

# Monitoring Soil Biological Quality in the Veneto region

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In **2009 ARPAV** (Regional Agency for Environmental Prevention and Protection) started a soil quality monitoring program in the Veneto region

## The aim:

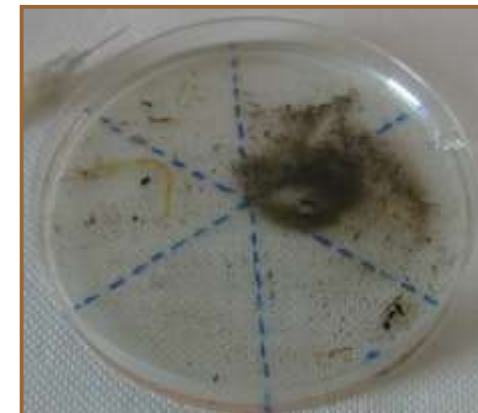
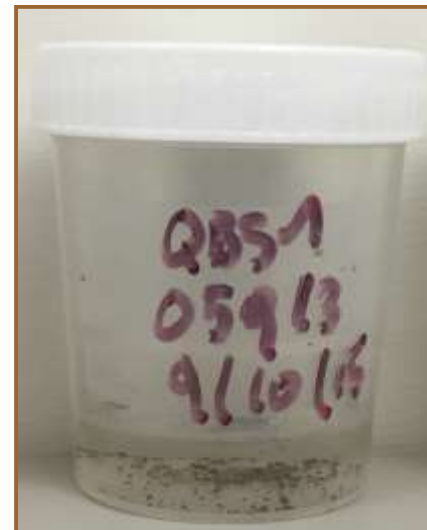
- to investigate the **soil biological quality** in the region
- to identify **reference values** according to different land uses
- to highlight soil **degradation** or **pollution**



## QBS-ar index

Soil Biological Quality based on soil arthropods  
(Parisi et al., 2005)

The higher the soil quality the higher the number of microarthropod groups morphologically well adapted to the specific soil habitat





## QBS-ar index: **EMI**

(Eco Morphological Index)

morphological characters: 1 to 20



**EMI: 4**



**EMI: 20**

The QBS-ar index value is obtained from the **sum of the EMI scores** of all collected groups, based on the principle that is more important the degree of soil adaptation than taxonomy.

If in a taxonomic group, biological forms with different EMI scores are present, the **higher value** is selected to represent the group in the QBS-ar index calculation.



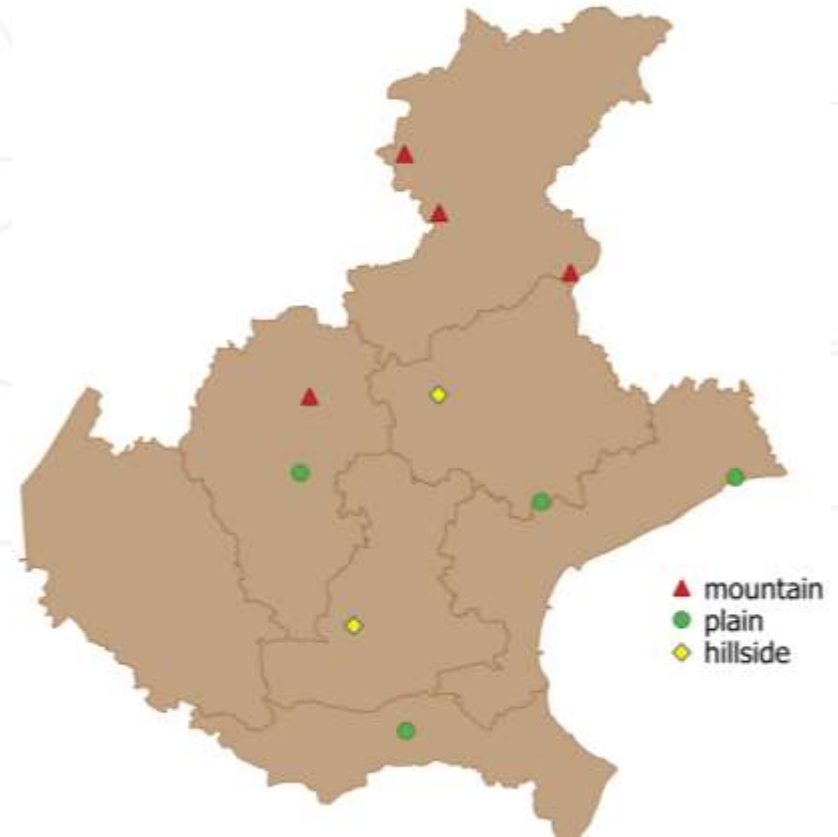
# Monitoring stations

Since **2012**, 10 monitoring stations have been set up in the Veneto region:

- **4** in **plain** areas
- **2** in **hilly** areas
- **4** in **mountain** areas

All stations are **representative** of the regional environment for:

- land use
- soil characteristics
- parent material
- climate conditions



# Land use in monitoring stations



**18** different types of **land use** (crops or natural vegetation) have been studied

**204** QBS-ar data:

- **158** plain areas
- **17** hilly areas
- **29** mountain areas



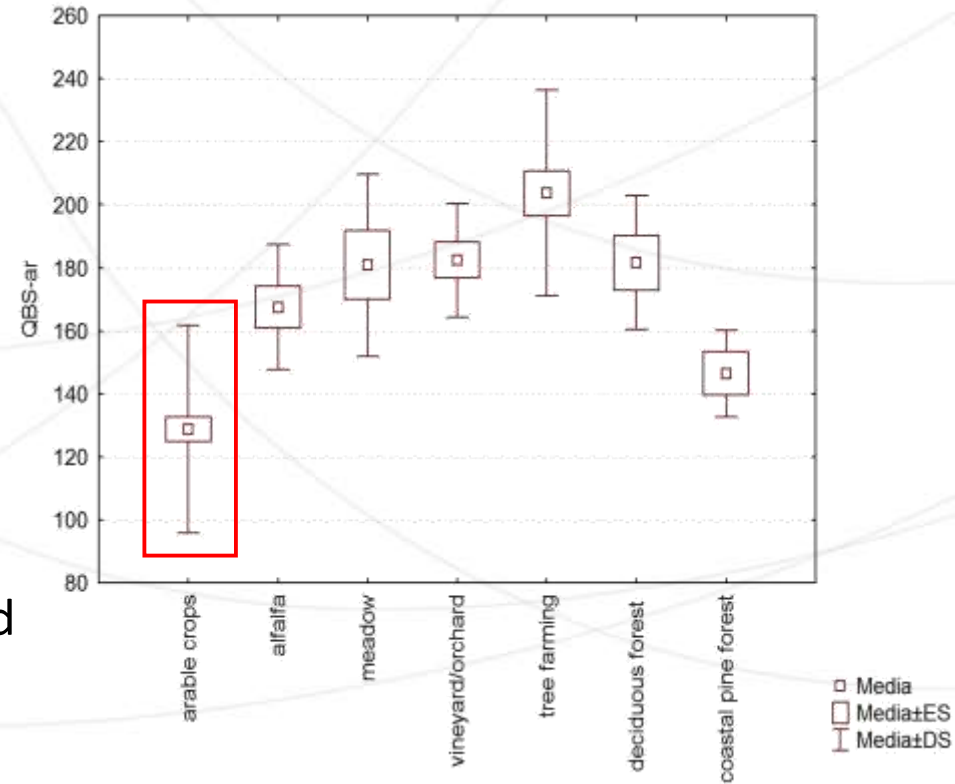
PLAIN	4	wheat
		rape
		corn
		soybean
		sorghum
		vineyard
		orchard
		farm tree forest
		alfalfa
		meadow
		coastal pine wood
		vineyard
HILL	2	deciduous forest
		meadow
MOUNTAIN	4	pasture
		beech forest
		spruce wood
		white fir wood



# Results: plain areas

## QBS-ar values

- arable crops (100 - 150)  
 ☞ lowest QBS-ar values
- meadows (> 150)  
 ☞ good biodiversity pool
- orchards and vineyards (> 150)  
 ☞ despite heavy machinery passages and phytosanitary treatments
- forest tree farming (180 - 220)  
 ☞ low human impacts and high biodiversity shrub and tree species





# Results: biodiversity in plain areas



## Arthropod comparison between meadows and arable crops

	arable crops	meadows
Taxa	%	%
Pseudoscorpiones	0	0,6
Acari	48,6	49,5
Isopoda	0,3	2,0
diplopoda	1,3	0,7
Paupoda,	0,9	0,3
Symphyla	1,0	1,8
Chilopoda	0,7	0,9
Protura	0	0,5
Diplura	1,5	2,4
Collembola	35,4	17,3
Coleoptera larvae	2,2	1,3
Hymenoptera	4,3	12,3
<b>Taxa tot</b>	<b>15</b>	<b>19</b>

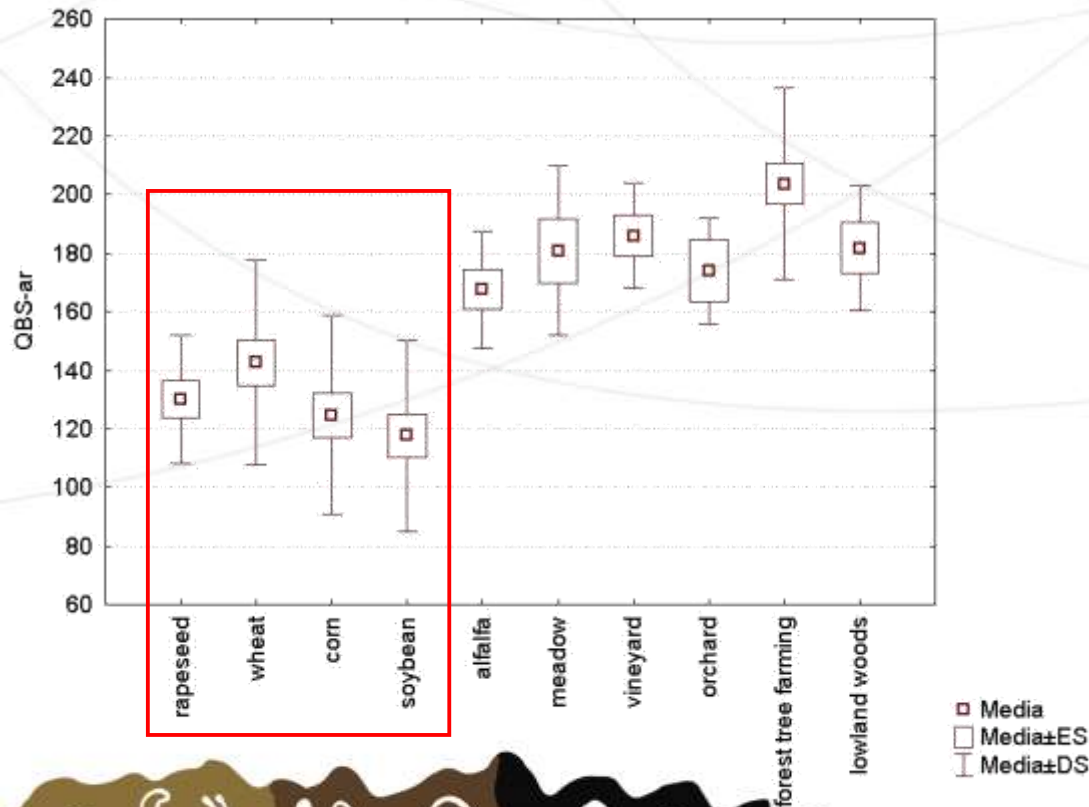




# Results: land use and soil parameters



In plain areas the main factor influencing QBS-ar index is **land use**: arable crops have the lowest QBS-ar index, number of taxa and density per square meter

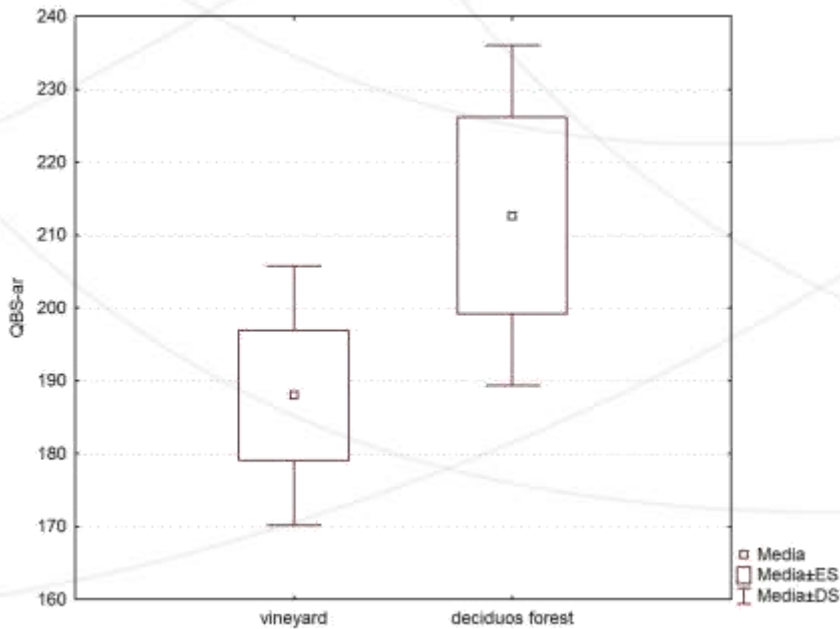


The effect of some **soil parameters** was additionally tested:

- **Texture**
- **pH**
- **organic carbon**

Only **coarser soil texture** and **high soil salinity** were found to provide a lower biological quality.

## QBS-ar values (average)



- Deciduous forest (213):
  - ☞ calcareous substratum (240)
  - ☞ acidic substratum (190)
- Vineyard (188)



The **highest biological value** of natural environments is confirmed compared to the agricultural environment (vineyard).

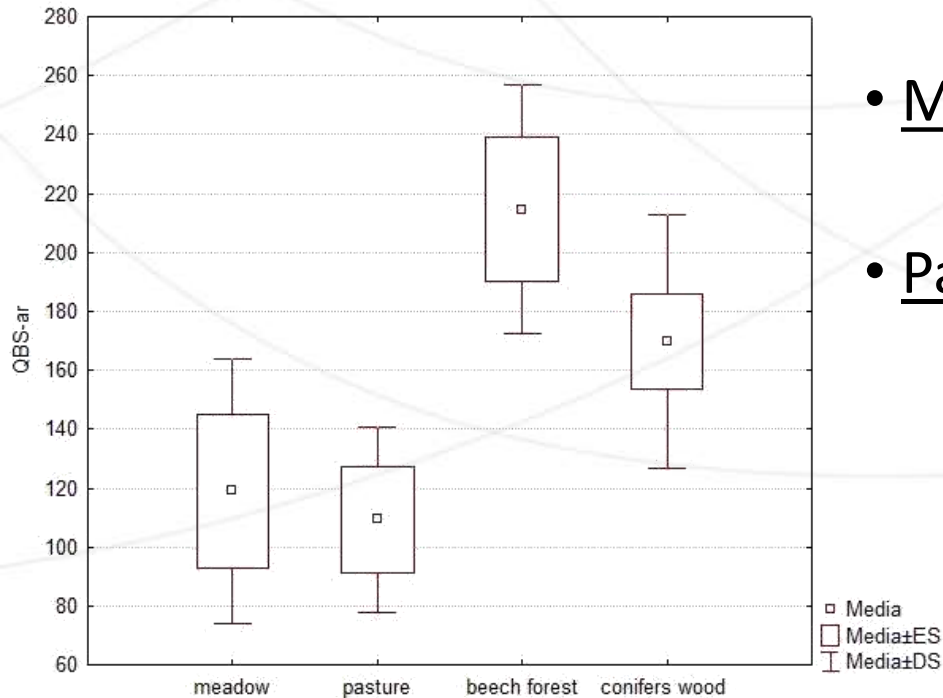
In the **deciduous forest** probably the **pH** of the substratum (calcareous or acid) influences indirectly the growing vegetation and directly soil fauna.

# Results: mountain areas



## QBS-ar values (average)

- Beech forest (**215**)
  - ☞ low values due to the acid litter
- Conifers wood (**170**)
  - ☞ livestock grazing for example
- Meadows (**119**)
  - ☞ “disturbed” by machinery passages
- Pasture (**109**)





# Results: litter in mountain areas



	Conifer wood litter	Beech litter
<i>Pseudoscorpiones</i>	2,83	0,13
<i>Opilioni</i>	x	0,13
<i>Araneae</i>	0,24	1,15
<i>Acari</i>	55,66	46,62
<i>Isopoda</i>	x	0,70
<i>Diplopoda</i>	x	0,70
<i>Paupopoda</i>	1,18	0,57
<i>Symphyla</i>	0,24	x
<i>Chilopoda</i>	x	0,19
<i>Protura</i>	x	0,19
<i>Diplura</i>	x	0,32
<i>Collembola</i>	33,25	48,03
<i>Hemiptera</i>	x	0,25
<i>Coleoptera</i>	0,47	x
<i>Coleoptera larv.</i>	x	0,25
<i>Hymenoptera larv.</i>	0,24	0,38
<i>Diptera larv.</i>	0,94	0,13
<i>Lepidoptera larv.</i>	4,95	0,25
<b>taxa tot</b>	<b>10</b>	<b>16</b>
<b>n°/m<sup>2</sup></b>	<b>14.133</b>	<b>52.333</b>
<b>QBS-ar</b>	<b>155</b>	<b>202</b>

In mountain stations, a litter clod was collected

**Beech litter** seems to be more hospitable for arthropods than **conifer wood litter**

In beech litter we find:

- higher QBS-ar
- more total taxa (7 with maximum EMI)
- more of triple of arthropods per m<sup>2</sup>





**Reference QBS-ar values** have been established in different Veneto region land uses.

The index was found to be helpful to highlight potential soil degradation or pollution

- **arable crops** have the low QBS-ar values due to the environmental impact of farming
- **meadows** are a reservoir of biodiversity
- biological richness in **orchards** and **vineyards** (despite the heavy machinery treading and phytosanitary treatments) due to grass cover between rows





In the agricultural land uses, the coexistence of **different habitats** has the higher protective value for biodiversity

In the same direction go practices preventing landscape **simplification** as **farming hedges** and **wooded areas**





**Thanks for your atten**

