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► **To cite this version:**

Michela Bevione, Nicolas Buclet, Jean-Yves Courtonne, Pierre-Yves Longaretti. Socio-ecological transition, wealth creation and territorial metabolism: the case of the production of the AOC-labelled cheese Beaufort in the Maurienne Valley. ESEE 2019 - 13th International Conference of the European Society for Ecological Economics, Jun 2019, Turku, Finland. pp.1-4. hal-02430879

HAL Id: hal-02430879

<https://hal.inria.fr/hal-02430879>

Submitted on 7 Jan 2020

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Socio-ecological transition, wealth creation and territorial metabolism: the case of the production of the AOC-labelled cheese Beaufort in the Maurienne Valley

Michela Bevione^{1,2}, Nicolas Buclet², Jean-Yves Courtonne¹, Pierre-Yves Longaretti^{1,3}

1. STEEP-team, Inria, Grenoble, France.
2. Pacte Laboratory, Grenoble, France.
3. CNRS, Grenoble, France.

Objectives of the study

This PhD thesis, started in October 2016, aims at analysing socio-ecological dimensions of human activities creating wealth by coupling quantitative-biophysical approaches and qualitative and socio-economic methodologies to assess territorial metabolism. By focusing on the interactions between flows and actors, the methodology we propose aims at providing a methodological framework for the understanding of a territory and its capability.

This thesis contributes to the interdisciplinary research field of territorial ecology, which have emerged in France in recent years inheriting from industrial and urban ecology (Madelrieux et al. 2017). Territorial ecology aims at better understanding the modes of interaction between societies and their environment by focusing on the relationships between the metabolism (material and energy flows) of a territory and its social, political and economic organization. It also purposes to capture the interdependence towards other territories as well as the internalization and/or externalization of environmental pressures (Madelrieux et al. 2017). Despite recent developments, quantitative, biophysical works remain dissociated from socio-economic, qualitative approaches (Buclet 2015).

Previous works in territorial ecology (Buclet 2015) propose an analytical framework to describe wealth creation in a territory through a systemic approach based on the notion of sub-system creating wealth. After identifying structuring human activities in a territory (according to their relevance in economic and social terms), material and immaterial flows circulating within and throughout the sub-system are traced and analysed in combination with actors' organisation system. Material, monetary and immaterial resources enter the sub-system as an input and they get transformed into material products, monetary incomes and/or immaterial resources. The origin of input resources and the destination of output products is a central point of the analysis, as well as the retroactions that outputs have, in a positive or negative way, on input resources and other human activities in the territory.

The aim of this thesis is to verify the operationality of such an analytical framework and to propose a combined quantitative and qualitative methodology to contribute to the understanding of a territory and its capability. This involves examining the degree of autonomy of the territory in terms of actors' capacity to control their own socio-economic future (Buclet, forthcoming), and evaluating the ecological sustainability of human activities and their impact on territorial resources. Which flows circulate within and throughout the territory and which are the environmental pressures related to them? How actors' strategies can influence the circulation of flows and their environmental pressures? Which internal or external perturbation factors can have an impact on the circulation of material flows and their environmental pressures in the territory?

The replicability of the methodology to other territories at intraregional and departmental scale is one of the goals of this thesis. Indeed, this is a pertinent scale to conduct research to nourish local action, as dynamics of territorial production often do not match with administrative and political boundaries (Pecqueur 2017). Therefore, since statistics are usually not available for unofficial boundaries such as intraregional and intradepartmental territories and direct data collection would be too complex and

time-consuming, we think that developing a transposable, replicable methodology represents a significant contribution.

Case study

As a case study for this thesis, we chose to focus on the production of the AOC-labelled cheese Beaufort in the Maurienne Valley (Savoie department, Auvergne-Rhône-Alpes region, France). Indeed, agriculture plays a structuring role for the economic and social dynamics of the valley, and the landscape construction induced by farming activities contributes to create favourable conditions to the development of the touristic sector (Buclet, forthcoming). Beaufort represents the flagship product of the agricultural sector in the valley and most of farms are dedicated to milk production for the Beaufort industry (Plan Stratégique Agricole et de Développement Rural de Maurienne, 2011).

Beaufort production is subject to some technical specifications imposed by the Beaufort Syndicate and the National Institute of Origin and Quality. In particular, only a confined area of the Savoie and Haute Savoie departments is allowed to dairy farming for Beaufort production and livestock feed is constrained in terms of importations of fodder and choice of feed supplements. Three cooperatives produce Beaufort in the Maurienne Valley, collecting milk in their specific areas of activity, producing and retailing Beaufort independently. Together with the other cooperatives of the Beaufort industry in the Savoie and Haute Savoie departments, they collaborate to collect whey and to transform it in a cooperative workshop in order to add value to this by-product. Several organisations deal with technical support and monitoring of the Beaufort industry from farming to retailing, which represent an advantage for data collection and fieldwork.

Methods

On the quantitative front, we apply Material Flow Analysis to model the circulation of material flows related to the Beaufort production within and throughout the territory of the Maurienne valley. The research effort concerns the analysis of material and energy flows related to livestock feed, milk production, milk transformation and commercialisation of dairy products and by-products, covering the entire supply-chain of Beaufort industry. We investigate the origin of input resources as well as the destination of dairy products and by-products for valorisation and commercialisation. Coupling MFA with Life-Cycle Analysis allows us to evaluate the environmental pressures related to the circulation of material flows and their internalization and/or externalization. Monetary flows are taken into account as well in order to provide an evaluation of the financial viability of the Beaufort industry in the valley.

On the qualitative side, actor analysis allows us to enlighten the organisational, relational structure of material flows circulation, and to deep comprehend the reasons why flows circulate (in a specific way). Through documentary review, direct observation and semi-directive interviews we investigate the decision-making processes behind the circulation of flows and the actors' degree of freedom in their choices. The approach of territorial resources (Kebir 2004) provides a framework to apprehend the way actors unveil, seize and construct material and immaterial resources to create wealth, by interacting with their environment and its richness. Therefore, immaterial aspects of territorial metabolism (informational flows, traditional techniques, local specificities) are part of the analysis, accordingly to their connection and translation into materiality and their relevance in the comprehension of the capability of a territory.

Results

We represent the circulation of material flows through flow maps, showing the movement of material and monetary resources and products, their direction, source and destination. We focus on the circulation of flows related to the Beaufort industry within the Maurienne Valley and between the valley and other territories. Through Sankey diagrams (a specific kind of flow maps, where the width of the arrows is proportional to the flow quantity) we present the dominant contributions to the overall material flows circulation. This kind of representation is appropriate to characterise the circulation of material flows, the allocation of environmental pressures throughout the Beaufort industry, as well as the monetary dimension and the added value associated to Beaufort production. Mapping the geographical origin of input resources and the destination of output products and incomes allows to evaluate actors' capacity to create wealth through the activation and mobilisation of local resources and/or their dependence on foreign inputs.

Furthermore, results include schematic representations of the relations between local, extra-territorial actors and the circulation of material, environmental and monetary flows. The influence of immaterial resources (informational flows and traditional *savoir-faire*) and local infrastructures on the circulation of flows, and vice versa, is illustrated. Finally, positive and negative retroactions induced by output products on input resources for Beaufort production are drawn, as well as the interactions with other sub-systems creating wealth in the valley.

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Short abstract

This PhD thesis, contributing to the interdisciplinary research field of territorial ecology, aims at analyzing socio-ecological dimensions of human activities creating wealth by coupling quantitative-biophysical approaches and qualitative, socio-economic methodologies to assess territorial metabolism. By focusing on the interactions between flows and actors, the methodology we propose aims at providing a methodological, replicable framework for the understanding of a territory and its capability. The production of the AOC-labelled cheese Beaufort in the Maurienne Valley (Savoie department, Auvergne-Rhône-Alpes region, France) is the case study for this thesis.