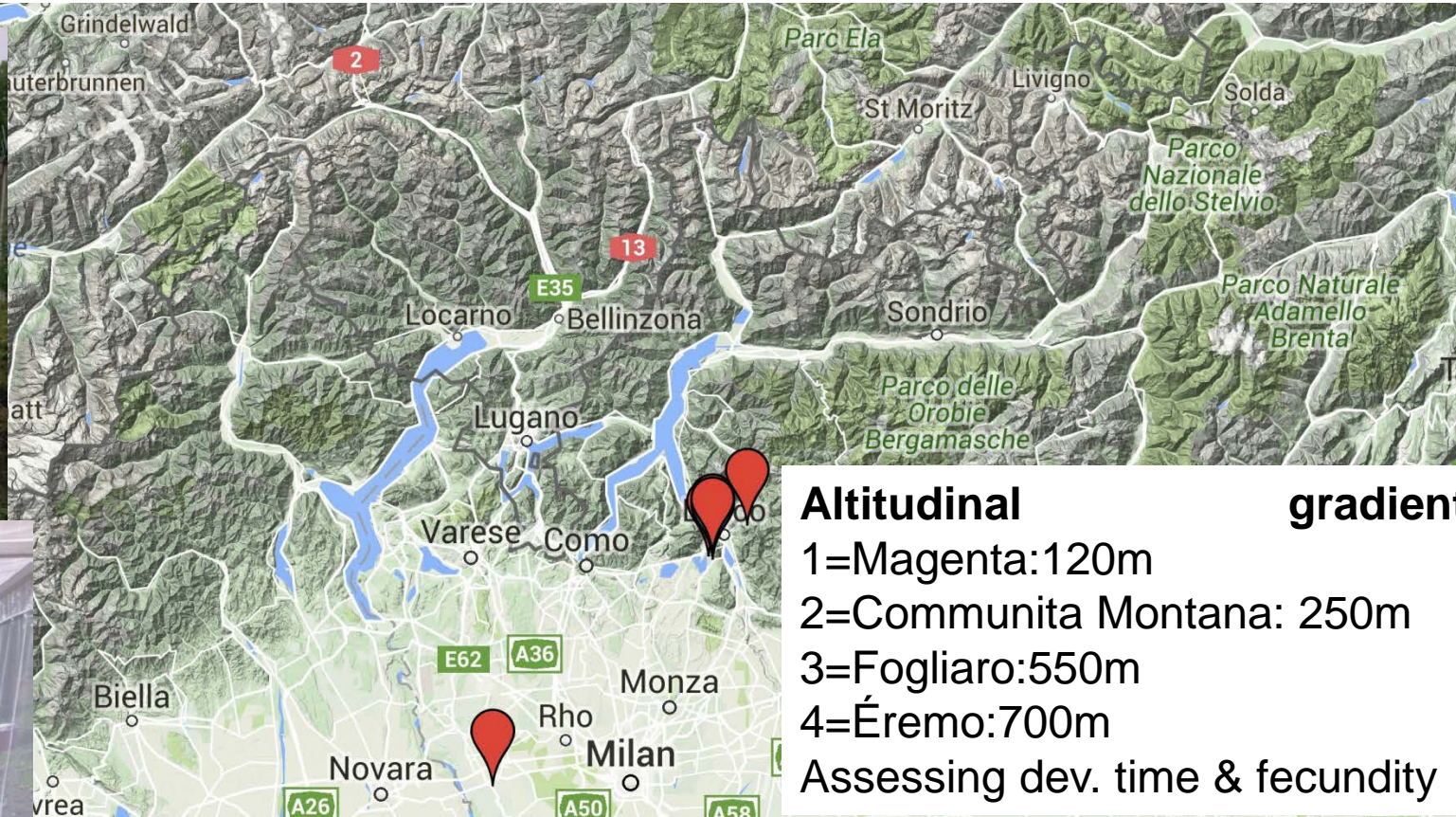
Suitable habitats and distribution of *Ophraella communa* in its native and introduced European range

Sun et al. in prep.



Overlap with ragweed in the native (62%) and introduced range (18%) of ragweed further extension both north- and eastwards would be highly welcome

Drivers of population build up and spread of *Ophraella*



Data on temperature dependent development to be used for

- developing models for the population dynamics of *Ophraella*
- for predicting spread
- to later link the demographic models for ragweed and *Ophraella*

Damage by *Ophraella communis* on ragweed can be high



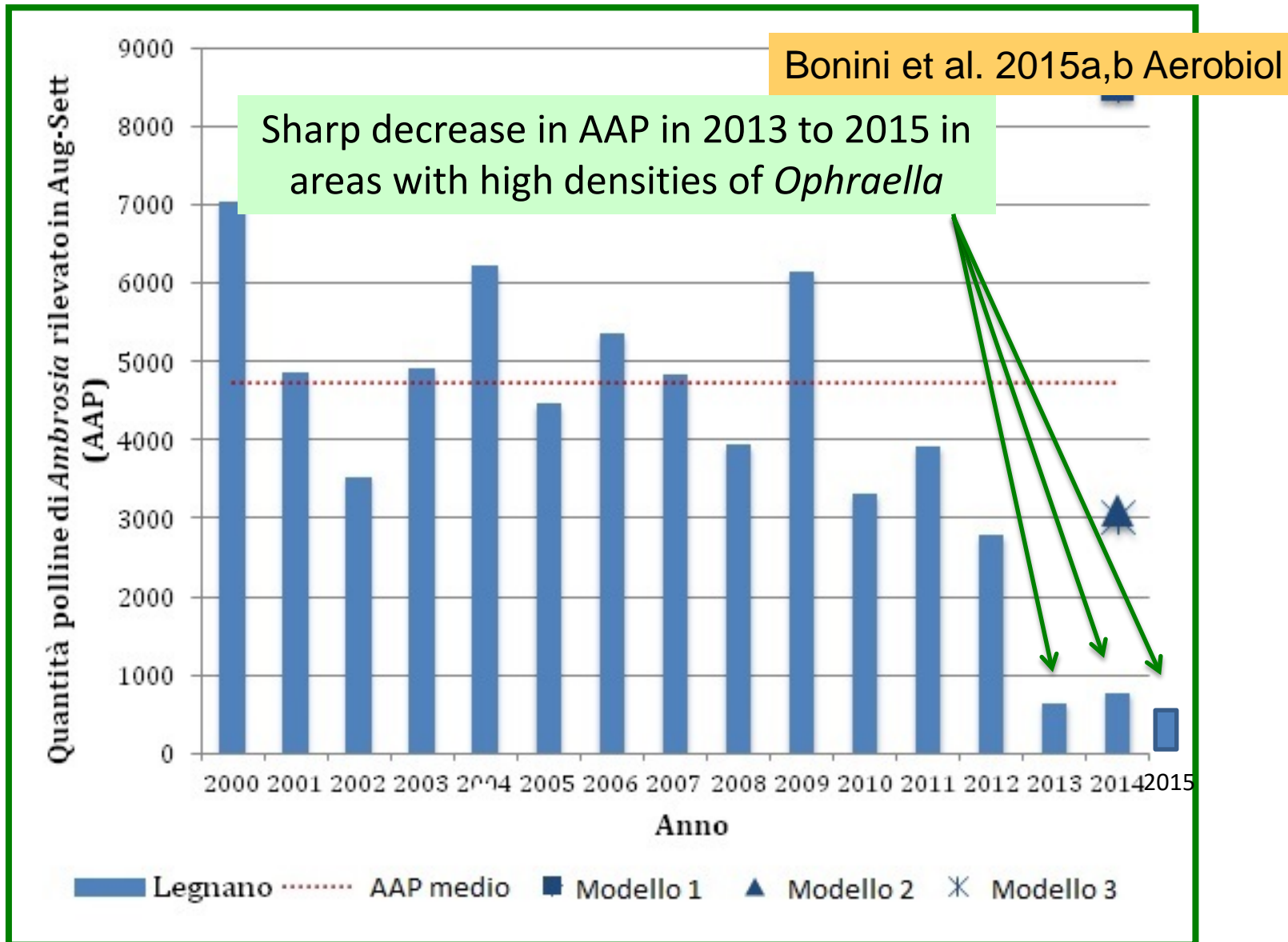
Often nothing left.....!

Study site in Magenta in Sept. 2013



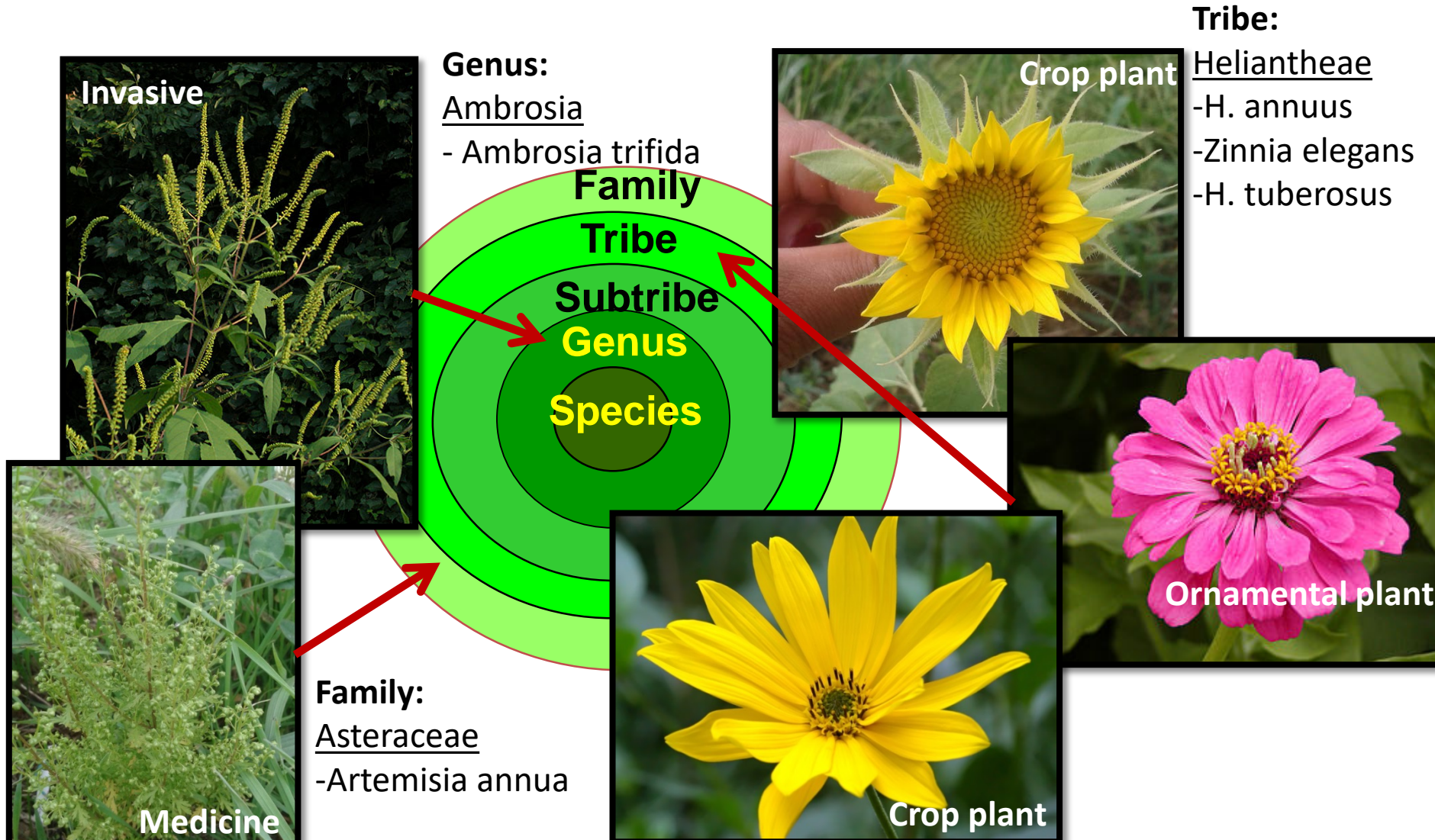
All plants killed prior to flowering,
even late attacked plants are prevented from flowering

Ambrosia pollen recorded annually during August-September (AAP) from 2000 to 2015 at Legnano



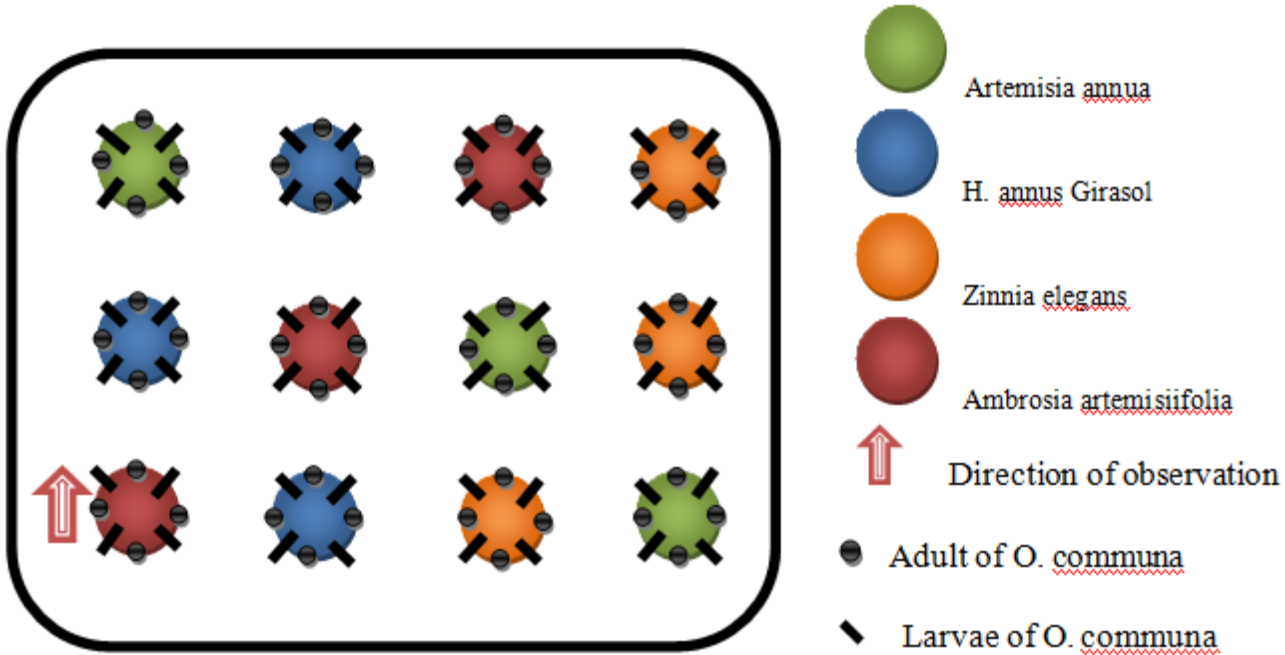
One of potential **risk** = non-target effects need for host-specificity tests

The closer the relatedness of the plant species the more likely it is attacked



Host range and host specificity tests

Q lab tests in the presence and absence of the target

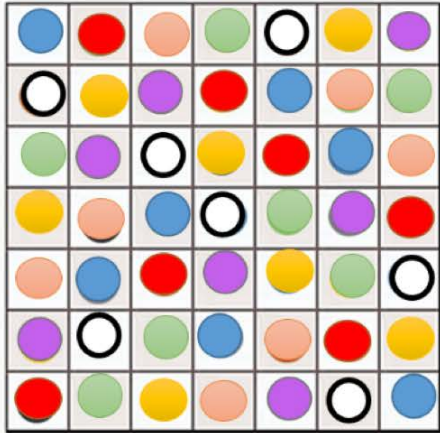


- (i) ornamentals,
- (ii) sunflower varieties,
- (iii) six ragweed species,
- (iv) native endangered species



Field tests in the presence and absence of the target

Abbiategrasso



The setup was realized **in 2014 & 2015** at **4 sites** and in **3 cohorts** (early May, mid-July and early September), and **5 assessments** (week zero, after one, two, six and nine weeks)

SYMBOL	PLANT SPECIES AND DESCRIPTION	Stage (SIZE)
	Helianthus annuus PR64H42 (CULTIVATED)	2-4 leaves
	Helianthus annuus PR64H42 (CULTIVATED)	6-8 leaves
	Helianthus annuus PR64H42 (CULTIVATED)	>8 leaves
	Helianthus annuus Sunrich orange F1 (ORNAMENTAL)	>8 leaves
	Helianthus annuus Iregui (MANURE)	>8 leaves
	Guizotia abyssinica Niger (MANURE)	>8 leaves
	Ambrosia artemisiifolia Ragweed (CONTROL)	>8 leaves



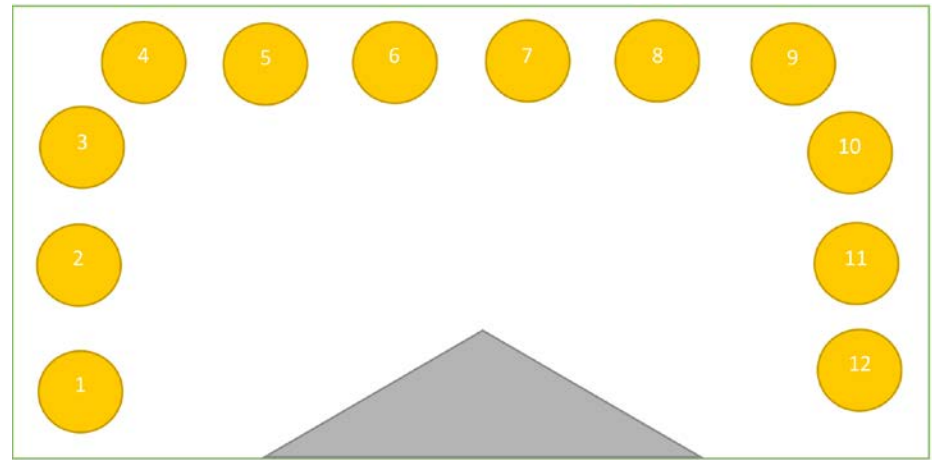
Establishing latin square design on 1 May 2015 in Italy



Performance tests with *Ophraella communa* on ragweed and sunflower in the field

3 cages each with each 6 sunflower and 6 ragweed plants, randomly arranged

Transfer of 2 first instar larvae of *O. communa* (originating from a total of 12 females) per plant



Non-target field survey (in presence of *Ambrosia* and *Ophraella*)

exotic
native
crop

*Helianthus
annuus*



*Helianthus
tuberosus*



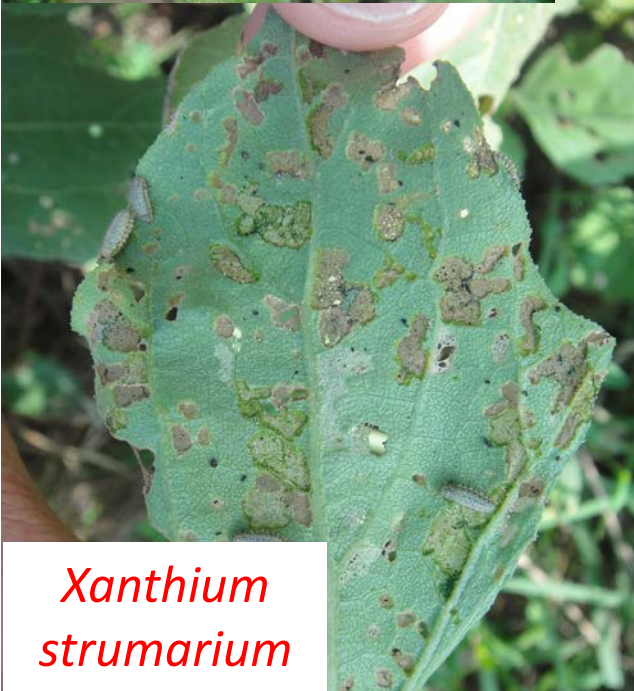
*Buphthalmum
salicifolium*



*Ambrosia
trifida*



*Xanthium
strumarium*



Special focus on **Sunflower**: different varieties for oil production, ornamentals and green manure





12 April 2015:

hunting for overwintering *Ophraella* in the Milan area

➤ *Ophraella* occurs from mid April on



Risk for sunflower early in the season



Near Saint Exupery Airport
(Lyons) **Mid- May 2004**



near Bourges - **June 2015**



- Susceptible period of sunflower is early **May –mid June** (2-6 leave stage)
- *Ophraella* can kill plants at this stage
- Need for field studies in 2016 in areas with *Ophraella*



In the Qlab,
Ophraella lays
eggs and can
destroy small
sunflower in the
absence of
ragweed

Risk for oilseed sunflower up to harvest



Sunflower and ragweed co-occur

- ... but sunflower for oil production is already harvested end of August
- little risk to sunflower once the critical period has passed
- tolerable risk for sunflower in China
- no record for *Ophraella* damage on sunflower in North America!



In Rovio **on early October 2015**: considerable damage on young plants by both larvae and adults of *Ophraella* in the absence of ragweed

Risk for ornamental and green manure sunflower



Sunflower is grown throughout the season as an ornamental



Sunflower as green manure; sown **21 August**, foto 18 Nov. 2015

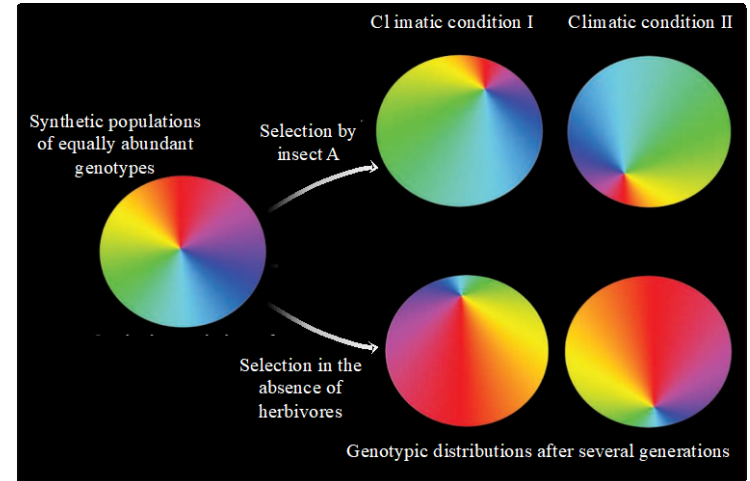


Young sunflower later in the year can be considerably damaged
(**1 October 2015**)

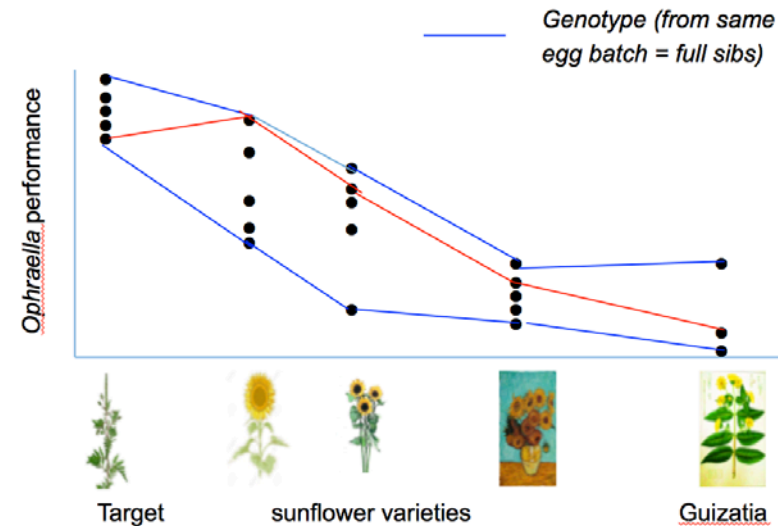
- young sunflower both used as ornamental and green manure are at risk later in the season (**Aug. – Oct.**) during their establishment phase
- this we have already tested!
- ... but so far this situation is not yet given

The way forward: making biological control more predictive by including evolution: two studies underway

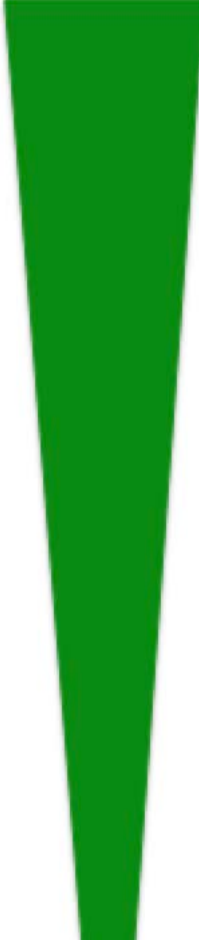

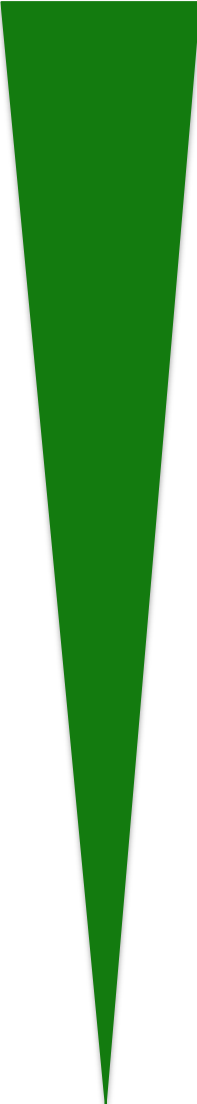
Ophraella and climate as drivers of demography and evolutionary change in ragweed



Evolution in *Ophraella*: Evaluating the potential of *Ophraella* to adapt to temperature and host plants



Management options for *Ophraella communa* and their consequences

Management options	Expected outcome	Benefits	Risks	CBC
Stimulate spread (rearing, mass releases in all ragweed infested areas), selection for cold adapted strain	Rapid coverage of ragweed infestations, high population build-up early in the season; large benefits for human health and agriculture			
Do nothing (wait and see)	Intermediate spread and population buildup, will not cover ragweed populations in NE-Europe			
Mitigation (insecticides, restricted transport, etc)	Reduced spread and delayed population buildup, e.g. in areas with sunflower cultivation			
Deliberate Introduction				

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