



## **Annex I: Project Report AGORA / PSC Plant Science Family Program, CRAG-3\_139921**

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### **Extract:**

## **Impact Analysis and Evaluation**

### **Aims**

The aim of the expedition evaluations was to assess level of participant satisfaction with the format and level of engagement with scientists (short-term outcome after the expeditions matched with benchmark values defined before expeditions) and to find out if the knowledge transfer goals were achieved and to establish if the events were a good opportunity for intergenerational (social) learning for both: short-term outcomes after expeditions matched to long-term impact 10 – 12 months after expeditions.

### **Summary**

The surveys showed a high level of satisfaction with the design of the expeditions and the amount of information presented. The explanations of the scientists were rated highly understandable for the majority of adults and youth over 12. There was a lower level of comprehension for the under 12's but they nevertheless enjoyed interacting with the scientists. This was shown by their comments.

The overall learning objectives were attained for the expeditions. The lowest level of learning was for the children under 12 in the topic of plant breeding. However from the interviews it was apparent that the children and youth over 12 had learnt a lot more about wheat breeding than the survey had indicated. This could be due to survey design, or that face-to-face interviews prompted a more thorough response.

During the interviews the majority of participants agreed or strongly agreed that the practical activities during the expeditions had helped them to better understand plant science. An analysis of the comments and keywords shows that youth had an excellent recollection of the activities and instruments such as thermal cameras which are very visual. Hands-on activities which took some time



to do and were novel, such as the apple tree grafting or gluten experiment, flower specimen collecting or digging out plant clones, were recalled more often than shorter activities such as looking at stomata with the cellscope or longer activities that they had likely encountered before such as vegetable DNA extraction, neither of which were recalled.

In the time available we were able to convey some concepts and methods from plant-breeding and alpine plant research, to raise awareness of plant science, but not necessarily details of individual research projects. The expeditions were a positive experience for participants and on the whole a good format, if somewhat intensive. Participants from the Furka expedition were particularly effusive and would highly recommend the expedition to their friends.

### **Methods used for Analysis of Outcomes and Impacts**

Our evaluation follows a logic framework that links the project plan and its defined activities directly with outputs (table 1), measurable short-term outcomes (table 4) and long-term impacts (table 5).

#### **Short-term outcomes**

1. Satisfaction of visitors with the expeditions and interactions with scientists
2. Achieving the learning objectives (Learning of plant-science related concepts and scientific terms)
3. Awareness of Plant Science Research and whether their opinion/perception of plant science had changed as a result of participation in the event

After each expedition participants were asked to fill in a questionnaire with a set of individual questions. There were surveys for participants 12 years and over and for below 12 years.

Questions can be classified in the categories “General Satisfaction and Expectations” (2 questions), “Experience of social learning and dialogue with scientists” (2 questions), “Understanding of Scientific Terms”, (2-4 questions), “Awareness of Plant Science Research” (1 question) and opinion of the event theme and desire to learn more whether it had changed as a result of participation in the event, i.e. “Perception” (1 questions).

Answers to questions in the categories of “General Satisfaction and Expectations” and “Experience of social learning and dialogue with scientists”, “Awareness of Plant Science Research” and “Perception” could usually be done on a 4–point scale with items ranging from “Strongly agree” (=1) to “Strongly disagree” (=4). For these questions in the analysis neighboring categories were merged, i.e. strongly agree, agree /disagree; strongly disagree. Responses in these categories have been pooled over all expeditions and giving percentages based on filled in surveys per question.

In these categories some questions had different item scales, from too long, just right, too short for length of event for example.

For questions regarding the understanding of scientific terms free text answers were possible. Answers were rated by the evaluator with 1 point for a correct answer. Percentage of respondents that achieved in one point was calculated with pooled data for all expeditions and based on filled surveys for these questions.

Surveys were created with SelectSurvey.net and completed online after the events, via a link sent to participants.

In total N=102 questionnaires were completed (from 151 participants, 68% feedback rate), with N=73 for youth >12 respondents and N=29 for youth < 12 respondents.

#### **Interviews – long-term impacts**



Ten to 12 months post event we carried out 24 face-to-face interviews with expedition participants. This was not part of the original evaluation plan but we became interested in the long-term impacts (if any) of the expeditions and how these could be assessed.

Seven adults and seventeen youth were asked 8 (youth) or 11 (adults) questions with scale answers from strongly agree (=1) to strongly disagree (=5). In the analysis neighboring categories were merged, i.e. strongly agree, agree /disagree; strongly disagree. For questions see Appendix 3.

The first question tried not to lead and asked what came to mind when they thought about the expedition. “When I think about the expedition the following words come to mind”. The second question asked about recollection of keywords “The following words or concepts are familiar to me”. The matching of recollection was then self-graded by the interviewee from 1-5 depending on how well they remembered the words.

The next four questions were about the learning experience: if they had learnt from the practical or hands-on activities, if they could recall any experiment and if participating in the expedition had prompted them to think more about plant science since then. We then asked if they recalled learning with their families and with other families as a positive experience. Have they looked for more information in the media or done anything similar at school (made conceptual connection)?

Most interviews were in German, some were asked in German and youth responded in English, hence some comments are mixed. 11 youth interviews were in German, 4 English and 2 mixed. Five adult interviews were in German and 2 in English.

The interviewees made several comments that were not quantifiable with the scale 1 - 5 but nevertheless showed concept, activity or other keyword recollection. These were evaluated by giving a point for every person who recalled one or more concepts or activities.

Summary of the logic framework results in Table 4, 5.

**Table 4** Overview of the results of the logic framework – outcomes from 5 expeditions in 2013. Percentage of agreement for the indicators to be fulfilled was defined before the expeditions by a benchmark value of 45%. Results for satisfaction and awareness show the percentage of participants that strongly agreed or agreed with the statements. Absolute numbers are in brackets. Responses have been separately analyzed for adults and youth; and children below 12 years. Responses to questions about learning objectives were free text and were separately analyzed (see Methods).

Description	Indicators (measurable)	Source of Verification	Percentage of Responses
<b>Outcomes</b>			
Satisfaction of Visitors	45% of participants strongly agreed, agreed that the expeditions had the right length	Questionnaire	Adult/Youth: 77% (43 responses) Children: 60% (15)
	45% of participants strongly agreed, agreed that the expeditions met my expectations		Adult/Youth: 86% (43) Children: 47% (15)
	45% of participants strongly agreed, agreed that the information provided by the scientists was understandable		Adult/Youth: 85% (41) Children: 87% (15)



	45% of participants strongly agreed, agreed that learning with children/adults was a positive experience		Adult/Youth: 95% (40) Children: 100% (15)
Achieving the learning objectives	45% participants give correct answers to questions regarding concepts and scientific terms (no pre-test / post-test design implemented).	Questionnaire	
	Smart Breeding: What are the traits we want to breed? <i>Learning objectives: knowing methods to study the function of genes and how to find the genes responsible for traits</i> What is a gene? What is DNA?		Adult/Youth: 83% (12) Children: 83% (6)
	Plant Breeding: Conventional vs. molecular breeding <i>Learning objectives: knowing the principles of modern breeding techniques, What is the difference between conventional breeding and biotechnology?.</i>		Adult/Youth: 82% (11) Children: 17% (6)
	Alpine regions and global change: Alpine regions as storehouses of biodiversity <i>Learning objectives: Get a feeling for the amount of biodiversity in alpine grasslands. Understand how biodiversity is important for ecosystem services. What is biodiversity? Why is it important?</i>		Adult/Youth: 88% (24) Children: 71% (7)
	Alpine regions and global change: monitoring ecosystem changes: Invasive plants as model for climate change <i>Learning Objectives: Understand how plant scientists can monitor ecosystem changes due to global change using the vegetation as proxy. Understand that this data can be used for modeling long-term changes in ecosystems. What are the effects of land use changes on biodiversity?</i>		Adult/Youth: 77% (13) Children: 50% (2)
Awareness of Plant Science Research	45% of participants rated plant science research as very important, important after participating in the expeditions	Questionnaire	Adult/Youth: 97% (37) Children: 100% (11)
	45% of participants strongly agreed, agreed that their perception of plant science had changed as a result of the expedition		Adult/Youth: 61% (28)

The below benchmark response of the youth under 12 that the expeditions did not meet their expectations can be explained by their comments, in that they did not know what to expect beforehand so their expectations could not be met.

After expeditions 61 % of adults said their perception of plant science had changed as a result of the expedition. This question was possibly not elegantly formulated, as several comments were that they already had a positive perception of plant sciences. Unequivocal was the importance of plant science for society with 97% of adults and youth expressing it as important or very important.

### Results for Impact

When interviewed 12 months post-event the 17 youth showed a good recollection of activities and concepts but this was not necessarily reflected in their recollection of keywords which were read to them. (Konventioneller Pflanzenzüchtung, Molekular Pflanzenzüchtung,"Smart breeding", Neophyten, Archaeophyten, Artenvielfalt,Globale Änderungen in den Alpen). For all expeditions 64% did not recall



any of the keywords and 36% did. If we look at the recollection of concepts or activities from the expeditions recollection of one or more concepts was 100%.

One comment from an 11 year old was: "I was interested in concepts, not vocabulary. I learned about plants receiving heat, cloning as reproduction of plants". A 14 year old said she did not remember any of the keywords but then went on to say: "Climate change affects plants, plants evolve according to climate. We did an experiment with a heat camera (cool), and looked at plant clones - don't get genetic diversity you get when a plant reproduces with pollen". Another 14 year old said: "(The scientists) change the characteristics of wheat that it grows bigger and better, they take one and then change what they want (by breeding)".

For adults interviews showed that they had a reasonable recollection of the vocabulary used during the expedition: 71% said the terms biodiversity and global change in the alps were familiar to them, but only two recognized the term Neophyten and one knew conventional or molecular plant breeding. If we look at the recollection of concepts or activities or other keywords from the expeditions, recollection of one or more concepts was 100%.

41% of the young people and 43% of the adults agreed or strongly agreed that they had thought or researched about plants after the expedition. 35% of the youth said that since the expedition they had done something similar in school, but a few comments mentioned links such as "something about plants in school" or "In der Schule: Alte Steinzeit, wir haben Körner gemahlen", "in der Schule sind wir auf ein Bauernhof und und haben Apfel angeschaut". None – neither adults nor youth - had specifically sought out or attended further events about plant science, this was expressed with regret.

The majority (76%) of youth agreed or strongly agreed that the practical activities had helped them to better understand plant science. An analysis of the comments and keywords shows that youth had a excellent recollection of the activities and instruments such as thermal cameras which are very visual. Hands-on activities which took some time to do and were novel, such as the apple tree grafting or dough washing, flower specimen collecting or digging out plant clones (Furka), were recalled more often than shorter activities such as looking at stomata with the cellscope or longer activities that they had likely encountered before e.g. Vegetable DNA extraction, neither of which were recalled.

One or two 14 year-olds were dismissive or negative at first but then remembered a number of activities; "it was raining and we had to look at wheat... geeignet Weizenarten. Stadium camera, heat camera, different techniques needed to make crops, breeders of wheat try to make better plants from domesticated varieties of wheat – we looked at how they got them.

**100% of the adult** participants felt that the hands-on activities gave them a better understanding of plant science but they were on the whole less specific about recalling individual experiments than the youth.

Table 5: Impact analysis is based on interviews with 7 adults and 17 youth 12 month after the expeditions in 2013. Responses have been separately analyzed for adults and youth (below 12 years).

Description	Indicators (measurable)	Source of Verification	Results
<b>Impact 1</b>	Is the learning during the expeditions sustained after 12 months? 45% of participants recollected one or more individual concept  45% of participants recollected one or more scientific term from the expeditions.	Interview	Adult: 100% (7) Youth: 100% (17)  Adult: 71% (5) Youth: 65% (11)



<b>Impact 2</b>	Is the positive intergenerational (social) learning experience sustained? 45% participants strongly agreed, agreed about learning between generations.	Adult: 100% (7) Youth: 76% (13)
<b>Impact 3</b>	Is the awareness of plant sciences and plant relevant issues, i.e. sustainability in food production, management of the environment, and ecosystem services provided by plants sustained? E.g. awareness in media, visit of other science-related events, joining activities in school.  45% participants named one activity or school activity that they have joined or one media news item that they became aware of after the expeditions.	Adult: 43% (3yes,3 no, 1 don't know) Youth: 41% (7)
<b>Impact 4</b>	Participants attended another science event in the 12 months after the expedition.  Youth: 45% participants did something with plants at school.  Adults and youth: 45% of participants attended another scientific event.	Youth: 35% (6 yes or maybe)  Adult: 0 Youth: 0
<b>Impact 5</b>	Participants felt that the interactive, hands-on activities had helped them learn about plant science  45% could recall on experiment or hands-on activity that they carried out during the expeditions	Adult: 100% (7) Youth: 76% (13)

### Lessons learnt about visitor evaluation

The online surveys were on the whole too long for the participants. Towards the end of the questions responses tailed off and particularly the under 12s skipped questions. There were written comments in the surveys and verbally stating that responders felt “abgefragt” or interrogated. One mother felt that too much learning measurement was done in relation to the length and context of the expedition. For example “I just wanted to do something fun and educational with my children and it changed the experience (negatively) having to fill out a 20+ question survey” (M.B).

The survey design was too imprecise for the learning objectives “Plant breeding Message 1: What are the traits we want to breed?” and “Message: Why we need to monitor ecosystem changes from local to regional scale“. This is an important lesson to very closely match learning objectives and survey questions.

The interviews in contrast were not perceived as a burden. The interviewer travelled to the expedition participants so it did not cost them time, only 10-15 mins per interview. The experience was pleasant and natural and even the teenagers who were at first not engaged became more animated as the interview progressed.

From this experience we would recommend a short (max 10 questions) interview or survey to be filled out on site with an interviewer post event, and when desired, a face-to-face interview 10-12 months post event.