An agroecological inquiry into the sustainability of a small-scale goat farm in a mountain village in northern Italy

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Foreword

Enrolled in the Agroecology master's program at the Swedish University of Agricultural Sciences, I first came to Trento as an Erasmus student at Trento University in April 2022. Marco Tasin, a former lecturer at my home university, had moved back to his hometown Trento and created a farm called Mani in Tera. As I was coming from an academic background in Economics and Finance, from the University of Exeter in England, I was eager to delve into farming and reached out to Marco for an opportunity to learn. He then connected me with Professor Francesca Forno at Trento University's Anthropology Department, and, shortly thereafter, I became an Erasmus student at her department, tasked with studying the regional organic and biodynamic farming movements. This journey led me to work in four different farms: two vegetable farms (Mani in Tera, Azienda Agriecologica Mussoni Tomas), one medicinal plant farm (Naturgresta), and one goat farm (Capra Punk). I stayed in Trentino until mid-June and knew that I wanted to return. Recognising the potential for writing my thesis, I considered it a win-win opportunity to get to come back and focus my research on the goat farm given its remote location, challenges, reality checks, and the inspirational strength of its people. In the meantime, I wrote two essays focusing on the environmental impact of goats as well as their resilience value for this particular family and community.

One year later, in April 2023, I returned for a two month stay and immersed myself in the business to understand its dynamics fully. I believe that for a genuine agroecological practise, learning should be a mutual process, benefiting both parties. While Ernesto Benfari, the goat farmer, offered me a system to write my thesis about, along with free housing and meals, I reciprocated by providing a helping hand, discussions on ideas and sometimes collaborative innovation. Additionally, the uniqueness of my situation, being a student from Sweden researching a goat farming business in Italy, intrigued many, and essentially served the function of an effective marketing campaign for his business.

Abstract

This dissertation addresses the sustainability profile of Capra Punk, a goat farm situated in a mountain village in Trentino, in northern Italy. Through a blend of qualitative and quantitative data analysis methods, using participatory observation and questionnaires, the study evaluates Capra Punk's sustainability from an agroecological point of view. It reveals that Capra Punk is facing considerable sustainability challenges despite having come far in its agroecological transition. Financial and temporal constraints, along with an asymmetrical subsidy landscape, present obstacles for the farmer, Ernesto, in maintaining and developing the business. Although Capra Punk aligns with the objectives of the Italian CAP strategy and the Trento Five Priority Goals (SproSS), there is a lack of appropriate support for small-scale farmers like Ernesto. Consequently, this case study highlights the broader systemic challenges within agricultural support systems and the need for more effective alignment between policy objectives and their practical implementation.

Keywords: Goats, Margone, Sustainable Development, SDGs, Agroecology, Farming, Farming business, Agroecosystem, Economic-, Social-, Environmental viability, Trentino, Trento, Common Agricultural Policy (CAP), Trentino Provincial Sustainable Development Strategy (SproSS), Support.

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1. Introduction

The Covid-19 pandemic (Gebeyehu et al., 2023), extreme climates (Vogel, 2019), rising geopolitical instability (Behnassi and El Haiba, 2022), and trade disputes (Hopewell and Margulis, 2023), have exposed the fragility inherent in global food supply chains. Alongside the negative environmental externalities of industrial agriculture, the growing global human population, and the sustainable development objectives signed by all UN countries, these events highlight the need to rethink the design of our food systems to prioritise sustainability and resilience.

Within a European Union context, the EU Green Deal acknowledges, amongst other measures, the importance to support farmers transitioning to more sustainable practises and to reinforce farmers already employing sustainable practises (EU, 2021). Attaining sustainability involves social, environmental, and economic considerations, and it's difficult to achieve complete sustainability, as one dimension often collides with another (UN, 2015). Especially for small-scale farmers, market conditions and agricultural policy are failing to promote economic sustainability (Guth et al., 2022).

Looking at dairy goat farms in FGIS countries (France, Greece, Italy, and Spain), Pulina et al. (2018) showed that a significant number of these farms are not financially viable. In Italy, where goat farming is mainly semi-extensive and extensive, goat milk isn't subsidised like cow and buffalo milk. This makes it difficult for goat farmers to compete for income and charge prices that cover their costs, earn profit and are reasonable for consumers. Mena et al. (2017) observed that goat pastoral systems in Andalusia are declining despite their social and environmental benefits. Furthermore, Papadopoulou et al. (2021) found that for Greek sheep and goat farms creating time for grazing commonly involves opportunity costs comparable to the lower costs of external feeds, thus only really contributing to the well-being of the goats and, generally, ecological services. Pulina et al. (2018) and Mena et al. (2017) propose that a strategic priority for Italy (Spain) should be to pay extensive and semi-extensive goat farms for their "ecosystem and social services" to address economic difficulties and disparities.

Ernesto, a small-scale dairy goat farmer in a mountain village in northern Italy, embodies this broader struggle for sustainability and resilience. His farming business, along with the institutional support systems, will be the focus of this dissertation.

1.1 Case Study: Capra Punk

Capra Punk is a goat farm situated at an altitude of 900 meters in Margone, a mountain village in northern Italy. Ernesto, the farmer, has a background in law and tourism and had no previous agricultural experiences when he created the business in 2022. The name of the farm is based on "Capra", which is Latin for goats, and "Punk", which refers to their rebellious character. Capra Punk bridges both natural and agricultural ecosystems. of the goats graze in about 10 hectares of forest throughout the year, resulting in a total farmland area of 10,15 hectares. With a herd size of 25 does, Capra Punk is slightly smaller than the Italian average of 36 does for goat farms (Pulina et al., 2018), which is still small-scale compared to averages in Spain (60), Greece (160), and France (190). Furthermore, like many goat farms in FGIS (France, Greece, Italy and Spain) countries, Capra Punk processes the milk itself and produces a range of artisanal products, such as fresh cheeses, cave-aged cheese, salami, and acid-whey-based bread, which are sold at local markets and regional fairs.

1.2 Value of this paper

As highlighted by Sandrucci et al. (2018), there is a lack of research on goat farming systems in Italy, with limited studies available. Existing literature is primarily concerned with goat production systems in Lombardy, in northern Italy, and with specific aspects such as milk composition (Pazzola et al., 2019; Paschino et al., 2020), physiological attributes

(Pragna et al., 2019; Yadev et al., 2013; Silanikove, 2000), environmental impacts (Zucali et al., 2020; Elias and Tischew, 2016; Lascano et al., 2011), and diseases (Di Cerbo et al., 2010; Lambertz et al., 2019). However, a critical gap exists in studies specifically addressing the sustainability of goat production systems, particularly through an integrative approach as part of the overall farming system and extending beyond surveys, like Ripoll-Bosch et al. (2012) for dairy sheep in Greece. Drawing on this, as far as I'm concerned, this dissertation is the only paper which discusses the sustainability of a(n) specific (extensive) dairy goat farm in northern Italy. Therefore, it offers valuable insights into the realities of managing a(n) (extensive) dairy goat farm in this setting. By highlighting the challenges, it can help aspiring farmers making decisions and it can help policymakers with identifying areas where current policies are either non-existent or existing ones are inadequate.

1.3 Mission, Research questions, Hypothesis

The aim of this paper is to discuss the sustainability of Capra Punk. This involves identifying the necessary steps, along with the responsible parties, required to establish it as a viable farming business across all dimensions of sustainability: social, economic, and environmental.

By the end of this paper, I hope to have answered these questions:

1. How sustainable is Capra Punk from an agroecological point of view?
2. Which challenges contribute to the difficulty of being sustainable?
3. What changes are necessary to improve business viability and sustainability?
4. Should institutional frameworks like the Trentino Five Priority Goals (SproSS) and the Italian Common Agricultural Policy (CAP) play a role in facilitating these changes, and if so, for what reasons?

Hypothesis: Although Ernesto is still young at 34 years of age, and he's incredibly hard working and purpose-driven, achieving economic sustainability is a considerable challenge given the limited herd size and animal-friendly business model. Without institutional support, sustaining Capra Punk is physically exhausting, socially taxing, and economically improbable for Ernesto.

1.4 Road map

The thesis is structured into six sections. After the introduction, the paper discusses the underlying theoretical frameworks that guide it. These include the concept sustainable development, the Sustainable Development Goals (SDGs) as applied within the Italian national and regional context, the Italian Common Agricultural Policy (CAP) strategy and the Trentino Five Priority Goals. Additionally, it provides a brief overview of Agroecology and its recent political and practical significance, along with an introduction to the Tools of Agroecological Performance Evaluation (TAPE) analysis framework. The next section presents the material and methods, including participatory observation, questionnaires, and the TAPE framework. Thereafter, the results section delves into the farming system using the TAPE framework and is followed by a discussion of the findings. Finally, the conclusion evaluates the farming system's sustainability and discusses areas for improvement.

2. Theoretical Framework

2.1 Sustainable Development

With technological innovations like fossil fuels extraction and combustion, N-fertilisers, and pesticides, alongside land use changes in favour of agricultural production and a growing human population, the nature, scale, and complexity of the consequences of our actions have expanded and intensified. It's within this context, the recognition of our immense capabilities and their associated risks, that the concept sustainable development was coined over 30 years ago, in 1987, with the publication of the Brundtland report by the United Nations. Titled "Our common future", the report emphasised that economic, social, and environmental health go hand in hand, and must be addressed in tandem to facilitate a "development that meets the needs of the present without compromising the ability of future generations to meet their needs" (Brundtland, 1987).

In the years following 1987, sustainable development has increasingly shaped national and international agendas, paving the path for Agenda 21 in 1992 and more importantly, the Millennium Declaration in 2000. The latter represented the first global initiative to tackle a set of social, economic, and environmental issues. Central to the declaration were the Millennium Development Goals (MDGs) composed of 8 goals and several quantitative targets to be reached by 2015. However, as the target year approached and it became clear that the goals would not be achieved, the UN organised a conference in 2012, resulting in Agenda 2030 and the Sustainable Development Goals (SDGs). Like the MDGs, the SDGs reflect a global participatory scheme for addressing global challenges, with clear deadlines and targets. It aims to address the climate emergency while building equal and competitive societies that have eradicated hunger. To achieve this, several instruments are used, including political, technological, and financial strategies (European Commission, 2021). The private sector plays an important role, leveraging problem-solving capacity, innovative mindset, and financial resources essential for reaching the ambitious goals by 2030. However, everyone is encouraged to participate. Evidently, the ability to participate varies across the world, and so do responsibilities.

Figure 1. UN Sustainable Development Goals (UN, 2015)

According to the FAO (2017b), food and agriculture can be linked to all the SDGs. Drawing on this, the infrastructure around food has a decisive impact on ensuring a sustainable development.

Figure 2. Food and Agriculture and the SDGs (FAO, 2017b)

2.1.2 National: The SDGs and Italy

Being a UN member country, Italy adopted the global sustainability agenda in 2015, and created the National Strategy for Sustainable Development 2017/2030 (NSDS). In line with the five P's that conceptually underscore Agenda 2030 – People, Planet, Prosperity, Peace, and Partnership – the National Strategic Objectives, 21 in total, are grouped into these five areas (Italian Ministry for the Environment Land and Sea, 2017).

Italian ambitions include to promote de-urbanisation in marginal areas, address poverty and social exclusion within and in-between communities and territories, preserve natural and cultural heritage, reverse biodiversity loss, establish a circular bioeconomy that pushes for local distinctiveness, and minimise emissions while offsetting disruptions to carbon, phosphorus, nitrogen cycles.

Given the situational differences between the regions, regional and local authorities have implemented their own strategies in line with the National Strategic Objectives. The following section outlines how Trentino contextualised the National Strategic Objectives.

2.1.3 Trentino and SDGs

In 2018, Trentino created the Provincial Sustainable Development Strategy (SproSS), which led to the publication of the Final Provincial Strategy Document in 2021 (Provincia Autonoma di Trento, 2021). The document highlights 20 objectives organised into five priority goals. The goals are to create 1) a smarter Trentino, 2) a greener Trentino, 3) a more connected Trentino, 4) a more social Trentino, and 5) a Trentino closer to its citizens. Stakeholders in the development process were civil society, local NGOs, public tourism agencies, foundations, private sector, municipal mayors, and public entities. The methodology used to decide on the targets and measures that would indicate progress was to model future scenarios based on macro trends.

1) **A smarter Trentino**: the aim is to implement sustainable waste management systems, to promote zero-waste projects, to create a circular bioeconomy, to promote education opportunities for everyone at every age group and to provide support mechanisms for the completion of education programs.
2) **A greener Trentino**: the aim is to increase the use of renewable energy, and simultaneously decrease the total energy use which is to say to make the energy use in homes and industries more efficient; to promote biodiversity by preserving natural ecosystems and resources, all whilst remaining mindful of the challenges posed by the climate crisis. Objectives target water, emissions, and biodiversity.
3) **A more connected Trentino**: the aim is to decrease the use of non-renewable energy in the transportation system and in doing so contribute to cleaner air. This involves investing in more pedestrian and bike lanes, to promote the use of electric vehicles and to put in place electric charging points. Moreover, it entails to incentivise non-renewable energy production and consumption by communities using, for example, photovoltaic energy.
4) **A more social Trentino**: the aim is to foster a culture that is free from both discrimination and violence and is inclusive. Getting there involves objectives related to housing, gender equality, poverty reduction, corporate social responsibility, and engaging youth into sports. (A more social Trentino)
5) **A Trentino closer to its citizens**: the aim is to build resilient communities and bring them together by promoting sustainable development (all previous points) across urban, rural, and mountain regions. This involves identifying and emphasising the unique characteristics of each area by drawing on the expertise of local actors (values).

2.2 CAP

The Common Agricultural Policy (CAP) is the oldest still active policy of the EU. Created in 1962, the founding countries (Spain, France, Belgium, Germany, Italy, Netherlands) of the then European Communities, wanted to create a coherent support system for European agriculture. Today, an astonishing 1/3 of the EU budget is used to (European Parliament, 2024):

1. provide affordable, safe, and high-quality products for EU citizens
2. ensure a fair standard of living for farmers
3. preserve natural resources and protect environment

The CAP has been reformed a few times, and the recent CAP reform 2023-27 intends to provide more specific support to farmers and give more freedom to member countries in interpreting objectives due to differences of local needs.

2.2.1 Descaling CAP: The Italian CAP Strategy

Unsurprisingly, the Italian CAP Strategy follows current best practise and is divided into an economic mission, an environmental mission, and a social mission (European Commission, 2024).

Economic mission
Involves helping farmers through direct (€17.61 billion) and redistributive (€1.76 billion) payments, and sectoral (€3.26 billion) support. By improving the design of the economic support system, the hypothesis is that there will be more viable farms and thus a supply chain that will be more competitive internationally.

Environmental mission
Involves reimbursing farmers for their costs (spent and opportunity) of implementing climate and eco-friendly practises such as cover cropping, setting up flower (buffer) strips, reducing their use of synthetic N-application and pesticides. Moreover, €2 billion will be invested in pollinating organic farming so that, by 2027, the principles of organic farming will command 25% of all UAA.

Social mission
Given the trends of urbanisation, farm consolidations, and a decreasing number of people employed in agriculture, the social mission is to boost the socio-economic health of rural and peri-urban areas by primary enlisting the help of the younger generation, women, and the long-term unemployed. This involves creating and incentivising agricultural and other job opportunities in rural areas, establishing food and bio-districts, smart villages, and promoting animal welfare (increase space per animal, time spent outside stable, limit use of antibiotics, antiviral etc.).

Lastly, the CAP Strategy emphasises the need to upgrade agricultural production systems and rural areas through innovation and digitalisation. A key aspect to this is creating an infrastructure which allows farmers, entrepreneurs, and workers to receive such knowledge and training. Achieving this involves educating consultants, encouraging existing knowledge exchange groups such as the Agricultural Knowledge and Innovation System (AKIS) and groups within the European Innovation Partnership (EIP).

2.3 Agroecology: A brief history and definitions

Since the term agroecology first appeared in scientific literature in the 1920s (Bensin, 1928), its meaning has constantly evolved, aligning with the ever-changing socio-cultural zeitgeist, and capturing the attention and intentions of various groups (Wezel et al., 2009). Following the Green Revolution in the 60s, agroecology transcended its scientific roots, diversifying into practical applications in the 80s and political dimensions in the 90s. Based on this holy trinity of science, practise, and social movement, agroecology can be characterised as a holistic and evolving approach to agriculture that reimagines the entire food system beyond mere production methods. Its significance lies not only in what is produced and how it is produced, but also encompasses considerations of who benefits, along with the broader externalities involved. Through the integration of ecological principles with socioeconomic factors, agroecology aims to offer a pathway towards resilient and ecologically sustainable food systems.

Various definitions of agroecology shed light on its multifaceted nature:

According to Agroecology Europe “Agroecology is considered jointly as a science, a practise and a social movement. It encompasses the whole food system from the soil to the organization of human societies” (Agroecology Europe, n.d.)

Francis et al. (2003) define agroecology as “The integrative study of the ecology of the entire food systems, encompassing ecological, economic and social dimensions, or more simply the ecology of food systems”.

Food and Agriculture Organisation (FAO) of the United Nations view agroecology as "an integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of food and agricultural systems. It seeks to optimize the interactions between plants, animals, humans and the environment while taking into consideration the social aspects that need to be addressed for a sustainable and fair food system" (FAO, 2018)

Despite regional varieties in the expression of agroecology, certain universal principles remain applicable across diverse contexts. The next section outlines the 10 Elements of Agroecology as developed by the FAO (2019).

2.3.1 Ten Elements of Agroecology

As indicated, to the FAO, agroecology offers the opportunity to create a sustainable and fair food system that is capable of meeting current and future world population food needs. To help policymakers, practitioners, and stakeholders with agroecological transition processes, in 2019, following multi-actor meetings, the FAO created the "10 Elements of Agroecology". Notably, the FAO formalised the work of Altieri (1995) and Gliessman (2015), incorporating the five principles of agroecology and the five levels of agroecological transition into an UN-endorsed framework.

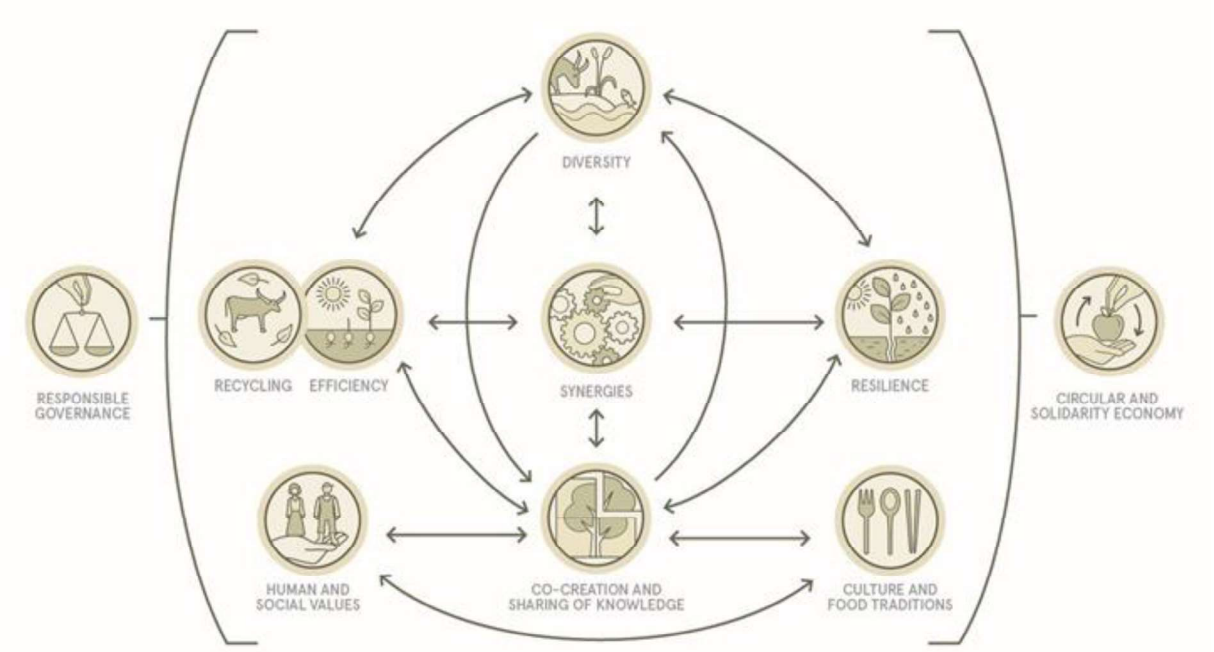

Figure 3. Ten Elements of Agroecology (FAO, 2018)

The elements Diversity, Synergy, Recycling, Efficiency, and Resilience focus on agricultural production. On the social and cultural front, the elements Co-Creation and Sharing of Knowledge, Human and Social Values, Culture and Food Traditions, delve into the dynamics shaping agroecological emergence. Lastly, Circular and Solidarity Economy and Responsible Governance address socio-economic structures aligned with agroecology.

2.4 TAPE

Testing the hypothesis that agroecology can enhance food system sustainability and fairness, the FAO was tasked to develop an analysis framework, which is based on the 10 Elements of Agroecology, and evaluates the performance of agroecological system. Leveraging existing frameworks like MESMIS, GTAE, SAFA, and RISE, the TAPE (Tool for

Agroecological Performance Evaluation) framework and database was created in 2019. The framework incorporates a standardised protocol and metrics applicable to any context, thereby enabling the establishment of a comprehensive database, which serves as a repository for evidence on agroecological practises. Furthermore, the database allows for comparisons of agroecological systems across geographies, as well as timeframes, offering context-specific analysis and snapshots, making it an invaluable tool for evaluating the diverse dimensions of agroecology (i.e. measuring performance prior and post implementation of an agroecological principle).

2.5 Literature review

Why Goats are also known as "Village Banks" and "Friends of the Farmers"

In comparison to other ruminant livestock, goats are unmatched in their abilities to cope with both short-term and long-term climatic shocks, making them a valuable socioeconomic insurance for people worldwide (Silanikove, 2000). Beyond their cultural, environmental, and climatic contributions, setting up a goat production system is more cost-effective compared to other ruminant farms. This relative affordability has played an important role in the doubling of the global goat population to over one billion since the 1980s (FAO, n.d.).

From a nutritional point of view, goat milk and goat meat contain healthy proteins and fat, which are more easily absorbed by the human body due to their closer genetic resemblance compared to other ruminants (Pragna et al., 2018). Furthermore, goats are superior in (a) regulating their metabolism depending on food supply (Yadev et al., 2013), (b) converting food to feed (Silanikove, 2000), and (c) adjusting to or withstanding extreme climates.

Environmentally speaking, goats have a particular grazing behaviour. Unlike other ruminants, goats tend to feed with their heads up, targeting bushes, branches, and leaves, removing fire-sensitive vegetation. For this reason, goats have been used to help clear forests and promote fire-resistant vegetation.

1927 Goat Tax

In 1927, Italy implemented a goat tax, resulting in the displacement of people living in marginal rural areas. It became too expensive to keep goats, and because goats commonly served as "village banks", families had to migrate, fuelling urbanisation and the abandonment of homes and villages throughout northern Italy (Morettini, 2023). Beyond its social impact, the tax caused a decline in the goat population and essentially rebalanced the proportions and utilisation of ruminant animals in Italy. Because the ecological rationale underlying the tax was unjustified, the 1927 Goat Tax underscores the necessity of well-designed environmental policies that include socioeconomic considerations. Although the tax no longer exists, challenges persist due to subsidy schemes and power struggles between landowners (i.e. municipalities) and pastoralists, further complicating extensive goat production systems. Morettini (2023) emphasises the necessity for regional policies and national/international directives to acknowledge the contextual differences in lifestyle, geography, agricultural affordances, and food security prospects, to prevent social injustice in marginal areas.

Goat farms and goat breeds in Italy

In Italy, dairy goat farming systems vary in kind ranging from intensive indoor systems to extensive pastoral systems. In intensive systems, breeds like Saanen and Alpine are often chosen for their high yields, whereas in more extensive systems, local varieties adapted to the given outdoor environment are more common (Sandrucci et al., 2018, Manfredi et al., 2010). Over the past two decades, technological advancements and economic incentives have led to a notable increase in the number of intensive goat production systems.

Goat Milk Production

Sandrucci et al. (2018) explored the correlation between management practises, goat breeds and milk quality and quantity in Lombardy, Northern Italy. Their study involved interviews with farmers from 173 farms who were either producing milk for on-farm cheese production or supplying milk to cheese producers. They found that the average milk production per goat including both intensive and extensive goat farms was 1.25kg per milking.

As goats produce less milk (300-600 litres/year) than dairy cows (3000 litres/year), they require less water and feed. It is worth noting, however, that in some settings, such as Europe, cow milk is subsidised, which eventually pays for the costs of water, feed, and the original infrastructure investment, which differs from the situation with goats.

SDG Performance Italy and Regions

According to the European Sustainable Development Report 2022 (Lafortune et al., 2022), which assesses the performance of European countries, EFTA countries, candidate countries, and the UK, in achieving the SDGs, Italy was ranked 19th out of 34 in 2022. Having fulfilled 70.6% of the targets, there remains significant work ahead for Italy to improve its sustainability performance (Lafortune et al., 2022).

At the level of the targets, the performance of the regions varies widely within and between the sustainability dimensions. An emerging pattern is that northern regions and northern cities are at the top of sustainability rankings. In turn, central regions and cities exhibit higher scores than southern regions and cities. Based on the individual sustainability dimensions, the northern regions are ranked 1st socially and economically, while the central region is ranked 1st environmentally. Specifically, three northern regions – Province of Trento and Province of Bolzano (Trentino Alto Adige), and Valle d'Aosta – consistently display the best sustainability performances, regardless of how performance is measured; if across dimensions or based on a singular one, if weighted by SDG goal (EWG) or by SDG indicators (EWI). Notably, these three regions had low scores in SDG target 2.4, indicating a struggle to increase the cultivation of organic crops to 25% of all utilised agricultural area. Abruzzo is an outlier amongst the southern regions, scoring above the national average in all contexts, while Marche and Toscana shine in central Italy. It is important to recognise that the analysis is based on 28 targets proposed and measured by ASviS, with a disproportionate representation across goals. Therefore, while providing valuable insights for policymakers and civil society, the highlighted trend may not fully represent the region's performance in meeting the SDGs.

Given that there is a long way to go, D'Adamo and Gastaldi (2022) propose that Italian regions must enhance (a) local resource efficiency, (b) free more funds for research and development given that investments and innovation trigger economic growth and job creation, and (c) enable the establishment a more circular economy, aligning with the "green, bio and circular Made in Italy" program. Their paper concludes on a somewhat pessimistic note, highlighting that "Sustainability is not a trend, and the natural disasters of recent times define the urgency of implementing policies that promote sustainable actions and practices".

3. Materials and Methods

3.1 Data collection and interpretation

The information was collected following two strains of inquiry: participatory observation and TAPE surveys performed as semi-structured interviews. Furthermore, secondary information was collected using google scholar to learn about (a) the cultural, economic, social, and environmental values of goats, (b) the history of the 1927 goat tax and the associated socio-economic implications for mountainous areas in northern Italy, (c) the sustainable development performance (Sustainable Development Goals) of Italy and its individual regions, (d) the Italian CAP Strategy, (e) Italian farm structures, and (f) the Provincial Strategy for Sustainable Development (SproSS) of Trento Province. All this helps explain the farming business Capra Punk and whether it's supported in its agroecological transition.

Participatory Observation and PRA

Participatory observation entails that you as a researcher actively engage in the activities of the system under study. There are three parts to it: preparation, participation, and processing and analysis. In the final step, the observer withdraws from the system to objectively analyse the experiences (Chambers, 1994).

Participatory Rural Appraisal (PRA) grew out of the Rapid Rural Appraisal (RRA) framework in the late 1980s. Opposing the unilateral approach of RRA, PRA emphasises collaboration and empowerment by facilitating inclusive discussions with people part of the system under study. Thereby, this approach encourages collective participation in analysing findings, outlining key takeaways, and coming up with suggestions for improvements (Chambers, 1994; Townsley, 1996).

In my journey to understand Capra Punk, I immersed myself in the business to grasp its dynamics fully. For a genuine agroecological practise, I believe that learning should be a mutual process, benefiting both parties. While Ernesto offered me a system to write my theses about, along with free housing and meals, I reciprocated by providing a helping hand, discussions on ideas and sometimes collaborative innovation. Additionally, the uniqueness of my situation, being a student from Sweden researching a goat production system in Italy, intrigued many, and essentially served the function of an effective marketing campaign for his business. Furthermore, beyond contributing to the TAPE database, this analysis can help Ernesto with identifying his farming system's status as well as areas for improvements.

Prior to entering the farming system, I already had defined the aim for this paper (assess the sustainability performance of Capra Punk), the analysis framework (TAPE), and the research methodology (participatory observation and surveys wrapped up in semi-structures interviews). In preparation, I documented all the relevant questions, I anticipated requiring answers to. Additionally, I decided for myself that I would stay for a maximum of two months. Throughout my stay, I took notes on insights relevant to the aim of this paper (i.e. what the farmer thinks of the subsidy landscape) and kept a diary recording my experiences. This included informal conversations and hands-on tasks, such as goat herding, attending, and selling cheese and bread at markets and fairs, and communicating with customers and other producers. Upon leaving the farming system, I analysed my notes, and started writing this paper.

TAPE

As indicated, I used the TAPE analysis framework to assess the sustainability performance of Capra Punk. Presuming that societies will need to revise their agricultural systems, as well as other aspects of their food system (IPBES, 2019; FAO, 2018), it is likely that the adoption of TAPE will grow, making this analysis an important contribution to future policy recommendations.

The TAPE analysis framework comprises four steps. Step 0 sets the scene. It describes the production system and factors regulating agroecological emergence. Step 1 assesses the agroecological character of the farming system based

on the "10 Elements of Agroecology". Step 2 measures the sustainability performance using the "10 Core Criteria of Performance". These are spread across five dimensions outlined in Table 1, along with the assessment methodologies and the associated SDG indicators. Finally, step 3 discusses how the enabling/disabling environment (Step 0) shapes the agroecological character (Step 1) and how this in turn affects performance (Step 2).

I posed the questions of the TAPE questionnaire to Ernesto for steps 0 to 2, while step 3 findings resulted from informal conversations. The calculations for depreciation of machinery and equipment were based on Ernesto's estimates and publicly available company information. Given that women serve as proxies for calculating the value for the criteria dietary diversity, I directed the specific survey questions to his partner, Margi, also adopting a semi-structured interview approach. Steps 0 to 2 are covered in the results section, with step 3 comprising the discussion.

Although I spent close to two months in Margone, finding time to go through the TAPE questionnaire with Ernesto was everything but easy. Despite sharing meals every day, and our many car journeys going to markets, we rarely engaged in more formal conversations about Capra Punk. While we did discuss topics such as business philosophy, strategy, potential, and his personal motivations, it was more in a jovial, unstructured manner. Ernesto's busy schedule, and many phone calls, coupled with our exhaustion come evening, and family dinners, further complicated scheduling. With weeks passing by, I had to remind myself of what I had set out do and took on a more serious and structured approach to get the necessary information for my thesis. Despite my efforts, it wasn't until February 2024 that I managed to source all the information for TAPE. I had previously sent questions by email dating back to August 2023, which Ernesto promised to answer whenever he found time. Ultimately, I resolved all outstanding queries through these two phone calls on the 25th and 26th of February 2024. Arguably, this timeframe really underscores the time constraints and pressure Ernesto is on, among other things.

Table 1. "10 Core Criteria of Performance of Agroecology and their Links to SDG Indicators" (FAO, 2019)

MAIN DIMENSION	#	CORE CRITERIA OF PERFORMANCE	PROPOSED METHOD OF ASSESSMENT IN SURVEY	SDG	SDG INDICATORS
Governance	1	Secure land tenure (or mobility for pastoralists)	Type of tenure over land: property, lease + duration, verbal, not explicit (SDG 1.4.2, 5.a.1 and 2.4.1 sub-indicator 11) Existence and use of pastoral agreements and mobility corridors	1 2 5	1.4.2 2.4.1 5.a.1
Economy	2	Productivity	Farm output value per hectare (SDG 2.4.1 sub-indicator 1) Farm output value per person	2	2.3.1 2.4.1
	3	Income	Outputs - inputs - operating expenses – depreciation + other income (SDG 2.4.1 sub-indicator 2)	1 2 10	1.1.1, 1.2.1 and 1.2.2 2.3.2 2.4.1 10.2.1
	4	Added Value	Net income +rents +taxes +interests – subsidies	10	10.1.1 10.2.1
Health & nutrition	5	Exposure to pesticides	Quantity applied, area, toxicity and existence of risk mitigation equipment and practices	3	3.9.1 3.9.2 3.9.3
	6	Dietary diversity	Minimum Dietary Diversity for Women (FAO and FHI 360, 2016)	2	2.1.1 2.1.2 2.2.1 2.2.2 2.4.1
Society & culture	7	Women's empowerment	Abbreviated Women's Empowerment in Agriculture Index, A-WEAI (IFPRI, 2012)	2 5	2.4.1 5.a.1 5.a.2
	8	Youth employment	Access to jobs, training, education or migration (SDG	8	8.6.1

		opportunity	8.6.1)		
Environment	9	Agricultural biodiversity	Relative importance of crops varieties, livestock breeds, trees and semi-natural environments on farm (SDG 2.4.1 subindicator 8.1, 8.6 and 8.7)	2 15	2.4.1 2.5.1
	10	Soil health	Adapted SOCLA rapid and farmer friendly agroecological method to assess soil health (Nicholls et al., 2004)	2 15	2.4.1 15.3.1

Future Scenarios

To provide clarity on where Capra Punk is heading, this section, based on participatory observation insights, outlines the possible future pathways for the business. It describes Ernesto's necessary requirements for continuing the business and his vision both for Capra Punk and Margone.

4. Results

4.1 TAPE

4.1.1 Step 0 - Describing the system and its stage.

The paper looks at a silvopastoral goat farm based in the mountain village Margone in the north of Italy. At 950 meters above sea level, Margone rests on a plateau on Monte Gaza. Looking to the south, you can see as far as Arco and the northern tip of lake Garda, while to the north, the false peak of the 1600-meter mountain just escapes the density of the forest. A narrow road clinging to the mountain connects Margone and its neighbouring village, Ranzo, to the village Lon (alt. 552m) and the rest of Trentino. The city of Trento is about a 30-minute drive away, and Rovereto, Trentino's second largest city, is about 40 minutes away. Of the nearly 30 houses in the village, most are currently inhabited.

Table 2. Info Capra Punk

Name	Capra Punk
Type of production system	Silvopastoral dairy goat farm
Country	Italy
Region	Trentino
Municipality	Valle dei Laghi
Village	Margone (traditional writing: Malgon)
Coordinates	46°04'05.41"N 10°57'43.34"E[2]
Inhabitants	45 (2011)
People in household	5
Employed in production system	1

Capra Punk is a goat-based farming business which specialises in artisanal cheese making. It is different to other regional goat farms in that (I) it is based on a mountain, (II) the goats get to graze in the local forest throughout the year, and (III) hard cheese is aged in a cave. Moreover, (IV) the farmer had no previous agricultural experience when he started the farm, two years ago, and (V) given the size of the goat herd, the stable provides a lot of space, which is unusual due to the economics of space. The following paragraphs will provide some background of the farmer, Ernesto, and his family, describe Capra Punk's outputs and properties, and outline the economic, environmental, social, and cultural setting of the production system.

Ernesto lives in Margone together with his partner, Margarita, and their three children: Stella (4), Arturo (7), and Bruno (9). Before settling in Margone about 4 years ago, they lived close by in different villages. Margaritas parents, Gianni and Alba, had already lived in Margone for more than 10 years, and the house they bought and now live in is basically composed of two separate houses. So, today, Gianni and Alba live in the house on the first floor, and Ernesto, Margarita, and their children, live in the house on the second and third floor. The garage, heating facility, and the cheesemaking laboratory are located on the ground floor.

Margone
The terrain is mostly steep and there is a shortage of water. The former implies that other ruminants, maybe except for sheep, would struggle coping with the topographical challenges, and the latter keeps farmers from setting up shop in the village. Therefore, if the goal is to make a living by working with the immediate surrounding, then aside from stable-kept livestock production, there is little else to do to than goat farming. The land around the village is divided amongst

[2] GeoHack

the inhabitants, and while some households grow vegetables, the yield doesn't meet their demand for vegetables throughout the year. Hence, they source their food from mainly supermarkets but also farmers markets. Beyond Ernesto, one more person in the village keeps goats (13) and sheep (7). She allows them to graze around her and her husband's house, which is separated from the rest of the village by grassland. She doesn't have a farming business, but it's unclear if she milks them.

Goats and Margone

While goats arrived in northern Italy about 7,500 years ago, it's unclear when goats first appeared in Margone. However, it's likely that both domesticated and, especially, wild goat species came to populate and roam in and around Margone long before the earliest documented evidence. This evidence, found in a document at the Valle dei Laghi municipal office dating back to 1787, suggests that more than 100 people resided in Margone at the time. With each family keeping a few goats, the goat population exceeded 100. The document goes on to describe that local goatherds would lead the goats to graze in the forest and on pastures every morning. What happened since is not well-documented, but events like the 1927 goat tax led to drastic changes in both the goat population and residents of Margone.

Figure 4. Goats outside Margone winter 2023/24, photo by Ernesto

Outputs

Cheese, Yoghurt, Gelato, Salami, Bread

The goats yield about 20 litres of milk a day, averaging around 1l per goat. With a lactating period of seven to eight months, 6,300 to 7,200 litres of milk are produced each year, ceteris paribus. The milk is not an end-product but is transformed to a range of cheeses such as robiola, cacioricotta and cave cheese, as well as to yogurt, and gelato. As a by-product in the making of robiola, acid whey, is either returned to the goats, who love this liquid, or it is used in the

making of bread (collaboration with a Pizza baker in Trento). Each year, a few goats exit the system, either due to factors like age-related decline in milk production and quality, or because of illnesses and diseases such as anaemia. In the former case, Ernesto sends the goats to a butcher based in Roncone (1 hour away) who produces about 70kg of salami annually from Ernesto's goats. In the latter case, the animals are collected for incineration in Lavis (Vialo Trento Trade). Ernesto pays the butcher €35 per goat, and he pays the disposal company €4 per goat.

GHG

The system emits greenhouse gases, most notably methane as part of enteric fermentation, but also carbon dioxide and nitrous oxide through the fossil fuel-based machinery. Additionally, the demand for industrially produced feed indirectly contributes to the use of synthetic inputs, such as nitrogen fertilisers and synthetic plant protection products (i.e. synthetic pesticides, herbicides, fungicides). However, this dissertation is not concerned with investigating the direct and indirect emissions coming from this production system, although it would strengthen the environmental discussion. For a comprehensive analysis, I recommend conducting a Life Cycle Analysis (LCA).

Manure

While it is unclear how much manure the goats produce, it's not a relevant factor for this analysis. Inside the stable, manure gets mixed with hay and woodchips before being biannually applied onto local fields. During grazing, the goats also produce manure, which potentially increases soil organic matter content but also evaporate as a GHG. Like GHG emissions, this analysis will not address soil organic matter production.

Enabling and disabling environment

As highlighted in Table 3, almost 60 million people live in Italy, with 23 million people in employment. 41.5% of the total land area was agricultural land in 2020, totalling 12.5 million hectares. In the same year, the average farm size of approximately 1.3 million farms was 11.1 hectares (Table 5), ranking 10th in Europe (Eurostat, n.d.). Furthermore, around 913,400 people, 4% of the workforce, are employed in the agricultural sector (Table 3).

Economy

Despite the challenges posed by the COVID-19 pandemic and ongoing geopolitical conflicts in the sense of the Russia-Ukraine war and the Hamas-Israel war, Italy's GDP has been growing since 2020, with a 7.1% growth between 2021 and 2022, and a predicted growth rate of 0.7% for 2023 and 0.6% for 2024 (ISTAT, 2023). This trend is mainly attributed to an increase in domestic demand and increases in production costs and prices, which, in turn, caused a slight decrease in production volume, particularly in the agricultural sector. Agriculture including forestry and fishery represented 2.2% of GDP in 2022.

Table 3. Info italy[3]

Population	58,850,817
Average age	46.2
People in employment	23,085,750
Unemployment rate (%)	8.1
Employment in agricultural sector	913,400
GDP (current LCU)	2.085 trillion
GDP per capita (current LCU)	33,260
GDP growth (annual %)	3.7
Agriculture (forestry and fishery) share of GDP	2.2%
Inflation, consumer prices (annual %)	8.2

[3] Istat, Eurostat, Worldbank

Land surface area (sqkm) (2020)	302,068 (30,206,800 ha)
Forest area (% of land area) (2021)	35%
Agricultural land (sqkm)	121,315 (44%)
CO2 emissions (metric tons per capita) (2020)	4.7

Agriculture Profile

Around the world, Italy is known for its incredible food and wine culture. Despite ranking as the 8th largest country in Europe by landmass (Eurostat, n.d.), Italy is one of the largest and most diverse food producers and processors in the world, owing to its climate, soil, and topographic conditions. Fruits, vegetables, durum wheat, and olive oil are primarily produced in the southern regions, while the northern regions specialise in dairy products, grains, soybeans, and meat. Wine, "il nettare degli dei" (the nectar of the gods) is produced throughout the country, with the south being the largest producer by landmass and the Veneto region, in northern Italy, the largest producer by volume. In the province of Trento, production centres around grains, vegetables, wine, potatoes, and cheese (CREA, 2022).

Table 4. Info Province of Trento and Italy[4]

Metrics	Province of Trento	Italy
Farm area	16,462,350	12,523,540
UAA	345,950	121,790
Farms	14,000	1,130,530
Livestock farms	3,649	246,000
Grazing livestock farms (excluding cows)	570	41,420
UAA (ha)	88,640 (3rd smallest)	12,041,230
Livestock Unit (LSU)	53,360 (3rd smallest)	9,809,120
Sheep and Goats	58,356 (4th smallest)	7,577,689
Goats Trentino Alto Adige (2022)	35,982 (Istat)	1,010,143
Sheep Trentino Alto Adige	74,954 (Dec 2022) (Istat)	6,567,546

Farm consolidation

Consistent with what has been going on in other European countries since after World War II, the number of farms has been decreasing in Italy whilst the average farm size has been increasing (Eurostat, n.d.). This trend was exacerbated by the CAP reform in 1970, which, noticing that average farm incomes did not increase despite the budgeting policies and the boost in production, aimed to structurally reform European farms. To illustrate, there were around 3.1 million farms in Italy in 1982, and, in 2020, this number reduced to around 1.1 million, showing a 65% cut over almost 40 years (CREA, 2022). Simultaneously, over this period, the average farm size increased from 5.1 to 11.1 hectares (CREA, 2024). Given that UAA remained relatively constant around 12.5 million, the takeaway is that farms merged into larger units, which is true all Italian regions. Relevant to this paper, the number of farms in the province of Trento (the region Trentino Alto Adige is commonly divided into the province of Trento and the province of Bolzano) was 14,240 in 2020, the third lowest amongst all Italian regions, and the average farm size was 8.6 hectares, the fifth lowest (CREA, 2022).

CAP Strategy

As mentioned, the Italian CAP strategy mainly involves helping farmers through direct and redistributive payments (economic mission). For farms to qualify for these yearly payments, they must be larger than 5 hectares in size. While the average farm size is 11.1 ha in Italy, 63% of all farms are smaller than 5 ha (Table 5) and thus remain unsupported. Notably, in 2020, a staggering 20% of all farms in Italy were smaller than 1 ha (CREA, 2022). This suggests that the larger farms are picking the longer straw in the CAP lottery, receiving yearly payments per hectare, whereas small-scale farmers must rely on themselves, other parts of the CAP, and/or work additional jobs.

[4] Istat, CREA, Eurostat

In Ernesto's case, he supplements his income by working as a baker from November 2023 to March 2024. However, he was also approved a €40,000 EU bursary as part of the CAP rural development plan (social mission) in the summer of 2023. He's already received €30,000 in November 2023, with the other €10,000 arriving sometime in 2024.

Table 5. Number of farms per farm size bracket Italy 2020[5]

Farm size bracket	Number of farms	Percentage of total farms
Total	1,130,530	100
0[6] ha	12,500	1.1
x < 5 ha	713,340	63
5 ha < x < 20 ha	269,250	24
20 ha < x < 50 ha	85,940	7.6
50 ha < x < 100 ha	32,160	2.8
100 ha < x	17,340	1.5

Table 6. Number of farms per farm size bracket Province of Trento 2020[7]

Farm size bracket	Number of farms	Percentage of total farms
Total	14,240	100
0 ha	410	3
x < 5 ha	11,000	78.6
5 ha < x < 20 ha	2,000	14
20 ha < x < 50 ha	320	2.3
50 ha < x < 100 ha	120	0.9
100 ha < x	160	1.1

Stakeholders

He collaborates with the farmer's union Coldiretti in two ways: he pays them for managing his tax declarations and they organise the markets he participates in. On a monthly basis, he voluntarily submits his cheese for laboratory tests, using the bacteria populations as feedback for enhancing his cheesemaking techniques. Furthermore, he has taken a sanitation course with an employee at the laboratory, calling her at times for advice on best practises, free of charge.

He attends markets, and occasionally fairs, where he cooks for people and gives talks on Capra Punk. A partnership with a pizza baker in Trento involves using acid whey from robiola making for bread production. To manage surplus cheese, he collaborates with Biocesta[8], a health food store in Trento, and a restaurant in a nearby town. Furthermore, he cooperates with two farmers in product sales at markets.

[5] Eurostat (n.d.)
[6] No longer engaged in agricultural production
[7] Eurostat
[8] Biocesta del Gusto – Dove trovarci

Figure 5. Ernesto at a Thursday market at Piazza Santa Maria Maggiore, photo by author

Certification and Licenses

Since almost all sales happen face-to-face, customers know where the milk comes from and, to varying extent, the values on which Ernesto operates. Banners and signs around the market stand further underscore this. Despite the proposal by a former university lecturer, now small-scale vegetable farmer outside Trento, to create an "Agroecology label", other farmers rejected this arguing that enough certifications (Organic, Demeter) already exist, and that it wasn't necessary given their face-to-face business model.

Like many farmers in the region, Ernesto is licensed to sell his products and to cook and sell food in any public place in Northern Italy. Liberal regulations allow producers to combine their products with other's as long as the majority of the ingredients are theirs (grey zone). For example, in Ernesto's case, the bread consists of someone else's Pasta Madre (starting culture) and flour, but because he produces the acid whey, he is entitled to sell the bread. From an economic perspective, cooking at fairs and producing bread is creating value added products, which is allowing him to make more money of out of the same litre of milk.

4.1.2 STEP 1 - Characterisation of Agroecological Transition

The CAET score for Capra Punk is 69%, indicating that Capra Punk has achieved 69% of the agroecological characteristics defined by the FAO. Interestingly, when considering equal weight across the three dimensions – ecology, society, economy – of Agroecology, the overall CAET score is 72%. Strengths and weaknesses are outlined in Table 7 and Figure 6, and the following sections delve into each element in more detail.

Table 7. CAET for Capra Punk 2023

Dimension	Elements of agroecology	Capra Punk Score
Ecology	Diversity	0.57
	Synergies	0.75
	Efficiency	0.5
	Recycling	0.5
	Resilience	0.58
Social	Culture & food tradition	0.67
	Co-creation & sharing of knowledge	1
	Human & social values	0.75
Economy	Circular & solidarity economy*	0.83
	Responsible governance*	0.75
	CAET	**0.69**

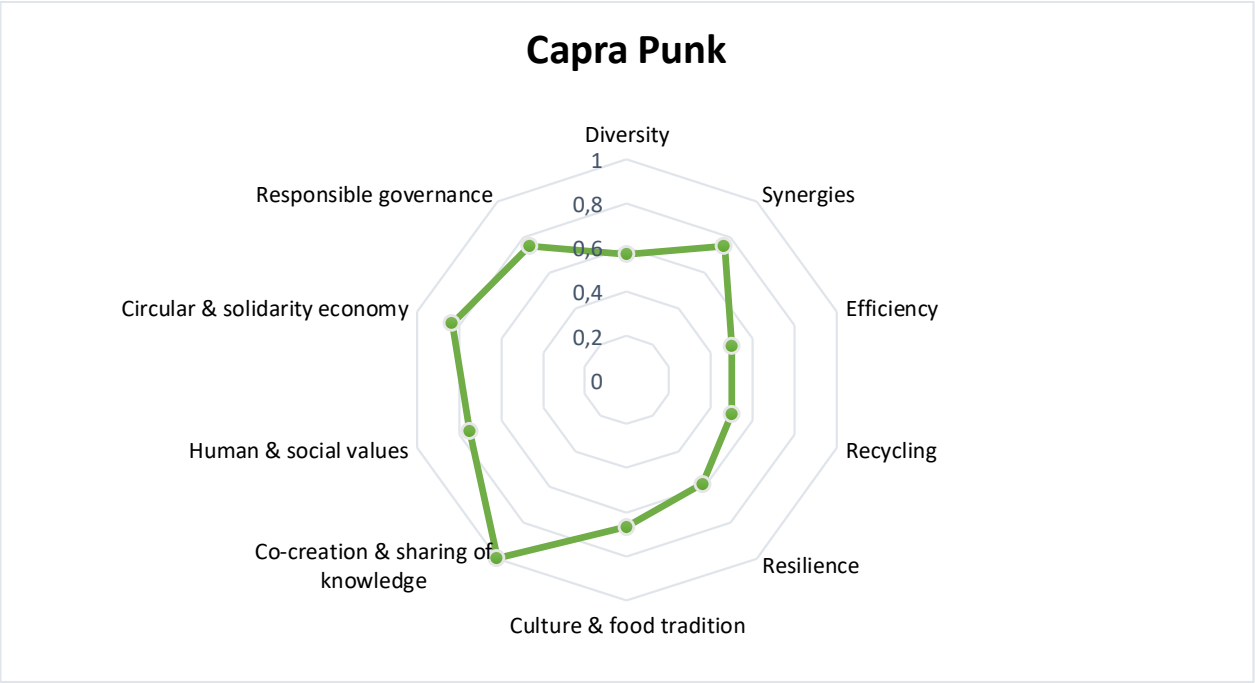

Figure 6. Spider Diagram Capra Punk CAET 2023

Elements characterising the Agroecological field practises (0,58)

Diversity (0,57)

Indices: (a) Crops, (b) Animals (including fish & insects), (c) Trees (& other perennials), (d) Diversity of activities, products, and services

Capra Punk is exclusively a goat-based production system. Most of the goats are of the breed Nera di Verzascha while the rest are mixed breeds (bastards) with origins in Mochina, Alpine, and Saalen. The land housing the stable (230sqm) comprises 1500sqm, features patches of grass and one tree, and is surrounded by trees, bushes, and wildlife. The farmland also comprises of another enclosed area located 1km away, where two billy goats roam freely. This area features lush grasslands, trees, and is bordered by a dense forest. Moreover, the forest around Margone is part of the farmland albeit unofficially (will dive into this in another section). Income is based on the production of cheese, yogurt, gelato, bread, and salami, and from cooking food at events. He processes the milk on the farm and cooperates with a baker in the production of bread in that he provides the acid whey which otherwise would be fed back to the goats. In addition to attending markets and events, and hosting groups for lunch in Margone, he is open for interviews and

people who want to come and visit the farm. During my stay, a kindergarten group came to visit the baby goats (kids), and later, when I already had left, students working in the Spanish Pavilion at the Biennale Architecture 2023 came to visit Ernesto and learn about the goat production system (the theme of the Spanish Pavilion for 2023 is *Foodscapes*).

Figure 7. Hosting mountain bikers for lunch in Margone, photo by author

Synergies (0,75)

Indices: (a) Crop-Livestock-Aquaculture Integration, (b) Soil-Plants system management, (c) Integration with trees (agroforestry, silvopastoralism, agrosilvopastoralism), (d) Connectivity between elements of the agroecosystem and the landscape

During the grazing season, from the end of March to the beginning of November, the goats primarily consume locally sourced feed. In addition to the grass which Ernesto provides, hay and pellets are sourced from around northern Italy. Goat dung and acid whey are reintegrated within the farm system or within other local food producing systems. Additionally, the goat dung serves as fertiliser for the forest which, in turn, provides feed for the goats. As summer transitions into winter, alongside the time they spend in the forest, they graze on enclosed grasslands next to village for some hours each morning.

Given the small size of the goat herd, it is unlikely that they are having a negative effect on the forest. The forest trees and bushes provide the goats with leaves, shade, things to scratch themselves with, and ample opportunities for "climbing".

While mobility is not officially recognised, the agroecosystem practically also incorporates the surrounding forest, which remains lush and mainly untouched. The forest is creeping around the official farmland, both areas spatially defined by fences. The soil in the primary farmland, where the stable is located, has been disturbed and compacted from all the vehicles coming in and out yielding patches of grass, but also patches of bare soil. The bedding in the stable is layered with woodchips, goat dung, and hay, all of which become integrated over time.

Efficiency (0,5)

Indices: (a) Use of external inputs, (b) Management of soil fertility, (c) Management of pests & diseases, (d) Productivity and household's needs

Almost all the inputs come from the market: money is borrowed, pellets and hay are purchased, fuel and electricity are purchased, the material (second-hand) used to build the stable was purchased, and the laboratory equipment's were one-time purchases. Despite these obvious market dependencies, the farming system is constructed in a way that it relies as little as is possible, given physical, mental, and economic limits, on the use of external inputs. For example, feed purchase is complementary to grazing.

Goat dung mixed with hay and woodchips is used to fertilise two vegetable plots, one belonging to the family, and the other, to friends of the family. Moreover, the mixture is also distributed onto fields which Ernesto uses to cut grass on for the goats.

Drawing on my experiences, as a household we used around one litre of goat milk to make cappuccinos and cereals, and one litre lasted us about two days. Also, whenever yogurt was made, we used some together with jam to spread on bread. And on the rare occasion that not all the bread was sold, it's consumed by the family. This suggests that everything that is produced ends up with consumers. And obviously, the family is not meeting their household needs by relying on the goats alone. As of writing, the farmer is trying to repay the loans he had taken to run the farming business.

Recycling (0,5)
Indices: (a) Recycling of biomass and nutrients, (b) Water saving, (c) Renewable energy use and production, (d) Management of seeds and breeds

Drawing on the previous section, aligned with Trentino Priority Goal 2, every output of the system that can be recycled, is recycled. From old semi-rusty screws to unsold cacioricotta to manure to acid whey, Ernesto tries to maximise their use. Notably, his innovative integration of acid whey into breadmaking was recognised by the farmers union Coldiretti who awarded him The Trentino Green Oscar award in the category "Energy for the future and sustainability" (Coldiretti, 2023).

Furthermore, the bedding, which over time transforms into a rich mixture of goat dung, woodchips, and hay, is removed about every 8 months. It is then used to fertilise the fields producing grass for the goats and vegetables for his family and friends.

Each year, a few goats exit the system, either due to age and a decline in milk production and quality, or because of diseases such as anaemia and, in winter 2022, chlamydia. In the former case, Ernesto sends the goats to a butcher who makes salami, and in the latter case, the animals are picked up for incineration.

As of writing, there are water tanks at the stable, but no water harvesting method is in place. However, the farmer intends to collect water from the roof at the stable and at the hut located up the mountain where the goats graze. Moreover, no renewable energy is currently used or produced due to both temporal and financial constraints. Maybe, this is an area where the provincial government can help, given their aim to establish sustainable energy communities (Priority Goal 3). Interestingly, his family's house is heated using fuelwood coming from the forest. With few people in the village, and even fewer using fuelwood, and considering the large and lush forest, it appears to be a very sustainable practise for now.

Lastly, while all animals come from the market, and were either gifted to Ernesto or bought by him, he keeps two billy goats to inseminate the does (females) every year, suggesting that he now breeds his own goats. However, if he wants

to expand production, he will probably need to buy more goats unless he manages to drastically improve the living conditions for the kids (baby goats).

Element of resilience (0,58)

Indices: (a) Stability of Income/Production and capacity to recover from perturbations, (b) Mechanisms to reduce vulnerability, (c) Indebtedness, (d) Diversity of Activities, Products and Services

As a startup, Capra Punk has yet to prove its long-term viability. 2023 marked the first full year of operation, and now serves as a benchmark for future progression and analysis. Although it's too early to evaluate its ability to respond to various kinds of stressors, a notable challenge arose between 2022 to 2023, when chlamydia unexpectedly entered the herd. Despite four goat fatalities and four miscarriages, most goats survived, partly due to the application of antibiotics. Fortunately, the business is insured against many eventualities, such as this one. Looking at it from another perspective, during emergencies like pandemics and climate change, the goats themselves can be viewed as a security blanket given their exceptional abilities to provide nutritious nutrition.

Elements characterising the social dimension of Agroecology (0,8)

Culture & food tradition (0,67)

Indices: (a) Appropriate diet and nutrition awareness, (b) Local or traditional (peasant/indigenous) identity and awareness, (c) Use of local varieties/breeds and traditional (peasant & indigenous) knowledge for food preparation

The family is aware of the necessity of a balanced and nutritious diet. They all eat a variety of vegetables, grains, nuts, goat milk and cheese, and, occasionally, meat. Goat farming is a local tradition dating to at least 1787, and goats have since played an important role in the local landscape, providing families with milk and meat. Nowadays, like back in 1787, the goats get to spend a lot of time grazing in the forest. Ernesto feels very connected to the land and to traditions, and he almost experiences it as his duty to preserve this traditional way of doing agriculture in Margone. Moreover, in the past, people wouldn't travel miles to work to make a living, and Capra Punk is an opportunity for him to make a living working the land. To emphasise his respect for traditions and (natural-cultural heritage), he (a) uses the village's old name "Malgon" on Instagram and Capra Punk stickers, which he, by the way, has attached to his car, and (b) would gladly do something else if someone qualified came and wanted to take on the business (tradition).

Prior to creating Capra Punk, only a handful of domesticated non-milk producing goats existed in Margone. Since then, Ernesto has bought and was gifted goats, suggesting that they are external inputs. However, all these goats have their origins in breeds native to the Alps and are thus fit for the challenges posed by the topography and climate in Margone. Moreover, two rounds of kids have since been born, making them the first generation born and bred in Margone.

Complying to traditional cheese making methods is difficult due to international hygiene standards. Preferably, he would use locally sourced wood for milk-handling purposes, using its bacterial properties, but this can't be done if he wants to sell in local and regional markets.

Figure 8. Goats grazing, view overlooking the valley to the south of Margone, photo by Ernesto

Co-creation & sharing of knowledge (1)

Indices: (I) Platforms for the horizontal creation and sharing of knowledge and good practises, (II) Access to agroecological knowledge and interest of producers in agroecology, (III) Participation of producers in networks and grassroot organisations

Farmer unions such as Coldiretti provide advisory and accounting services to its members. While Ernesto is an active member, enlisting their advisory, he has learned to keep low expectations regarding the quality of advice received. It appears that there is a lack of expertise within the union when it comes to aging cheese in caves. Participating in markets each week is useful in that producers not only get to speak with consumers, but also to other producers. While it generally leads to jovial relationships, my experience is that Ernesto is a very curious and open-minded person, looking to learn as much as possible from and with others. Moreover, his open-mindedness leads to him engaging with almost anyone, of interest, of course, regardless of if they grow vegetables, mushrooms, cows, or goats. Arguably, his willingness to taking a step back and hearing what other people have to say, is one of his strongest assets, which demands a lot of respect given the many things he has going on.

Prior to setting up the farming system and during its early stages, Ernesto visited established goat farms in the region, and is to this day still in contact with them, mainly through markets. Interestingly, he doesn't view the other goat farmers as competition because he thinks that there is room for mutual growth given the momentarily limited market for goat products (the pie can still grow).

While Ernesto wasn't familiar with the term Agroecology before my arrival in 2022, he certainly was conscious of its principles. As demonstrated in this section, Ernesto is all about connecting with people and exchanging knowledge and experiences, making him a practical manifestation of Agroecology.

Human & social values (0,75)

Indices: (I) Women's empowerment, (II) Labour, (III) Youth Employment and Emigration, (IV) Animal Welfare

Ernesto makes all the decisions regarding Capra Punk. Margarita works as a kindergarten teacher, and her income primarily feeds the family. In the region, there are organisations for women led by women. Additionally, there are communities such as *Zappadori* and *Palestra Populare*, which are anti-fascist, anti-racist, pro-communitarian and advocate for equal rights and various other things, aligning with Priority Goal 4. Ernesto actively participates in *Palestra Populare*, taking part in assemblies and weekly boxing classes. I participated in the general assembly of *Zappadori* last year, in 2022, and I participated in an informal assembly of *Palestra Populare* this year, and what I found was that men and women were equally represented. Moreover, while a man chaired the general assembly of *Zappadori*, a woman chaired the informal assembly of *Palestra Populare*.

The farmers that I've interacted with generally run small-scale farms with no employees. While Ernesto and the Italian government think that many young people see no future in agriculture, most farmers I've met in Trentino are in their 30s. Exposing my availability bias, the average age of Italian farmers is the second oldest amongst EU countries with an average age of 57 (Eurostat, n.d.). While it's impossible to predict if Ernesto's children one day will work full time in the business – especially as the eldest child is only 9 years old – it's likely that, if the business still exists, they will eventually help with farm chores.

It was clear to me that Ernesto is committed to encouraging the natural behaviour and needs (ethology) of his goats. Despite constantly facing time constraints, he prioritises providing grazing opportunities throughout the year and the farm's spacious stable provides ample space for the small herd size, which is unusual given the economics of space.

Elements characterising the economic dimension (0,79)

Circular & Solidarity economy (0,83)
Indices: (I) Products and services marketed locally, (II) Networks of producers, relationship with consumers and presence of intermediaries, (III) Local food system

All products are sold within the region, with the Thursday and Saturday markets located in Trento. While most of his customers are regulars, I've noticed that there are always new faces at each market. Intermittently, Ernesto will travel to fairs located further away, but a rule of thumb is that he must be backto milk the goats in the morning.

He primarily communicates with customers face-to-face, but he also communicates and can be contactedthrough Instagram and WhatsApp. Rarely, he sells surplus cheese to intermediaries if any remains unsold at the end of a market. In such cases, he collaborates either with Biocesta, a health food store in Trento, or a restaurant close to Margone. The chef is a friend, and him being aware of the challenges of primary producers, he aims to support them whenever possible.

Houses in rural and peri-urban areas commonly have small gardens where residents are growing their own vegetables such as tomatoes, zucchinis, cucumbers, and salads. However, this production doesn't fully meet their food needs. Instead, food is primarily bought from supermarkets and farmers markets. Most of the food found in supermarkets stems from outside of Trentino. Fruits and vegetables are typically sourced from the south of Italy as well as Spain, while regional milk is commonly supplemented by Austrian milk.

The food at the farmers markets is local, regional, or national, depending on the market. It's common for farmers to buy products from one another out of curiosity and support. Simultaneously, it's also common for farmers to share their products with each other, especially if there are leftovers by the end of the day. For example, Ernesto and I used to share homemade bread with cacioricotta, olive oil, salt, and pepper, and get honey, wine, focaccia, and cow meat (in return).

Furthermore, Ernesto collaborates with other farmers to enhance efficiency. For instance, he partners with Chiara and Stefano, who produce mushrooms and flowers, to sell each other's products at different markets on Saturdays. This partnership expands their customer reach and increases revenues. Moreover, Lorenzo, a vegetable producer, sells Ernesto's products at the market every other Thursday, freeing up Ernesto's time for other chores. Evidently, these collaborative relationships showcase the entrepreneurial mind-set of Ernesto and other Trentino farmers, who mutually benefit from supporting each other.

Responsible governance (0,75)

Indices: (I) Producers' empowerment, (II) Producers organisations and associations, (III) Participation of producers in governance of land and natural resources

This element is concerned with the scope to which producers are supported in their effort to make a living, and the extent to which they are part of decision-making processes related to the governance of land and natural resources. The score of 75% suggests that producers are empowered. As previously mentioned, there are farmers unions, and Ernesto has been a member of the farmers union Coldiretti since 2023. In addition to providing accounting and advisory services for their members, they organise the Thursday and Saturday farmers markets.

Figure 9. Author labelling yoghurt ahead of a Thursday market, photo by Ernesto

In terms of being involved in the governance of land and natural resources, Ernesto's participation is limited. Although he's filed for the right to herd his goats in the local forest and discussed the possibility of dedicating 5 hectares of forest around Margone for the goats to graze on with the mayor of Valle dei Laghi, nothing has materialised. This shows that while producers can engage in conversation with the municipality, their practical influence appears restricted. Nonetheless, the fact that the goats still graze in the forest, and the municipality is aware of this, suggests an unofficial attitude of do whatever you want but just don't overdo it.

4.1.3 STEP 2 - Multidimensional Performance of Agroecology

Dimension Governance

I. Land tenure

The farmland used to belong to Margarita's brother Francesco, who permitted Ernesto to use it free of charge. This arrangement was based on a verbal agreement, with an understanding that Ernesto would eventually purchase the land. In July 2023, Ernesto did buy the land, totalling 1500 sqm, for €15,000. While he is now the official owner of this land, it is still illegal for him to take the goats grazing in the forest (common land). Despite this, Ernesto perceives the access to the forest as being relatively secure, especially given that foresters drive to and through Margone every week, can see clear signs of free grazing livestock and don't do anything about it. Like the situation around Marijuana in Amsterdam, grazing in the forest may be technically illegal but is tacitly allowed.

Dimension Economy

II. Productivity

There are several metrices on measuring the performance of agricultural systems. The traditional approach is going by yield per hectare or animal per hectare and disregarding currently non-monetary values like nitrogen leaching per hectare and pesticide use per hectare. According to TAPE, such narrow focus can lead to the overestimation of the utility of conventional agricultural production systems. As an alternative, TAPE suggests using production value (€) per hectare and production value per person (FAO, 2019). Consequently, this section compares these values for Capra Punk with the national average value of agricultural production per hectare and per person.

Production value

Ernesto produces mainly fresh cheese. The production of cave-aged cheese is still in its experimental phase, with only occasional sales. While bread is sold for €10 per kilogram, Ernesto makes €3 and the baker €7. I extrapolated from the weekly figures to estimate total production value over the 8-month lactation period. In total, the annual production value (gross production) equals €28,591 for 2023.

However, Ernesto also earns income from participating in events like fairs and providing lunch for visitors in Margone. Like cave-aged cheese, this income varies. While he primarily focuses on selling and using his own cheese and bread, Ernesto also incorporates external ingredients, creating value-added products. Although the production value of his goat products is already accounted for in Table 9, Ernesto proposed an additional €1,200 for 2023 to represent the created added value in the annual gross production total. Adding this sum to €28,591, the revised annual gross production is €29,791.

Table 8. Production Capra Punk 2023

Animal Products	Quantity produced (kg/year)	Quantity sold (%)	Price at the gate (€/kg)	Gross production (€/year)
Robiola	384	98	23	8,655
Cacioricotta	96	98	23	2,164
Ricotta	160	98	23	3,606
Cave-aged cheese	110	50	50 > x > 40[9]	2,500
Yoghurt	720	98	10	7,056
Salami	70	100	35	2,450
Bread	720[10]	100	10 (3)	2,160

[9] The exact price/kg depends on the quality of the batch.

Total				28,591
Revised Total				29,791

The next step involves converting this annual gross production to Purchasing Power Parity (PPP) ($). According to the latest data in 2022, the PPP value between the Euro (€) in Italy and the US Dollar ($) stands at 0.596 (OECD, 2024). So, if we convert €1 in Italy to US Dollars we get:

$$€1 * (0.596\ PPP\ value) = \$0.596$$

This indicates that the purchasing power of €1 in Italy equals $0.596 in the US. Consequently, converting the annual gross production value of Capra Punk using PPP to US Dollars, we get the following value:

$$29{,}791€ * 0{,}596 = 17{,}755\$$$

Farm agricultural land

According to TAPE, the "farm agricultural land area is defined as the area of land used for agriculture within the farm". Therefore, the calculation productivity/ha includes the official and unofficial farmland comprising Capra Punk. Because Ernesto estimates that the goats graze on roughly 10 hectares, the farm agricultural land area of Capra Punk is 10,15 hectares.

Full-time Equivalent (FTE)

Mirko, a Margone local in 2023, worked as goat herd from the end of March to the beginning of June, for a total of 10 weeks, working on average 5-hour days, 4 days per week. The fact that the combined workload for Ernesto and Mirko for 2023, assessed using the FTE metric (EU, 2020), was equivalent to the workload of 2.2 people, speaks volumes of Ernesto's workload (Table 10).

Table 9. FTE Capra Punk 2023

Worker	Ernesto	Mirko
Hours a week	84 (12*7)	20 (5*4)
Hours a year	4368 (84*52)	200 (20*10)
Full time equivalent (FTE)	2.1 (4368/2080)	0.1 (200/2080)

Production value per ha and per person

Drawing on the production value, the farm agricultural land, and the FTE, we can calculate the Capra Punk production value per ha/year and per person/year. These values including their calculation are depicted in Table 11.

Table 10. Production Value Capra Punk 2023

Metric	Value	Calculation
Production value per ha/year (€)	2,837	€29,791 / 10.15
Production value per person/year (€)	13,541	€29,791 / 2.2

Italian Agriculture

Around 60 million people live in Italy, with about 23 million people in employment. 4% of the working population, 923,400 (2020), work in agriculture, forestry, and fishery (Istat, n.d.). Agricultural land has decreased from 70% in 1961 to 44% in 2020, comprising a total of 12.6 million hectares, ranking 11th in Europe (Eurostat, n.d.).

[10] Average of range 620-800kg

Table 11. Key Agricultural Metrics Italy

Country	National Value of Agricultural Production (inc. fishery and forestry) (€)[11]	Total National Agricultural Land Area (ha) (2020)	Employed in Agriculture (inc. fishing and forestry) (2020)	National average value of production per hectare/year (€)	National average value of production per person/year (€)
Italy	60.335 billion	12.6 million	923,400	5,102	69,664

Comparing the production values of Capra Punk with those of the national agricultural average (Figure 10) reveals considerable disparities in productivity, with figures indicating 51% and 85% lower values for Capra Punk. Production value per hectare per year is at €2,837 for Capra Punk (Table 11), notably lower than the national average of €5,102 (Table 12). And production value per person per year is at €13,541 (Table 11), strongly contrasting the national average of €69,664 (Table 12). These figures suggest that Capra Punk produces little economic value per working hour when compared to the national agricultural average, highlighting an efficiency deficit.

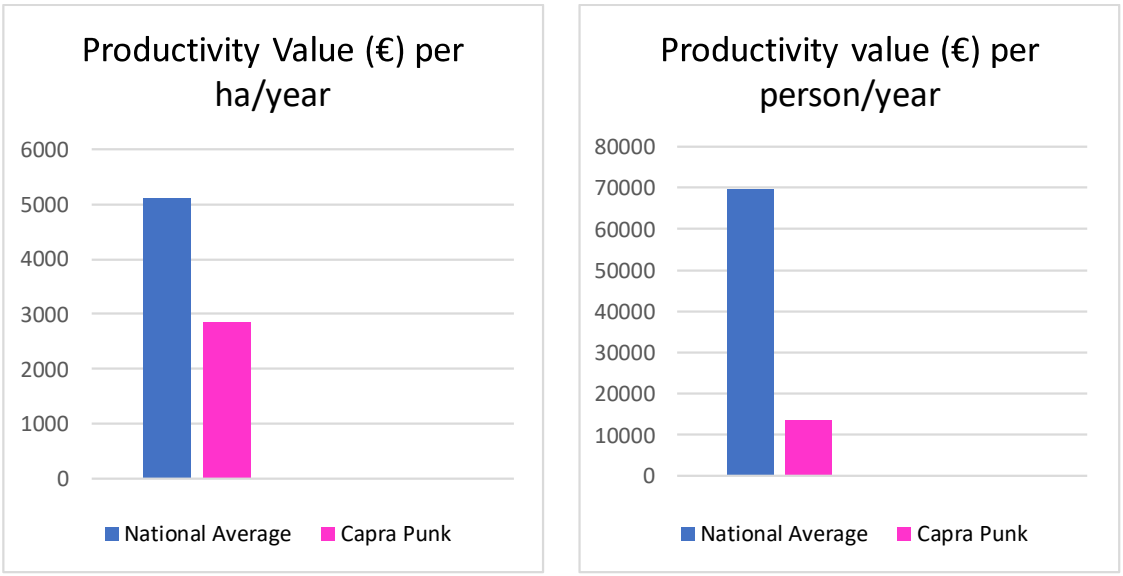

Figure 10. Comparison Production Value Capra Punk and National Agricultural Average

III. Income

Throughout 2023, around 20 litres of milk are produced daily. Over the lactation period of eight months, this amounts to 4,800 litres of milk produced annually, ceteris paribus. Ernesto roughly charges €4 per litre of milk for a production cost of about €7.15 per litre, including cost of inputs and taxes, cost of hired labour, loans interest and cost of renting land, and depreciation of machinery and equipment, €34,345 in total. Consequently, the profit margin per litre of milk is negative €3, resulting in an overall annual net income of roughly negative €15,14 if not for the EU Rural Development subsidy of €30,000. With the subsidy factored in, the annual net income is €25,466 (Table 13). Momentarily, the income is mainly used for business maintenance, tax, and loan payments. Meanwhile, the family relies on Margarita's income for their cost of living.

Table 12. 2023 Family Net Income (€)

Family Net Income =	Values expressed in €/year
Gross product	29,791

[11] Istat

+ Subsidies	30,000
- Cost of inputs and taxes	7,755 + 500
- Cost of hired labour	2,252
- Loans, interest and cost of renting land	16,560
- Depreciation of machinery and equipment	7,778
Total	24,946
PPP (USD)	14,868

Inputs and taxes

Ernesto purchased 30 bales of hay for €2135, plus €550 for transportation, totalling €2690. Furthermore, he bought pellets on two occasions, spending a total of €800. Monthly expenses included €150 for electricity, €10 for laboratory water use, and €5 for stable water use. He also spent €150 for disinfectants and around €2,600 for fairs including the participation cost, ingredient cost, and cost of hired one-time labour. Taxes are calculated in April 2024 for Capra Punk and will, according to Ernesto, amount to roughly €500.

Table 13. 2023 Cost (€) of inputs and taxes

Item	Hay	Pellets	Electricity	Water	Disinfectants	Fairs	Taxes
Cost	2685	800	1,200	140	150	2,600	500

Labour

Mirko earned €5 per hour, working on average 5-hour days, 4 days per week, for roughly 10 weeks. He didn't work as a goat herder for the money but because of the fulfilment he found of being in nature together with the goats. His income was supplemented with social aid.

The vet came twice, incurring a cost of €50 on each occasion. Additionally, Ernesto had to dispose of three goats, with a collection and incineration cost of €4 per animal. Four other goats were brought to the butcher, charging him €35 per goat. Furthermore, the accounting and advisor services provided by Coldiretti cost him €1,000. Adding the expenses yields a total annual cost of €2,252 for 2023 (Table 15).

Table 14. 2023 Cost (€) of hired labour

Worker	Annual cost (€)
Mirko	1,000
Veterinary Service	100
Incineration	12
Butcher	140
Coldiretti	1000
Total	2,252

Loans, interest, and cost of renting land

Ernesto took a €30,000 loan from a bank in January 2023, with a 1-year maturity and an interest rate of 4.6%. Consequently, throughout 2023, he paid €1,380 per month, totalling €16,560. The loan was fully repaid in January 2024. Additionally, he is repaying a separate €50,000 bank loan, taken in 2021, through €5,000 instalments due every September for a duration of 10 years. This loan is excluded from Capra Punk's annual costs as it supports his family's income.

Table 15. 2023 Cost (€) of loans, and cost of renting land

Loans and interest	Cost of renting land	Total
16,560	0	16,560

Depreciation

The Straight-line Depreciation method is commonly used in agricultural systems for estimating the depreciation of machinery and equipment. Its formula provides simplicity and a steady and predictable annual depreciation expense, and it was therefore used to calculate the annual depreciation of machinery and equipment of Capra Punk. Please refer to Table x in the appendix for the figures and calculation.

$$Depreciation\ expense = \frac{(Cost\ of\ asset - Salvage\ value)}{Useful\ life}$$

Where cost of asset refers to the initial purchase cost of a machinery or equipment, salvage value refers to the predicted value of an asset at the end of its lifespan, and useful life indicates the lifespan of an asset.

The Mitsubishi truck, the tractor, and the trailer were gifts. Therefore, Ernesto did not incur a cost and the value of depreciation is €0 for each of these three items. However, he pays €500 per year in insurance for the truck. The Bobcat was already 30 years old when Ernesto purchased it for €5,300 in 2023. Given the limited usage (5 hours per week) and the newly inserted engine, he estimates that he will probably be able to have it for another 50 years.

Table 16. 2023 Depreciation (€) estimates of machinery and equipment

Bobcat	Tractor	Hay[12]	Truck	Pastomaster	Thermocloser	Lab Equipment	Milking Table	Stable	Trailer	Cave	Total
106	0	105	500	2,200	200	0	1,200	3,900	0	220	7778

As illustrated in Table 18, the family net income per family agricultural worker is significantly higher than the median national income, €25,466 compared to €17,695, accounting for the €30,000 CAP bursary.

Table 17. Comparison Family Net Income/Family Agricultural Worker with Median National Net Income

Metric	Value
Family net income/family agricultural worker	€24,946
Family net income/family agricultural worker (PPP)	$14,868
Median national net income	€17,695[13]
Median national net income (PPP)	$10,546

IV. Added Value

With the previous section highlighting the economic performance of Capra Punk, this section explores if the farming system creates any wealth. For Capra Punk, this involves subtracting subsidies and adding the cost of hired labour and interest payments to the family net income (Table 19). Putting the resulting gross added value into the context of the Italian agriculture, Table 20 illustrates that Capra Punk creates substantially less wealth, €15,783, than the Italian agricultural GDP per agricultural worker, €40,729.

Table 18. Gross Added Value Capra Punk 2023

Gross Added Value =	Values expressed in €/year
Family net income	24,946
- Subsidies and income from rented land	30,000
+ Cost of hired labour	5,952

[12] Press, rotation, cutter, manual.

[13] Istat

+ Interest on loans and cost of renting land	16,560
Total	17,458
PPP (USD)	10,405

Table 19. Comparing Gross Added Value Capra Punk 2023 with National Agricultural GDP per Agricultural Worker

Metric	Value	Calculation
Gross Added Value per Agricultural Family Worker (€)	17,458	17,458/1
National Agricultural GDP per Agricultural Worker (LCU (€))[14]	38,7812	35,442,000,000/913,000

Dimension Health and Nutrition

V. Exposure to Pesticides

The feed is sourced from both industrial farms and cooperatives that work with industrial farms. Although Ernesto is uncertain about the specific substances used in plant treatment, it is very likely that pesticides are indirectly entering the system. However, because Ernesto does not directly apply pesticides, not to mention the fact that a substantial amount of the feed intake comes from premium organic land, reducing the opportunity cost of exclusively stable-kept goats, Capra Punk receives a green score for this criterion.

VI. Dietary diversity

8 out of 10 food groups were consumed in the last 24 hours by Margarita (Table 24 in the appendix). Having shared meals in the household for about two months, I think that these 24 hours are accurately representing her standard meals.

Dimension Society and Culture

VII. Women's empowerment

The survey (Table 25 in the appendix) biases the result by assuming that both adults work in the production system, which isn't the case for Capra Punk. Consequently, the criterion is inappropriate. Except for the domains "Time use" and "Leadership in community", with the further exception for some subareas, the remaining domains address decision making within the production system and the associated income. Since Margarita doesn't work at Capra Punk, the WEAI score of 0.434 appears low. However, looking at all other areas of assessment beyond the ones dealing with the decision making over the production process and income, she demonstrates empowerment. Because Ernesto uses all his income to maintain the production system and to repay loans, it's primarily Margarita's income which provides food and clothes for the family. If they need more, they will use money from Capra Punk.

VIII. Youth employment opportunity and migration

Given that there are no young adults, 15-24 (FAO, 2019), working at Capra Punk, this criterion cannot be evaluated and is marked N/A.

Dimension Environment

IX. Agricultural biodiversity

To measure the agrobiodiversity of the farming system, we make use of the Gini-Simpson index and begin by calculating the level of agrobiodiversity for each of the following categories: (a) Crops, (b) Animals and (c) Natural vegetation, trees, and pollinators.

[14] Istat

Thereafter, we take the average of the three categories to get the level of agrobiodiversity of Capra Punk. The Gini-Simpson index measures the probability that any two randomly selected individuals belong to different species and yields a score between 0 and 1 (0-100%). Consequently, a high score suggests a high diversity of species and breeds.

Gini-Simpson index for animals

Table 20. Gini-Simpson Index for Animals Capra Punk 2023

SPECIES/BREEDS	# OF INDIVIDUALS	n	n(n-1)
Nera di Verzasca	18	18	306
Bastards	27	27	702
Sum	45	45	1008

$$\text{Gini Simpson Index} = 1 - \text{D}$$

$$\text{D} = \frac{\sum \text{n}_\text{i}(\text{n}_\text{i} - 1)}{\text{N}(\text{N} - 1)}$$

$$\text{N} = 18 + 27 = 45$$

$$\text{N}(\text{N} - 1) = 45(45 - 1) = 1{,}980$$

$$n_1 = 18(17) = 306$$

$$n_2 = 27(26) = 702$$

$$\text{n} = n_1 + n_2$$

$$306 + 600 = 1008$$

$$\text{D} = \frac{\sum \text{n}_\text{i}(\text{n}_\text{i} - 1)}{\text{N}(\text{N} - 1)}$$

$$\text{D} = \frac{1008}{1{,}980}$$

$$\text{D} = 0.51$$

Both calculations show that if you were to randomly select two individuals from the group, the probability that you will select different breeds is 50%.

Natural vegetation, trees, and pollinators

Table 21. Natural Vegetation, Trees, and Pollinators Capra Punk 2023

INDICATOR	ANSWER	SCORE
Beekeeping	No	0

	Yes, wild Yes, raised	0.5 1
Productive area covered by natural or diverse vegetation	Absent Small Medium Significant Abundant	0 0.25 0.5 0.75 1
Presence of pollinators and beneficial animals	Absent Little Significant Abundant	0 0.33 0.66 1

$$\frac{2}{3} = 0.67$$

$$(0.51 + 0 + 0.66) = 1.17$$

$$\frac{1.17}{3} = 0.39$$

For this system, the Gini-Simpson index for animals is 0.51. Because no crops are cultivated, the Gini-Simpson index for crops is 0. The score for natural vegetation, trees and pollinators is 0.667. By adding the sums of each category, we get 1.17. And if we divide 1.17 with the number of categories (3), we get a score of 0.39, which translates to an agricultural biodiversity score of 39%.

X. Soil health

Because the goats are mainly out grazing in a forest for around 8 months a year, and they spend the remaining time in a stable filled with hay, manure, and woodchips, not much can be said about soil health. The forest is very much intact and untouched, so it is dense and lush. If we think of this as part of the agroecosystem than the score would be very high. However, given that TAPE doesn't provide guidelines for evaluating soil health in pastoral systems, this core criteria of performance cannot be scored.

Table 22. Core Criteria of Performance (Step 2) for Capra Punk 2023

Core criteria of performance	RESULTS
Secure land tenure	Document and perception of secure land
Productivity	€ 2,837/ha/year (Average Italy 5,102)
	€ 13,541/FTE/year (Average Italy 69,664)
Income	Family Net Income/Agricultural Worker > Median National Income
Added value	Gross added value < 0.8 x national agricultural GDP per agricultural worker
Exposure to pesticides	Synthetic pesticides are not directly used
Dietary diversity	Minimum dietary diversity for women = 8
Women's empowerment	A-WEAI = 0.434
Youth employment opportunity	N/A
Agricultural biodiversity	39%
Soil health	N/A

4.1.4 Step 3 – Analysis of Step 1 and 2

The CAET score for Capra Punk is 69%, suggesting that the farming business has come far in its agroecological transition. Comparing the scores between the three dimensions reveals that Capra Punk's characteristics and environment align well with the social and economic aspects of fully established agroecological systems, scoring 80% and 79%, respectively. While there is considerable room for improvement in agroecological field practises, momentarily at 58%, it's important to remember that a low score doesn't necessarily mean that it must increase: a particular level may already represent the maximum of what is achievable for a specific context. For example, the relatively low scores in the element Diversity (58%), and the criteria Agricultural Biodiversity (39%), reflect that Ernesto only keeps goats and doesn't grow any feed crops. However, accounting for Margone's topography and agricultural possibilities, these scores are already high. With regards to the elements Efficiency (50%) and Recycling (50%), their low score can be explained by the startup nature of Capra Punk and the fact that Ernesto works alone. Faced with temporal as well as financial constraints, he hasn't yet been able to install water tanks and invest in renewable energy infrastructure. And while discussions revealed that he will address these areas as soon as possible, recognising their importance, he would appreciate support with this. Aligned with Trentino's goal of developing energy communities and strengthening marginal areas, funding renewable energy infrastructure in Margone would benefit not only Capra Punk but also help the remote community to sustain itself. And in the context of TAPE, this would elevate Capra Punk's efficiency and recycling efforts and thus enhance the CAET value. Overall, despite limitations, Ernesto is attempting to create a circular economy and zero-waste agricultural system to the best of his abilities. As he points out, it's just a matter of finances, time, and timing.

4.2 Future Scenarios

There's a fork in the road awaiting Ernesto and Capra Punk in December 2024. By then, Ernesto wants to decide if to continue pursuing this business or to stop and do something else. The following are the foreseeable paths and Ernesto's decision-making criteria:

Scenario 1: Continuing the business.
This is conditional on that he (a) has found a partner joining Capra Punk, (b) he has more than 60 milk producing goats, (c) clear revenue streams, and (d) works less hours.

Scenario 2: Closing the business.
If any of the abovementioned scenarios don't materialise, especially criteria a-c, Ernesto will sell the goats and think of something else to do.

Future focus: a scattered land strategy
Bread:
Interestingly, Ernesto is more interested in making bread than cheese, and he would like to increase bread production in the future, crafting it himself in Margone. Pulina et al. (2018) suggest that developing novel products using goat and sheep milk (here, acid whey), can be an important step in promoting future business viability for small-scale farms in the goat and sheep sector. The current arrangement with the pizza baker, Alex, entails that Ernesto receives €3 out of the €10 selling price. With a weekly production of around 25kg, Ernesto makes €75. While this is great given that he previously and still, mainly, feeds the acid whey back to the goats, he could make more money from this by-product by producing the bread himself. Ernesto already owns the appropriate infrastructure for bread making and he's an experienced baker. For instance, he's working as a baker from November 2023 all the way to the end of March 2024 to supplement his farming income. Furthermore, he would like to eventually lower the price to around €6 to €7 per kilogram.

Cave-aged cheese:

Ernesto would also like to increase the cave-aged cheese production. Not only would this potentially ensure cash flow throughout the winter months but also reduce his workload by trading some days of cumbersome Robiola making. However, this venture depends on increasing milk production, which, in turn, depends on either increasing his herd size of milk producing goats or securing an external source of additional goat milk, which so far has proven challenging. Furthermore, he needs expert advice on cave-aging cheese. But due to the lack of local expertise, including among farmers and the farmers' union, Ernesto plans to go to France and learn from experts in 2024 or 2025. Nevertheless, ideally, an expert would visit the cave in Margone and provide advice based on the specific conditions of the cave.

Goatherd:

Maximising grazing time for the goats is important to Ernesto, but it presents challenges. When he's away, they stay in the stable. When he's in Margone doing farm chores, he must pause his tasks to guide them into the forest, from where they'll graze on their own. Back in the village, he would resume his chores and periodically check their whereabouts using Kippy GPS. If they stray towards the fields around Margone or the mountain road connecting Margone and Ranzo to Lon, Ernesto must again interrupt everything and intervene, which can be time and energy consuming. Ideally, Ernesto would like to rely on someone else for goat herding to take some pressure of his chest and free up valuable time. However, considering Margone's remote location, its 45 inhabitants, and Capra Punk's currently stringent budget, finding an available and willing goatherd poses a challenge in and of itself. As indicated by Papadopoulou et al. (2021), "If not organized carefully, farms which graze more do not reduce their feeding costs or they counterbalance this reduction with increases in labor expenses".

Village hall, Bar, Bed & Breakfast, and Refuge:

Interestingly, there is a village hall in Margone, located next to his house, which once served as a bar and refuge hosting villagers and travellers. Given the various groups of people passing through today, such as hikers, mountain bikers, paragliders, climbers (many crags around Margone), and tourists, Ernesto envisions reopening the village hall one day. This idea involves providing local vegetables and Capra Punk based bread, cheese, and milk, thereby establishing Margone as a food district. Arguably, the vision is achievable with institutional support from CAP and the Trentino Five Priority Goals under the banner "rural community development initiative".

5. Discussion

As highlighted by Pulina et al. (2018), Mena et al. (2017), Tsiouni et al. (2021), it's incredibly difficult to achieve economic sustainability as a small-scale small ruminant farmer in the FGIS countries. The case study of Capra Punk and Ernesto confirms these findings and underscores the physical and mental burden accepted and paid by a small-scale farmer who is aiming to establish a viable farming business in all dimensions of sustainability.

Given the limited application of the TAPE framework, the analysis presented here lacks comparative data based on the same analysis protocol. It's only when TAPE grows in actual use, beyond solely being a theoretical framework and database, that this analysis will be valuable to the FAO in understanding the role of Agroecology in creating resilient food systems. Nevertheless, this analysis is valuable in providing insights into the realities faced by farms like Capra Punk and farmers like Ernesto and it can be compared to studies based on other methodologies.

Funding

According to the European Commission, CAP income support amounts to a minimum of €200 per hectare in 2023. Hypothetically, even if the current farming area of 10,15 hectares were to constitute "eligible hectares"[15], an extra €2,000 would indeed be helpful but not transformational for Capra Punk. This only highlights the necessity for Ernesto to either produce or source more milk to enable (economic) sustainability for Capra Punk.

Despite securing a €40,000 bursary under the CAP rural development program, funding remains insufficient. Similarly, Rocha (2017), in a study examining factors contributing to the resiliency of small-scale rural farms in the Garfagnana Valley in Italy, found that EU funding is limited and when available, comes with numerous criteria and bureaucratic obstacles, thus necessitating strong collaboration amongst local stakeholders. While setting up a dairy goat farm is cheaper than, for example, a dairy cow farm, it still requires large investments in infrastructure, machinery, equipment, goats, and ongoing maintenance costs. Since establishing Capra Punk in 2022, Ernesto has invested his entire savings, approximately €30,000, and taken three loans totalling €90,000 to get the business up and running. The €40,000 CAP money solely serves the purpose to repay the loans and is based on a 10-year lock-in, requiring most of Ernesto's income to come from farming during this time. Evidently, this exposes him to uncertainty and potential opportunity costs, not to mention the obligation to pay back a portion of the grant in case the business closes. However, looking at it from the sunny side up, limited funds have forced Ernesto to be innovative and efficient. The fact that he was closing yoghurt caps with a clothes iron instead of a thermocloser is a testament to this financially induced creativity and comprehension of necessity. Or, again, take the use of acid whey, creating economic value with a conventionally though waste product.

Economic viability: a matter of scale

Speaking of funding, confirming the findings of Pulina et al. (2018), the obvious Achillies heel of Capra Punk is its economic viability, a challenge directly tied to its scale and business model. This is reflected in the values for Productivity and Value Added. Notably, without the EU bursary, the value for Income would be considered unsustainable, marked in red. Currently, the infrastructure is not optimised economically, and Ernesto could easily quadruple current milk production without requiring significant increases in his workload or investments in larger machinery and equipment. Furthermore, increasing milk production would allow Ernesto to meet the existing interest (not guaranteed) from supermarkets and restaurants, arguably the gateway to broader cultural acceptance and economic stability. Consequently, expanding the goat herd, or at the very least, sourcing more milk, would enable Ernesto to maximise the existing infrastructure, establish Capra Punk into key markets, and enable room for economic sustainability. Arguably, this requires funding, given that 18 Nera di Versasca cost him €4,500 in 2022.

[15] European Commission (2023)

The sensitivity of prices and keeping the head above water

Momentarily, Ernesto's cheese is about as expensive as the goat cheese of other producers. While some of their farms may be semi-extensive, those that age cheese use standardised refrigerators. Therefore, considering the time and methodology of Ernesto's production, it could be argued that his products should be more expensive. However, if he were to reflect the time and effort in the prices of his products, this would probably have an adverse effect on both existing and potential customers. Unlike cow and buffalo milk, goat milk is not subsidised, and thus more expensive, raising considerable concerns about the logic and fairness of the subsidy landscape. Anyhow, he must be cautious with pricing, balancing customer expectations and affordability with his own economic sustainability.

Fresh cheese, cave-aged cheese, or bread

Furthermore, he still needs to decide which product to prioritise. As clarified, finding an answer depends on finding appropriate help with aging cheese, experimenting with bread production in Margone, and fundamentally, the amount of available milk. Arguably, considering Ernesto's challenges in standardising his production for cave-aged cheese, it would be a lot easier for him if structures were in place to facilitate knowledge transfer in this area. For example, with local expertise limited and Ernesto's plans to visit France, funds for such an excursion would be both helpful and justified, especially considering the cultural heritage value of cave-aged cheese.

Workload

Given the long, demanding days and the limited time at his disposal, Ernesto could consider registering his farm on woofing.com or partnering with agricultural departments of universities, as has been done by other farms in the region (i.e. Naturgresta, Azienda Agriecologica Mussoni Tomas). Arguably, committing to these opportunities could increase the likelihood of finding someone willing to share the workload, potentially by helping with goat herding.

Favourable conditions

While the physical and socio-economic environment presents considerable challenges to Capra Punk's agroecological journey, there are also favourable aspects to consider. Farmer's markets, though complementary to supermarkets in northern Italy, are deeply embedded into the fabric of Italian culture and are providing opportunities for producers like Ernesto to establish a presence. Furthermore, he is fortunate in that health food stores are gaining in popularity and that he finds ways to distribute his produce, i.e. restaurants and supermarkets.

Environmental and ecological considerations

Ernesto argues that his small herd size has minimal impact on the otherwise untouched forest on Monte Gaza. Even if his herd was to increase to more than 100 goats, their grazing behaviour wouldn't have a big impact on the forest ecosystem. As the goats move through the forest, led by their leader, they cover a lot of width, which means that not many goats forage on the same bush or climb on the same tree. While his knowledge is experiential and not scientific, he wants to deepen his understanding of how the goat's grazing behaviour affects the forest ecosystem. Therefore, and drawing on his conversation with the mayor, he suggests allocating an area of land for the goats to graze and conducting trials indicative of changes in bare soil levels, species diversity, species richness, and other parameters. Arguably, if the studies were to suggest that the presence of the goats is a favourable contribution to the forest ecosystem, it would strengthen the case to include them into the municipal forest management plan and change the mobility status to legal. Furthermore, this could potentially lead to discussions around compensating Ernesto for the ecosystem (and cultural) services his goats provide, as recommended by Bernués et al. (2011) and Pulina et al. (2018).

Future research

Beyond exploring the positive implications of grazing farms to initiate discussions around compensating farmers for providing ecosystem and social services, within the context of Capra Punk, there is room for conducting a more thorough environmental analysis of the farm, by for example doing a Life Cycle Assessment. However, I would argue that there's no relevance to this beyond revising the farm's agroecological character. Instead, looking at broader implications, this case study shows that there's a clear gap between policy objectives and their practical support. In my

opinion, this take-away necessitates further studies into the sustainability of small-scale farms like Capra Punk, especially those situated in marginal areas. Should further case studies confirm this gap, they may contribute to establishing an evidence base that can help to develop more effective policies around agricultural support.

6. Conclusion

Without a doubt, Ernesto is incredibly committed to making Capra Punk sustainable in every aspect. Coming from a background in law and tourism, he's singlehandedly carrying on a local tradition in Margone, and sharing its fruits locally and regionally. Arguably, this makes him the poster child of the CAP rural development program and SproSS. Despite being engaged in different knowledge platforms and finding various ways to distribute and sell his produce, the workload is physically and psychologically overwhelming and simply not sustainable in the current pace. Not to mention, that economic viability remains a challenge.

While Ernesto may address barriers such as product focus and scaling up production, cave-aging cheese requires expertise, which requires funding. Expanding production requires buying more milk or additional goats, and possibly hiring another person to manage the workload. While Ernesto could save for this, he's struggling to make ends meet, and given the startups young age and financial struggles, it's unlikely that he will be able to invest in in additional resources prior to 2024.

Due to the competitive nature of the milk industry, it's incredibly challenging for a business model based on maximising grazing time and cave-aging cheese, alongside a small herd size, to compete with business models based on housing ruminants in stables. Adding to this complexity is the unfair competition with subsidised cow and buffalo cheese producers. Clearly, it has taken exceptional vision, drive, and dedication to establish and develop Capra Punk, for which Ernesto is worthy of both recognition and respect. In effect, his predicament can be compared to that of the knight in the tale of Monty Python, who despite having his limbs cut by his adversaries, calls for their return. Yet, as the sketch points out, there comes a time when one's voice falls silent. To prevent this from happening, policymakers should, amongst other things, be questioned for creating skewed subsidy landscapes that essentially are handicapping dairy goat producers like Ernesto. Similar to the findings of Tsiouni et al. (2021) for goat farms in Greece, it's likely that Capra Punk won't survive without subsidies. Furthermore, considering that a farm like Capra Punk aligns with the social, cultural, and environmental values and ideas of the institutional support frameworks CAP and Trento Five Priority Goals, farms like his should be supported in achieving their mission. It's instrumental that institutional frameworks walk their talk, and don't leave our farmers hanging. As Guth et al. (2022) highlight, agricultural policy must be more effective in promoting the financial viability of small-scale farms. As clarified, while CAP income support won't be life changing for Ernesto, sectoral support can at least contribute to creating a level playing field (regaining his limbs). Additionally, funding under the CAP rural development program remains crucial. Similarly, funding from SproSS will be welcomed with open arms whenever it becomes available.

To sum up, temporal and financial constraints hinder Capra Punk's sustainable development. And ironically, it's just a matter of time and finances before Capra Punk can increase its agroecological character and achieve social, economic, and environmental sustainability. Hopefully, both for Ernesto and the Trentino, this will be before December 2024.

7. Assumptions

This paper assumes that the agroecosystem comprises the stable as well as the forest. As such, the forest is part of the natural ecosystem, and it is simultaneously part of the agroecosystem. Thus, there is no clear boundary of where the agroecosystem begins and ends. On paper, it exists on the 1500sqm on which the stable is based, but in practise, it is considerably larger, estimated at 10,15 hectares.

8. Limitations and Ethical considerations

Delimitation

1. I don't address methane emissions coming from the production system.
2. I don't address the carbon dioxide that is added into the soil.
3. Reading English summaries to Italian papers and papers published in English may have left out valuable information.

Participatory observation

Aside from the objectivity of the researcher (Lincoln and Guba, 1985), a common criticism of the participatory observation methodology is that the mere presence of the researcher can influence the behaviour of the system under study (Fink, 2010). Moreover, subjects may have strategic reasons to portray themselves differently or to perform different tasks than usual (Fink, 2010). While it's reasonable to expect that such distortions would naturally smooth out over time, the exact duration for such adjustment is unclear and seems to depend on both system and researcher. Considering the labour intensity and consistent high levels of stress in the case of Capra Punk, I would argue that there was little opportunity for pretence, especially as I was living with the family in their home.

Thoughts on TAPE

To ensure that all farms can be analysed and later compared, TAPE is based on a standardised questionnaire. However, given the scope of this objective, some factors are given more weight than others, and some factors are overlooked altogether. Unfortunately, TAPE doesn't adequately address pastoral farms, making it unclear how to account for farmland area in such systems, thus complicating evaluations.

Furthermore, given that human decision-making is influenced by heuristics, it's easy to make quick comparisons by putting graphs and numbers side by side. However, comparing quantitative scores across contexts, such as the scores of Capra Punk with the scores of a vegetable farm in Puglia, can be misleading. Scores must be interpreted within their specific contexts and it's therefore generally more appropriate to compare farms which share similar settings. Otherwise, in addition to step 3, where step 1 is explained by step 0, one possible solution is to assign an additional score that reflects the extent to which a farm is maximising its agroecological potential with respect to local conditions. Arguably, this would allow for comparisons across settings while addressing human heuristics.

Language barrier

My basic knowledge of the Italian language limits this research in that I couldn't read the national and regional strategic documents like SproSS in Italian. Instead, I either had to rely on English summaries or had no material to work with. Arguably, someone fluent in Italian would be better suited to connect the performance of Capra Punk to the objectives outlined by the national and regional strategies. Nonetheless, besides this, I don't think the language barrier limited my understanding of Capra Punk. Ernesto is fluent in English, and aside from conversations in English, I learned a lot by simply getting involved into the farm's daily activities.

Appendix

Table 23. Machinery and Equipment

Machinery/equipment	Quantity	Price per unit (€)	Years used by farmer	Years planning to use	Depreciation value
Bobcat	1	5,300	March 2023	Until worn out	(5,300-0)/50
Tractor	1	5,000 (Margi)	2021	Until worn out	0
Hay (press, rotation, cutter, manual)	1 of each	Cutter (850), rotation (400), press (gift), manual (gift)	2021-2022	Until worn out	(1,250-200)/10
Mitsubishi Truck	1	Gift, he pays €500/year insurance	2021	Until worn out	(27,000-5,000)/15
Carpigani Pastomaster 60he	1	27,000	April 2023	20	(2,200-200)/10
Thermocloser Yoghurt Thermocap	1	2,200	May 2022	10	(1,500-1,500)/5
Trailer	1	gifted	2020	Until worn out	0
Milking table	1	1,200	2021	Forever (steel)	(9,800-2,000)/2
Stable	1	9,800	2021, 2022	Dec 2024	(11,000-0)/5
Lab furniture	1	1,500	2022	5, except for steel	
Cave	1	1,100	2021	5	

Table 24. Dietary Diversity

FOOD GROUPS:	Yes, I ate it in the last 24 hours	No, I did not eat in the last 24 hours
GRAINS, WHITE ROOTS (bread, rice, pasta, flour, white potatoes, white yams, manioc / cassava / yucca, taro, etc.)	Yes	
PULSES (beans, peas, fresh/dried seed, lentils, including hummus, tofu and tempeh)	Yes	
NUTS and SEEDS (Tree nut, groundnut / peanut or certain sees, or nut/seed “butters” or pastes)	Yes	
DAIRY products (milk, cheese, yoghurt or other milk product but not including butter, ice cream, cream or sour cream)	Yes	
Meat, poultry, fish (beef, pork, lamb, goat, chicken, fish, seafood, animal organs)	Yes	
EGGS from poultry or any other bird (beef, pork, lamb, goat, chicken, fish, seafood, animal organs)	Family	No
DARK GREEN leafy VEGETABLES (any medium to dark green leafy vegetables, including wild/foraged leaves)		No
DARK YELLOW or ORANGE FRUITS and VEGETABLES (mango, papaya, pumpkin, carrots, squash, orange sweet potatoes)	Yes	
Other VEGETABLES (cucumber, eggplant, mushroom, onion, tomato, etc.)	Yes	
Other FRUITS (avocado, apple, pineapple, etc.)	Yes	

Table 25. WEAI Protocol Margarita

DOMAINS	AREAS OF ASSESSMENT	ANSWER	SCORE	WEIGHT
Productive decisions	About CROPS PRODUCTION, ANIMAL PRODUCTION, OTHER ECONOMIC ACTIVITIES	» Myself or Both of us » My Husband or Someone else	1 **0**	1/4
	About MAJOR & MINOR HOUSEHOLD EXPENDITURES	» Myself or Both of us » My Husband or Someone else	**1** 0	1/4
	Perception of decision making about CROPS PRODUCTION, ANIMAL PRODUCTION, OTHER ECONOMIC	» No decision » Just little decisions » Some decisions	**0** 0.33 0.66	1/4

	ACTIVITIES	» In great part/totally	1	
	Perception of possibility of decision making about MAJOR & MINOR HOUSEHOLD EXPENDITURES	» No decision » Just little decisions » Some decisions » In great part/totally	0 0.33 0.66 **1**	1/4
Access to and decision-making power about productive resources	Secure land tenure for men and women (From the results of 3.4.1)	» Green for women » Yellow for women, yellow or red for men » Yellow for women, green for men » Red for women, red for men » Red for women, yellow for men » Red for women, green for men	**1** 0.75 0.5 0.25 0.1 0	1/4
	Access to credit	» Possible for women in secured channels » Possible for women in non-official channels only, possible for men non-official channels only » Possible for women in non-official channels only, possible for men in official channels » Not possible for women, not possible for men » Not possible for women, possible in non-official channels for men » Not possible for women, possible in secured channels for men	**1** 0.75 0.5 0.25 0.1 0	1/4
	Ownership of CROPS, SEEDS, ANIMALS, and OTHER PRODUCTIVE ASSETS	» Myself or Both of us » My Husband or Someone else	1 **0**	1/4
	Ownership of MAJOR & MINOR HOUSEHOLD ASSETS	» Myself or Both of us » My Husband or Someone else	**1** 0	1/4
Control over use of income	Decisions about the use of the revenue generated by CROP PRODUCTION, ANIMAL PRODUCTION and OTHER ECONOMIC ACTIVITIES	» I did not contribute or I contributed in few decisions » I contributed in some decisions » I contributed in almost all the decisions	**0** 0.5 1	1
Leadership in community	If these groups exist in your community, how often do you participate in their activities and meetings? WOMEN'S ASSOCIATIONS AND ORGANIZATIONS	» Never/almost never » Sometimes » Most of the times » Always	**0** 0.33 0.66 1	1/2
	COOPERATIVES FOR RURAL PRODUCTION Social Movements, Union of Rural Workers, Political Groups, Religious Groups, Training for, Capacity Development, Other	» Never/almost never » Sometimes » Most of the times » Always	0 **0.33** 0.66 1	1/2
Time use	More than 10.5 hours spent working per day	» Women no » Women yes, men yes » Women yes, men no	1 **0.5** 0	1/2
	Time spent in AGRICULTURAL ACTIVITIES + FOOD PREPARATION & DOMESTIC WORKS + OTHER GAINFUL ACTIVITES	» Women's time > men's » Women's time < = men's	0 **1**	1/2
Total			43.3%	

Figure 11. Cave-aging cheese, photo by Ernesto

Figure 12. Capra PUNK, photo by Ernesto

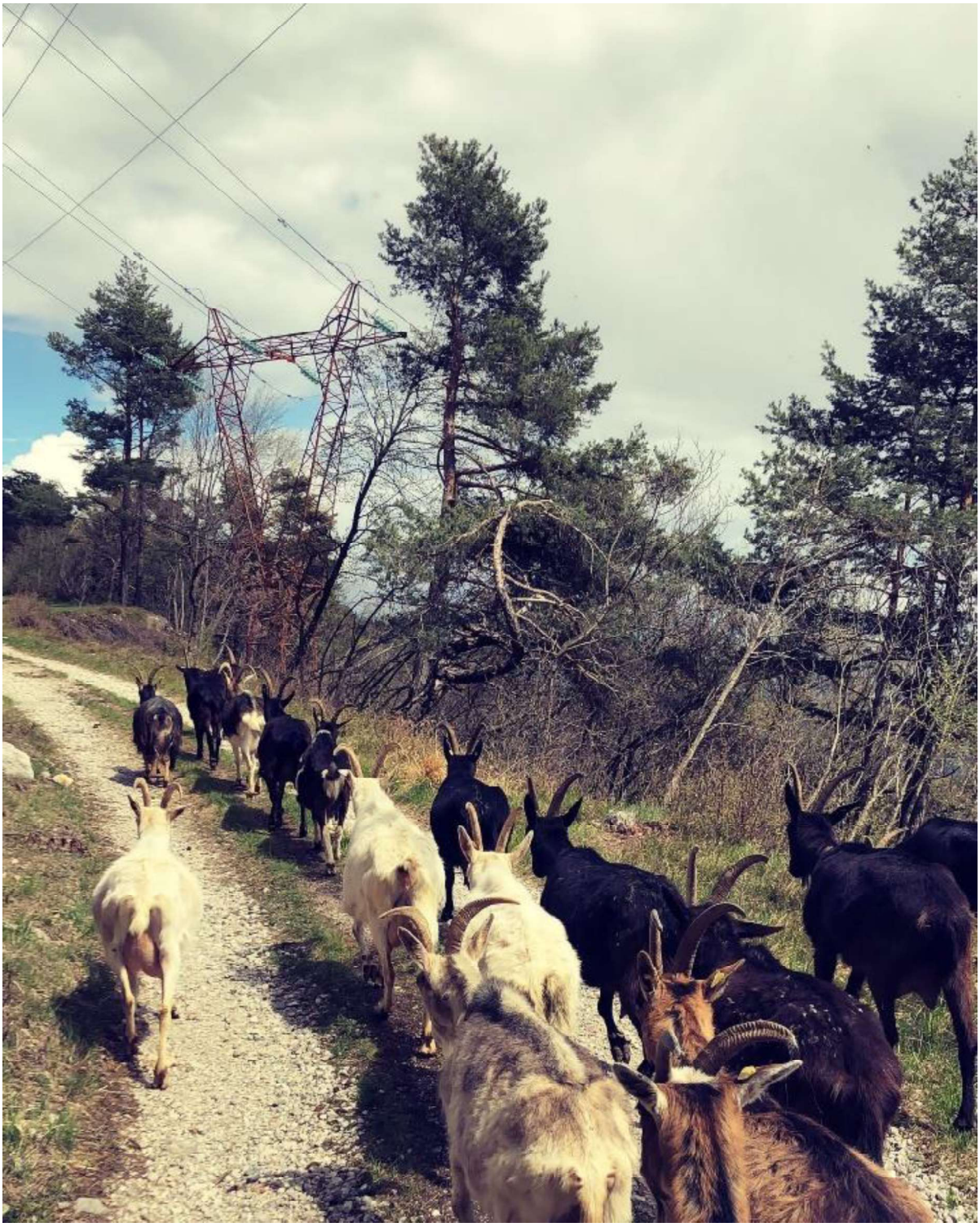

Figure 13. Walking into the forest, photo by Ernesto

Figure 14. Post milking, photo by Ernesto

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Popular Science Summary

This dissertation addresses the sustainability of Capra Punk, a goat farm situated in the mountain village of Margone in northern Italy. It's a relatively young farm, having been created in 2022. Based on its geography, topography, history, and management style, Capra Punk is an unconventional farm. The goats graze in the local forest throughout the year and the farmer, Ernesto, produces a range of fresh cheeses, cave-aged cheese, gelato, salami, and acid whey-based bread.

The case study of Capra Punk illustrates the complex challenge for (small scale) farms attempting to attain overall sustainability. Although Ernesto provides ample space for his goats in the stable, allows them to graze in the forest, connects with customers and producers at market and fairs, and shares his philosophy on farming and cheesemaking openly, he struggles with financial viability. Evidently, employing environmentally and socially sound practises doesn't guarantee economic reward.

A crucial obstacle in the case of Ernesto's Capra Punk is its scale. The farm produces too little milk to leverage its infrastructure and to create cash flow throughout the year (fresh cheese during summer months and cave aged cheese during winter months). Another challenge is the fact that goat milk isn't subsidised in Italy, which puts Ernesto at a disadvantage as he's competing with subsidised cow and buffalo milk farmers who can afford to sell at lower prices.

Furthermore, this case study sheds light on the discrepancy of specific policy objectives and their practical support for small-scale farmers like Ernesto. Although Capra Punk aligns with the objectives of the Italian CAP strategy and the Trento Five Priority Goals (SproSS), he's largely operating in isolation from them. Consequently, this highlights the broader systemic challenges within agricultural support systems and the need for more effective alignment between policy objectives and their practical implementation. However, being a case study, additional research on farms like Capra Punk is necessary to gain a more significant understanding of this discrepancy.

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