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# How do plants adapt to climate change?

*A digital collection and trend analysis of phenological  
Citizen Science data with students*

Sebastian Stuppan, 2021

## **Constitution of the class**

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- ▶ *Secondary science education, Alpnach, Switzerland, Students  
15-16 years old*
  
- ▶ **Intention and goals**
  - ▷ *Practice phenological research*
  - ▷ *Collect and analyse data*
  - ▷ *Enhance the understanding on the environmental issues*
  - ▷ *Improving the awareness of the complexity on the  
environmental impacts*

# PhaenoNet.ch – Swiss platform for phenological research

- ▶ Science-based seasonal observations by students and adults (lay people and experts) → "**Citizen Science**".
- ▶ Initiated by GLOBE Switzerland - online since April 2012
- ▶ **Cooperation** with ETHZ (Eidgenössische Technische Hochschule Zürich), MeteoSwiss, Geographical Institute of the University of Bern, Science et Cité, Federal Office of Environment



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## Implementation: Collecting data on the environment with students

- ▷ **Instructions:**
  - > **Log in to [app.phaenonet.ch](http://app.phaenonet.ch) and add objects**
  - > **Observation guide for e.g. hazel**

### Beobachtungsanleitung Hasel *Corylus avellana*

	PHÄNOPHASE	IM STRAUCH	FOTO
	BLÜTE		
<b>Start of blooming</b>	<b>Beginn der Blüte</b> Drei männliche Blütenkätzchen am Strauch haben sich auf 4-6 cm Länge gestreckt, ein Teil der Blüten dieser Kätzchen sind geöffnet und geben gelben Blütenstaub ab. Ob das Stäuben schon eingetreten ist, lässt sich gut feststellen, wenn man die Kätzchen schüttelt. BBCH*: 60	3 Kätzchen im Strauch	
<b>General blooming</b>	<b>Allgemeine Blüte</b> 50% der männlichen Blütenkätzchen des Strauches haben sich auf 4-6 cm Länge gestreckt und stäuben, wenn sie geschüttelt werden. BBCH: 65	50% der Kätzchen	
<b>End of blooming</b>	<b>Ende der Blüte</b> 95% der männlichen Blütenkätzchen des Strauches sind verwelkt und nicht mehr stäubend, oder die Kätzchen sind unreif vertrocknet. BBCH: 69	95% der Kätzchen	

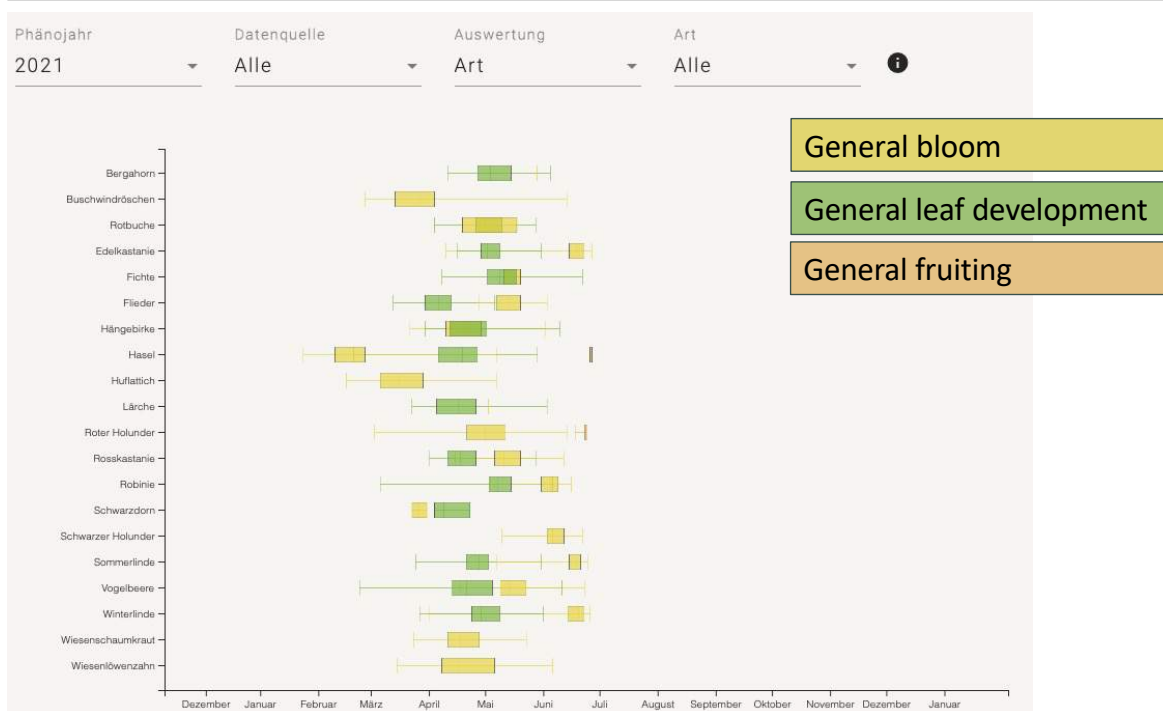
- ▷ **Data collection from April to June 2021 (teams of 2 students and field excursions)**

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## Implementation: Predefined analysis of the data within the WebApp with students



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## Implementation: Analysing phenological data with students

### ► Example

#### Working with the data

- ▷ **Question:** How has the beginning of the *general blooming* period of the hazel changed in the last 11 years?
- ▷ **Hypothesis:** The *general bloom* takes place earlier due to climate change.
- ▷ **Material & Method:** Data of 11 years *general bloom* of the hazel (median) from phaenonet.ch
- ▷ **Result:** calculate trend line in MS-Excel
- ▷ Discussion and conclusion: Plenary discussion

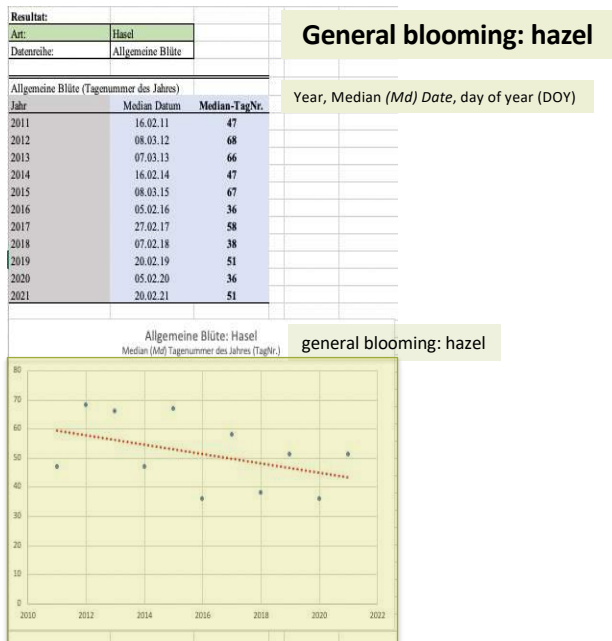
### ► Advanced task: Investigate your own question in a team.

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# Implementation: Analysis and modelling phenological data with students

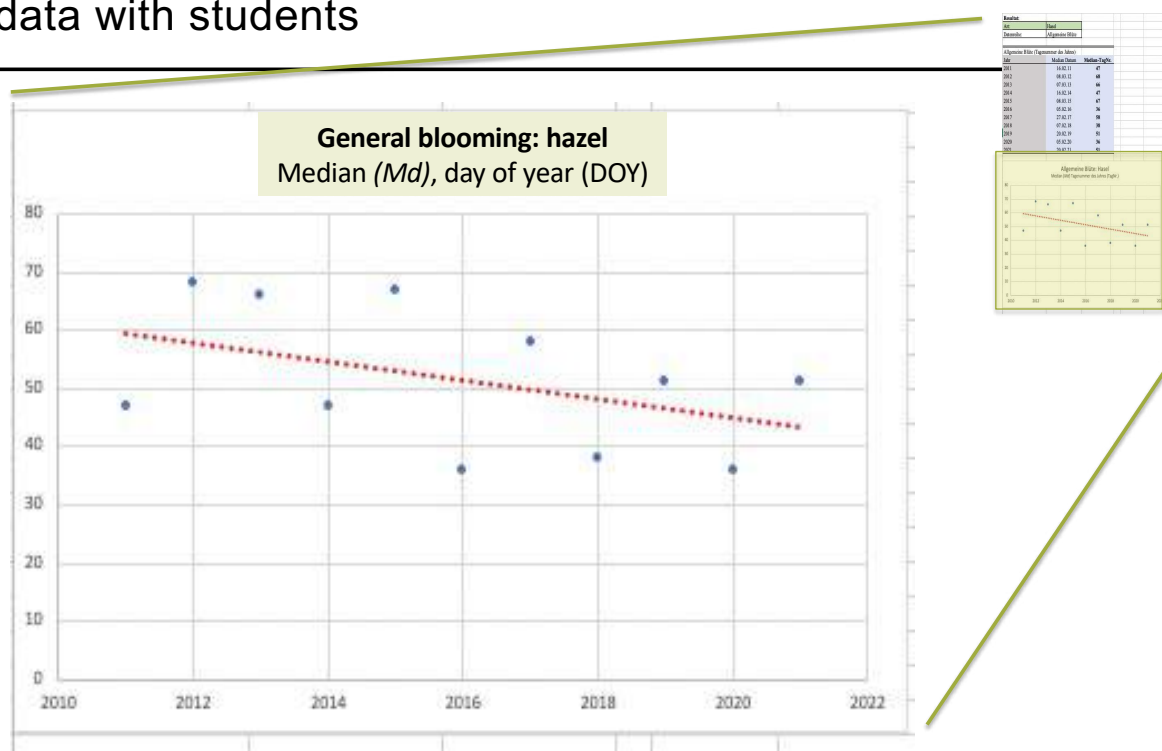


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# Implementation: Analysis and modelling phenological data with students

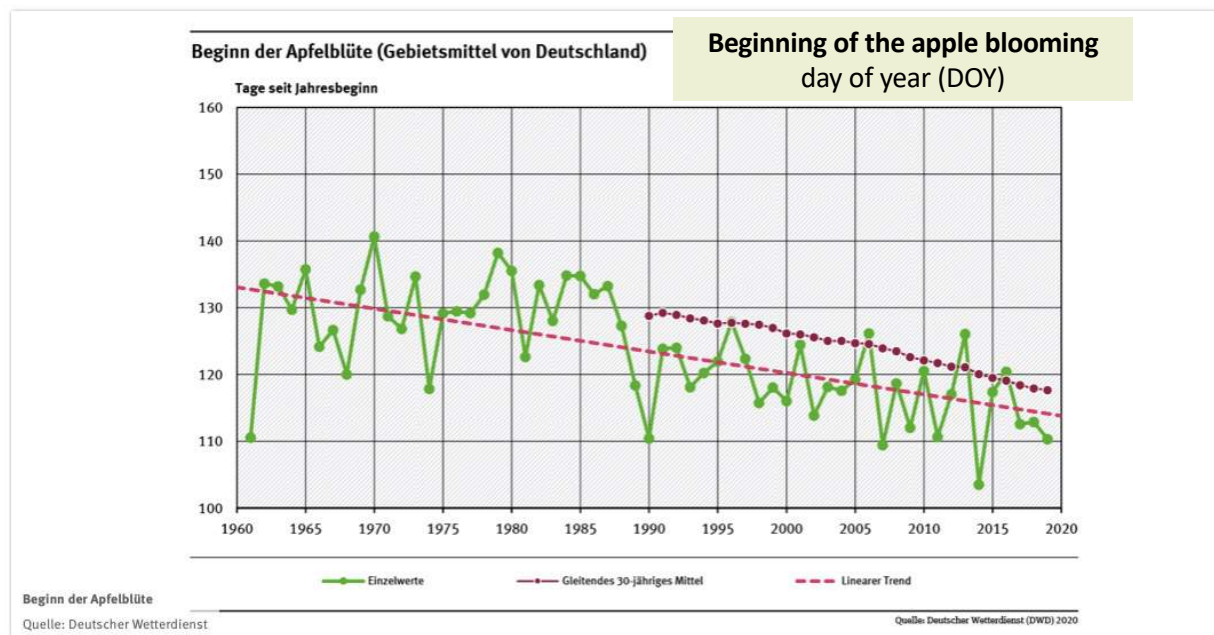


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# Studies / Publications (a.o. German Weather Service, 2020)



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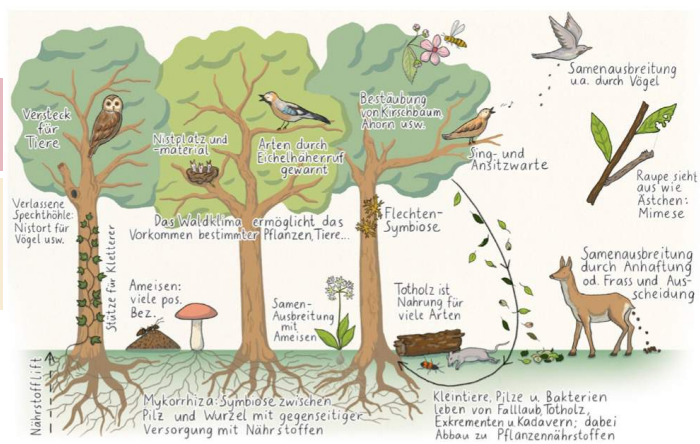
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## Discussion and conclusion: Plenary discussion with students

- ▶ Climate change has huge implications on environment - symbioses
  - ▷ How quickly can the plants adapt?
  - ▷ Do interactions between plants and animals still work? .. Migrating birds, pollination by insects ...
  - ▷ Food resources?

Flowers are not pollinated if the insects haven't hatched

Winters become shorter and warmer: Pathogens can survive and spread




Zwischen den Pflanzen, Pilzen, Flechten, Tieren und Mikroorganismen, die an einem Ort zusammenleben, bestehen unzählige gegenseitige Abhängigkeiten. Hier dargestellt ist eine Auswahl von Symbiosen und anderen positiven Beziehungen zwischen rund 25 Arten eines Laubwaldes im schweizerischen Mittelland. Illustration: Ruth Cortinas

Gigon, Symbiosen, 2021

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**Thank you for your attention**

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## **Model quality** of the trend line

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- ▶ A certain caution is required when dealing with the results:
  - ▷ *We have not advise the quality of the model. It would be important to calculate more statistical parameters in the background to not overestimate the model.*
  
- ▶ ***Nevertheless, the analysis is impressive***



