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Panos Petridis • Marina Fischer Kowalski (Eds.)

6th Summer School on “Aquatic and Social Ecology” on Samothraki, Greece

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Social Ecology Working Paper

Panos Petridis, Marina Fischer Kowalski (Eds.)

**6th Summer School on “Aquatic and Social Ecology”
on Samothraki, Greece**

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Organized by:

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1. The 6th Summer School on “Aquatic and Social Ecology” on Samothraki: Introducing this volume

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The 6th Summer School on “Aquatic and Social Ecology” took place on the island Samothraki, Greece, between the 21st of June and the 1st July 2019, aiming to apply methodological approaches used in socioecological and aquatic research in a local setting, while supporting local sustainability initiatives and building synergy with the efforts of Samothraki to become a UNESCO Biosphere Reserve.

Theoretical input was provided by several members of the long-lasting research consortium (including researchers from the University of Natural Resources and Life Sciences in Vienna, Austria; the Hellenic Centre for Marine Research, Greece; the University of Waterloo, Canada; and the Instituto Superior Técnico in Lisbon, Portugal), each presenting different aspects of current and future research undertaken on the island.

For the most part of the summer school, students were split in smaller groups and conducted fieldwork in an array of social and natural science methods. Six modules were performed in parallel, each consisting of an information block, participating field research, data analysis and reporting. Each method was practically demonstrated by a tutor guiding the small student group throughout the field work.

The current volume comprises of the reports from the modules performed in the summer school 2019. These included:

- (a) **Soft tourism:** A module focusing on prospects of a sustainable tourism on Samothraki, split into two sub-groups: (i) one focusing on ways to improve the synergy between tourism and local food production, by assessing the use of local food on Samothrakian restaurants, and (ii) a second focusing on a sustainable future for the municipal campsite ‘Platia’, that would respect the area’s forest status, while continuing to provide accommodation to about one third of tourist overnight stays.
- (b) **Waste management:** A module that focused on organic waste management, and in particular evaluated the composting program that was initiated in primary schools by the ‘Sustainable Samothraki’ association.
- (c) **Water management:** A module focusing on the water metabolism of the island that assessed water management practices and measured water

physicochemical parameters, thus contributing to ongoing research that aims to produce a preliminary water resources management plan for the island.

- (d) **The future of agriculture:** Another key module, split into two subgroups, (i) one evaluating the past, present and future of the 'Sown Biodiverse Pastures' project initiated on Samothraki in 2015, and (ii) a second, assessing obstacles and potentials of the local agricultural market on Samothraki by producing a map of key structures and trade relations on the island.

As in all previous occasions, we would like to acknowledge all researchers and tutors organising the modules, and all students who actively engaged and animated them, contributing in ongoing research. Moreover, we have greatly benefited from local support, and would like to thank our local partners from the association Sustainable Samothraki, in particular Giorgos Maskalidis, Jaqueline Kirby and Carlota Marañón, social cooperative Varades for hosting us at the municipal camping, as well as the Mayor of Samothraki Thanasis Vitsas and mayor-elect Nikos Galatoumos. And of course all interview participants who once again contributed to our research by sharing with us their knowledge, but also concerns, hopes and visions for a thriving Samothraki environmentally sound, and socially cohesive.

2. Local Food in Samothrakian Restaurants

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2.1 Abstract

The following paper contributes to the ongoing sustainability research on the Greek island of Samothraki. The research conducted for this paper aims to understand the landscape of tourists' food supply, since this has significant effects on the island's sustainability. The food offered in restaurants, the perception of restaurant owners and food preferences of tourists were explored through interviews. Even though the restaurants use local ingredients from Samothraki to a certain degree, increased food demand and variation in seasonal products make it difficult to serve only local ingredients throughout the tourist season. Olive oil, goat and sheep meat and their dairy products, fish and seafood, as well as honey and wild vegetables are mainly purchased from local producers. Other ingredients are provided only partly locally, and many are imported. One of the obstacles that emerged was the insufficient local food production, another the legal situation when purchasing from local farmers. A close social network and capital largely influences the possibility to purchase local food. The EU subsidy system was also mentioned to counteract diverse local food production and sales. To enhance local food production, collaboration between restaurants and farmers should be promoted. Our findings show that the current legal situation not only prevents an increase in local food production, but it also drives producers to find illegal solutions for collaboration. Further research concerning local food production and sales, and the connection with EU regulations, is recommended.

2.2 Introduction

Samothraki is a Greek island located in the Northern Aegean Sea which has been of interest to international researchers in the field of sustainability sciences since 2007. The relatively small island of 178 km² with about 2800 inhabitants is largely part of the Natura 2000 network. In 2011, the Municipality applied for becoming included in the UNESCO World Network of Biosphere Reserves for its ecological richness and cultural heritage (Fischer-Kowalski et al. 2011). Samothraki is a perfect study object for the complexity of sustainable development due to several factors, for instance limited

resource availability, a fragile ecosystem and socioeconomic issues, like slow population decline and the consequences of the Greek governmental and economic crisis. All these challenges might lead to tipping points. Therefore, several scientists are investigating these topics and trying to support the local population to get on a path towards more sustainability (Petridis and Fischer-Kowalski 2016). The overall aim of Samothraki's island study is to find sustainable solutions for the burdens the island is facing through the transition from a traditional to an industrial society.

With an ongoing labour shift from the agricultural to the service sector (in 2011, 66% of the workforce was employed in the service sector), and approximately 54.000 visitors in 2015, including an estimated number of 36.000 tourists, tourism plays an important role in the island's economy and sustainability. Tourism on Samothraki is highly concentrated in July and August. Therefore, environmental pressures like increase in waste, water pollution, GHG emissions through transportation, demand of imported food etc. is significantly higher during summer (Schwaiger 2017). This leads to an impairment of infrastructure and interferes with the distribution of local resources, such as agricultural products. When exploring Samothraki's touristic development, the question of sustainable and local food supply should be taken into account. Throughout this paper and the conducted research, the term "local" is defined as "from Samothraki".

Currently there is not enough local food production on Samothraki to provide for everyone during the main season (residents and tourists). Among residents it has been observed that they cover around 50% of their food demand from local sources. There is also a will to share local food in networks of families, friends and neighbours due to better food quality, taste, solidarity, support for local economy and environmental reasons. Furthermore, there is a potential to increasingly use traditional knowledge as a tool to promote sustainable lifestyle (Petridis and Huber 2017).

Previous studies describe a transition from a traditional agricultural society towards a modern industrial society on the island mainly based on tourism. This leads to a tendency towards a westernisation of food consumption (Petridis and Huber 2017). However, the local food usage of restaurants and tourists' preferences for local food have not been investigated so far and are the focus of this paper. Due to the island's characteristics it was assumed that an increase in locally produced food would have a positive impact on the island's sustainability and local economy.

The first overall aim of the research conducted for this paper was to understand the landscape of tourists' food supply by exploring the food offered in restaurants and the food preferences of tourists, and by analysing the perception of restaurant owners. Moreover, the second aim was to promote collaboration between restaurants and

farmers to enhance the utilization of local food. At that time, the idea of the municipality was to set up an online platform where farmers could easily offer their products to restaurants. The potential of this project as well as obstacles to further collaboration are investigated in this paper.

In order to reach the indicated research aims, four main research questions were outlined:

1. To what extent do restaurants use local ingredients from Samothraki?
2. What are the possibilities and challenges in using more local products in restaurants?
3. To what extent can an online platform enhance the use of local products on Samothraki?
4. What are the preferences of tourists regarding local food in restaurants?

2.3 Methods

To cover all research questions, two interview guidelines were designed - one for restaurant owners, and one for tourists. Suitable places (restaurants), which qualified for the research questions had to be found and restricted to a reasonable number. According to the developed sampling strategy, two pilot interviews were conducted, followed by a collective reflection process to adjust and refine the guidelines concerning the interview setting. In addition to structured interviews with restaurant owners, an interview with a local farmer and one with an employee of the municipality were arranged. These interviews helped to cross-check the impressions that emerged through the interviews with the restaurant owners and to gain additional information. At the end, the interviews and collected data were evaluated and put into context of the research questions.

The interview guidelines for restaurant owners and tourists were based on two different approaches. The interviews with restaurant owners were structured, but in many cases also included some unstructured questions that emerged in the course of the interview. In some cases the process even ended up in an open discussion. This approach was used to collect basic information and hard facts, but also to build a flexible setting and interact more freely with the owners of tourism establishments. By this means, background stories were gathered and the source of used ingredients was identified by a previously designed list. Furthermore, insights into the owners' social embeddedness on the island were gained. In contrast, the design of the questionnaire for tourists was kept short and limited to a sequence of four structured questions on their food preferences when on holiday. The collected data was later used for a comparison to the statements of the restaurant owners.

The restaurant sampling was created by search engine hits and geographical division of the island. Most of the places considered were found using the search engines Google Maps and TripAdvisor. The top-rated restaurants were chosen, assuming that they are the ones with the highest food turnover and that they are the “pioneers”, shaping the landscape of tourist food supply on the island. Permanently or seasonally closed restaurants were excluded. Smaller places like *Ouzeris* which serve only small snacks or *méze* (small dishes, comparable to Spanish *tápas*), cafés and fast food places were also not taken into account.

Geographically, the island was divided into three zones: North-Eastern Samothraki, Central and Northern Samothraki, and Southern Samothraki. In the North-East large campsites and many other tourist accommodations are located; in Central and Northern Samothraki the two biggest villages can be found and the South of the island attracts many tourists with its wide sand beach and traditional villages. Eventually, eight out of nine selected and requested restaurants were open for collaboration and interviews. Furthermore, 37 tourists were interviewed in tourist facilities like restaurants or beach bars.

2.4 Results

2.4.1 Usage of local ingredients in Samothrakian restaurants

Figure 1 shows the main ingredients used in restaurants and their share of being produced or bought locally (blue) or imported (red).

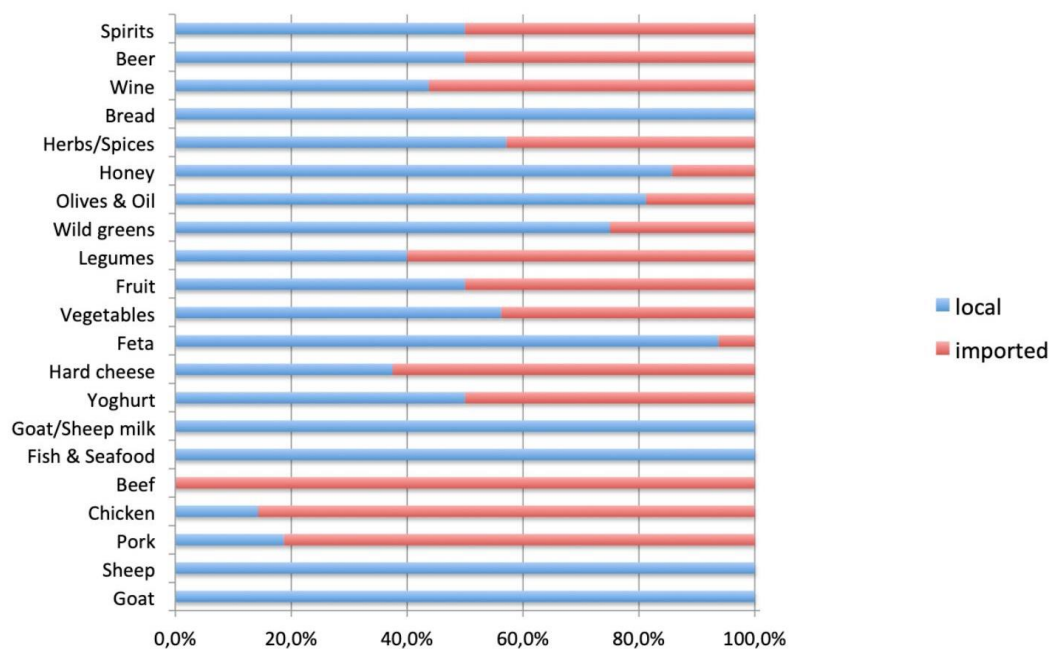


Fig. 1: Use of local vs. imported ingredients in Samothrakian restaurants

The table shows the proportion of local and non-local ingredients as stated by the restaurant owners. It must be noted, that 100% refer only to the number of restaurants which actually use the ingredient. That means that 100% do not necessarily represent all of the eight restaurants for all products. Furthermore, there are some notes to add:

- Beer is only partly produced locally: *Fonias* is the beer brand of the only local brewery, but the ingredients (hops, malt) are imported. Other beer brands are imported.
- Although all restaurants buy bread in local bakeries, it has to be considered that the flour for the bread is imported, at least to a certain extent.
- Some products have to be imported as they are not cultivated or produced on the island, for example beef, specific herbs or vegetables, whereas some other products do have potential in increasing the share of local production as they are produced on the island (but not always in a sufficient amount), for example honey, olive oil, legumes, vegetables, cheese, yoghurt, chicken or pork.

Almost all of the interviewed restaurant owners would favour offering a broader variety of local ingredients. Almost a third answered that they do already serve all available local products, and most of them doubted the possibility to purchase more local ingredients. A number of obstacles were mentioned, which are described in section 3.2. About half of the interviewees stated they were open for a collaboration platform to increase local exchange of food, while others said that they are not in need of further collaboration or are sceptical about the implementation or the benefit of the platform. When asked about their perception of the tourists' food preferences, more than half of the restaurant owners believed that tourists prefer local food, two did not know, and only one interviewee felt that tourists like to eat what they are used to. All restaurants offered local food from Samothraki. In addition, most restaurants also offered 'western' meal deals and breakfast options, which are not 'traditionally' Greek. Therefore, a tendency of both traditionalism and modernisation could be observed in the menus.

Another important aspect was the strong seasonal character of the menus. During low season, restaurants barely serve all the food on their menu, especially concerning main courses. However, during high season in July and August, all restaurants claimed to serve all the dishes on their menu due to a highly increased food demand which influences the amount and variety of needed ingredients. The relative use of imported food during high season seems to depend on the particular menu and available suppliers. It remains an open question if and how local food production could generally cover the increased demand of ingredients during that period.

2.4.2 Possibilities and challenges for increasing the share of local products

One of the obstacles indicated by restaurant owners was the insufficient local food production on the island to meet the tourists' food demand. This especially concerns vegetable production, which is rather limited. This problem is partly related to legal issues on the island which constrain a further increase in local production. In general, many small-scale local farmers are not officially licenced and therefore not allowed to hand out receipts for their products. This results in problems for restaurant owners who would like to legally purchase local food. Moreover, the application of EU subsidy policies on the island seems to reward goat husbandry over diverse vegetable production among farmers. More specifically, according to our interviewees, the EU legislation requires a monoculture in order to provide farmers with subsidies, thus promoting a more professional, large scale type of farming that is unsuitable for small islands such as Samothraki. In other words, if local farmers want to add a series of agricultural products to their annual production instead of cultivating only one kind (e.g. tomatoes or wheat), they will not receive any subsidies. This condition either leads to a production of a very limited variety of products that cannot cover the diverse needs of the local restaurants, or to the illegal production of undeclared products that are difficult to be legally sold.

Social networks and capital largely influence the possibility to offer local food. Restaurant owners who are originally from the island or have been living there for a longer time have fewer difficulties in networking and collaborating. Also, they may have bigger family support which constitutes a huge advantage when it comes to find local producers or produce and sell food themselves - even if this might be illegal. Within this smaller social network, cooperation tends to be strong. Outside of these closed networks, distrust and scepticism are common and present a major problem for collaboration.

Furthermore, the interviews show that restaurant owners are not prepared to push new structures themselves but wait for somebody else to do it. They are also sceptical to engage in a possible internet platform for more cooperation and would rather wait and see if the project is effective. Moreover, people who have been integrated on the island for a very long time and take advantage of their social capital, do not perceive the problem of overall collaboration as such. Only a few were in favour of an external platform for collaboration and stated that networking on the island largely happens informally and personally, e.g. in cafés. Restaurant owners who recently immigrated or only spend time on the island during high season do not have as much social capital and therefore have more difficulties in meeting legal requirements. They were more

in favour of an external platform assuming they would benefit from it to a greater extent.

Interestingly, price seemed to be one of the minor issues. Most of the interviewees stated they would buy local food as a matter of principle, even if the price was higher. However, in some cases restaurant owners claimed that there is a certain price threshold above which even if they would like to have more local products in their menu they would not be able to afford it.

2.4.3 Preferences of tourists regarding local food in restaurants

The 37 tourist interviews show a balanced gender and age distribution (19 females and 18 males of all ages between 17 and “grandparents”). 59% of the interviewees were Greek, 27% Romanian, 8% Bulgarian and 6% from other countries. Duration of stay varied between 3 days and 1 year (military service). Excluding the military servants, the mean duration of stay was almost 10 days.

As an introductive open question, they were asked about their food preferences in general to get an insight about important criteria in tourists’ food choices. 59% stated that they prefer special foods or ingredients (for example fish, seafood, meat, goat, salads), “local food” was answered by 49% of the interviewees and almost 30% mentioned “traditional food”. Interestingly, only 5% mentioned quality, for example “freshness of food” being important in their food preferences.

92% answered that local food in general is important to them, but the personal spontaneous definition of “local food” differed among the interviewees - most of them (73%) defined it in terms of local products, dishes or specialities, while 16% defined local food as being part of cultural and/or traditional identity. A few people had different definitions, like “home-grown” or “different from home” or had none at all. We should note however that the diverging answers may not be necessarily contradictory.

The purpose of the final question was to investigate the importance of products served in restaurants being locally produced. 92% answered that it was “very important” or “important” to them, 3% stated that it was “quite important” and 5% said it was “not so important” to them, as shown in figure 2.

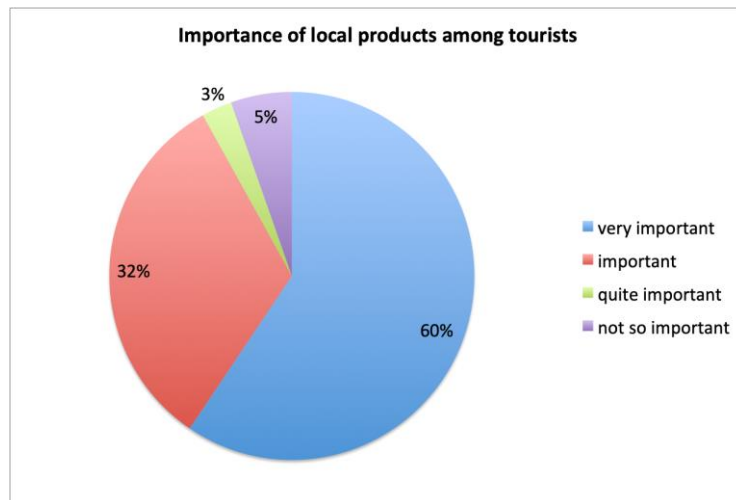


Fig. 2: Importance of local products among tourists

2.5 Discussion

In conclusion, one can say that almost all restaurant owners seemed to be in favour of an increased local food production. Also, the tourist interviews show that there is a large base of potential demand for more local food on the island. Our results indicate a general positive attitude and willingness towards an increased use of local ingredients, and also that it would be economically promising. Therefore, further potential may lie in marketing the locality of the served dishes to attract more tourists.

However, the current legal structure on the island plays an important role regarding the obstacles and possibilities of increasing the use of local food and its variety on the island. Generally the legal structure, including the EU subsidy system, seems to counteract diverse local food production and sales. People who have been integrated on the island for a long time use unofficial ways, mostly within their immediate social network that they obtained throughout the years. Finding solutions like these in the face of legal constraints is much more difficult for people who have not been based on the island for a long period of time. The legal circumstances not only prevent a promotion of local food production, they also support illegal solutions for collaboration. Therefore, one can find high tolerance for these solutions within an exclusive group of citizens on the island.

As long as there is a tolerance towards illegal forms of collaboration and a structure that supports these forms, legal forms of cooperation between farmers and restaurants in order to increase local food production on the island is prevented and the conventional structure is strengthened. In this way, equal rights for the island society as a whole are prevented and individual strategies are rewarded.

Regarding the potential implementation of an internet platform for more cooperation, it is recommended to consider different target groups and their social capital. Regarding the controversial culture of distrust and solidarity it would be necessary to analyse which third party would fit best to manage and establish this cooperation platform. Another important point is to take into account the probably low internet usage of some parts of the target group. Therefore, physical elements should be explored as part of establishing a new cooperation structure on the island (e.g. markets, personal networking).

Exploring the field of legal constraints among our interview partners opened up new perspectives but also included many contradictions. A more profound evaluation of legal issues was not possible during the research period. For further research, it is recommended to take a deeper look into the legal issues concerning local food production and sales and the connection with EU regulations. Likewise, an analysis of alternative options to an internet platform could be part of future research. Since the used ingredients varied partly between restaurants, a broader and more detailed data collection of those ingredients and their origins is recommended.

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3. Primary Schools Composting on the Greek Island of Samothraki: A Case Study

Elisabeth Bergler¹, Benjamin Fleischmann¹, Kristina Huda¹, Alejandro Marcos-Valls², Dimitrios Papageorgiou³, Martina Perzl¹, Paula-Marie Rolshoven, Theresa Seitz¹, Simron J. Singh⁴ (tutor)

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3.1 Abstract

Around the globe, waste management has become more and more challenging – especially on islands, where space and resources are highly limited. On the Greek island of Samothraki organic material contributes 40-60% of the total municipal waste. In response, the association *Sustainable Samothraki* has started a school project initiating an education programme and composting activities with school children in primary schools. During the 6th Sustainable Samothraki summer school, qualitative interviews with the teachers, children and parents involved were conducted to research the composting project's impact. This paper aims to present the summer school's findings about the Sustainable Samothraki Composting Project's success, potentials and barriers.

3.2 Introduction

Currently, the planet generates 41 Gt of waste annually (or DPO – domestic processed output), which is 66% of total materials entering the economy each year. On a global scale, recycling is very modest, amounting to only 4% of the inflows (Haas et al. 2015). Islands, and specifically small islands, face even more difficulties and barriers in managing their waste. Since landfilling is often impossible due to lack of surface and aesthetic disturbances, just as it is for illegal dumping and waste burning, the question of how to treat waste still remains. From the islands of Hawaii down to the Canary Islands and across the Mediterranean to Malta, to mention only a few: costs to ship the waste to the mainland are high and local waste management often inefficient. In parallel, the tourism sector thriving on these islands aggravates the waste situation by creating more waste that needs to be managed (Eckelman et al. 2009, Santamarta et al. 2014, Camilleri-Fenech et al. 2018).

Only few studies related to waste management on small islands are available today. Case studies from Hawaii, Malta and the Canaries show that there is no straightforward solution for those islands to manage their waste. Reasons are mainly limited space and restrained recycle and resale opportunities. While some of these islands are currently trying to improve their waste management – e.g. through decreasing the greenhouse gas emissions by optimizing the routes of waste transportation in Malta (Camilleri-Fenech et al. 2018) – other solutions proposed need time and an educational process in order to be implemented. Another study on Small Island Developing States (SIDS) shows that waste is least present where states or islands are more material self-sufficient (Mohee et al. 2015). The main driver of waste generation are consumption patterns, in particular on an island where most waste is caused by imported products. This means that waste could be reduced by decreasing dependency on imported materials, *such as “food, fuel, and manufactured goods to satisfy [...] modern physical resource needs”* (Hawaii, Eckelman et al. 2009, p.759), increase local materials, reduce food waste and packaging as well as set up awareness campaigns to inform the population about risks that go hand in hand with inappropriate waste management (Eckelman et al. 2009, Santamarta et al. 2014, Mohee et al. 2015, Camilleri-Fenech et al. 2018).

Each year, the Institute of Social Ecology (BOKU, Vienna, Austria) together with the Hellenic Centre for Marine Research (HMCR, Athens, Greece) organize a summer school on the Greek island of Samothraki, in the northern Aegean Sea, to study and seek solutions to complex sustainability problems on small islands. As part of this scientific enquiry, participatory action research is conducted. During the summer school of 2016, a group of researchers and students studied the island’s waste management system in some detail. Beside a number of interviews and use of secondary data from the municipality, they collected waste samples and conducted a waste decomposition analysis. A key finding was that, on average, organic waste comprised of 40 to 60% of the municipal waste (Noll et al. 2016). This meant that the island could save on shipping costs for up to half of the current municipal waste to the mainland, if organic waste could be separated and recycled through composting activities *on the island*.

One of the outcomes of the 2016 summer school was the birth of the local association *Sustainable Samothraki* in 2017, with the mandate to enhance the local socio-economic and environmental conditions. Already before the association formally existed, the members found themselves deeply concerned as much about possible health risks as about the damage done to the terrestrial and marine environment, generated by the island’s inappropriate waste management.

Taking the findings of the 2016 summer school on waste issues, Sustainable Samothraki initiated the project “Composting: Nature’s Way of Recycling”, through

which they implemented composting facilities and a composting routine for children in the primary schools of Kamariotissa, the island's biggest settlement, in Lakkoma and in a youth centre in Chora. Through various educational games, the children learned about the importance of composting and had the opportunity to compost organic waste brought from home by themselves in “RE:THINK” composting bins. Throughout this process, not only the children but also their educators and parents were informed about the correct usage of the composting bins.

The 2019 summer school took place on Samothraki from the 22nd of June to the 1st of July. One of the goals of this summer school was to evaluate the project and progress towards the project goals, while offering recommendations for the next period. Through interviewing kids and parents involved in the composting project, as well as the teachers and stakeholders leading it, a general understanding of the perception concerning waste could be achieved. Gathering different values, opinions and perspectives, the aim of this paper is to help Sustainable Samothraki to discover improvement opportunities, detect barriers and therefore support the expansion of the initiative across the entire island. Reaching this goal would not only improve the living-conditions on Samothraki, but also support the possibility of the island being included in UNESCO's World Network of Biosphere Reserves and thus of conserving its unique habitats, natural and cultural characteristics.

3.3 Methodology

For our research, we used a case study approach and preliminary generated our data through semi-structured interviews with stakeholders who have been involved in the project – teachers, parents, and children. Our main goal was to assess values, opinions, and perspectives on this initiative and to identify opportunities and barriers. Therefore, our research was also a pedagogical experience for the team.

3.3.1 Qualitative Research

Defining qualitative research isn't an easy thing to do, because it intersects many academic disciplines, fields, traditions, and associated assumptions, concepts, and terms. Nevertheless, the definition of Denzin and Lincoln (2000) describes the features of qualitative research well:

“Qualitative research is a situated activity that locates the observer in the world. It consists of a set of interpretive, material practices that make the world visible. These practices transform the world. [...] At this level, qualitative research involves an interpretative, naturalistic approach to the world. This means that qualitative researchers study things in their natural setting, attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them”.

Therefore, the main reason why we chose a qualitative research approach was that we wanted to experience the circumstances around the composting project by talking to the people involved, and to interpret what we learned from them.

Besides its interpretive character, qualitative research is also of an iterative nature. This means that “[...] *the researcher may need to reconsider or modify any design decision during the study in response to new developments or to changes in some other aspect of the design*” (Maxwell 2018). In this respect, we had to be very flexible and open to changes, when we worked on the island with different people. As described in section 3.4, we had to get to know the stakeholders at the beginning and to conduct some initial interviews as a pilot. This helped to build categories and to substantiate our research interest to explore and generate more detailed information.

3.3.2 A Case Study Approach

As a specific concept of qualitative research, we used a case study approach to evaluate the project because of its specific context. We expected this specific context to lead us to a better understanding of the waste problems of small islands in general. Berg defines a case study in general as a “[...] *method involving systematically gathering enough information about a particular person, setting, event or group to permit the researcher to effectively understand how the subject operates or functions*” (Berg 2007). In our case, this means that we wanted to investigate the specific case of the composting project to learn more about the waste situation and treatment on Samothraki. Furthermore, Yin (2014) emphasizes the importance of the real-world context when working on a case study. Especially, referring to the specific context of the small island community of Samothraki is essential for understanding and evaluating the composting project.

3.3.3 Semi-Structured Interviews

For data collection, we conducted semi-structured interviews with the stakeholders of the research project. Before we interviewed any participants of the project, we talked to the project coordinator to get to know the initiative better and to create a typology of the stakeholders we planned to interview. These stakeholders were mainly children, parents, and teachers, who have been involved in the project. The contact to this target group was established by the project coordinator.

The semi-structured interviews were open-ended (Bernard 2006) and the interviewees were invited to speak freely and to share their opinions and points of view. Nevertheless, we drafted some key questions to guide the interviews. In addition, the interviewees were invited to ask questions about our work, interest and background. Fortunately, two members of our group spoke Greek. They took the lead and/or acted as interpreters for the group where necessary. We had a friendly

introduction at the beginning of the interviews, in which we explained the purpose, why we were doing the interviews and how we had structured them, we also took their permission to take notes during the interviews.

3.3.4 Categorization of key issues

For the first couple of interviews we wanted to learn more about the initiative, its system boundaries, and the role of stakeholders. Therefore, the interviews were open-ended and descriptive. On this basis, we came up with a preliminary list of evaluation criteria that helped us guide further interviews, organize our data, and formulate research questions:

- Appropriateness of the target group:
“In which way can the selected target group be seen as reasonable to start with both spreading awareness and nudging behaviour regarding waste management?”
- Level of participation:
“What was the level of participation in the project and what does this imply about the success of the project?”
- Communication and education:
“How was communication and the pedagogical aspect designed and delivered, so as to affect the level of awareness and personal engagement on the topic of waste and composting among the participants?”
- Barriers and challenges:
“Which are the barriers and challenges that hinder the implementation of the composting project at the schools of Samothraki?”
- Incentives:
“What are the incentives for various groups that motivate participation in the school composting project, and also become involved in the waste situation on the island?”
- Recommendations:
“What might be easy wins and what might be mid or long-term actions required to gain wider acceptance and impact from the composting project in the future?”

3.4 Findings

3.4.1 *Appropriateness of the Target Group*

The primary target group for the project “Composting: Nature’s Way of Recycling” were children. They were the subjects for both educating and spreading awareness, but also for bringing organic waste from home and participating in composting activities at the school. The basic assumption was that children could influence behaviour at home, “educating” their parents on waste issues, and urging them to separate waste at home. Environmental education can be found in many curricula of educational institutions around the globe. For pupils, it is essential to learn in which environment they are living in and to get in contact with real human-nature-related challenges. The human induced waste problematic for example, is deeply related to their way of living and its accompanying environmental issues. While confronting children with these problematics they get the opportunity to gain awareness about how humans are influencing the environment and to change their daily routines in a sustainable and responsible way as well as to create actively the environment itself (Bryant and Hungerford 1977).

Generally, our interview partners confirmed that the children were an ideal starting point. They also underlined their potential to change long term behaviour on Samothraki, while also leveraging more immediate actions with respect to separating organic waste. The development of attitudes towards the environment starts already with an early age (Bryant and Hungerford 1977) and does not easily change once those become habitual. Almost all interviewees emphasized this process. In addition, the young children can be effective when promoting environmentally responsible behaviour in others (Leeming and Porter 1997). Some of the interviewed mothers confirmed that. Besides the active and conscious composting together with their children, their awareness about the waste management issues on the island increased.

However, it was difficult to account the extent of impact children had on their parents through this project. To answer this question, a longer-term study would be required. For that, the maintenance of the project and its active participation of certain stakeholders is necessary (Demerell et al. 2013). Nevertheless, children will influence the environmental quality for a longer period and supporting them in adapting and changing their daily practices in favour for a sustainable environment is crucial (Damerell et al. 2013).

Certainly, to change behaviour and practices of adults are more challenging and the target groups must be extended at a certain point of time. Therefore it is important to demand for legislative change and further effort should be contributed by the

government to inform the whole Samothrakian community about waste management issues, which was also requested by our interviewees (Ifegbesan 2009).

3.4.2 Level of Participation

As mentioned earlier, Sustainable Samothraki's initiative "Composting: Nature's Way of Recycling" included two schools in Kamariotissa and Lakkoma, and two cultural centres in Lakkoma and Chora. Three teachers from these two schools added the composting project in their school program and through that motivated the children and the parents to participate. Sustainable Samothraki prepared games for children, and information about composting in order that the children get an insightful understanding about composting and the importance of it.

Of the two schools and two cultural centres that participated in the project, only the Kamariotissa school maintained compost data. This was largely due to the enthusiasm of one teacher of this school, who has an environmental education background and is very informed on sustainability issues. It is important to note that the composting bins in the cultural centre in Chora got removed after some months to the school in Kamariotissa, due to lack of composting organic material. The decision was taken because the children active in the cultural centre in Chora were the same children which were going to school in Kamariotissa. For this reason, they were bringing the organic matter to the school, and not to the cultural centre.

In Kamariotissa school, children of four classes took part in the composting program. The green bucket the children brought from home to school is of the capacity of 4.5 litres each. The data provided by the teacher running the project in Kamariotissa are as follows:

- 130 children go in the Kamariotissa school
- from the 4 classes 36 children were actively participating in the program
- 337 buckets were collected for the school year 2018/2019
- 58 buckets were collected by four teachers participating
- 279 buckets were brought by the children

The approximate organic waste gathered in one school year was 330 kg.

From the school in Lakkoma the only information we got from the interviews we conducted is that 20 children were actively participating in the program. They had not kept track of the data and so we could not assess how much organic matter was gathered.

As mentioned earlier, our primary method for the evaluation of the success of the composting project was through conducting qualitative interviews. We interviewed

children and parents, which participated in the project. Through the interviews of the children, it was obvious that a big motivation of the children to take part in the project was because they wanted to protect the environment. When children were asked: *“what would they like to do when they grow up?”*, several of them answered that they would like to do something that concerns protecting the environment and keeping it clean. This indicated that the information materials and games have had an influence on the children and expanded their ecological knowledge about the matter.

Regarding the participation by families, it should be noted that the majority of those who were enthusiastic about the project and active in separating the organic matter at home were not long-term locals to Samothraki. Often such families were living in Samothraki because their spouse or parents were posted there on government service (e.g. military, coast guards) for some years. Besides their awareness about waste management was the fact that many of these families have no animals, which they could feed with the organic matter, thus enhancing their participation.

In general, the project has been welcomed positively among families who live on Samothraki for a certain duration, or who have made Samothraki their new home. Most of the families expressed their willingness to continue participating in the initiative and have even spread the news to their families and relatives elsewhere. Since the project aims at raising awareness and educating children and parents about composting the most important stakeholders are part of the program and it seems promising that the composting initiative could grow. Sustainable Samothraki already has had meetings with the military, discussing the potential of expanding the composting initiative to their facilities as well.

Parents and teachers expressed in general the same opinion that the initiative has been very successful. Considering the fact that it started as a pilot project, the participation it received can be considered a major achievement. The main achievement is the awareness about the issue of waste among the children and through them also to their parents. Lastly, the willingness from all stakeholders to continue the initiative and even the potential of expanding it, indicates a huge success.

3.4.3 Education and Communication

“People know about the problem with the waste, but don’t think about what happens when they throw organic waste in the bin...” (Participating mother).

As found throughout the interviews, there is general awareness among the local population about the waste issue on the island. However, the interviewees also described a lack of interest and knowledge about the improvement possibilities for the island’s waste management. By targeting the education and engagement of children, the school initiative has managed to spread knowledge about composting

and benefits of proper waste management among local households, as stated during the interviews.

At the very beginning, the initiative held an event for parents and teachers as well as for the school children involved. The event, inviting teachers and parents, aimed at informing them about composting potentials and about the initiative's education programme and composting activities for and with the pupils. The parents were given an information brochure covering the basics of composting: What is the school project about? How does composting work? What can or cannot be composted? etc.

The main objectives of the launching event for the children were to educate them about waste issues and composting as well as to raise general environmental awareness. A major goal was to accomplish these goals, while establishing positive connotations with the covered topics. Learning activities about composting as well as sources, reasons and consequences of (im-) proper waste management were presented in the form of games and interactive play. This connected the children to the topic and made the learning more fun. It included games like colouring pages, mazes, and quizzes (e.g. which waste belongs to which bin?) on the one hand, as well as outdoor activities like mixing and maintaining the compost altogether with the teacher and classmates on the other hand. These interactions endorsed a feeling of responsibility for the composting project among the children. In this way, the pupils were not only taught about the issue of waste itself but also about how they themselves could become part of the solution.

In addition, the teachers acted as role models by demonstrating their own involvement and positive attitude to the topic of waste. For instance, one of the teachers started by bringing her own bucket to school in order to serve as an example and to motivate the pupils to participate.

"In the beginning many children were like 'Ew, it's gross, it stinks, I don't like this', but then we showed them how relaxed we (the teachers) were with it and how the smell was no problem for us, and that it's okay and important to deal with compost.(...) No garbage is useless." (A participating teacher).

As a result, the pupils experienced composting and learning about waste management to be something joyful and common rather than unpleasant and odd. As stated by Samuelsson and Carlsson (2008), combining learning and playing promotes sustainable education and long-term learning-outcomes. When asked about their future (*"What would you like to do when you grow up?"*), many of the children expressed their desire to help keep the environment clean and protected. This indicates the influence of the information materials and games on expanding the pupils' knowledge and awareness about ecological matters.

Inclusion of children's environments is known to enhance their learning mechanisms (Vreugdenhil 2009). By involving the pupils' parents, their area of learning as well as their area of content and skill implementation were broadened from school to their homes. *"If you don't learn it as a child, it's hard to change as a 50 year old – if change shall happen, the kids have to be involved"*, said an interviewed mother. She added, her child had encouraged her to participate in the project. As a result, she had learnt a lot about composting and waste management, that she didn't know before. According to her, this mechanism of encouragement and knowledge transfer applied to most of the participating parents. The school children thus had triggered and promoted environmentally responsible behaviour in their homes and families. Via social media, many of the parents then started communicating and sharing their knowledge, questions and experience (e.g. on Facebook, as for them the platform is easy and convenient to use). The initiative consequently has not only helped raise awareness and provide knowledge for individuals (i.e. the pupils involved), but it also affected entire households and encouraged them to contribute to a more sustainable future.

However, continuity and intensive support are considered key elements, when targeting long-term habit change (e.g. Klein et al. 2011). In school, the pupils have been confronted regularly with the composting project. For example, there are signs about composting and the project (e.g. colourful information sheets and posters using simple words and pictures) spread across the school site while the composting container is placed next to the school's playground. Despite the high contact frequency, a significant decline in interest and participation was observed after school breaks, as explained by many of the interviewees. The examples given described a decrease of involvement and collected buckets after the Easter holidays and summer breaks. This is indicative that a profound habit change has not yet been established, and so waste separation and composting has yet become a habitual task. Therefore, continuous and frequent communication activities as well as a reduction of participation barriers are of utter importance, when thriving to induce long-term change within the target group (see following section).

Some of the interviewees proposed placing flyers and other information materials at fire stations and military facilities as they are considered frequently visited venues on the island. In addition, the interviewees attributed a potential snowball effect to the initiative's impact. Many of the participating parents serving in the army showed interest in continuing a comparable project after leaving Samothraki.

In conclusion, the school initiative helped raise awareness and engagement among the participating children and parents, as assured by the interviewees. This could be achieved through linking the topic and education about it to fun activities as well as

by involving the pupils' parents and by enthusiastic teachers acting as a role model, by communicating positive attitudes and engagement.

3.4.4 Barriers and Challenges

Our interviewees also identified a set of barriers that hinder greater implementation of the composting project in the schools of Samothraki. They referred to challenges they themselves had to go through that, if overcome, would enable further engagement of the participants and smoother operation of the project, and therefore impact. These mostly relate to the practicality of the process, accessibility to the composting sites and matters of general convenience.

Regarding practicality, issues that came up mainly had to do with the transportation of the material to be composted. Both teachers and parents spoke about the complaints of a school bus driver regarding the physical characteristics of the waste and pointed out his/her reluctance to allow transporting it to school. He/she would not permit children to carry their buckets in the school van because of the bad smells coming out of the organic waste interior. One parent also mentioned that a fully loaded bucket requires a lot of effort by a six- or seven-years old child to carry it. Considering that kids carry their already heavy school backpacks, any extra weight is an exaggeration.

The matter of accessibility was discussed only by parents and mainly those who wanted to get further engaged with the waste management idea. According to school instructions, parents are welcome to get involved and support the processes at home, like waste separation, but only students are allowed to bring organic waste to the school composter. In addition to that, the waste disposal can only take place at days and times when schools are operating, while other public composting facilities do not exist on the island. As a result, parents cannot fully get involved to the project and students are forced to interrupt their participation on weekends and during school holidays (e.g. three summer months). Especially in cases of multi-member families, where organic waste of one day can easily exceed the bucket's capacity, the non-access to the composter may create frustration and therefore discontinuity. The school and time dependency of the project hinders the total commitment of parents and students to the project and makes it difficult for both to experience composting as a normal daily routine/task.

One barrier mentioned by most parents, an actively involved teacher and a member of the 'Sustainable Samothraki' association, is the high 'teacher dependency' of the project. The whole implementation and facilitation of the composting project in each class is run by the teacher of the class. It is very common that a teacher who is responsible for the first grade one year, will not take the second grade or will not even be on the island next year. So even in cases where a teacher is committed and

supportive to the project in one year, its continuation is not guaranteed, as it exclusively depends on the intentions and motivation of next year's teacher. This fluctuation of teachers contributes to the lack of continuity of the project and makes it difficult for the participants to create a composting habit and build an adequate level of awareness on the issue.

In addition to that, we observed a lack of motivation from the majority of school teachers to get involved in the project (only three out of thirteen at the school of Kamariotissa), as well as a lack of interest of some parents to let their kids participate. It was mentioned that quite a few parents were difficult to convince about the composting project. There were cases where excited students were not allowed to participate at the end due to their parents' decision. The rationale provided was that the waste separation process was perceived as a "dirty" task that is not worth the effort. This reluctance was primarily a concern to those parents who are permanent inhabitants of Samothraki and was described as an example of their general unwillingness to participate in school meetings and projects. Moreover, many of the local families did not participate because they use their organic waste as animal fodder, thus closing material loops at home, and is a common practice in agrarian and rural communities. It is still a question, however, how the non-animal-edible organic waste are handled.

3.4.5 Incentives

After discussing barriers and challenges connected to the implementation of the composting project at the schools of Samothraki, we asked our informants what incentives could drive changes to improve the project in the schools, and the general waste situation on the island. As a complex issue, there were no simple answers to this question. The following paragraphs summarize different perspectives from the interviewees.

The project in the schools did not include any individual competition or award from the beginning. Even though at least one of the schools had a small gift for the student who brought more waste to the composter, students were not aware of this award so a priori it did not affect their participation. When asked about the possibility to include a competition component as an incentive there were opposing views. Some interviewees thought that it could be a good incentive to participate and to bring more waste. On the contrary, some interviewees were more cautious and expressed that competition could discourage students that were not bringing a lot of organic waste to stop bringing buckets, and/or could exclude students that were having other good practices with organic waste at home (food leftovers to animals, composting at home, etc.). As views were contrasting, a more detailed analysis will help to understand the

potential and limitations of using these competition elements as an incentive to manage organic waste.

Most of the interviewees mentioned that the main incentive to participate in the project was to have a motivated individual that serve as a role model and a driving force to contribute. This person was often the teacher in charge of leading the project in the schools, but also mothers (parents) and children that felt they are contributing to protect the environment with their actions. Other incentives suggested by the interviewees to achieve a lasting habit change was to address some of the barriers and challenges described in the previous section: infrastructures and accessibility. According to most of the interviewees, the lack of permanent infrastructures hinders a real change in waste separation. Permanent composting bins in different locations and/or access during summer would ease that some families continue separating while school is closed, thus reducing organic waste that needs to be transported from the island.

Related to the general situation with waste in Samothraki, there were also different views on what could incentivize better waste management. While some interviewees focus on information and educational campaigns to increase awareness to empower people to change behaviour, some other interviewees pointed out that 'most of the people' would prefer to 'pay more for the municipality to deal with the problem'. Some interviewees were sceptical about the use of economic incentives, such as tax reliefs for people separating or fines for those not separating while others were not so prescriptive and saw potential to explore innovative policies in this direction. Voices from the municipality and business argue that a top-down solution (from policy-makers) together with information for citizens would be the best incentive for people to change their habits in relation to waste but the lack of money to implement an integrated plan has been a key limitation until now.

3.5 Recommendations

When reviewing the literature about (community) composting it becomes apparent that various small-scale decentralized composting schemes are operating all over the world, in developing and developed countries, in rural as well as in urban areas. Often, they are initiated by non-governmental organisations (NGOs), community-based groups or motivated individuals. To round up our report we will conclude with some recommendations in this section by linking understandings we gained in our research with experiences from other community composting sites.

The recommendations we offer refer to different time scales and range of impact. Recommendations concerning the composting project itself are named as "micro". On the other hand, recommendations addressing broader aspects of the waste issue on

the island are summarized under the term “macro”. Recommendations that might need just short-term actions are found in the category “easy wins”. If mid or long-term actions are required, recommendations are summed up in the category “perseverance” (see figure 1).



Figure 1: Recommendations about composting clustered in scale of time and range (own figure)

3.5.1 Micro-Easy Wins

3.5.1.1 Continuity during school breaks

As discussed earlier, continuity is considered a crucial element when targeting long-term habit change. Continuing the composting project during school holidays could prevent the decrease in involvement and divert waste from being exported out of the island during these periods. An easy win for the project could be to discuss with the stakeholders on how to organise the composts during school breaks.

3.5.1.2 Improved data collection

Another “easy win” on the project-level could be improved data collection. Providing a simple count list, so teachers can keep track of the date, source and number of buckets the pupils brought (as one teacher in Kamariotissa already did), the collected amounts of the installed composters could be easily compared as well as the success over the different years. This information can detect particularly flourishing composters or seasons or instability on certain locations or periods of time. It can

identify gaps and opportunities in the project, increase transparency and the professional status to serve as a basis for discussion with the municipality and for external promotion of the project (Harper et al. 2004).

3.5.2 Macro-Easy Wins

3.5.2.1 More information in public

To create awareness on the island through information dissemination about the waste issue but also about the actions each individual can take would be critical. Putting signs next to the municipal bins informing residents about waste separation and how to use organics instead of dumping it could be a good starting point. The composting project can serve here as a best-practice example.

3.5.3 Micro-Perseverance

3.5.3.1 Recruit engaged volunteers

The interviews with Jacqueline Kirby, the project coordinator, showed that the Sustainable Samothraki association works with very little human resources and when it comes to the composting project. In effect, she is almost doing everything by herself. As we stated before, intensive support is considered another key element, when aiming long-term habit change. To recruit engaged volunteers to support Sustainable Samothraki initiatives might require some time and some mid and long-term actions like acquiring reliable volunteers, instructing and training them and give ongoing support. On the other side, having the project more broadly positioned, it can provide better support to the partners in the project and is better prepared for future progress.

3.5.3.2 Cooperation with alternative target groups

A future progress for example could be an expansion of the target groups. There are already ideas within the association to also get pre-schools on board as well as the local military. As many residents of Samothraki are employed by the army, collaborating with them could reach quite a number of people. On the one hand side the project could engage a population that do not have school going children, but also the fact that such families may not have a garden or animals to feed with their organic waste. On the other hand, there are parents that got already in touch with the project because of their children. However, their amount of organic waste exceeds the size of the buckets or they are in search of a solution during school holidays, another drop-off option for their organic waste could be their work place. There are some fruitful examples in Minneapolis, USA or Victoria, Canada where collaboration takes place

between local neighbourhood associations and the municipal waste collection service. Organics recycling drop-off bins are installed at a local grocery's parking lot (in the case of Minneapolis) or at people's backyard (in the case of Victoria) and regularly picked up and brought to a community composter by the municipal waste collection. In the case of Victoria people receive compost in exchange of installing a bin in their backyard.

As Summer School researchers in 2016 found out that an average of 40% to 60% of the municipal waste on Samothraki is organic (Noll et al. 2016), it goes without saying that an action plan to ensure appropriate organic waste management would be very critical and useful. But it seems that Samothraki has still a long way to go. As our interviews and observations have shown, there is a lack of infrastructure and municipal support regarding the waste issue on the island. We therefore conclude this chapter with the last category ("macro-perseverance") and some suggestions that would involve the local municipality.

3.5.4 Macro-perseverance

3.5.4.1 Improvement of existing infrastructure

As a starting point, there should be a political will and policy that is willing to tackle the island's waste issue. This includes proper infrastructure that is easily accessible for the residents, appropriately maintained and a culture that is encouraging residents to separate waste. Besides actions such as raising the awareness about waste on the island, promotion of household waste separation, encouragement of institutions, companies and residents to go for composting, the municipal authority could also set initiatives around compost municipal organic waste like grass clipping or leaves instead of dumping in the residual waste.

3.5.4.2 New regulations on waste

When it comes to the composting project in particular means of rewarding the amount of waste that was avoided (and therefore decreased the costs for transportation and disposal) should be set, for example subsidies for further waste prevention actions (for examples and case studies in Asia see Harper et al. 2004, for Sub-Saharan Africa Drechsel et al. 2001).

3.6 Conclusion

As inferred from the interviews and research, choosing school children as primary target group has shown to be an effective way to educate not only the pupils themselves but also their parents. By wrapping the topic of waste management and related knowledge around fun activities like games and events, the children's involvement and awareness have been raised. Consequently, the engagement of their

homes, i.e. their parents' households, has been encouraged as well. For most participants, the main incentive was the experience of contributing to the solution of an important issue as well as having a motivated and motivating role model, e.g. the teacher. However, barriers like the dependency on the teachers' motivation, participation interruption during school breaks and carrying the extra weight of the composting material from their homes to school pose challenges to a successful long-term habit change.

One of the easy-wins for more successful long-term habit change implies eliminating participation interruption during the summer breaks. For broader impact, we recommend placing signs next to municipal bins across the whole island of Samothraki, informing residents about waste separation and composting potentials. The school composting project can serve as a best-practice example. More broadly and long-term, the role of the municipality cannot be understated. Policies and infrastructure need to be devised for the island, to incentivise, support and promote small scale initiatives such as the one by Sustainable Samothraki association. Many would follow suit, and would want to be part of this important journey.

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Appendix 1: Interview Guidelines

Questions to the project coordinator

1. What drove this initiative? What were the motivations that led to create the project?
2. Which were the main phases of the project?
3. How did you pick your target groups? Were all schools invited to participate in the initiative?
4. What were the enabling factors for the initiative?
5. What were the barriers that slowed down the initiative?
6. Which means did you use to involve the children?
7. Which games did you design?
8. What worked best, what not?
9. Have you received feedback?
10. Did Sustainable Samothraki provide support during the ongoing project?
11. What kind of data have you recorded related the project?
12. What will the compost be used for?

Questions to the school children

1. Did you participate in the project? If not, why?
2. What did you do?
3. How did you understand it?
4. What can you compost?
5. How many buckets did you bring to school? Who brought the most and why?
6. How did you like it? Why? Why not?
7. Would you like to do it at home?
8. Was it difficult to convince your parents?
9. What do you want to be when you grow up?
10. Do you know what happens with the waste? Who collects it and where does it go?
11. Did you talk to your friends about it?
12. Will you continue to do it in the summer/next year?

Questions to the parents

1. What happens with the waste in your household?
2. Do you have animals? Why? Why not?
3. When you heard about the project what was your first impression?
4. Did you talk about the issue of waste in the past?
5. Are you more aware about the issue of organic waste now?
6. What was working? What was impractical?
7. What are you doing in the summer with the organic waste?
8. Do you experience waste as a problem on the island?
9. What do you think motivates people to take care of the environment?
10. Would you continue composting and recycling when moving somewhere else? Did you spread the word about the composting?

Questions to the teachers

1. What's your role in the project?
2. What motivates you to participate?
3. Was waste before an issue that you were aware of?
4. What were the barriers of the project?
5. What worked? What did not work?
6. How could more kids/families get motivated?
7. Were there learning outcomes?
8. Was the project successful? If so in which way?
9. What do you think motivated the people who participated to do so?
10. What was the motivation and incentives?
11. Was the feeling of competition and discrimination created by the kids?
12. Will you continue participating in the project next year?
13. Suggestions for improvements?
14. Do you think that the awareness could be spread (to other places they will live) somewhere else?
15. Did you get feedback from the parents?

The interviews with the hotel owner and the researcher emerged spontaneously. Therefore, we didn't have a list of explicit questions.

Appendix 2: Field notes template

The information is used in an anonymous way if the opposite is not explicitly mentioned.

Principal information

- Date
- Name
- Sex
- Location
- Role
- Setting

Interview summaries

- Key topics
- Evaluation categories: Appropriateness of the target group; level of participation; education and communication; incentives; barriers and challenges; recommendations.
- Observation
- Key impressions and feelings detected by the interviewers
- Summary of the interview notes

Appendix 3: Information on the interviewees

Code	Date	Sex	Location	Setting	Role
C01	23rd of June, 30th of June, 2019	Female	Chora, Samothraki	At the interviewee`s home	Project coordinator
C02	24th of June, 2019	Male and female	School in Lakkoma, Samothraki	Single Interviews with the children in turn	Students who have been participating in the initiative
C03	24th of June, 2019	Female	Harbour of Kamariotissa	Interviews with three mothers together at a Café.	Mother of a student who has been participating in the initiative
C04	24th of June, 2019	Female	Harbour of Kamariotissa	Interviews with three mothers together at a Café.	Mother of a student who has been participating in the initiative
C05	24th of June, 2019	Female	Harbour of Kamariotissa	Interviews with three mothers together at a Café.	Mother of a student who has been participating in the initiative
C06	25th of June	Female	Chora, Samothraki	Interview at a Café	Mother of a student who has been participating in the initiative
C07	25th of June	Female	Chora, Samothraki	Interview at a Café	Owner of the Café and mother of a student who has been participating in the initiative
C08	25th of June	Male	Chora, Samothraki	Interview at a Café	Owner of the Café
C09	27th of July	Female	Chora, Samothraki	Interview via Skype	Teacher at the school in Kamariotissa
C10	27th of July	Female	Chora, Samothraki	Interview at a Café	Teacher at the school in Lakkoma
C11	28th of July	Female	Kamariotissa	Interview at the interviewees home	Mother of a student who has been participating in the initiative
C12	28th of July	Male	Kamariotissa	Interview at a Café	Former major of Samothraki
C13	28th of July	Male	Kamariotissa		Owner of a hotel
C14	30th of June	Female	Therma	Interview at the Varades camping	Anthropologist

4. Water Metabolism and Water Management on Samothraki island: Evaluating Water Availability, Abstraction and Quality

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4.1 Introduction

Islands offer a natural framework to study aquatic and social ecology, featuring an ecosystem and society conditioned by the surrounding waters, yet in complex interaction with regional and global systems (Petridis et al. 2017). On Samothraki, the characteristics of insularity are re-framed in such a way that carry the potential for emancipatory change. Within summer schools 'Aquatic and Social Ecology', activists, scientists and students work towards sustainable pathways for this small island of the Northern Aegean. As a cultural value, ecological resource and economic utility, 'water' is one of the socio-ecological dimensions addressed.

Samothraki is exceptionally rich in water sources of high quality, and its crystal-clear springs (Skoulikidis et al. 2014) and streams hidden in the slopes of Mt Saos attract many visitors. Most of the springs are of drinking-water quality and serve predominately domestic use, and secondarily livestock and farming water consumption needs (Skoulikidis et al. 2019). However, the island currently suffers from temporary water shortages during dry summers, a decrease in water quality of a couple of streams and socio-economic tensions due to poor water management (Skoulikidis et al. 2019). Other problems frequently encountered in the region include catastrophic flash floods due to steep slopes and limited groundwater aquifers located within magmatic rocks (Skoulikidis et al. 2019), and substantial erosion and soil loss through natural causes and excessive overgrazing (Panagopoulos et al. 2019). An effective water resources management plan including flood control management is not in place, leading to ad-hock, individualistic and short-sighted solutions to the problems occurring.

4.1.1 Research

In order to deal with the issue of water management on Samothraki, the University of Natural Resources and Life Sciences (BOKU), Austria, through the SamoMAB project, assigned a contract to the Hellenic Centre for Marine Research, Greece. The main objectives of this contract are the illustration of the existing water management system, the estimation of the available water resources, the estimation of water uses

and water demands and the elaboration of a preliminary water resources management plan for the island.

In their first report, HCMR researchers found that domestic water consumption exceeds domestic water needs by a factor of 2.3, while registered irrigation water consumption is 8.8 times lower than the water needs of the crops cultivated (Skoulikidis et al. 2018). Together with the statement of former mayor Athanasios Vitsas, and field observations of individually installed irrigation pipelines, this leads to the assumption that irrigation water needs are largely met through unregistered (thus illegal) surface water abstractions. In order to prevent future water shortages and an intensification of socio-economic tensions, the report concludes that monitoring of water consumption and the available water resources are necessary.

Based on the aforementioned situation, a module regarding water management was developed in the context of Samothraki Summer School 2019. This module allows students to gain insight in academic interdisciplinary research and experience field work, while researchers have the opportunity to progress in their work through the contributions of students.

4.2 Materials and methods

The purpose of the 2019 Summer School's water module was to continue with the collection of data on water availability, abstraction and quality within the frame of SamoMAB. Although we visited 14 streams, 8 springs and drillings, we could measure the water velocity and physicochemical parameters only in certain streams sites (Table 1). We recorded the coordinates (Figure 1) and took photos at all points. To georeference the abstraction points, the GPS tool Garmin Etrack20 was used.

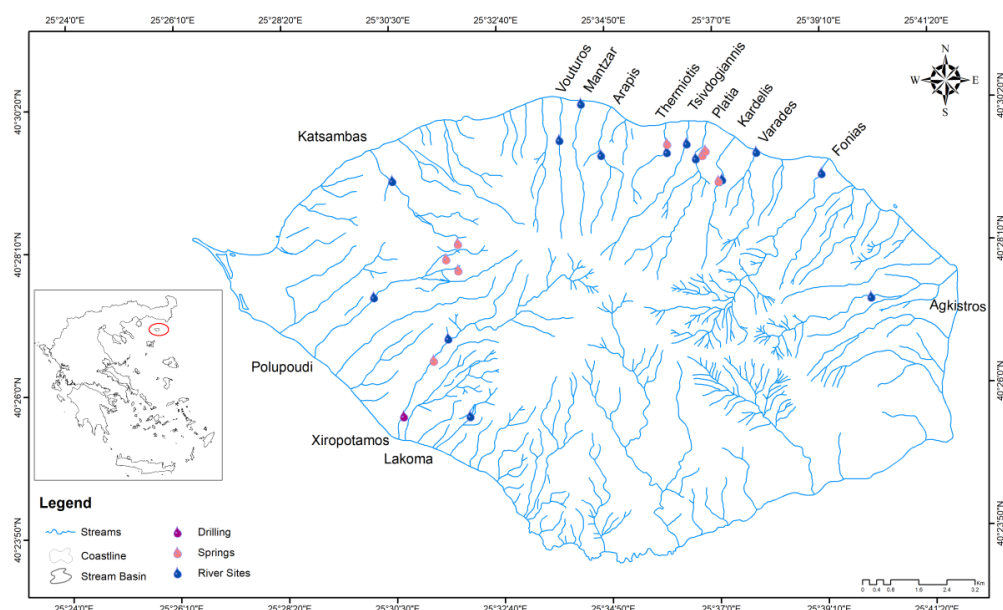


Figure 1: Map of visited sites during Samothraki summer school 2019

For our discharge measurements we used a “Global water” instrument. In streams for which the flow meter could not be used, due to their shallowness or inaccessibility, we applied the bucket method. For this method, a bucket with a definitive volume is filled by stream water and the time which it takes to fill the bucket was measured. Discharge measurement provide information on the volume of water flowing in a river per second. It is calculated by multiplying the stream cross section (determined by multiplying mean stream depth and width) by the mean velocity of stream water.

Regarding physico-chemical parameters, we measured pH, temperature, dissolved oxygen, conductivity and total dissolved solids using a Horiba U-50 Multiparameter water quality meter. A correlation analysis (Pearson correlation coefficient, r) was applied in order to detect any significant correlation between physico-chemical parameters and certain environmental factors (geology, land use, habitat, elevation, slope, catchment area) of the basins of each stream site, which were provided by the tutors. Pearson’s correlation coefficient r is calculated using the formula:

$$r = \frac{\sum(X - \bar{X})(Y - \bar{Y})}{\sqrt{\sum(X - \bar{X})^2} \times \sqrt{\sum(Y - \bar{Y})^2}}$$

where x and y are the variables tested and \bar{x} and \bar{y} are the average of all observed values of the respective variable. The resulting coefficient r varies from -1 to 1, with no correlation indicated at zero and positive (negative) correlation growing towards 1 (-1).

In addition to the fieldwork, we also held several meetings with the personnel of the Municipality's Technical Service Department which is responsible for the water infrastructure and water management on the island. During those meetings, we got access to data on water availability and abstractions collected by the Municipality, which we verified and completed where possible.

4.3 Results

4.3.1 *Current water management*

We found traditional water management systems at different stream sites. Some of them were operating like the one at Platia (Figure 2), others were abandoned (Figure 3) or damaged. None of them seemed to be in any kind of current use by the residents. PVC pipes were found in almost every stream we visited. Most of them seemed rather new. We also found some simple filter systems, consisting of a net and a bucket (Figure 4), to avoid pipe clogging from foliage. Some pipes had small holes on the upper side (Figure 5), probably to avoid overpressure inside the pipes.



Figure 2: Old water canal at Platia; Figure 3: Individualistic water abstraction (left) vs. old water canals at Xiropotamos.



Figure 4: Bucket filter; Figure 5: Overpressure hole in PVC pipe.

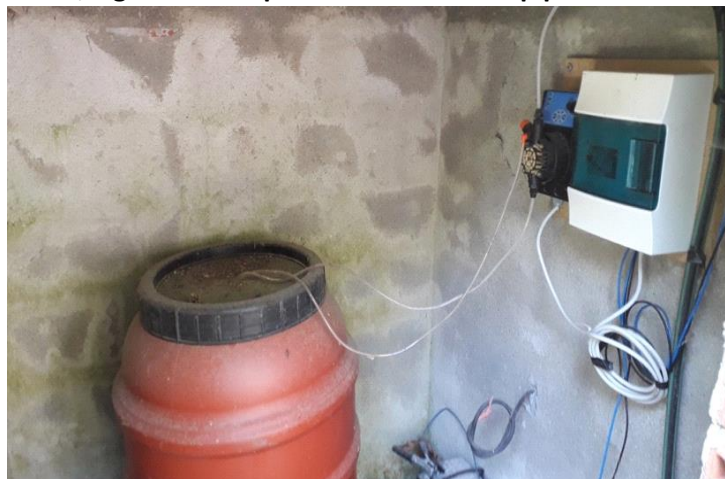


Figure 6. Water chlorination system

We visited eight municipal abstraction points of spring water and one drilling. Chlorination systems exist at reservoirs collecting spring water which are then used for domestic water supply (Figure 6). Water samples are tested by the Municipal

Water and Sewerage Corporation, Region of Eastern Macedonia and Thrace in Alexandroupolis. According to the local water management technician chlorination is taking place occasionally, since the water quality is considered sufficiently high.

4.3.2 Physicochemical parameters

Table 1 presents the results of field measurements for each stream site and the upstream basin characteristics. The highest discharge was measured in Fonias (0.0764 m³/sec), which is a perennially flowing. Agkistros and Xiropotamos follow with a discharge of ~0.026 m³/sec, while the discharge levels for Platia, Ano Kariotes and Grigorakis sampling sites range from 0.011 m³/sec to 0.015 m³/sec. Water temperature was generally high, ~ 21°C ± 3°C on the average. pH was slightly basic (average pH=7.75). Regarding conductivity, Katsambas and Lakkoma presented higher values (434 and 424 µS/cm, respectively) than the other streams.

Table 1: Physicochemical and environmental parameters per stream site (D: Discharge, T: Temperature, C: Conductivity, D.S.: Distance Source, Alt.: Altitude, Av. Alt.: Average Altitude, Av. S.: Average Slope, CA: Catchment Area, O: Ophiolites, G: Granites, S: Sediments, For.: Forest & semi natural areas, Agr.: Agricultural areas, Art.: Artificial surfaces, BE: Bedrock, BO: Boulder, GL: Gravel, CO: Coarse, S: Sand, CL: Clay).

												Geology (%)			Land uses (%)			Habitat (%)							
Stream Name	Sampling Site	D. [m³/sec]	DO [mg/l]	T [°C]	pH	C [µS/cm]	D.S (km)	Alt. (m)	Av.Alt (m)	Av.S (o)	CA (km²)	O	G	S	For.	Agr.	Art.	BE	BO	CB	GL	CO	S	CL	
Fonias	Fonias	0.0768	9.8	26.6	7.56	81	7.95	16	809	22	9.4	8.8	83	8.2	98.4	1.6	0	0	70	10	0	5	15	0	
Agkistros	Agkistros	0.0264	9.7	24.54	7.68	143	4.02	44	739	21	3.3	45.6	43.1	11.3	100	0	0	0	0	60	30	5	5	0	
Platia	Gria Vathra	0.0114	9.5	19.91	7.11	124	4.25	78	828	26	4.9	59.8	31.7	8.4	99.7	0	0.3	0	80	10	0	5	5	0	
Arapis	Ano Kariotes	0.0128	10.1	15.55	7.64	131	2.51	155	779	31	2.1	99.7	0	0.3	100	0	0	10	40	30	10	10	0	0	
Mantzar	Kato Kariotes	0.002	10.2	20.07	7.72	154	3.89	11	538	11	1.7	68.8	0	31.2	83.8	16.2	0	0	0	20	40	30	10	0	
Vouturos	Vouturos	0.0015	10.2	13.17	8.13	135	2.82	11	748	27	1.5	70.2	0	29.8	84.7	15.3	0	0	30	40	10	10	10	0	
Polupoudi	Polupoudi	0.005	8.3	22.49	7.85	420	1.89	166	583	23	0.7	60.7	0	39.3	96	4	0	0	30	50	10	10	0	0	
Xiropotamos	Xiropotamos	0.0268	10.4	20.98	8.15	221	5.22	129	872	28	9.7	71	2.1	26.9	97.5	2.5	0	0	50	30	15	3	2	0	
Lakkoma	Lakkoma	0.0069	9.8	21.96	8.26	484	1.19	92	329	19	1.3	43.6	0	56.4	62	38	0	0	5	30	45	10	10	0	
Katsambas	Katsambas	0.0086	8.77	22.3	7.95	204	2.34	85	427	22	2.4	43.6	0	56.4	100	0	0	0	20	40	10	0	0	30	
Kardelis	Grigorakis	0.0153	10.1	20.17	7.83	73	2.78	211	643	28	1.7	14.4	80.1	5.5	100	0	0	0	10	30	20	10	30	0	
Tsivdogiannis	Tsivdogiannis	0.0011	9.6	22.12	7.77	159	4.29	36	740	24	2.0	86.3	0	13.7	89.2	0	10.8	5	5	60	20	10	0	0	
Thermiotis	Therma	0.0036	9.9	16.99	7.84	177	2.06	100	402	22	1.4	92.3	0	7.7	98.6	0	1.4	0	0	70	10	10	10	0	
Varades	Varades	-	-	21.67	7.23	138	3.56	10	414	19	2.4	14.9	54.5	30.6	100	0	0	0	5	30	25	0	20	20	

4.3.3 Data analysis

For this report we focused on significant correlations among the measured physiochemical parameters and stream basin characteristics (geomorphological and geological characteristics and land uses). Specifically, the results of our analysis showed that the discharge significantly correlated with distance to source ($r=0.795$), catchment area ($r=0.791$), granite portion in the steam basin ($r=0.61$), boulders ($r=0.55$) and water temperature ($r=0.56$). Moreover, temperature had a significant negative correlation ($r=-0.61$) with the ophiolite portion in the steam basin. Significant

correlations presented agricultural areas and forest and semi natural areas with pH ($r=0.54$ and $r=-0.54$, respectively) and conductivity ($r=0.65$, $r=-0.61$, respectively). The latter, correlated significantly with the sediments portion in the steam basins ($r=0.71$). Furthermore, there was a significant correlation between sediments and agricultural areas ($r=0.59$), as well as a significant negative correlation between sediments and average altitude ($r=-0.603$) and forest and semi natural areas ($r=-0.548$).

4.4 Discussion

The SamoMAB report concludes that the registered abstractions for irrigation water cover only about 11% of the estimated irrigation water demand. This suggests that water for irrigation is largely being abstracted in an unregistered manner. During our fieldwork, we observed water abstraction infrastructures consisting of PVC pipes, buckets and rudimentary filters on nearly every river, which supports the result of unregistered water abstraction on a large scale. These individually managed, ad-hoc pipe systems, besides water withdrawals, adversely impact the aesthetics of the landscape.

Water quality is influenced by geological, hydrological, climatic and anthropogenic factors (Boon et al. 1992). Regarding water quality, most of the investigated streams had good physicochemical conditions. Geologically, the basement unit of the island consists of low grade metamorphosed sedimentary and volcanic rocks. The main part of the island however is composed by acid (granites) and mafic (ophiolites) magmatic rocks and the streams examined mainly drain these kinds of rocks. The sedimentary formations of the island comprise restricted limestones, sandstones and shales (Heimann et al. 1972, Tsikouras and Hatzipanagiotou 1998), while in the lowlands alluvial deposits prevail.

Water temperature is considered as a one of the important factors that controls aquatic life in a headwater stream (Wetzel 1983). Geological factors may affect water temperature and pH values. The significant negative correlation between water temperature and the ophiolite portion in the steam basins may be explained by the fact that groundwater aquifers which developed in ophiolite rocks are deeper and larger than granitic aquifers. Thus, stream water draining ophiolite rocks is more laden with cooler groundwater than streams draining granites.

The overall slightly basic pH values might be due to calcite dissolution found in sediment particles or due to photosynthesis (Kumar and Prabhakar 2012) taking place in stream pools. The positive correlation between pH and agricultural areas may be attributed to calcite dissolution related with alluvial sediments that host agriculture. The significant negative correlation of pH and conductivity to forest and semi natural areas can be explained by the fact that the thin soils developed on magmatic rocks of these mountainous areas are poor in calcite material. Conductivity values can stem

from anthropogenic factors such as the inflow of untreated wastewater. From the streams measured, Katsambas and Lakkoma illustrate higher conductivity levels. This is probably due to the inflow of untreated wastewater from Chora and Lakkoma settlements.

As the above shows, our observations during our fieldwork confirm that there is an urgent need for an improved water management strategy. Water management is inefficient, individualistic, and prone to natural as well as anthropogenic pressures. To make meaningful statements on the surface water availability and quality, long-term observations are necessary. The fieldwork which we did in the context of the summer school (part of a long-term monitoring program undertaken by the Samothraki Nature Observatory - SNO) contributed to the SamoMAB project. Interdisciplinary, long-term research is an important prerequisite for sustainable transformation on Samothraki, and as such needs to be continued for future sustainable pathways to be found.

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5. Obstacles and Potentials of the Local Agricultural Market on Samothraki

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5.1 Abstract

On the Greek island of Samothraki, transdisciplinary research on sustainable solutions for pressing socioecological problems has been conducted since 2007. The agricultural sector plays a key role in Samothraki's social and ecological development and is responsible for several sustainability issues on the island. Due to high numbers of sheep and goats, largely sustained by the subsidy schemes of the EU Common Agricultural Policy (CAP), the situation appears neither socially nor ecologically sustainable. Although there have been various improvements lately, such as the reduction of the number of animals which are still exceeding the island's biocapacity, many challenges remain. We conducted semi-structured interviews in which we focused on income strategies among local farmers and evaluated obstacles and potentials for the local agricultural market. We could identify bottlenecks (e.g. the dairy, the slaughterhouse, traders and the transportation company), that hinder income generation from agriculture and push farmers towards exporting. Additionally, we found that the development of the agricultural sector is still affected by the financial crisis in Greece, as well as general mistrust among farmers. Nevertheless, in 2018 a farmers' cooperative was formed, which yields great potential for improving agricultural structures and therefore, farmers' income. An additionally planned agricultural office may support farmers and ensure better information and communication among them.

5.2 Introduction

The long-term transdisciplinary research project on the Greek island Samothraki pursues both academic goals with a practical outcome (Fischer-Kowalski et al. 2011, Petridis et al. 2017). Apart from the 'academic' challenge of exploring factors that contribute to or hinder island sustainability, the project aims at finding practical solutions for socioecological problems.¹ Researchers support the local population in finding ways for a transformation of the island's economy towards more sustainable practices. One important part of this strategy is the designation of the island as

¹ Find detailed information on the project 'Sustainable Samothraki': <http://sustainable-samothraki.net>

UNESCO Biosphere Reserve. This process involves numerous environmental, social and economic challenges, some of them tackled during this year's summer school. In our module we focused on the agricultural sector, in particularly livestock. Research on agricultural activities is crucial, since they are responsible for several sustainability issues on the island. The livestock farming system has a central role because of continuous overgrazing by sheep and goats, which puts a lot of pressure on the island's ecosystems.

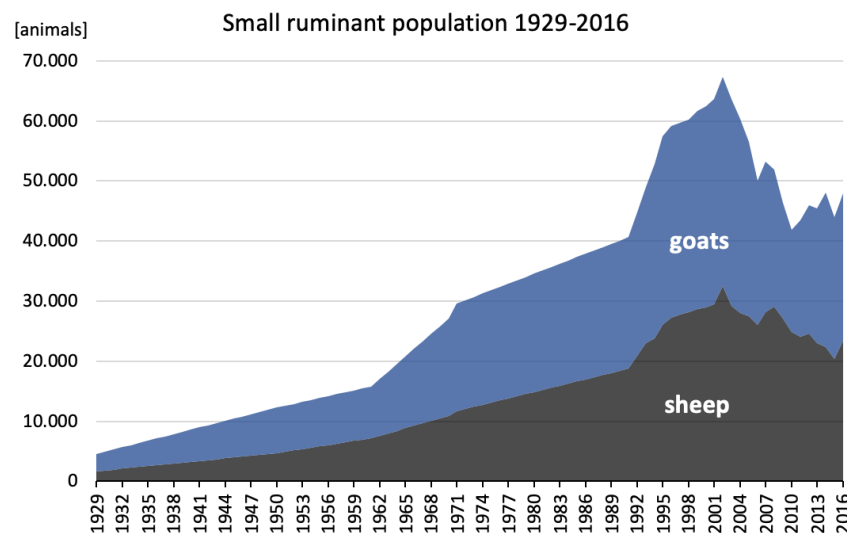


Fig. 1: Small ruminant population 1929-2017

Number of sheep and goats have increased dramatically in the past decades, as livestock breeding was strongly supported by European agricultural policies and their implementation by local authorities (Noll et al. 2020). By the year 1960 there were about 15.000 small ruminants on the island, rising to 70.000 in 2002, declining to around 50.000 thereafter (Fig. 1). As feed prices rose, the necessary supplementary feed was not provided. Hence, the metabolic requirements of the animals could not be met with locally available resources, while animals overutilized local grazing resources extensively and were severely undernourished (Fetzel et al. 2018). The overuse of local grazing resources, coupled with the steepness of the terrain, caused significant soil erosion and deterioration of the forest regenerative capacity (Biel and Tan 2014, Panagopoulos et al. 2019).

Nevertheless, livestock is underutilized and local farmers find themselves in a non-resilient economic situation. This reflects the situation of the majority of European small-scale farmers, who often find themselves in a vulnerable position coping with low income and rising input costs due to industrialization and globalization of the agricultural production. Global agricultural industrialization leads to a decline in prices on markets and make it extremely difficult for small-scale farmers to compete. The island condition pose additional challenges, especially since Samothraki's farmers are confronted with inefficient distribution and marketing channels, as well as missing

local synergies and cooperation. As a reaction to this increasingly difficult situation, farmers on Samothraki increased their livestock numbers in the past, to receive more EU Common Agriculture Policy (CAP) subsidies (Petridis et al. 2017: 125).

Following results of prior socioecological research on agricultural sustainability on the island, in this paper we aim at gaining a better understanding of obstacles and main elements of the local agricultural system in order to identify better marketing opportunities for local farmers on Samothraki. By exploring the field of agricultural production and marketing via qualitative guided interviews, we aim at identifying potentials and opportunities for a more effective agricultural distribution and an improvement of farmers' income.

5.3 Methods

For this research project we used semi-structured qualitative interviews guided by a pre-developed questionnaire. According to Helfferich (2014), this is a *“widespread, differentiated and methodologically comparatively well elaborated method for producing qualitative data [...], the individual interviews can be compared well because the interview situation is similar and similar or same questions are asked”* (Helfferich 2014: 559, 565; translation N.W.). The responses by the interviewees were written down by one or two persons while the other person conducted the interview in English with a Greek translator. This allowed us to gather information about the type of agricultural products produced, if they are sold locally or are exported and the quantities and season in which they are sold. Moreover, we asked about marketing opportunities, distribution channels and future prospects. The interviews were conducted wherever it was most convenient for the interviewees, in most cases at their workplace. The questions were asked in English and were then translated into Greek. The interviewees gave their answers in Greek which were then translated back into English and documented with an audio recorder complemented by field notes. In total we conducted 7 interviews: three with local sheep and goat farmers, one with the manager of the dairy, one with the president of the olive press cooperative and one with the president of the new farmers' cooperative (c.f. annex). The latter is one of the most progressive and promising local actors for a transformation of the local trade relations, which we explore in more detail in section 5.5

5.4 Results: The current agricultural structures and the local market

To create a sustainable income situation for farmers, while reducing the number of animals on the island and therefore decrease ecological pressures, the agricultural value chain must be improved through marketing and innovation. For this reason, we analysed local market structures and processes regarding production and sales in order to assess obstacles and potentials of the local agricultural market.

5.4.1 Local market structures

Fig. 2 is the result of a production and distribution network analysis of local livestock products and shows the structures of the local market, key elements in the production and distribution as well as trade relations on Samothraki.

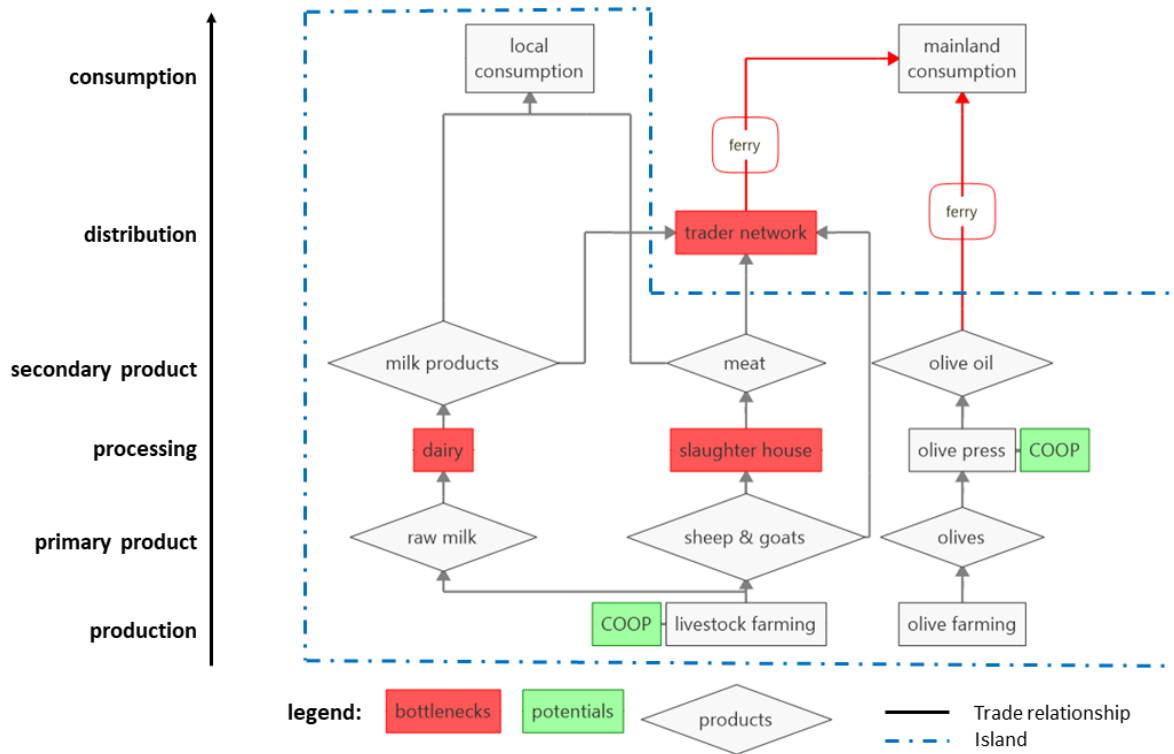


Fig 2: Key structures and trade relations on Samothraki (own design)

It only covers commercial agricultural production; self-supported agriculture without large quantities of livestock or olives, were not covered by our research as this represents only a very small share of the total agricultural output. The key structures are represented by rectangles and produced primary and secondary products are represented by rhombuses. The black lines show the trade relations between the elements, the blue dashed and dotted line represents the research boundary which is in our case the island. Green rectangles have been identified as structures that have a high potential for positive development on the local market. These are the two cooperatives, namely the recently formed livestock cooperative and the already established olive press cooperative. In contrast, red rectangles have been identified as bottlenecks for the local market. These are the slaughterhouse, the dairy, the trade network and the ferry as mode of transport to the mainland.

Among the agricultural production we identified two main branches that produce for the market, namely livestock and olive farming. The latter only derives two main products, namely olives and oil. Livestock production, mainly sheep and goats, derive meat and milk from the animals, while wool and skins are mainly being dumped. The

milk is partly processed further to milk products such as yoghurt and different kinds of cheese. The cheese production on farms is mostly for private consumption.

For large scale processing of primary and value-added products, certain processing structures and infrastructures are required. Therefore, production of processed products depends on the slaughterhouse, the dairy and the olive press. The meat is partly sold directly to consumers on the island, partly processed in the slaughterhouse and partly sold directly as live animals to traders. The slaughterhouse is municipally owned but currently rented out to a private manager who demands a higher price than the municipality did before. The milk is processed into a variety of cheeses and yoghurts in the only dairy on the island that also sells the produced cheese on the island. For processing the olives into olive oil, an olive press is required. Such an investment created for long an impassable financial barrier for single farmers. A cooperative was founded in 2012, with the goal of buying and managing an olive press which would allow the processing of olives directly on the island. At the moment the olive oil is delivered to the mainland by ferry and sold via wholesale. The processed meat and dairy products are partly sold to local consumers, but especially the meat is mostly exported to the mainland and the farmers rely on intermediary traders from the mainland for selling their goods.

For all goods that are exported, the ferry is the only means of transportation to the mainland. Therefore, the ferry infrastructure and timetable have a high impact on the marketing and distribution of products for farmers. Since our main research focus were the livestock farmers, we did not inquire in detail into the olive production, and relevant production steps before export may be missing.

5.4.2 Production and sales

Regarding meat production, there are generally two main sale seasons on Samothraki. During Easter (March/April), where mostly lamb is sold and usually exported at a higher price and July/August, when goat and sheep are sold for local use at a lower price (c.f. Interview 6). According to our interviews with the farmers, most of the meat is either sold on the island to private buyers or live animals are sold to traders, who come to the island and buy from individual farmers. For local use (own use/ for family and friends or even for rent payments) the animals are often slaughtered privately, although this is forbidden by law. Only a small part of the meat goes to local restaurants, as the restaurant owners usually slaughter their own animals. The farmers usually don't have cooling or storage facilities, so their products are delivered directly to the customers (c.f. Interview 1, 3, 6).

Since there aren't many local consumers and the local supermarket is not allowed to sell the local meat directly, most meat is exported (c.f. Interview 6). To export the meat, the animals are either sold alive or slaughtered at the local privately managed

slaughterhouse. According to our interviews, the slaughterhouse is quite controversial as there is dissatisfaction about the apparently insufficient built infrastructure, missing licenses and about the fact that there is a contract with only one trader as well as relatively high fees (c.f. Interview 1, 2, 6). Due to these issues the newly formed farmers' cooperative decided to slaughter their animals in Thessaloniki, which was cheaper, even including transportation fees (c.f. Interview 6). Moreover, the farmers in the cooperative achieved 30-40% higher prices for their meat as they delayed the sale for one month while the other farmers sold their meat at the usual low prices. Until recently the meat traders were therefore always able to push the prices down to 3,80 EUR per Kilo, leaving only a very slim profit margin, creating great frustration and distrust among the farmers. So, the cooperative already has impacted the power of traders regarding price politics on the island (c.f. Interview 6). Furthermore, the wool and skin of the animals are currently not utilised, as there isn't a profitable opportunity (c.f. Interview 1, 6). However, the farmers' cooperative is currently collecting them to sell them in winter (c.f. Interview 6).

Dairy production is very limited since there is only one dairy on the whole island, usually producing from April to July/August and collecting the milk only once a day. Furthermore, the dairy is only relevant for the farmers nearby due to a lack of cooled transportation infrastructure and its low capacity (c.f. Interview 1, 5, 6). All farmers interviewed stated that they have no means for cooling and storing their dairy products, making them completely dependent on the dairy. Therefore, many farmers that live further away cannot access the dairy, thereby being forced to limit their sales to direct on-the-farm sales. Currently an expansion of the dairy production is not an option for farmers. The dairy sells its cheese locally in supermarkets under a Samothraki label and in its own shop on the island and in Alexandroupolis (c.f. Interview 5). However, since the local dairy is not willing to expand, the newly formed cooperative is seeking for more export options. They are planning to expand and therefore invest in cooled transportation and sales in Alexandroupolis (c.f. Interview 6).

Regarding the sale of olive oil, it is mostly exported and sold via wholesale. The olive oil production often only generates a side income for many farmers. Since the production of small quantities of oil costs as much as the production of large amounts, farmers only harvest if there are enough olives, otherwise it does not pay off. The olive oil cooperative plans to expand their business in different directions like an own local label, a certified organic production or distribution of their products to restaurants, shops and supermarkets. However, at present there is limited funding for realising these projects (c.f. Interview 4).

5.5 Discussion: obstacles and potentials of the local market

5.5.1 Obstacles

There are various reasons why the local market does not prosper, and farmers find themselves in a non-resilient position. One big obstacle that we discovered is the local processing, distribution and trading structure that does not support farmer's investments in the local market. On top of the general industrialization and globalization of agriculture, during our research we observed a particular deadlock situation on Samothraki. We identified four crucial bottlenecks, which are influencing the scope of action of farmers who try to make a living on the local agricultural market. We discovered that the slaughterhouse, the dairy, the trader network and the transportation system are bottlenecks in the local market, which contribute to the insufficient income situation of farmers.

5.5.1.1 Bottlenecks

The slaughterhouse represents a major obstacle for the expansion of meat production on Samothraki. As already mentioned, the slaughterhouse charges high prices and offers inadequate infrastructure, therefore creating a burden for the farmer's meat production. If farmers seek to export, the fee is covered by the buyer but in this case, the meat is sold to traders who have the trading power to determine the prices (c.f. Interview 1, 2, 7). The farmers are dependent on the prices set by the traders because the trader network is the only distribution channel for meat exports, if one isn't a member of the farmers' cooperative. Moreover, traders utilize the existing mistrust among the farmers to push the prices down through an informal price agreement among them, which makes the trader network a further bottleneck regarding the meat production (c.f. Interview 7). This has changed dramatically since the establishment of the farmers' cooperative, as discussed further down.

The dairy represents one significant obstacle for the expansion of dairy production on the island since it has a monopoly on local milk processing. However, it only produces 60-70 days a year and offers no proper cooling transportation for the whole island. Since the farmers cannot afford cooled transportation and no common suitable infrastructure is in place, export is also not an affordable option (c.f. Interview 1, 5, 7). This situation creates a major obstacle for farmers' income regarding dairy production indicating the huge potential for increased milk production on the island. From the interview with the owner of the dairy on Samothraki we were informed that it does not even generate profits. The business is only continued for sentimental reasons of the manager, who is now responsible for the dairy in the third generation of the family and who sees the future marketing potential in olive oil rather than dairy products (c.f. Interview 5).

5.5.1.2 Infrastructure and transportation

The existing transportation system on the island represents another great obstacle for agricultural incomes. Since there is no proper cooling and storage facilities, farmers always have to sell their products directly (c.f. Interview 1, 3, 6). Beyond that, transportation of their products over the sea represents a major obstacle for exports. The farmers complained over high costs set by the ferry manager and an unreliable timetable. There also have been reports, where the transport of livestock was denied by the ferry, on the basis of bad smell (c.f. Interview 1, 2). It has to be noted that during the writing of the report, a new company took over the ferry connection between Samothraki and Alexandroupolis. Therefore, challenges and opportunities regarding transportation would require a new evaluation after a certain time.

5.5.1.3 Local demand and export orientation

Apart from these local bottlenecks that create an inappropriate environment for locally derived and stable income, farmers are also forced to develop export strategies due to the lack of stable local demand. Farmers mentioned the highly concentrated tourist season of less than two months which only provides a highly irregular income (c.f. Interview 1, 4, 5). Restaurants and hotels that could offer a more regular income, often have their own supply of animals but complain about little and unstable supply by farmers (c.f. Interview 1). Moreover, there is no marketplace where products could be sold weekly or monthly. The distribution of the products locally is organized individually, and many farmers provide some products, such as cheese, only for themselves.

Since the structures of the local market don't provide sufficient income opportunities, export orientation is the main income strategy of the farmers we interviewed and for the farmers' cooperative (c.f. Interview 1, 3, 6). However, due to the lack of diversified distribution channels, they are very much depended on the insufficient services of the described bottlenecks. The export orientation on the island also gives the traders a strong advantageous bargaining position (Interview 2, 3, 6).

5.5.1.4 Economic crisis and mistrust

Another structural obstacle mentioned in all our interviews is the economic crisis, which still influences local sales. All farmers stated they have witnessed a dramatic decrease in sales since the economic crisis started, and which never recovered. On top, there is a declining population on the island, meaning that farmers face problems with succession. We also identified a large amount of mistrust among farmers as well as farmers and other actors which is hindering cooperation. This is supported by the lack of information and communication as well as a missing platform of exchange.

5.5.2 Potentials

While there are many obstacles that indicate a grim future for agriculture, we have also identified potentials for improving the agricultural value chain and thereby the agricultural income. In particular, our interviews with the head of the newly founded cooperative and the head of the olive press cooperative provided some potential for change of current deadlocks.

5.5.2.1 The farmers' cooperative

The recently founded farmer's cooperative has shifted the trade relationship towards a more positive outcome for the cooperative members who are now able to demand fair prices without being pressured to sell under value. This new formation yields high potential for a better and stable agricultural income. It was founded in 2018, despite the deep-rooted mistrust and the lack of knowledge among the farmers, factors that have been identified as main problems from last year's research team (Apostolopoulos et al. 2019: 9). According to their findings, there have been two main issues concerning the establishment of a cooperative. First, there was a difficulty with starting a cooperative overall, due to lack of knowledge. Second, there was a general mistrust towards cooperatives, representatives and local authorities but also among the farmers. Apart from that, previous efforts to form a cooperative have failed because of missing commitment and trust (Apostolopoulos et al. 2019: 5).

The newly formed cooperative also had to overcome these issues. The head of the cooperative who is responsible for assisting the local farmers in applying for CAP subsidies, is therefore a very trusted person among the farmers. She reported that at the beginning there were only two farmers available, and that it took a long time to convince more farmers to join the cooperative. Due to the economic crisis and inflation, farmers apparently had a great incentive to join the cooperative as one year later they were already 32 farmers, which is a big success and an important step in overcoming past failures. In spring 2019, the cooperative achieved so far 30-40 percent higher prices for meat sales, as compared to individual farmers. Furthermore, they organized a cheaper solution for slaughtering in Thessaloniki, which wouldn't be profitable for a single farmer. In addition, they are planning to expand the milk producing season to about 8 months and invest in proper infrastructure to get a contract with the milk industry in Alexandroupolis. Since they have to spend 2% of their budget to educational purposes the farmers' cooperative has also the potential to provide proper agricultural training. While the cooperative ensures higher and more stable prices in the future, non-members will have greater disadvantages (c.f. Interview 6).

5.5.2.2 Agricultural office

In the near future there will be an agricultural office led by the head of the cooperative who was elected in the town council. The municipality will then be able to officially

support the cooperative through this office. It is further planned to establish a permanent contact person that can be consulted regarding agricultural problems. At present, the farmers' contact person is the mayor, which is not an optimal situation (c.f. Interview 6). There is also the possibility that this office will provide better information and communication channels and therefore yield great potential in reducing the built-up mistrust on the island.

5.5.2.3 The olive press cooperative

Alongside the farmers' cooperative there is an olive press cooperative since 2012 on the island. At the moment there are around 135 farmers in the cooperative and the number is increasing. The cooperative has many plans for the future, and it could be a good initiative to improve the local market on the island. At the moment they are selling their oil via wholesale but in the future, they are planning a Samothraki label for the distribution on the island as well as an organic certification (c.f. Interview 4). As for now their funding is very limited because of the poor olive harvest last year. Also, there are plans to merge the two cooperatives (c.f. Interview 4, 6).

5.5.2.4 Local Samothraki label

To improve local marketing, we also inquired the possibility of introducing a Samothraki label. Since the most important goal for the farmers' cooperative is to achieve a decent and stable income, they focus on export strategies and the creation of a local label is not prioritized (c.f. Interview 4, 6). However, there are potentials for several products. For the olive oil distribution, a local label could improve local marketing substantially, in line with the local beer brewery that was established in 2016 (c.f. Interview 4). For the future, the head of the farmers' cooperative can also imagine a local Samothraki milk label; a label for meat would lead to too much bureaucracy (c.f. Interview 6).

5.6 Conclusions

The goal of future agricultural development on Samothraki is to reduce the number of animals, and consequently the pressure on local ecosystems, while at the same time create a sustainable income situation for farmers. Improving the agricultural value chain through marketing and innovation on Samothraki seems to be a promising strategy to stabilize farmers' income and reduce their dependency on subsidies (Petridis et al. 2013: 7).

Nevertheless, there remain many obstacles regarding the local agricultural market on Samothraki, which are hindering investment into the local market, therefore supporting an export oriented income strategy. Especially the identified bottlenecks, namely the slaughterhouse, the dairy, the trader network and the transport system constrict farmers' possibilities, by creating an unprofitable environment. Farmers are

confronted with expensive services and limited opportunities to expand and depend on existing distribution channels, which limits their abilities to get reasonable prices and invest in innovation and marketing. In addition, this non-resilient situation is further fuelled by insufficient infrastructure, such as the transportation system, currently dependent on a single ferry company.

However, we also discover many uncertainties on the demand side, as there is a 'missing link' between consumers and producers. The business strategies of some of the farmers we interviewed were guided by clientelist decisions that reward an individual farm in the short-term but create an economic deadlock and no-growth situation in the long-term. Also, the uncertain situation of farm successions reduces incentives for innovation and creates a grim outlook for the future. This can be seen in the general mistrust among farmers towards other farmers, other actors and technological innovations, such as an online communication platform.

Yet, this seemingly deadlock situation also leaves a big potential for improvement. Forming a new cooperative represents a big step against mistrust and for the development of resilient structures. The farmers' cooperative already achieved higher prices and fewer cost for their members and increases farmers' optimistic perception for the future of agriculture on Samothraki. At the moment, non-members have to live with the negative consequences, as traders try to level out these new power structures. But since anyone can join the cooperative, there is a possibility to create a trusted and profitable environment for all farmers on the island. For now, there is still deep-rooted scepticism that needs to be overcome but better conditions and the fact that the state subsidises farmers in a cooperative by tax reductions could encourage farmers to join.

Furthermore, the establishment of an agricultural office in the near future is a promising development. It will give farmers opportunities to provide better information and communication channels and connections between farmers and consumers. The suggested communication platform on which farmers could communicate about collaborations, production or alternative ways of distribution could reduce the large amount of mistrust among farmers and other actors on the island. Since the new town council is highly motivated, this also yields great potential for new projects like a seasonal local market, which has been envisaged in the past (Fetzel et al. 2018, Noll et al. 2020).

The farmers' cooperative has the possibility to not only improve a better and stable income for farmers but also work against deep rooted agrarian social issues and reduce ecological pressures, by providing better prices for fewer animals, thereby enabling the reduction of the number of animals per farm. For future research opportunities, the influence of the farmers' cooperatives on agricultural income, on sales and marketing structures and the transportation system as well as on the

established mistrust, will be of great interest. Also, the impact and development of the newly formed agricultural consultancy office is going to be significant.

While in this research project we focused on the livestock farmers, further research could investigate the potentials and barriers of the olive production, which is another important pillar for the local economy. Moreover, instead of a focus on the microeconomics of the island, further research could investigate the legal and political framework determining the actions of the farmers, possibly searching for reform potentials in collaboration with other actors such as local and national authorities and NGOs. In addition, we also recognized the importance of further investigating the local impacts of the financial crisis on the island.

Finally, another urgent issue seems to be farm successions and missing incentives for new generations. Farm successions are very sensitive processes and their success is significant for the future development of Samothraki's agricultural structures. Especially on Samothraki this social issue must be tackled, since trust is of great importance in the process of succession.

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Appendix 1

Interviews

Interview 24.06.2019	1		farmer
Interview 25.06.2019	2		farmer
Interview 25.06.2019	3		farmer
Interview 27.06.2019	4		head of the olive press
Interview 27.06.2019	5		head of the dairy
Interview 28.06.2019	6		farmer
Interview 28.06.2019	7		head of the farmers' cooperative

6. The Past, Present and Future of the Sown Biodiverse Pastures Program on Samothraki Island: An Evaluation

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6.1 Abstract

Sown Biodiverse Pastures (SBP) are a system of pastures that differ from conventional ones by making use of the diversity and functional complementarity of plant species to increase crop production. SBP come as a nature-based approach to reverse the degradation of Mediterranean ecosystems, like the ones occurring on the island of Samothraki. Farming practices on Samothraki, which include high grazing pressure, have pushed a large amount of local pastoral systems towards the edge of desertification. To reverse this, a program on the implementation of SBP is in place since 2015. The present study evaluates the past, present and future of the SBP program on Samothraki by assessing the success of implementation, the perceptions by farmers and the possibilities to extend the program. As the research questions of the study are quite diverse, different methods were used to approach them (e.g. semi-structured interviews, vegetation sampling, GIS and satellite data). Results indicate that the SBP program is successful; it is generally well accepted by the farmers and it has increased the productivity of the pastures. Although further work needs to be done on evaluating the success with other farmers and expanding the productivity assessment, the program is promising, and we have high confidence that it can be an essential component in solving some of the island's most pressing ecological issues. Nevertheless, various factors influencing the continuation of the program were identified, encompassing social, cultural and economic aspects. Therefore, future research will need to focus more on these aspects as well as on the future of the program with respect to climate change impacts.

6.2 Introduction

Sown Biodiverse Pastures (SBP) are a system of pastures that differ from conventional ones by making use of the diversity and functional complementarity of plant species to increase crop production. The SBP system consists of diverse seed mixtures of up to twenty different species or varieties, with a prominent role for legume species. Commonly SBP are more productive than natural grasslands and they are also richer

in number of species (Carneiro et al. 2005). Their high productivity is due to the fact that biodiversity allows the most adapted plants to prosper in each zone. The seed mix is designed specifically for each location after soil sampling and analysis. Species in the mix are adapted to soil physical and chemical characteristics, as well as to local climate conditions and therefore there is no single representative mix (Teixeira et al. 2010).

For the reasons mentioned above, SBP come as a nature-based approach to reverse the degradation of Mediterranean ecosystems, like the ones occurring on the island of Samothraki. Farming practices on Samothraki, which include high grazing pressure, have pushed a large amount of local pastoral systems towards the edge of desertification. SBP in Samothraki aim to tackle this problem through a process of ecological engineering, which can be referred to as “biodiversity engineering”, since it makes use of species diversification and richness to improve pasture persistence, herbage productivity and quality (Teixeira et al. 2015). On a wider scale, they could prove useful at attenuating further biodiversity loss and improving ecosystem services on the island.

For the purpose of the 2019 summer school we evaluated the ongoing SBP program (2015 to present) on Samothraki. In order to do so we followed a three-way approach: conducting interviews with local farmers to find out about their perspective towards the program, measuring the success of the established pastures directly (by assessing the aboveground plant productivity in several plots) and indirectly (by using GIS and remote sensing technology).

Thereby, our guiding research questions were on the one hand: What are the obstacles and opportunities for farmers in relation to the sown biodiverse pastures? And on the other hand: How successful are the SBP established in Samothraki? In addition to answering these questions, one goal was also to perform an island inventory mapping to assess potential areas for the establishment of new SBP. The methodology is explained in detail in the following section (section 3). Subsequently, our results are described (section 4) and discussed (section 5), before drawing a conclusion regarding the success of the program (section 6).

6.3 Methods

As the research questions of this study are quite diverse, different methods were used to approach them. To find out about obstacles and opportunities farmers faced in the program, semi-structured interviews were conducted. For evaluating quantitatively the success of the SBP established on Samothraki, vegetation samples were taken in several SBP plots. A second approach to assess the success of existing SBP was to use satellite data and derive a Normalized Difference Vegetation Index (NDVI). As a basis to identify potential areas for the establishment of new SBP, an island inventory

mapping was performed. These various methods are explained in more detail in the following, after a short introduction to the study site.

6.3.1 Study area

The study area is the Greek island of Samothraki in the north-east of the Aegean Sea, not far from the border to Turkey. Samothraki has an area of 180km² mountainous terrain that is currently inhabited by around 2900 people (Petridis et al. 2017). It is challenged by severe overgrazing, that has led to soil erosion, aridity, deforestation and a loss in vegetation cover, probably accompanied by a loss in biodiversity (Fetzel et al. 2017). Since 2015, the *Samothraki Seeding Project*, as part of the *Sustainable Samothraki Project*, is trying to restore pastures on the island by implementing SBP on several farms (Petridis et al. 2017). These farms and their pastures are situated predominantly in the coastal lowlands (Fig. 1). Vegetation samples for our study were taken from parcels P11, P12, P4 B&C and P22.



Figure 1: Location of all the SBP on Samothraki, indicating the period of sowing. Plots 4 B&C, 11, 12 and 22 were sampled in our study (Source: Jongen 2019).

6.3.2 Interviews

The conducted interviews were primarily of qualitative nature, asking about personal experiences and perceptions, with some quantitative questions for generating background information. Moreover, the interviews were semi-structured. In total we interviewed three farmers. All of these farmers were on a list of farmers participating in the SBP program. The other farmers on the list were unavailable due to the fact that the interviews were conducted during harvest time. The farmers we interviewed were all male and ranging in age from 44 to 68.

The questionnaire was developed following the general research question: 'What are the obstacles and opportunities for farmers in relation to the sown pastures?'. Thus, we asked for experiences, as well as opportunities and obstacles the farmers faced during the program. The interview consisted of 10 questions that were adjusted and/or extended depending on the answers and on the level of the farmers' involvement in the program. The interviews were analysed by comparing the answers. We grouped the answers according to 'general attitude', 'level of satisfaction', 'obstacles', 'opportunities', and 'recommendations', which allowed us to derive a general picture on the farmers' perceptions of the SBP program.

6.3.3 Vegetation sampling

To evaluate quantitatively the success of the SBP established on Samothraki, vegetation samples were collected, analysed regarding their productivity and compared to control samples from vegetation plots outside the SBP program. Vegetation samples were taken in four SBP plots (plot 4 B&C, 11, 12, 22). In addition, a control sample (barley; *Hordeum vulgare*) was collected in plot 11. The sampling was performed by cutting and collecting all the plant material within a certain quadrat (30×30 or 40×40 cm). Vegetation samples in plot 4, 11 and 12 were collected inside exclosure cages, previously installed in the parcels to exclude the presence of livestock and enable calculation of productivity (Fig. 2a); plot 22 was not grazed in 2019 so there was no need for cages. The different appearance of a SBP to a conventional pasture can be identified in Fig. 2b.



Figure 2: (a) Plot 4B: cage 2 (not grazed) vs. grazed SBP, June 2019; (b) Plot 22 (front) vs. natural pasture (back), June 2019. (Source: Jongen, 2019).

The samples were sorted, and the plant material was classified into three functional groups: grasses, legumes and forbs. Regarding the taxonomic aspect, plant material classified as grass belongs to the family Poaceae and plant material classified as legume belongs to the Fabaceae family. Any plant material that did not belong to the above-mentioned families was classified as forb. A high share of legumes in the sample is favourable, as legumes fix nitrogen in their root nodules². Once the plant dies, the nitrogen is released, and becomes available to other plants, thus providing a better fertilization of the soil.

Initially productivity was calculated from the fresh weight. Productivity is the quantitative measure of yield in a given measured area of field and is usually expressed in units of mass per unit surface, in our case in kg ha⁻¹. Samples were subsequently oven-dried (72h at 65°C) for productivity assessment based on dry matter weight calculations.

6.3.4 Inventory mapping

To assess the performance of existing SBP we used Normalized Difference Vegetation Index (NDVI) data. NDVI saturates for high biomass values as it represents the greenness intensity of vegetation rather than plant biomass (Hobbs 1995). Nevertheless, it is now commonly used by ecologists as a proxy for vegetation productivity (Pettorelli et al. 2005). Further information on NDVI can be found in section 3.4.1.

To enable the performance assessment, various plots including their respective control plots have been mapped since the start of the program in 2015. Furthermore, an additional inventory mapping was performed in June 2019 to identify suitable areas for future SBP. Therefore, different vegetation types and farming systems on the island were mapped using the Global Positioning System (GPS). The mapped locations were associated with NDVI data sourced from remote sensing. Subsequently, vegetation trends can be generated for each mapped location, with an overall time frame of ~4 years using a Geographic Information System (GIS). On the one hand, NDVI results can be used to assess and compare existing SBP with control plots and other vegetation types. On the other hand, further work will comprise the interpretation and assessment of the obtained NDVI trends to identify potential areas for future SBP.

To acquire useful and representative results for the given objectives of (i) assessing the performance of existing SBP and (ii) assessing potential areas of future SBP, different vegetation types and farming systems were selected across the island. In addition to mapping and analysing existing SBP plots (and their controls), selection criteria for the latter exercise were primarily based on the assumption of a land's

²Root nodules are found on the roots of plants, primarily legumes, which form a symbiosis with nitrogen-fixing bacteria (Wagner 2011).

aptness and plausibility for the use as grazing land for goats and sheep, i.e. land which is naturally suited to host pastures (e.g. natural grassland), land which is already under some sort of cultivation that allows for combined grazing (e.g. olive groves and vineyards) or land that could be used more productively when changed to pasture. The following vegetation types were thus mapped under the considerations mentioned: natural grassland, annual cropland (barley, oats), fallow land (at least in June 2019), olive grove, vineyard and phrygana (with *Sarcopoterium spinosum*).

Mapping was done with a standard handheld GPS device and photos of each parcel were taken. Mapping points within a given parcel were selected according to their relative absence of trees, as not to skew NDVI results. Figure 3 shows the island inventory of mapped vegetation types and their locations. Plots are scattered across the island, but mainly concentrated in the north-eastern and south-western coastal regions due to occurrence, suitability and accessibility. Further information on the mapped plots' vegetation type and farming practice can be found in Appendix A.

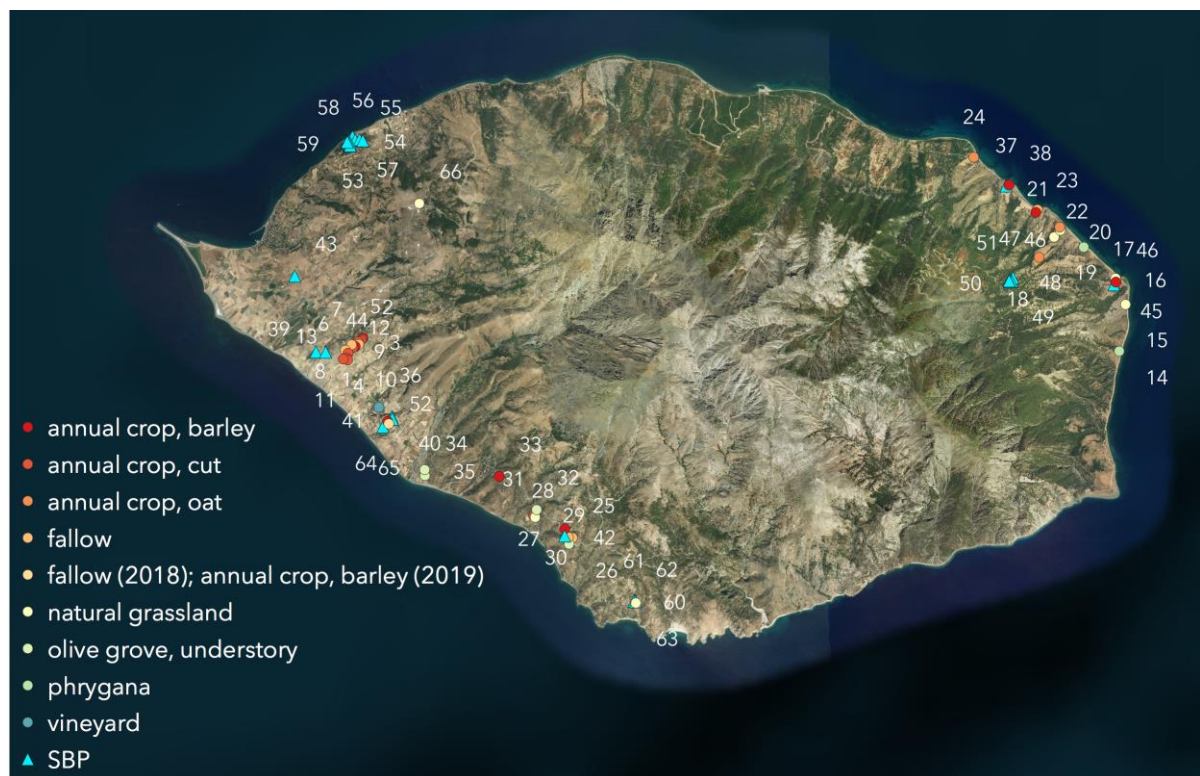


Figure 3: Mapped plots of different vegetation types and farming practices on Samothraki island; see Appendix A for further information.

6.3.4.1 Normalized Difference Vegetation Index

NDVI is an indicator to assess the live green vegetation of a given land surface by using remote sensing data from earth observation programs. The algorithm uses different

bands of the electromagnetic spectrum reflected by the earth's surface to calculate the occurrence of green-leaf biomass and derive for example crop yields, pasture performances and carrying capacities, as well as water stress, plant disease and insect damage (Benedetti and Rossini 1993, Justice et al. 1985, Weier and Herring 2000, Weber and Jongen 2017).

During photosynthesis, a plant's chlorophyll generally absorbs visible light (VIS) from 400-700 nm and its leaves simultaneously reflect near-infrared light (NIR) from 700-1100 nm (Weier and Herring 2000). Weier and Herring (2000) elaborate that *"if there is much more reflected radiation in near-infrared wavelengths than in visible wavelengths, then the vegetation in that pixel is likely to be dense and may contain some type of forest. If there is very little difference in the intensity of visible and near-infrared wavelengths reflected, then the vegetation is probably sparse and may consist of grassland, tundra, or desert"*. The difference formula is written as follows:

$$\text{NDVI} = (\text{NIR} - \text{VIS}) / (\text{NIR} + \text{VIS})$$

The result is a number between minus one (-1) and plus one (+1), with values <0 depicting water or snow, values ~0 depicting clouds or bare soil and values approaching +1 depicting a high occurrence of vegetation (Weber and Jongen 2017, Weier and Herring 2000).

To calculate the NDVI trends for the mapped locations we used publicly available satellite data from Sentinel-2 MSI (MultiSpectral Instrument) sensors, i.e. spectral image band 4 (RGB red, ~665 nm central wavelength, 10m resolution) and spectral image band 8 (near-infrared, ~835 nm central wavelength, 10m resolution) (Guerrucci and Huck 2019). We selected 1–3 images per month between 26.07.2015 and 25.07.2019 (a total of 75 images) where cloud cover was minimal to reduce aberration of results. We then calculated NDVI values for each mapped point/parcel and image in QGIS software.

6.4 Results

6.4.1 Interviews

Out of the four farmers that we interviewed, three had participated in the SBP program. Our analysis is based on these three interviews, referred to in an anonymous way as 'farmer 1', 'farmer 2' and 'farmer 3'. The transcripts of the interviews can be found in Appendix B.

6.4.1.1 General attitude and level of satisfaction

Farmer 1, participating since autumn 2015, was very satisfied with the SBP program and wanted to continue with it. He was generally happy with the performance of the pastures. He specifically appreciated that in periods of ample rainfall the SBP produce

constantly, in which case he was able to have his livestock grazing on the pastures repeatedly. When asked how happy he was with the program, on a scale from 1 to 10, he said “12”, adding that he always tells other farmers about the program.

Farmer 2 participated for one year only, between 2015 and 2016. He was dissatisfied with the program. He complained about the performance of the pastures, stating that “nothing at all would grow” and “there was no productivity at all”. When asked how happy he was with the program, again on a scale from 1 to 10, he said “1”, adding that he was not convinced of the practice and would not recommend the SBP to other farmers.

Farmer 3, having participated since November 2016, was generally satisfied with the SBP program and wanted to continue with it. He pointed out that the SBP would grow thigh-high, when there was sufficient rainfall. Asked to consider a scale from 1 to 10 when judging the overall satisfaction with the program, he said “7-8”, and explained that he appreciates the low costs involved and the high productivity of the SBP, but that he wishes to have the chance to sow a larger area.

6.4.1.2 Obstacles

Farmer 1 cited the dependence on the weather, in particular the water-availability, as a clear obstacle. In cold and dry conditions, the performance of the SBP is not good. Moreover, rainfall is needed for proper soil preparation for SBP, because without enough rain, the soil is too hard and difficult to plough. In addition, a potential obstacle mentioned by farmer 1 is the distance of the farm, where the animals are kept, to the plots used for SBP, because the animals need to be brought (often transported) to the pastures. He also mentioned that the lack of ownership over the pastures (since he only rents them) is an obstacle for having more SBP. Lastly, he stated that it would be good to have machines to remove the thistles before they can spread, but these machines are quite expensive.

Farmer 2 did not mention specific obstacles since he was in general not convinced by the SBP-program. Farmer 3 also complained about low productivity, when the precipitation is too low. Moreover, he mentioned that there would occur losses in vegetation cover, when the animals tear out the roots of the plants while feeding, as the soil is too dry to hold them. This is affecting the persistence of SBP over time. Farmer 3 also mentioned, like farmer 1, the lack of opportunity to sow larger areas due to a lack of ownership over more parcels. Lastly, farmer 3 thinks that it is an obstacle for the program that not all farmers correctly implement the instructions given for the preparation of the SBP.

To summarize, the farmers identified the following (potential) obstacles to the SBP program:

- a) the dependency on the weather and water availability,

- b) high distances of pastures to the farm,
- c) lack of ownership over land,
- d) instructions for SBP are not correctly implemented by the farmers, and
- e) a lack of machinery to remove thistles.

6.4.1.3 Opportunities

Not surprisingly, given the mentioned obstacles, farmers 1 and 3 envisaged opportunities for increasing the productivity of SBP through irrigation. Even farmer 2, in general rejecting the SBP program, mentioned that irrigation could be an opportunity to improve the performance of SBP. Farmer 1 and farmer 3 basically see the main opportunity of the SBP in their higher productivity - compared to other pastures, or even cropland. In their opinion, this already high productivity could be enhanced by irrigating the SBP. Another opportunity according to them is the very low workload associated with SBP, as they only have to be sown once in 10 years.

6.4.1.4 Recommendations

Apart from irrigating, which was recommended by all three farmers, both farmer 1 and 3 recommend that the instructions on how to implement the SBP are strictly to be followed, with farmer 1 stressing out that one week is the amount of time necessary for the best possible preparation. More specifically, he said that the soil should be prepared after the first rains, and thistles should be removed before they can spread. In addition, farmer 3 recommended having a mixture of 50:50 pastures and crops, because he said pastures are important when the animals need to produce milk, but crops are necessary to have enough feedstuff for the winter.

6.4.2 Vegetation Sampling

Productivity of the SBP was assessed from the vegetation samples in the different plots. Our results complemented the ongoing quantitative assessment conducted by program leader Marjan Jongen, who already assessed all SBP plots earlier in 2019 to report on the success and effects of the SBP program on Samothraki (see Jongen 2019). Differences between her results and ours might be due to the period in which the sampling took place. Our sampling took place 2-3 weeks after hers, with vegetation in a much more senescent state. In addition, the different levels of experience in sampling techniques might be responsible for differences between her and our results.

Productivity in the four SBP plots ranged from 3345 (plot 22) to 6680 (mean value for plot 4B and 4C) kg ha⁻¹ (Fig. 4-a)³. The profound differences in productivity between

³The productivity graphs (Fig. 4) presented here are based on dry weight. Using dry weight as a measure of plant growth tends to be more reliable (as compared to fresh weight), since plants have a high

plots are due to various reasons (soil quality, micro-climate, degree of wind exposure, differences in sowing technique, management, etc.), that go far beyond the scope of this study. Productivity in general could have been higher if the sampling had taken place earlier in the year, when the vegetation was in a less senescent state. Appendix C gives all aggregated data.

Data on functional group abundance indicates that grasses are most prominent in all plots except plot 11, where forbs dominate (see Appendix C). The percentage of legumes is relatively low, reaching a maximum of only 23,3% in plot 11. In general, it is preferable that forb abundance remains low in SBP, so in this regard plots 12 and 4B can be considered as the most successful ones, with forb percentage (average value for plot) reaching just 10% and 14,9% respectively.

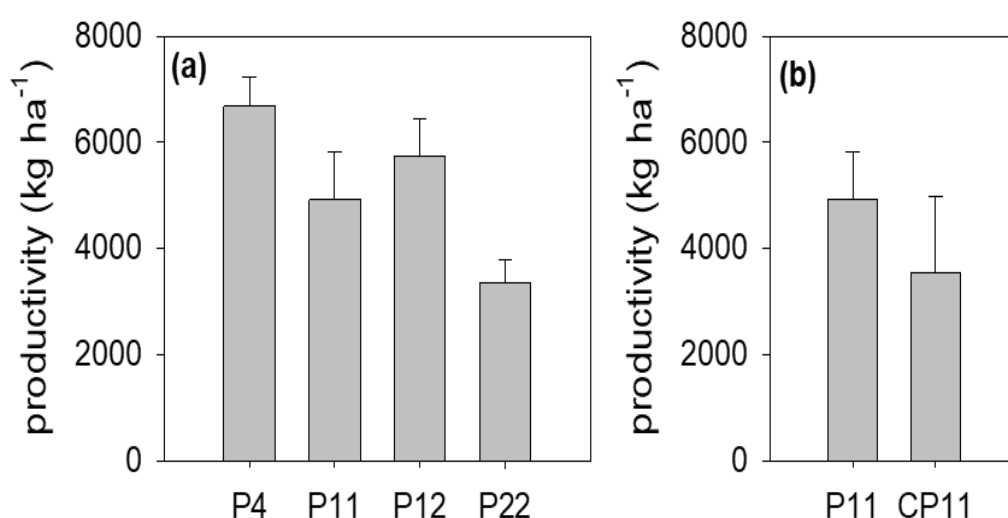


Figure 4: (a) - Productivity in kg ha⁻¹ in the four SBP plots assessed during the Summer School 2019, and (b) - Productivity of the samples taken in plot 11, showing the direct comparison between the SBP (P11) and the control, i.e. the annual crop barley (CP11). Data represents mean \pm SE (standard error). For further information see Appendix C.

Plot 11 had been sown with SBP since 2017, and exclosure cages were installed in 2018. However, in 2019 the plot was sown with barley. Nevertheless, the cages and immediate surroundings were not sown with the annual crop and SBP vegetation was still growing there (Jongen 2019). This presented the opportunity for a direct comparison of productivity between the SBP and the annual crop (i.e. barley) within the same plot (which means same biophysical conditions). Our data indicates a higher productivity in the SBP (4919 kg ha⁻¹) as compared to the barley crop (3532 kg ha⁻¹), see Fig. 4b. Especially the composition of functional types varies a lot here, with almost only grasses (97%) and no legumes in the barley crop sample and a much more

composition of water and the level of water in a plant will depend on the amount of water in its environment, which is very difficult to control (Wood and Roper 2000).

balanced composition, with about 23% legumes in the SBP sample (even though the forbs make a big part here with almost 50%) (see Appendix C).

6.4.3 Island inventory mapping and NDVI

6.4.3.1 Assessment of existing SBP

To assess NDVI of existing SBP, only a limited number of plots and time frames justify comparison in order to obtain valid interpretations. This limitation is primarily based upon the fact that most parcels were grazed at different points in time and for different timespans (which are often not known in detail). In this case NDVI data does not render any information on the potential productivity. Furthermore, a parcel's specific land-use before conversion to SBP is often unknown, and SBP sowing dates were irregular across seasons between 2015–2018. Available data thus allows for limited comparisons only.

Figure 5 shows the comparisons of SBP plots with their respective annual crop controls across seasons. NDVI values of SBP plot 1 (Fig. 5a) and plot 11 (Fig. 5b) are almost continuously above those of their controls. SBP plots 4B and 4C (Fig. 5f) show higher NDVI values than their control plots of annual crop (barley) and fallow land during the winter (November to February) and at peak biomass (May). The higher performance of SBP over annual crops is less explicit in plot 15 (Fig. 5c), plot 16 (Fig. 5d) and plot 22 (Fig. 5e).

Definite integral calculations of the area under curve (AUC), giving accumulated NDVI (NDVI_{acc}) values for the observed periods, nevertheless confirm the trend of SBP outperforming their controls. NDVI_{acc} increases between 3–23% in all SBP plots except for plot 22 the year before SBP was sown (Sep. 2017 – Aug. 2018). The relatively high values for plot 22 during this period can be explained by comparing climate data from the two seasons: mean temperature and total precipitation are 18°C and 996,6 mm in the 2017/18 season (year before SBP), and thus significantly higher when compared to 17,3°C and 610,6 mm in the 2018/19 season (SBP). Appendix D lists NDVI_{acc} values of all relevant plots. Appendix E lists the relevant climate data.

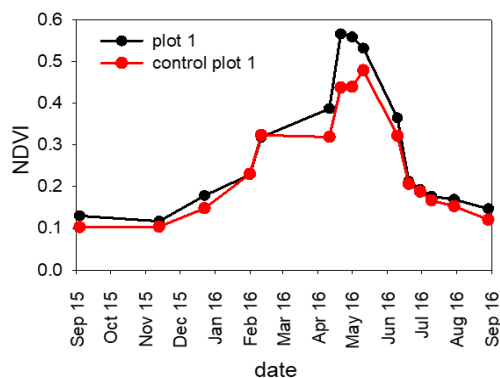


Figure 5a: NDVI trends of SBP plot 1 and its control plot of annual barley, Sep. 2015 – Aug. 2016.

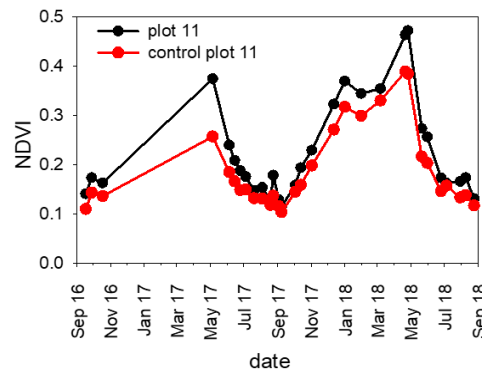


Figure 5b: NDVI trends of SBP plot 11 and its control plot of annual barley, Sep. 2016 – Aug. 2018.

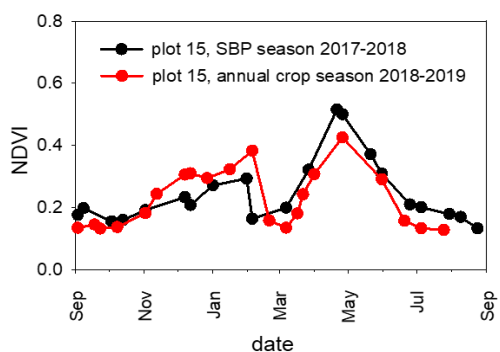


Figure 5c: NDVI trends of SBP plot 15 and its control plot of annual crop, Sep. 2017 – Aug. 2018 and Sep. 2018 – Aug. 2019 respectively.

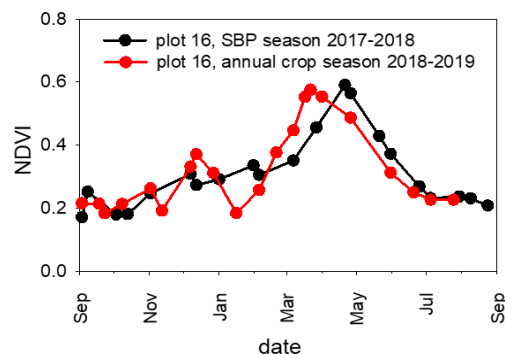


Figure 5d: NDVI trends of SBP plot 16 and its control plot of annual crop, Sep. 2017 – Aug. 2018 and Sep. 2018 – Aug. 2019 respectively.

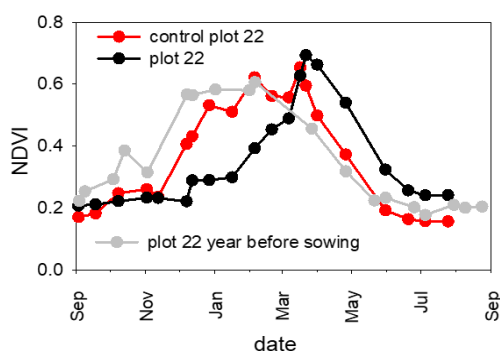


Figure 5e: NDVI trends of SBP plot 22 and its control plot of annual crop, Sep. 2018 – Aug. 2019; and plot 22 the year before SBP was sown, natural grassland, Sep. 2017– Aug. 2018.

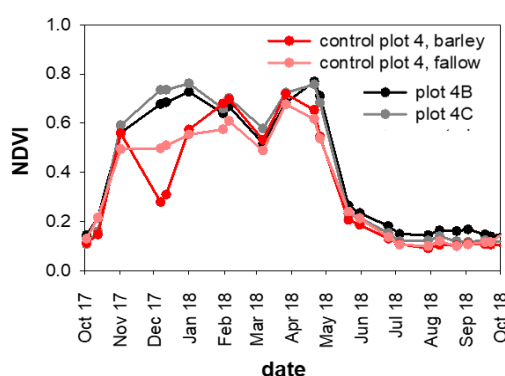


Figure 5f: NDVI trends of SBP plots 4B and 4C and their control plot of annual crop and fallow, Oct. 2017 – Sep. 2018.

6.4.3.2 Inventory mapping for the assessment of potential future SBP

Figure 6 shows average NDVI values for all mapped vegetation types between Sep. 2018 – Aug. 2019. Comparison shows highest overall NDVI for vineyard and highest NDVI at peak biomass (May) for SBP followed by annual crops. Phrygana and olive grove show overall medium NDVI, while phrygana shows relatively high values during the dry summer months (Jun–Oct). Natural grassland, however, performs weakest during the summer and only moderate during the winter growing season. The averaged NDVI trend of SBP plots shows a better performance than most other vegetation types over the whole observation period, indicating further potentials for sowing SBP in the future. This indication especially applies to natural grassland, annual crops and fallow, as well as to the understory of olive groves.

6.5 Discussion

Our results illustrate that, in general, the SBP program is successful. It is well perceived by most of the farmers and our vegetation sampling confirmed an increased productivity as compared to annual crops and other permanent pastures. NDVI trends and NDVI_{acc} of SBP and respective controls support this finding.

Additional interviews with farmers are needed, to allow for more decisive results regarding the perceived performance of the SBP. Nevertheless, the interviews with the three farmers participating in the SBP program allow us to gain some insights regarding the farmers' perceptions and evaluations of the program. This is important, as the success of the program depends as much on the farmers' perceptions, as on the objective performance of the SBP. Farmers might perceive the performance of the SBP differently than can be objectively measured. Moreover, they might have different reasons altogether to reject the program.

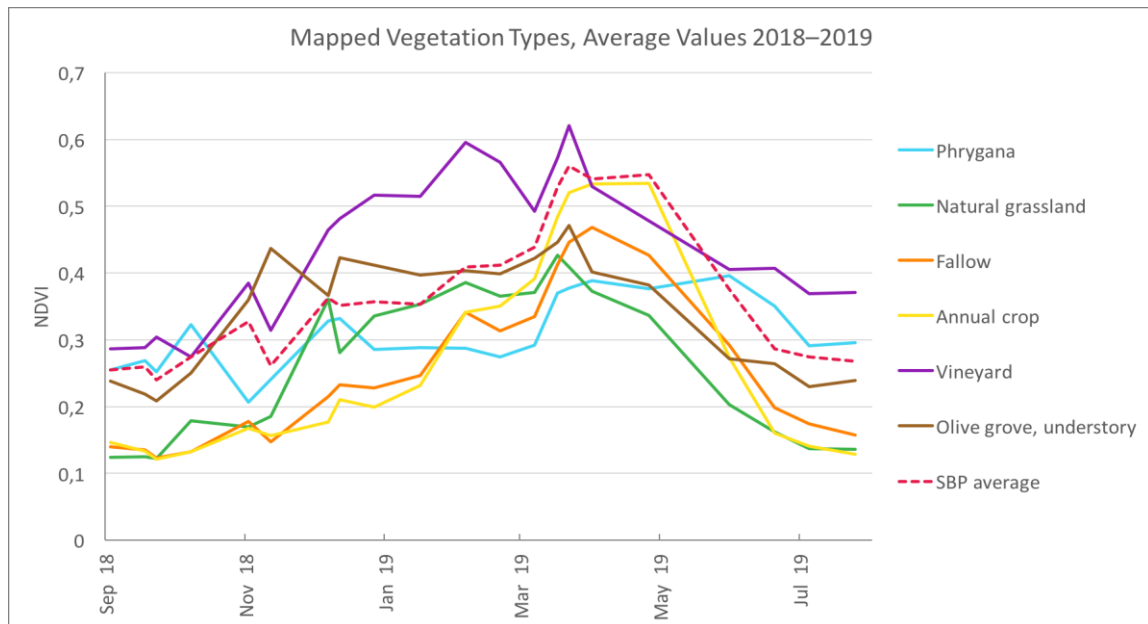


Figure 6: Comparison of mapped vegetation types between Sep. 2018 – Aug. 2019, with averaged NDVI values according to each vegetation type.

For our discussion of the results it is therefore perhaps a good starting point to look at farmer 2, who was dissatisfied with the SBP. How do we explain the dissatisfaction of farmer 2? Measurements taken in 2016 by program leader Marjan Jongen actually not only contradict his claim that nothing at all grew on the pastures, but collected field data indicated that his SBP (plot 1) performed quite well, definitely outperforming the nearby control plot sown with barley. Thus, either his perception simply differed substantially from the collected data, or he had other reasons, like e.g. stubbornness or other personal traits and emotions that influenced his perception, to bluntly express his dissatisfaction and claim that nothing at all had grown on the SBP. Other reasons might be that he had very different expectations which were not fulfilled or perhaps there was something entirely else that he did not like, but would not tell us in the interview. Nevertheless, the claim of farmer 2 that there was no productivity at all in his SBP, stands in stark contrast not only to vegetation data, but also to assessed NDVI trends. In addition, his opinion contradicts with the perceptions of the other two farmers, who both praised the productivity of their SBP.

While the opportunities (higher productivity, lower workload) and the recommendations (irrigation, follow the instructions regarding preparation and management) are straightforward, providing good advice for progressing the program in the future, it is worthwhile to take a closer look at the obstacles. In our opinion, the category of obstacles is the most interesting, because it articulates different dimensions: natural, socio-economic, educational, and perhaps even cultural ones.

Precipitation, temperature, soil conditions on the one hand are abiotic factors. On the other hand, these factors also have social aspects, most important of which are the

regulation and management of irrigation, that distribute the water provided by rainfall. Soil conditions and temperature (micro-climates through different vegetation types) are also in part culturally managed, as they can be influenced by fertilizers and the composition of surrounding plants.

Additionally, the ownership and topographical distribution of land, as well as the economic possibilities to afford machines for transportation and agricultural practices are socio-economic factors. Educational factors were mentioned in the form of knowledge, especially relevant regarding timing and method of sowing, removing thistles, and optimal soil preparation for the SBP. These aspects might also have cultural dimensions, since earlier studies on the island have revealed a particular stubbornness and reluctance towards cooperation amongst the farmers, as well as a reluctance to trust people who they consider as outsiders, i.e. people not born on the island, even if they have been living there for many years (Apostolopoulos et al. 2019).

The obstacle of ensuring enough irrigation was mentioned by all three farmers and is connected to another research field, namely the state and future of the water supply and distribution system on the island (also dealt with within the *Sustainable Samothraki Project*, see chapter 4 in this issue). From our point of view, the question of water availability and irrigation is therefore to be seen as an obstacle to agricultural practice in general and not only in regard to SBP, as there are no specific restrictions on it. Interestingly, farmer 2 claimed during the interview that climate change renders the soil drier, thereby pushing the demand for irrigation. The future development of the climate is definitely also one aspect to be considered in the forthcoming planning and analysis of the program.

Keeping all this in mind, the future of the SBP program is depending on different factors. Additional large-scale implementation on the island is only possible if there is a network of support and knowledge exchange amongst the farmers. At the personal level, the individual farmers must be open to change and new land management practices. This might be difficult as the majority of the farmers are of the older generation, used to their existing habits of agricultural practices. Nevertheless, the future success of the program is also dependent on weather conditions and the influence of future climatic changes. Although our inventory mapping shows that there are many suitable areas on the island to implement additional SBP, all these factors mentioned above must be taken into consideration as well.

6.6 Conclusions

All in all, we can state that our results still show a clear success of the SBP program. It is largely well accepted by the farmers, and it has increased the productivity of the pastures. In addition, the SBP program may positively affect biodiversity and ecosystem restoration on the island, as predicted by Jongen (2019) and Teixeira (2010, 2015). Nonetheless, it should be noted that the short time frame of the Summer

School limited our research substantially. To draw clear conclusions, additional studies and research are needed. The interviews we conducted only gave us limited insight, not representing the opinion of all farmers participating in the program. Conducting a comprehensive survey with all participants would be one of the future tasks. Therefore, cultural and economic influences on the farmers' perceptions and actions need to be considered in the studies, as well as the impact of climate change on the natural circumstances pushing or limiting the effects of the SBP on the ecosystems. Similarly, our findings on the SBP productivity need to be combined with the greater survey on productivity measurements already conducted by the program leader Marjan Jongen (Jongen 2019).

Inventory mapping and NDVI assessment of different vegetation types indicates potential for establishing SBP in the future. The inventory mapping, based on average values, shows that SBP performs better as compared to natural grassland, annual crops and fallow land, which may indicate that by converting any of these three vegetation types to SBP may increase productivity, as NDVI values are a proxy for productivity. Further analysis and assessment of our inventory mapping and corresponding NDVI data of the different vegetation types should be performed in a separate work package, to indicate potential areas for future SBP, thereby facilitating the expansion of the program on the island and maximizing its success.

Finally, although further research is necessary, the program is promising, and we have high confidence that it can play an essential role in solving some of the island's most pressing ecological issues (e.g. overgrazing). To continue and enhance the program's success, all the different aspects mentioned above need to be considered in future implementations, taking into account all the three dimensions of sustainability (ecological, economic and social).

6.7 References

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Appendix A

List of all mapped plots with corresponding vegetation type or farming practice.

ID	Plot No.	Vegetation Type / Farming Practice
1,6,23,28,33	-	annual crop, barley
18,21,24	-	annual crop, oats
2,3,4,7,10,11,12,13,30	-	annual crop, cut
5,8,9,22,25,27	-	fallow
14,17	-	phrygana
15,16,19,20,31,66	-	natural grassland
26,32,34,35	-	olive grove, understory
29,36	-	vineyard
38	control plot 1	annual crop, barley
64	control plot 4	annual crop, barley
65	control plot 4	fallow (2018), annual crop, barley (2019)
46	control plot 11	annual crop, barley
63	control plot 22	natural grassland
39	plot 2	SBP
40	plot 4B	SBP
41	plot 4C	SBP
42	plot 6	SBP
43	plot 8	SBP
44	plot 9	SBP
45	plot 11	SBP
46,47,48,49,50,51	plot 12	SBP
52	plot 14	SBP
53	plot 15	SBP
54,55	plot 16A	SBP
56	plot 16B	SBP
57,58	plot 17A	SBP
59	plot 17B	SBP
60,61,62	plot 22	SBP

Appendix B

Interview Farmer 1:

Date: 24.06.2019

Personal information:

Age: 44

Type / number of animals:

Sheep: 150

Goats: --

Pigs: 6 for own consumption

Chickens: some chickens for own consumption (most drowned in an accident)

Farm:

Size of the farm: 4 ha

Number of parcels: --

Location of the parcels: 2 ha on his farm, 1 ha on "this side", 1 ha "other side"

Type of management / area:

Annual crops: barley, oats, vetches

Seed price: barley 250€, oats: own seeds from previous year, vetches: 500€ IN TOTAL

Fertilizer: no

Labour cost in workdays per year: works alone

Bales: 275 (16,50€ for cutting and baling per 0,1 ha)

Irrigation: no

Fallow land: every year 1 ha

Olive plantations: 1 ha

Supplementary feed: corn (3t), barley grain (4t) at 250€/t at beginning of yr; in winter: 270-280€/t

Questions in relation to the Sown Biodiverse Pastures program:

1. Do you take part in the SBP program? yes

2. Since when? *autumn 2015*
3. How was your experience?
Happy, better if he could irrigate, then he could extend grazing period
4. Were you satisfied with the performance of the pastures? *yes*
 - a. If NO: Why not? (Could it be connected to the location of the parcel?)
 - b. If YES: What did you like specifically?
When there is rainfall it produces constantly, no worries about grazing. Puts animals in for several days, when the rain comes pasture is ready for grazing again, when enough warmth and humidity: very good, when cold and dry: bad
5. How much labour was involved during the preparation year?
One week for best possible preparation. Very thorough. Difficult when sown early: a lot of clay, if no rain: soil too hard, difficult to break.
 - a. Can you give an estimate on the total workdays per year you invested into the program in the following years?
Nothing. Only fencing (1 day) and bringing animals in and out.
 - b. How and why did the workload change compared to the other permanent pastures?
Difference to other pastures so big, would like to put SBP on all pastures he rents (15ha) if he owned them, very enthusiastic.
 - c. Did you hire extra labour force? How much did they cost?
Works alone
 - d. What kind of machinery did you use? Did you have extra costs because of the machinery? Do you have the need for additional machinery?
Own machines: tractor, ripper, seed drill, discs to break soil. Would like cutting palindrome for thistles before they spread their seed (costs 3000-3500€)
6. Did you use any fertilizer?
If YES:
 - a. What kind?
Phosphorus 1yr: 40kg (from program), next yrs: none
 - b. Was it because you were recommended to do so, or was it your own initiative? *Recommended.*
 - c. What did you pay for the fertilizer? --
7. Did you irrigate the pastures?

No. Would like to in future.

8. Do you have any recommendations for other farmers that are interested in the program?

Highly recommends it to other farmers, especially when animals close to farm and when possible to irrigate

- a. Did you have specific problems / recommendations for the preparation and sowing? --

9. Would you recommend the program to other farmers? Yes or No (short why?) --

10. How happy are you with the program in general? On a scale of 1-5.

12. Always tells other farmers about program.

Interview Farmer 2:

Date: 28.06.2019

Personal information:

Age: 68; all his life in Samothraki; retired

Type / number of animals:

Sheep: 200

Goats: 250; all animals no need to feed in old times as there was plenty of feed on the island; now much feed necessary; 1989 first goats roam freely always in the same spot in mountains, no much feed necessary; most farmers face same situation; became already difficult in 1980s!!! weather colder on the northern side of the island that's why problem with animals; thinks that main reasons for degradation of ecosystems are pests like caterpillars already since 1990s; earmarks on animals are problematic as they get caught up in trees and bushes etc; animals graze residues or directly crops, he does not make bales

Pigs: 0

Chickens: domestic use

Farm:

Size of farm: 120 stremma; difficult because of soil condition; barley and oat, vetch and rye; rented (40) and own land (80); uses fertilizers; EU obliged him to cultivate organic but production is much lower; subsidies provided for that; productivity: 200kg/stremma if good year; not satisfied with

SBPs as after sowing nothing grew; Marjan said soil is good but nothing grew; does not want to continue; leaving parcels on own luck might be better

Number of parcels: 3-4, distance max 4km

Location of the parcels: Kamariotissa 1 parcel; most land around camping site in Therma

Type of management / area:

Annual crops (for example barley, oats): If YES: which kind, price of seeds, fertilizer, labour cost in workdays per year and productivity in kg/hectare; bales, irrigation yes/no; costs;

Grasslands / fallow land:

Olive plantations:

Other:

Supplementary feed:

Do farmers buy supplementary feed? How much? Price?

Locally produced feed; corn barley, vico, trifoly (all that is available); 50t per year; 500 bales of hay; 250€/t; 7-8€/bale; all subsidy money he gets goes into feed;

Questions in relation to the Sown Biodiverse Pastures program.

1. Do you take part in the SBP program?

Yes; but not anymore!

2. Since when?

Only one season (1 year)

3. How was your experience?

Not good; nothing grew; better to leave parcels without SBPs

4. Were you satisfied with the performance of the pastures? *no*

If NO: Why not? (Could it be connected to the location of the parcel?)

nothing grew, no productivity at all!

If YES: What did you like specifically?

5. How much labour was involved during the preparation year?

- a. Can you give an estimate on the total workdays per year you invested into the program in the following years?

1 day; plan was to sow 20 stremma but he only sew 10, other 10 with barley; only 10 because not enough seeds

- b. How and why did the workload change compared to the other permanent pastures?

Only one day

- c. Did you hire extra labour force? How much did they cost?

Payed only for tractor; no additional costs

- d. What kind of machinery did you use? Did you have extra costs because of the machinery? Do you have the need for additional machinery?

He only lend a tractor for one day, costs unknown but he needed to pay for it;

6. Did you use any fertilizer?

If YES:

- a. What kind?

Were provided by Giorgos

- b. Was it because you were recommended to do so, or was it your own initiative? *Recommended by Giorgos*

- c. What did you pay for the fertilizer? *nothing*

7. Did you irrigate the pastures?

If YES: Do you think it was necessary?

No irrigation on SBPs

8. Do you have any recommendations for other farmers that are interested in the program?

He is not convinced and will not recommend SBPs to other farmers

- a. Did you have specific problems / recommendations for the preparation and sowing?

9. Would you recommend the program to other farmers? Yes or No (short why?)

10. How happy are you with the program in general? On a scale of 1-5:

(1); irrigation would be good!!! Climate change already affects as irrigation is required;

Interview Farmer 3:

Date: 25.06.2019

Personal information:

Age: 66

Type / number of animals:

Sheep: 45

Goats: 65

Pigs: 6

Chickens: 70

Farm:

Size of the farm: 30 stremma, on lease: winter barley

13 stremma, owner: 5 stremma under cultivation, the rest is
shelter for the animals, fallow

(1 stremma is 0,1 ha)

Number of parcels: 19,5 stremma, owner: SBP and olive farm, grapes

Location of the parcels: --

Type of management / area: see above

Annual crops (for example barley, oats): If YES: which kind, price of seeds per ha,
fertilizer, labour cost in workdays per year and productivity in kg/ha; bales, irrigation
yes/no; costs; when)

Grasslands / fallow land:

Olive plantations:

Other:

Do farmers buy supplementary feed? How much? Price?

Supplementary feed: *Corn and sorghum: 20€/ stremma, according to need (when
own production is not enough)
2018: 22t, 250€/ t
2019: 300€/ t
price changes due to production fluctuations in all of Greece,
import is more expensive, and the prices of ship transport vary*

Fertilizer: N+P, 1,5t, 18€/ 30 kg pack

Labour: "all day, all year", with his brother, cutting of twigs from olive
trees for animal feed is much work

Fallow: *every year, in rotation*

Irrigation: *usage of 1 municipal source, and 1 private source*
municipal: 2,7€ / hour, but price on distance to farm
private: all year, and sometimes all day, water for animals,
vegetable cultivation, watering takes place during the night

Questions in relation to the Sown Biodiverse Pastures program:

1. Do you take part in the SBP program? *Yes*
2. Since when? *Nov. 2016*
3. How was your experience?
Generally satisfied, pasture grows thigh high when there is enough rain, he mainly talks about problems if there is too little rain, irrigation takes rarely place, also not if SBP were sown under olive trees, good growth from October onwards as he says he followed all advice so there were no problems with the SBP transportation of animals to the pastures is no problem for him some losses occur when grasses eat
4. Were you satisfied with the performance of the pastures?
If NO: Why not? (Could it be connected to the location of the parcel?)

If YES: What did you like specifically?
5. How much labour was involved during the preparation year?
 - a. Can you give an estimate on the total workdays per year you invested into the program in the following years?
2006: not much labour for preparation because parcels were already prepared for crops, so he just had to sow: 1 day with the tractor
After that: no more labour input, so he is satisfied with that.
Some losses occur when animals eat the roots.
 - b. How and why did the workload change compared to the other permanent pastures?
Before he had barley and a legume (Vicia sativa), therefore he had the workload of preparation and sowing every year. He regrets that he has no larger area under BSP, so he would like to expand. He states that the cultivation is important when the livestock has babies - he recommends a 50:50 mixture of pastures and crops.
 - c. Did you hire extra labour force? How much did they cost? *no*
 - d. What kind of machinery did you use? Did you have extra costs because of the machinery? Do you have the need for additional machinery?
1 tractor, +1 other special machine
The cost is 20€ / stremma

6. Did you use any fertilizer? *yes*
 - a. What kind?
at the beginning one pack of N+P / stremma
 - b. Was it because you were recommended to do so, or was it your own initiative?
he used it according to Giorgos' instructions
 - c. What did you pay for the fertilizer?
16-20€ / pack
7. Did you irrigate the pastures? *yes, 4-5 times per year (April-May, sometimes also in June) because springs/rivers have little water*
8. Do you have any recommendations for other farmers that are interested in the program?
 - a. Did you have specific problems / recommendations for the preparation and sowing?
9. Would you recommend the program to other farmers? Yes or No (short why?)
Yes, he would recommend the program (fertilizers and tractor are the only investment, and the seeds are for free, but since there is no productivity during winter, it must always be complementary to other crops. He can recommend exactly the whole process, and he would be willing to pass on the knowledge to other farmers (concerning timing, grazing etc.).
He is very positive about the SBP, he tries to be honest with Giorgos, and wishes that all farmers would do exactly as they are told! He appreciates the fact that foreigners give their advice, and he is very happy with Giorgos.
10. How happy are you with the program in general? On a scale of 1-5
7-8: because of low costs and high productivity
if he had a wish, he would like a chance to sow a larger area

Appendix C

Aggregated data of all monitored plots on Samothraki during the Summer School 2019 indicating dry weight (DW) data (in g quadrat⁻¹) and functional group abundance (in %) for each sample.

plot	sample	quadrat size (cm ²)	grasses DW	legumes DW	forbs DW	rest DW	total DW	total DW (kg ha ⁻¹)	grasses (%)	legumes (%)	forbs (%)
11	cage 1.1	900	4,24	4,62	12,87	9,41	31,14	3460	19,51	21,26	59,23
11	cage 1.2	900	2,58	2,77	28,79	10,35	44,49	4943	7,56	8,11	84,33
11	cage 2.1	900	16,70	2,75	7,05	25,58	52,08	5787	63,02	10,38	26,60
11	cage 2.2	900	13,79	18,31	13,55	22,98	68,63	7625	30,21	40,11	29,68
11	cage 3.1	900	2,34	1,17	8,38	3,76	15,65	1739	19,68	9,85	70,47
11	cage 3.2	900	8,85	18,92	10,02	15,85	53,64	5959	23,42	50,06	26,52
11	control 1*	1600	42,63	0	0	0	42,63	2665	100	0	0
11	control 2*	1600	23,34	0	2,26	0	25,60	1600	91,17	0	8,83
11	control 3*	1600	101,32	0	0	0	101,32	6333	100	0	0
12	cage 1	900	20,23	12,67	4,26	6,97	44,13	4903	54,44	34,10	11,46
12	cage 2	900	47,77	0,46	1,40	14,96	64,59	7176	96,26	0,92	2,82
12	cage 3	1600	52,06	6,64	10,87	12,09	81,65	5103	74,83	9,54	15,62
22	quadrat 1**	900	-	-	-	-	24,09	2677	-	-	-
22	quadrat 2**	900	-	-	-	-	49,91	4656	-	-	-
22	quadrat 3**	900	-	-	-	-	29,09	3232	-	-	-
22	quadrat 4**	900	-	-	-	-	25,32	2813	-	-	-
4B	cage 1	900	29,43	4,72	5,18	26,50	65,82	7314	74,83	12,00	13,17
4B	cage 2	900	17,51	4,77	4,46	17,84	44,58	4954	65,48	17,84	16,68
4C	cage 1	900	45,84	15,01	13,35	12,45	86,65	9628	61,78	20,23	17,99
4C	cage 2	900	7,63	3,40	15,89	16,52	43,44	4827	28,34	12,63	59,03

* control is barley crop

** sample not separated in functional group

Appendix D

NDVI_{acc} values of the relevant SBP plots and their controls as a proxy to assess change in productivity.

Plot	Vegetation type	Season	NDVI _{acc}	Change in %
Plot 1 <i>versus</i> Control plot 1	SBP Annual crop	2015–2016 2015–2016	90,8 80,4	+13%
Plot 11 <i>versus</i> Control plot 11	SBP Annual crop	2016–2018 2016–2018	181,7 147,3	+23%
Plot 15 <i>versus</i> Control plot 15	SBP Annual crop	2017–2018 2018–2019	88,4 79.1	+12%
Plot 16 <i>versus</i> Control plot 16	SBP Annual crop	2017–2018 2018–2019	112,6 103,9	+8%
Plot 22 <i>versus</i> Control plot 22	SBP Natural grassland	2018–2019 2018–2019	116,6 113,1	+3%
Plot 22 <i>versus</i> Plot 22 (year before sowing)	SBP Natural grassland	2018–2019 2817–2018	116,6 207.3	-44%
Plot 4B <i>and</i> Plot 4C <i>versus</i> Control plot 4 barley <i>and</i> Control plot 4 fallow	SBP SBP Annual crop Fallow land	2017–2018 2017–2018 2017–2018 2017–2018	159.6 160.5 132.6 133.9	+20%

Appendix E

Climate data from Samothraki weather station, elevation 90 m, LAT: 40° 27' 47" N, LONG: 25° 30' 05" E (obtained from <http://penteli.meteo.gr/stations/samothraki/> and <http://stratus.meteo.noa.gr/> on November 21, 2019).

	Mean Temperature, °C		Precipitation, mm	
	2017/18	2018/19	2017/18	2018/19
Sep	22,9	23,5	345,4	21,8
Oct	16,9	18,2	157,2	21,2
Nov	13,5	13,7	115,4	95,4
Dec	11,7	8,7	55,8	129,2
Jan	9,1	8,5	145,6	143,0
Feb	9,6	8,6	66,8	35,6
Mar	13,1	12,4	55,8	79,0
Apr	17,8	14,0	3,8	39,6
May	21,6	19,5	22,8	3,4
Jun	24,5	25,7	23,4	8,8
Jul	27,0	26,4	3,8	26,8
Aug	27,9	28,2	0,8	6,8
Mean / Sum	18,0	17,3	996,6	610,6

7. Controversial Socio-Ecological Relationships: On the Political Ecology of Campsite Platia

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7.1 Introduction

Samothraki is a natural paradise and arguably one of the most beautiful islands in Greece. The imposing mountainous heart of the island combined with its untouched nature are exactly what lots of explorers and adventurers seek. A significant number of visitors choose camping for their accommodation on the island, to experience the natural attractions and enjoy a rather basic way of living during their vacation. The two municipal campsites on the island – Varades and Platia – host around 1.500 people daily during the peak summer season, which amounts to about 35% of the island's visitors in total. The campsite Platia, which is located on forest land, does not have a camping license, even though it has been operating by the municipality for many years. For legal reasons, though, no entry fees were cashed during the last few years. To deter people from free camping and to gain financial income from it, there is a consensus on the island that the campsite must be put in proper operation.

Still, the campsite faces an uncertain future due to diverse local interests and conflicts. Therefore, our team during the Summer School on Samothraki 2019 tried to investigate the status quo, the basic conditions and the different interests and conflicts around the campsite. Consequently, the formulated research questions were: Which is the status quo of the campsite and which conflicts and interests are expressed on the campsite Platia?

The paper starts with a general overview on eco camping tourism in the Mediterranean as a possible best-practice case for Samothraki. Next, the theoretical and methodological approach are presented and an evaluation of the socio-ecological problem is formulated through a political ecological theoretical framework. Finally, a conclusion deals with possible future strategies and recommendations.

7.2 Camping tourism in the Mediterranean: a review of the literature

The aim of this section is to place the conflict in a broader context. Considering that Platia campsite is situated on the Greek island of Samothraki, and being part of the Mediterranean, other eco-campsites in the Mediterranean are therefore investigated in order to find possible best-case scenarios for a future development of Platia.

In the past decades, there has not been a significant growth in camping tourism in Europe. According to Milohnić and Bonifačić (2014), the Mediterranean is in a stage of stagnation and decline in camping tourism. On the other hand, there is an increased demand for alternative accommodation, such as glamping and mobile homes (Milohnić and Bonifačić 2014). A negative trend concerning camping is noticeable in Slovenia. In response to excessive exploitation of the coast, one fifth of Slovenian coast has been proclaimed as protected area in which camping is prohibited, but other activities are implemented such as education, conservation and scientific research. The protected areas also present an opportunity for recreational and tourist activities (Jurinčič and Popić 2009) because the camping sites are usually in close proximity to protected areas and incorporating these kind of activities in camping offers could be a solution for the future development of camping tourism. One of the most common troubles in Mediterranean tourism is inefficient organization and management by authorities. This problem is evident in Turkey where several organizations are responsible for different types of recreation sites. Some authors see the management and design of recreation sites by a single authority as a possible solution for better institutional communication and commitment towards sustainable tourism (Atik 2010). Policies regarding the management of camping should be revised by improving coastal investments, reducing taxes, and supporting campground facilities to adopt eco-friendly quality standards (Doğantan et al. 2017).

According to Hrastnik and Vujčić (2000), there are good conditions for developing camping tourism on many locations at the Adriatic Coast. The possibilities are numerous regardless of whether the water and electricity infrastructure is available. Renewable sources, such as wind and sun, can provide a solution for requirements regarding water and power supply, heating and cooling, telecommunication, fire protection and other needs on remote locations. Moreover, camps with an existing infrastructure of water, power and telephone lines could significantly improve their energy efficiency and rely on solar and wind power. In Croatia, the use of solar energy in camps operating in the summer season is the only suitable and economically reasonable solution. It is often neglected that solar installations for hot water preparation have an average lifespan of about 10 years, after which they stop functioning due to construction and technical failures and inadequate maintenance. Unfortunately, instead of such solar installations the conventional electric water boilers come into use again (Hrastnik and Vujčić 2000).

There have been some positive examples in sustainable development of tourism in Croatia on the islands Unije and Krk. On the island of Unije the project "Island of Unije – A Self-Sustainable Island" was implemented. On the island of Krk there have been good practices of efficient use of energy resources, and the islanders seek to share their positive experiences and provide support to other islands. Being the Croatian leader in renewable energy and in separation and disposal of waste, the island of Krk

is the first one to separate and recycle waste. The first camp with 'eco-camping' certificate is "Glavotok" on the island of Krk. It uses a biological water purifier that allows to reuse water for sanitary purposes, and drinking water is obtained through desalination of seawater. According to Kovačić et al. (2018), primary selection on the island separates approximately 50% of waste (complying with the objectives of the European Union until 2020). The collected organic waste is used for making compost, which is then distributed to permanent and seasonal residents of the island. It is part of the Zero CO₂ Emission Strategy of the Island of Krk to make the island energy self-sufficient by 2030. In order to accomplish this, the plan is to develop utility plants for using renewable energy sources, recycling and water collection, as well collection of organic waste in households, tourism and agriculture. By composting, waste would be used for energy production (Kovačić et al. 2018). Another initiative in improving sustainability is the Energy Cooperative of the island of Krk. The project of this cooperative is the installation of photovoltaic power plants on roofs, by acquiring the status of privileged electricity producers (including procurement and installation of equipment). Apart from that, the cooperative organizes social groups related to possibilities of energy production from renewable sources and informative lectures for the population and various interest groups (Kovačić et al. 2018).

When considering possibilities of improving already existing campsites in Dalmatia, according to Hrastnik and Vujčić (2000), what is required is organisational and functional self-sufficiency in respect to transportation, water supply and energy supply, while still providing all the utilities that enable tourists to have an active vacation, recreation and entertainment. The authors suggest the camp to be organized in zones: 1) reception zone with an outdoor parking lot for new arrivals during the night, 2) zone of night silence, 3) catering and entertainment zone, and 4) sport and recreation zone. The transitory area could be installed between the silent and entertainment zone, as a botanical garden with autochthonous local and Mediterranean flora, or an orchard for organically producing fruits and vegetables. This could make the camping more attractive for tourists in the autumn and would contribute to the extension of the tourist season (Hrastnik and Vujčić 2000).

In camping tourism in Croatia, the focus is on the development of products they offer rather than on the construction of new accommodation units. The strategy for developing camping tourism aims to introduce various additional facilities within the already existing camping capacities and directing the offer towards specific niches in order to extend the duration of the season. According to Gašparin (2016), diversification of accommodation can be offered through differentiation of facilities according to various needs, such as family, sports, business etc. This kind of strategy is seen as a good opportunity for camps with low annual occupancy, a strategy that could capitalize on the existing comparative advantages. If the camp is themed, such as family camp, or eco-camp, this can contribute to increasing the occupancy of

accommodation facilities during the year, increasing the profitability of accommodation facilities.

European Commission's report on best environmental management practice in the tourism sector (Styles et al. 2013) gives a set of recommendations to improve camping management. These recommendations include the issues of transportation, biodiversity, water efficiency, waste, recycling, nature-based activities, and will be discussed under the 'Recommendations' section. The research on camping in the middle of the 20th century is dominated by concerns for social entertainment as part of campers' experience, but there is little interest in engagement with nature. After decades of environmentalism in politics and culture nowadays nature is to be taken into account more seriously in the discourse of both researchers and campsite management bodies (Garst et al. 2009).

7.3 Theoretical framework: political ecology

Political ecology is a wide-ranging academic discipline that includes social, ecological, political and economic considerations on topics such as marginalization, power relations and socio-ecological conflicts (Bryant 1998: 80). Arturo Escobar outlines political ecology as: *"the contingent study of the manifold articulations of history and biology and the cultural mediations through which such articulations are necessarily established"* (1999: 3), and: *"It highlights the interwoven character of the discursive, material, social and cultural dimension of human-environment relation"* (Escobar 1999: 2).

The political ecology approach helps to understand and analyse complex environmental, political, economic and social problems as well as their interplay and correlation, which are referred to as "conflicts". In this article, the term is used to identify tensions and conflicting interests and is further clarified in section 6. Additionally, political ecology pays attention to unequal relations in and amongst societies who are affected by changes in their environment (Bryant and Bailey 1997: 28f). Moreover, it provides alternatives to deal with those understandings and relations which should lead to "better" social-environmental governance. Therefore, we chose this approach, because it helped to discover certain conflicts on different dimensions, and it provides alternatives to act upon.

Point of departure for our research was the surprising fact that the area of Platia has been used as a camping ground for several decades (at least since the early 1980ies) and provided accommodation for a large share of Samothraki tourists without ever being properly legalized. The land belongs to the municipality who established certain basic camping infrastructures there in the 1980ies; but it is defined as "forest area" which legally prohibits most of these infrastructures, let alone their extension. While

for many years the camp was run as municipal camp and users were charged during one or two summer months, there never could be set up a proper sign informing visitors that this is so (a sun-dyed sign said something like “auxiliary camp”). During the last years, camping was for free because the municipality’s mayor legally could not charge the campers any more, the infrastructures deteriorated but were still served insofar as wastes were removed and freshwater supply for the showers was maintained. The local *cafeneion* informally took care of toilet cleaning. Still, the number of campers (approximately 1200 per night in the peak season) did not decline. For the island community, such kind of “illegal” camping (at the seaside) was seen as a preferable alternative to wild camping in the mountains and river valleys. The inability of the municipal council, and of a series of three mayors, to find a solution to this apparent deadlock and secure dearly needed income for the municipality, is worth an effort to explore the reasons.

7.4 Methods

In order to identify the status quo and the different perspectives, we interviewed various stakeholders from diverse social groups with different interests and perceptions about the campsite. The first group of social actors are people who have their centre of life in Samothraki. This group is further divided into “indigenous locals” and “locals”. This distinction was created by the local actors themselves, which is described in more detail in section 6.1 below. A second group of interest are foreigners and “non-locals”, which includes visitors from outside of the island, according to their accommodation preferences. Members of a local social cooperative which managed the cafe on the Campsite Platia until 2015 were also included as a separate group. Finally, officers working for the municipality and the government were crucial informants and represent administration. To interview those different groups we chose various interview styles (informal interviews, semi-structured interviews), depending on the situation and person. Further, observations on the campsite, mapping and questionnaires were done in order to define the research question and its context.

7.4.1 Interviews

Informal interviews were useful to get an overview about opinions on the campsite, and informal discussions were crucial for the selection of our interview partners and to get a first insight into the conflict. Semi-structured interviews are a form of data collection in which the researcher asks open-ended questions based on an interview guideline. Our guideline was based on information which was gathered beforehand from informal interviews and readings around the island and the campsite. The

interview guideline focused on the current use and management of the campsite, as well as on the perceptions and opinions on problems and conflicts, of possible future development of the campsite. See interview guideline in Appendix 1.

7.4.2 Mapping and observation

In order to get an overview of the campsite Platia and to document the status quo of the infrastructure for further research and have a communication aid, a map of the area was created, on the basis of existing maps the municipal administration provided, and a geodatabase was set up. Online land register or digital maps of the area were not available. The graphic map was drawn on satellite images from different years, available on Google Maps, and paper blueprints provided by the municipality.

These sources were also used to digitise plot boundaries and infrastructure to create a Google Earth database. During observation of the area by walking, pictures have been made including GPS data of the points where they were taken. They were included in the Google Earth database to verify locations of the infrastructure and to document its quality. Both maps are for communication purposes and to give an overview of the area. They allow rough estimates of distances and extensions but are not an accurate land register for precise measuring and do not relate to land borders precisely.



Fig. 1: Graphic sketch of campsite Platia



Fig. 2: Screenshot of the Google Earth Dataset

7.4.3 Analysis

After conducting the Interviews, the data was evaluated using qualitative content analysis (Mayring and Fenzl 2014). First, the informal and semi-structured interviews were transcribed based on the recordings. In this process, the main points raised in the data gathered are highlighted and assigned to categories (“coding”). Here, the different sources of information were indicated for each assigned information item. Through the coding procedure, knowledge about the dimensions of the conflict were extracted systematically. The categories were predominantly based on the concepts of political ecology and the semi-structured interview guideline. Additional categories emerged from the data throughout the coding procedure, which is called “subsumption”: the gathered information is analyzed thoroughly, and every bit of information needs to be assigned to an existing category. If no matching category exists, a new category has to be added to the codebook (Rager et al., 1999). This way, both the preconceived categories and those inductively generated from the given material were used (Schmidt 2010, Schreier 2014).

7.5 The campsite ‘Platia’

Samothraki offers two campsites, which are located on the northern side of the island. Camping ‘Varades’ is mainly designed for camping with cars and camper-vans and therefore has a more structured appearance due to the symmetrically organized camping plots and paved roads in between. ‘Platia’, only a few hundred meters away, is located in a platanus forest. The few paved roads lead up to small tracks which form a labyrinth-like web through the forest and the thick shrubland. Therefore, Platia has a more unstructured appearance, fitting into the natural landscape of the coastal forest. Both campsites are open from mid-June until mid-September, the peak tourist

season of the year, in which they accommodate about 40 percent of the 4.111 overnight stays of the island (Schwaiger 2017). An additional 7 percent are free campers (ibid.).

In 2017 a survey was conducted to characterize campers in more detail and find out about their needs. Over 75 percent of them were overly enthusiastic about camping on the island and stated that they want to visit again (Fischer-Kowalski 2018), mainly because of the 'wilderness experience', the trust among campers, the low cost and the absence of noise (ibid.). About half of them requested small improvements of toilets and showers, but surprisingly there was great refusal to modernise the campsite Platia (ibid.). If there would be a major modernisation, three quarters of the campers stated that they would rather free camp in the future (ibid.).



Fig. 3: Location of the two campsites Platia and Varades (Credits: Google Maps)

7.5.1 History

Camping tourism on Samothraki reaches back to the 1970s and gained more prominence during the 1980s. With more and more campers on the island, the municipality established organized campsites to regulate camping and to decrease the number of free campers. The campsite Platia was set up in the coastal forests and was kept as natural as possible and offered only basic infrastructure to attract campers looking for a wild camping experience. In 1979, a forest law was introduced in Greece which regulates the amount and type of infrastructure permitted on forest land, as well as the way of wastewater treatment. The campsite 'Varades' adapted to new regulations, whereas Platia was not adjusted to the forest law and therefore never gained a legal permission to be run as a campsite.



Fig. 4: The campsite Platia, located in the coastal forest (Credits: Wendler)

7.5.2 Status Quo

About two years ago, the municipality complied with the forest law and stopped charging entry fees for camping at Platia, as it was not legally adapted to the law. The survey conducted in 2017 among campers came to the conclusion that campers would be willing to pay 3-5€ a day, a fee which is currently missing (Fischer-Kowalski 2018). Regardless of its legal status, still many hundreds of campers use the ground, and the municipality therefore must ensure that wastewater and garbage is collected and treated. At the entrance of the campground is a Café run by local private businessmen. The plot of the Café is not forest land by law and can therefore be run independently from the camping ground. As a precondition to rent the Café from the municipality, the operator must do basic maintenance of the facilities of the campground.



Fig. 5: Café at the entrance of Platia (Credits: Wendler)

The observation on site showed that although the Café is in good condition and managed well, nearly all of the existing facilities on the campsite are not properly maintained and need maintenance. Doors, roofs and walls are run-down or broken, and only some of the toilets, sinks and showers are working. Garbage is collected and

thrown into piles by the campers themselves at certain collection points to be picked up by municipal garbage trucks every now and then.



Fig. 6: Run down Toilets (left) and improvised garbage collection (right) (Credits: Wendler)

With campsite Platia out of order, free camping is suspected to increase again. It is prohibited by law to camp outside organized camping grounds, but the municipality neither has the finances nor the personnel to impose measures to control free camping. In order to run the campsite legally, gain income from it and to reduce free camping, Platia must be adopted to the regulations of the forest law. At the moment, there are no substantial concepts or plans by the municipality nor by the inhabitants about how to adjust the campsite or how to finance the investments necessary. All the interviewees showed a common desire to keep it as natural and basic as possible and maintain its wild and tranquil character.

7.6 Evaluation of a socio-ecological problem

In this paper the different interests and motivations detected during the research are referred to as 'conflicts', in the sense of contradicting perspectives and visions. Although there is a noticeable disagreement on how to tackle social or environmental challenges, this is not necessarily expressed by actors actively participating in these conflicts or deliberately causing them. The conflicts unfold along different dimensions: socio-cultural, ecological, political and economic. However, these cannot be considered as separate but as interacting. The theoretical framework of political ecology was used to identify the conflicting interests around the campsite and help to understand their interplay.

7.6.1 The socio-cultural divides

As mentioned above, there are significant differences between indigenous locals, locals and foreigners on the island. Indigenous locals are defined as the people that

were born on Samothraki and remained there. They perceive themselves as ‘true’ and ‘full’ residents of the island. People that were born elsewhere and moved to the island at some point of their lives are considered locals, but they don’t have the status of full members of the local society, regardless of how long they have been living on the island. This is represented in everyday life and language on the island and a social segregation between those two groups. Still, they both distinguish themselves against people from outside the island community - foreigners or Greeks from the mainland. These dividing lines are relevant for the future of the campsite because indigenous locals distrust locals as well as foreigners.

There is a deep-rooted open conflict between free campers and a part of the local population on the island. This became very apparent in 2018, when the free campers from Platia put up a banner with a message saying: “Cops, owners of rooms to let, mayors, bosses: we will be free camping on your graves” (Fig 7). This triggered very emotional reactions from the locals, and it was even mentioned in the national media.

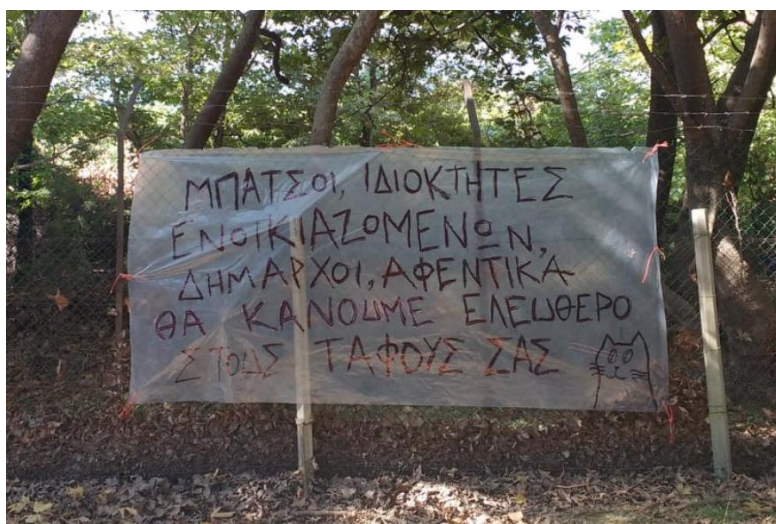


Fig. 7: The banner set up by Platia free campers

Another aspect of the socio-cultural dimension of the conflict is related to gender. The society is still characterized by rather traditional gender roles and both men and women have their own field of action. While men dominate the public sphere, women are rather confined to the private sphere. After work, men can be observed sitting in Cafés, while women use their time off work doing the housework and taking care of the children. According to one of our interviewees, this is part of the reason for the sustainability problems on the island, because the people that are interested in them and contribute actively to finding solutions are mainly women, but because they have a bigger workload than men, they hardly find time for it.

7.6.2 Ecological divides

The campsite is located in a beautiful old forest appreciated by indigenous locals, locals and foreigners alike. The interviews showed that it is considered a natural asset and a place that is important for the recreation of the local population as well. It is of utmost importance to them that nature there is conserved. Since the campsite is located in the forest, it is subject to forest law, which entails a number of restrictions. On the one hand, this secures the conservation of the forest, since not more than 10% of the total surface area can be built, but on the other hand it also limits the option space. This further complicates finding a solution, since it is difficult to build the infrastructure that would be necessary to keep the campground running by the legal standards of the camping law.

At the same time, as mentioned above, Platia must stay open for campers in order to keep them from free camping in other areas of the island, where the consequences would potentially be more challenging ecologically than in the dedicated area of Platia. Therefore, Platia is still used as a campsite, but is currently badly managed, which leads to ecological risks. Mismanagement of facilities, waste of water by infrastructure that is not maintained, inappropriate or no sewage and waste treatment, lead to pollution of the forest and the water. Additionally, there is a potential fire hazard at the campsite because of lack of control. Finally, another ecological challenge is that the peak tourist season is short and very intense, since most visitors come during July-August. This puts a lot of pressure on the delicate ecosystem within a short period of time.

7.6.3 Political divides

None of the interview partners mentioned that the future of the campsite is openly debated, nor that the problems are on a political agenda. Although the campsite is recognized as a common economic asset by the islanders and is a daily topic within the community, which also has a variety of opinions on how to tackle its current problems, it is neither extensively discussed on a political platform, nor is it part of the decision-making process in the municipal council. On an administrative level, interview partners of the municipality stated that they feel their hands tied by the burdens of bureaucracy. Proposals and requests from the municipality to the state and regional authorities need a long time to be processed or get altogether 'stuck in bureaucracy'.

7.6.4 Economic divides

The economic dimension of the conflict is one of the main obstacles. In order for Platia to become a legal campsite, major investments have to be made. In Greece there are generally hardly any loans granted for projects of municipalities. Banks inside as well as outside of the country are even less likely to give money to private entrepreneurs,

as Greece is ranked very low in its creditworthiness. Several private investors have made offers, but there is a major distrust against them, as various actors involved don't want Platia to change too much or become a standard mass tourism campsite, as they fear that investors only act in their own interest and are mainly motivated by maximization of profit. One of our interviewees stated that: *"we don't want an investor; we just want money"*. This shows that there is a reluctance behind letting a private person invest into Platia, because they might change the campground in a way that is against the interest of the local population, or they might just gain profits without properly taking care of the site.

7.7 Discussion

The problem can be summed up as follows: the campsite Platia is currently in a legally grey area – while it lacks the proper infrastructure to be run legally, it can't be closed down altogether, since it takes the load of free campers from the rest of the island. For this reason, the municipality currently keeps it running without charging any entry fees. Our results demonstrate that there is a general agreement between all actors involved that the infrastructure of the campsite Platia needs to be improved, while the 'natural' appearance should remain unchanged. We have identified three groups of people that showed similar views concerning this problem: indigenous locals, locals and foreigners. These are characterized by a lot of mistrust and scepticism against each other. Additionally, the locals/indigenous locals consider Platia their 'personal' asset, which is why they fear losing it. Since it is located on forest land the natural appearance must be kept, as by law only 10% of the surface area can be built up, but on the other hand this complicates find someone willing to invest in it. At the moment the municipality must take care of Platia's infrastructure, even though it can't generate any income from it. Since the municipality has very limited economic resources, it can't keep this up forever, which is why a solution must be found soon.

The aforementioned problems could be solved if an investor were found that would be willing to invest into the campground without changing it too much. But due to the economic crisis Greece is still experiencing, there are very few loans given out for projects in Greece. Since according to our interviewees, none of the locals would be able to provide the economic resources necessary to improve the infrastructure of the campground, a foreign investor with sufficient financial resources would have to be found, but the locals are afraid an outsider might take over the campground and change it completely in order to benefit economically. They consider Platia as an asset and it is important to them that they can benefit from it in the future, too. The Greek bureaucracy further limits the range of action, as processes typically take very long, and the results are uncertain. All this leads to the conflict being stuck, and it almost seems like there is no way out.

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Appendix 1: Interview Guidelines

The interview guidelines were created in the framework of political ecology, which divides the questions into: status quo/socio-cultural/political/economic/ecological	
Status Quo/History/Management	<p>How is the current situation on the campsite?</p> <p>How long does the campsite already exist?</p> <p>How did it develop?</p> <p>Who manages the campsite? How is it managed? Which role do certain stakeholders (e.g. municipality) play in managing the place?</p>
Socio-cultural/political	
<ul style="list-style-type: none"> Personal relations 	<p>Do you use/visit the campsite yourself?</p> <p>How often do you go there?</p> <p>What do you think about camping on the island in general?</p> <p>What's your personal opinion of the campsite <i>Platia</i>? Do you think the campsite should be maintained?</p>
<ul style="list-style-type: none"> Perceptions of others 	<p>What do locals (restaurant owners, farmers) think about the campsite and the campers?</p>
<ul style="list-style-type: none"> Conflict 	<p>Are there different interests from different actors? Which different interests exist on the campsite? How are different interests acted upon?</p>
<ul style="list-style-type: none"> Future/Development 	<p>Do you want to modernize the campsite or keep it as is? What suggestion and recommendations do you have for a sustainable development? Who should manage the campsite in the future?</p>
Economic	
<ul style="list-style-type: none"> Economic 	<p>Do you think the campsite offers a relevant income?</p> <p>Does <i>Platia</i> need an investor?</p> <p>If yes, would you prefer rather an outside or inside investor? Is there any person interested in it?</p>

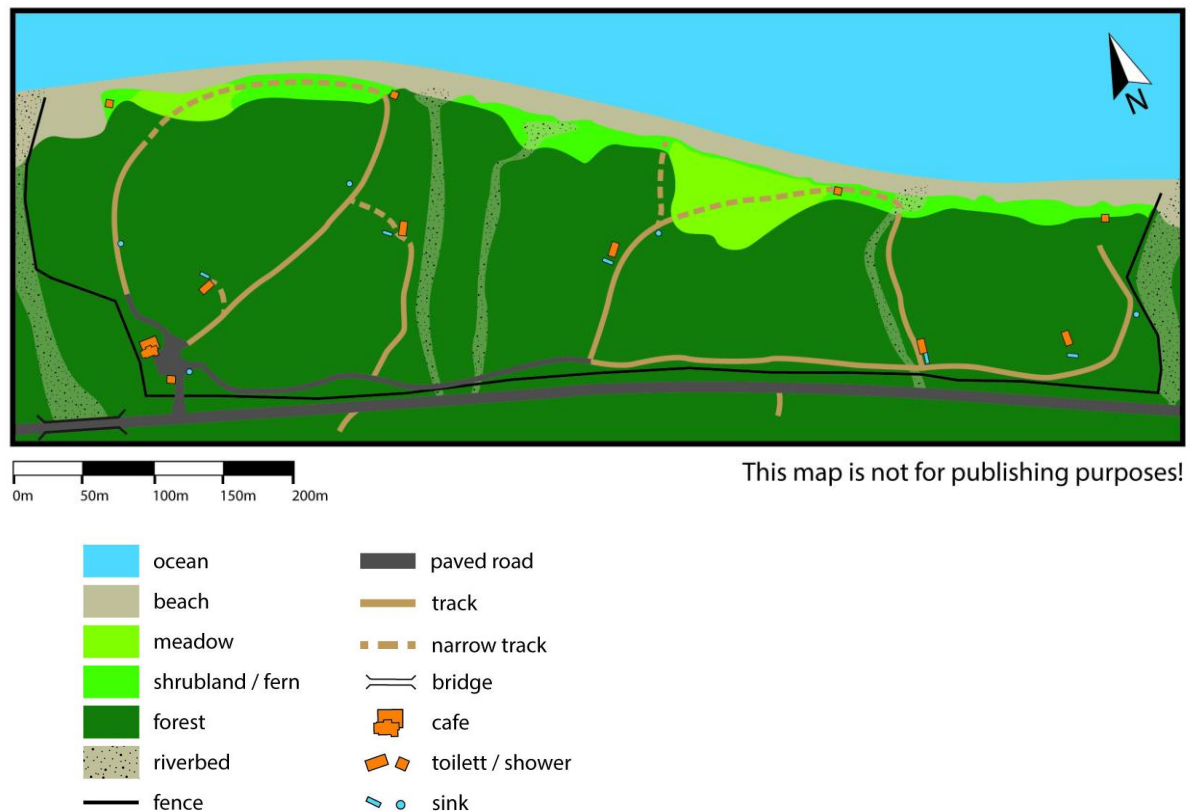
Ecological	
<ul style="list-style-type: none"> • Ecological /Infrastructure 	Does the campsite operate in an ecologically friendly way? Are there any ecological problems because of tourism? Does the campsite need a new form of infrastructure? How does the sewage system, waste separations etc. work? Where does the waste go?

Appendix 2: Concept for developing the area of Platia, Samothraki, into a legally licensed eco-campsite while maintaining its natural wilderness

Marina Fischer-Kowalski

Introduction

Platia is a fenced area of about 15ha directly at the northern coast of Samothraki. It is mostly covered by forest and dedicated as forest area. It belongs to the local municipality and has been used as a campsite for many years, but was never legalised as such. It is currently equipped with one café (in the entry area where construction is permitted), 15 toilets/showers/water sinks and a fire alarm with firehose system spread throughout the area. In earlier years, when the municipality still controlled entry, it counted up to 1200 campers per night in the main season.



A random survey of 430 campers in summer 2017 by the scientists from the University of Natural Resources and Life Sciences, Vienna, brought the following results: Of the campers, 80% came from Greece (among them 8% from Samothraki itself or from Alexandroupolis), and 20% from other countries. 15% were there for a short stay only (less than a week), and one third for three weeks or more; the average duration of stay is almost 3 weeks. 40% of the visitors were there for the first time – but more than three quarters of them said they would certainly come again. For a tourism site,

this shows a truly exceptional enthusiasm for the place. Less than 1% said that they would not come again.

What did make them so enthusiastic? The most frequent answers they spontaneously gave why they liked the place so much was “freedom”, “being in touch with nature”, “calmness/relaxation” and “solidarity, community”. They appreciated in particular wilderness (88%), trust among the campers (75%), informality and low cost (72%), tolerance for naked bathing, and for dogs (each about 60%), low noise level (52%), and no electricity (49%). With respect to these qualities, there was practically no difference between Greek and foreign visitors. The only improvement a slight majority asks for refers to toilets and showers –but only a minority asks for warm water (11%) or electricity (16%). Even to the contrary: there seems to be quite a resistance against a major modernisation of the camping site. If this happens, 19% would stop visiting Samothraki, 7% say they would rather rent a room, and 74% would then rather free camp.

As far as the economic benefit of the campers for the island is concerned, there is obviously income for the restaurants (40% go to a restaurant every day or every second day). We find also a certain willingness to pay for the camping: 3-5€/person/day seem acceptable for a large majority, while one fifth would not be willing or able to pay. Improvements on the camping site increase the willingness to pay only slightly. On the other hand, the campers pose just a small burden on the island infrastructure: 62% move by foot, bus or bicycle.

Development concept

Thus it seems possible, and well-adjusted to existing needs, to develop a low cost eco-camping site in this area that does not violate forestry regulations (in particular, not require building any additional infrastructure anchored to the ground) and thus be legally acceptable. It should put nature preservation above modern personal comfort. Therefore, it would not aspire to more than a one star certification according to Greek camping regulations. The legal requirements for certification will be met. In particular, within and beyond legal requirements, the following measures will be taken:

- a thorough repair of the existing showers, water sinks and toilets, making use of water saving technologies, without extending their ground area
- provide a regular (at least daily) cleaning and repair service to existing facilities
- establish a (dislocated) system of organic cleaning of the wastewater now collected in individual drainage pits that need to be regularly pumped out and their contents properly be disposed of and cleaned

- secure a low level of noise and air pollution by keeping motorized vehicles out of the campsite as far as possible (provision of shaded parking outside; price policies; caravans invited to choose the Varades Camp instead)
- offer alternate means for transportation for rent (bicycles, ...)
- provide night-time illumination at the toilets and along the main paths by solar lights, avoiding light pollution. Therefore, there is no need to electrify the whole area.
- control and if necessary updating the existing fire security facilities
- establish (decentral) facilities for a thorough separation of wastes, enforcement of rules not to soil the ground with cigarette butts, plastic and metal pieces
- establish Wi-Fi across the campsite, and using it (also) for the communication of events and programs on the island
- develop a low price policy for individuals/tents, but charge motorized vehicles to be parked within the ground. Taking into account that the area has served as a summer resort for many local people, favourable seasonal cards will be offered.
- make efforts to attract groups of people for educational or cultural events and offering them favourable conditions for their activities at the campsite
- lease the café to a local entrepreneur who is willing to share the philosophy of the place and collaborate in developing it further.

The eco-camp will offer two job positions all year round: one professional general manager responsible for finances, personnel, marketing, communication and program development, and one facility manager in charge of development and maintenance of all technical equipment. During the season that hopefully can be extended from the end of May to the end of September, further personnel will be employed. All employees will be offered education and training to develop their personal qualification further. The campsite will seek international recognition as an exemplary eco-camp (see for example <https://ecocamping.de/>) and thus support the island in its touristic reputation as well as in extending its tourist season.

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