

CASE STUDY

VOLVIC WATER CATCHMENT PROTECTION (FRANCE)

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Volvic Plant Location with the Auvergne
Regional Natural Park
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TRANSFORMING APPROACHES TO RURAL LAND MANAGEMENT

Stimulating long-lasting improve-
ments in the delivery of social,
economic and environmental
benefits from EU agricultural and
forest land



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1 Introduction: What is the case study about?

The target area is the catchment of Volvic Waters (also called impluvium hereafter), owned by Danone, which covers 3800 Ha across four communes of the department of Puy-De-Dôme¹ located in the surrounding of Clermont-Ferrand City (Map 1). These 4 communes all belong to the community of communes, or intercommunity, called “Volvic Sources et Volcans” (VSV) encompassing 7 communes and 18,000 inhabitants. Danone is one of the main regional employers (about 1000 employees on-site) and a significant source of local tax (about 40% of the VSV annual budget). Since 2007, the company has initiated a water catchment strategy that involves public stakeholders and land managers (farmers in particular) in order to prevent water from pollution, water shortage and improve its brand reputation.

The catchment area of 3800 hectares is mostly covered with forest (53%) and agricultural land (41%). Forest resources are dominantly private (86% of forests) and unmanaged. Agricultural land is mainly pasture supporting extensive cattle raising (mostly for meat production but also dairy). Agricultural production is generally not transformed locally and marketed outside the territory through the conventional market (only 2 farmers sell their meat under an official quality sign). The remaining 6% of the watershed correspond to urban areas.



Figure 1: Location of Volvic case study

The catchment is located at the piedmont of an old volcanic area (La Chaîne des Puys) with a medium altitude of 500m above sea level, and the highest point at 998 m. Despite the proximity with the Clermont-Ferrand agglomeration (300 000 inhabitants), the average density of population is low at only 63 inhab/km², with a concentration in the commune of Volvic (162 inhabs/km²) and a high dispersion in the rest (30 inhabs / km²).

The primary ESBOs are related to groundwater services. They correspond to water quality and mineral content stability on the one side and availability of regular water supply on the other hand. These primary ESBOs are linked to land-uses. Water quality depends on forestry and agricultural practices on the impluvium, while availability of water supply could be affected by the forest-agriculture equilibrium (eg: increase of forest’s surface reduces the volume of groundwater, and inversely).

Two other ESBOs that have been identified after the step 3 and 4 of WP4. They correspond to maintaining the landscape specificity of Volvic territory, and rural vitality. La Chaîne des Puys (the whole volcanic area) is candidate to become UNESCO world heritage, while rural vitality

¹ Volvic: 1300 ha, Charbonnières-les-Varennes: 1500 ha, Saint-Ours: 500 ha, Pulvérières: 500 ha.



is important for this low population density area. Having economic activity is vital for its existence. The catchment's exploitation, especially from Danone Water Company, contributes directly to maintain the rural vitality, while agriculture helps to keep the landscape attractive and accessible for tourists. The last identified ESBO is the biodiversity preservation. It concerns a few endangered "flagship" species (secondary ESBO), in particular the protection of red kite (*milvus milvus*) and few other species of bats who are in the EU bird and habitat directive list. Important for Danone and local authorities, but this ESBO was not fully shared by other actors in the participatory workshop.

All 5 ESBOs are interconnected, meaning that changes in the provision level of one ESBO could impact the others. Groundwater is more depending on landscape and biodiversity than other interconnected links among 5 ESBOs. The resource system is hence complex, because there're mutual dependencies between groundwater and surface resources (forest, biodiversity, landscape). But groundwater is the most valuable economic resource.

Two main downstream stakeholders have rights to use and distribute the water from the aquifer and thus depend directly on the water-related ESBOs (quantity and quality). 1. Volvic Waters Company (owned by Danone) uses 15%² of the aquifer water flow per year 2. The SMUERR – a public syndicate in charge of drinking tap-water distribution –uses 35%. Members of the SMUERR are local government agencies and authorities. It supplies drinking water for about 60,000 downstream households living outside the water catchment. The rest 50% of Volvic aquifer remains unused. It is worth noting that land-users do not use this specific aquifer groundwater (e.g. for irrigation purpose) and are thus not considered as beneficiaries from water services in this study.

In France, the legal framework (ownership rights, special rights-of-use defined by public authorities) plays an important role. In our study area, private and public ownerships are defined for land (see section 2.2. for more details). It is worth noting that there is no specific public regulation restricting the use of private land located in the impluvium with the aim to increase the supply of water services (farmers are free to choose their activities and practices). On the other hand, groundwater can be considered as a common resource of which exploitation rights-of-use are granted to Volvic waters company and to the SMUERR (withdrawal right in the approach of Ostrom and Schallager) by the government.

Two new local governance arrangements emerged and frame more or less the local management of ESBOs. The first and most important one manages the relationship between downstream local authorities (Volvic municipality and VSV) and Danone Company. This resulted in the creation of CEPV (Environment and protection committee of the Volvic water catchment area), a local committee gathering the 4 municipalities of the watershed and Danone. The mission of the CEPV is to collectively develop suitable policies for the management of the water catchment area. CEPV's members are key actors in the process of governance. The second governance arrangement is the forestry charter that governs the exploitation of public forest in a compatible way with landscape and groundwater. The forestry syndicate SMGF

² This figure was provided by the deputy mayor of Volvic commune



supports a forestry charter: it gathers mayors of all communes having public forest within the VSV (Volvic Source and Volcanos) intercommunity.

It is worth noting that land users (farmers, forest land owners) are not directly involved in these new governance arrangements aimed at enhancing the provision of ESBOs (see discussion in sections 2 and 3). One potential reason is that they are not organized. Farmers will probably be engaged in the future as Danone intends to invest more effort in encouraging them to change their farming practices. However, it is unlikely that private forest owners will be engaged in the governance of ESBOs because they possess small plots (2060 owners for about 2000 ha) and are mostly absent (living in other places, sometimes not being aware that they own forest plots in the impluvium).

A quick overview of historical data shows that it has never been any significant problems regarding groundwater services (e.g. water pollution, water shortage). Besides, up to now, the main threat toward groundwater services is rather associated with urban areas (e.g. obsolete water sanitation facilities) and infrastructures (ex. traffic accident involving trucks transporting hazardous waste). However, it is worth noting that traces of atrazine were found in Volvic water in 2012, reminding that the risk of pollution is not null and could potentially be linked to land-use practices³. Besides, the legislation for the mineral water license is stricter than legal requirements regarding quality standards of drinking water, as it requires stability of mineral content. Finally, risk associated with drastic land-use changes is expected to increase in the coming years in a context of increasing tensions on agriculture (ex. low prices). The sustainability of the overall system could thus be at threat if the link between agriculture and territory is not strengthened. This short description of the context explains why the current management strategy focuses on preventing the resource from potential contaminations (risk management) but also (see later sections for further explanations) about managing public image of Volvic water.

³ Some suppose that pollutions might come from maize cropping in this particular case, while others think that they come from railway chemical weeding by SNCF, the national company of rail transports.



Main Volvic CS characteristics

Region or locality	Main Farming/ forestry system	Area (ha) of initiative and CS if different	Key ESBOs covered	Total no. of farmers/ foresters involved	Other key stakeholders involved	Source(s) of funding	Start date of initiative	End date of initiative
France ; Auvergne-Rhône-Alpes region; department of Puy-De-Dôme; community of communes, or inter-community, called “Volvic Sources et Volcans” (VSV) ; 4 communes : Volvic, Charbonnières-les-Vareannes, Saint-Ours, Pulvérières	Farming (41%): extensive – permanent pasture-beef cattle. Forest (53%): mostly (86%) private unmanaged forest (marginal fuel wood collection) and extensively managed public forest for timber (14%)	3800 Ha	Groundwater quality Groundwater quantity Biodiversity conservation (birds, bats) Rural vitality (employment, agriculture decline) Landscape beauty (land uses highlighting geological formations)	2606 private forest owners 20 farmers owning land in the water catchment	Private company: Danone Local authorities: the 4 municipalities and the intercommunity Conservation NGO: LPO Research / academic institutions: VetAgro Sup	Danone (at least 300,000€ per year, not only for land-use interventions) Municipalities (100,000€ per year) CAP payments (1st and 2nd pillars) (but no condition regarding the provision of ESBOs). Probably other EU/ national / regional agricultural subsidies	2005 (creation of CEPIV)	Still going on



2 Definition of the social-ecological system (SES) studied

2.1 Figure of the SES

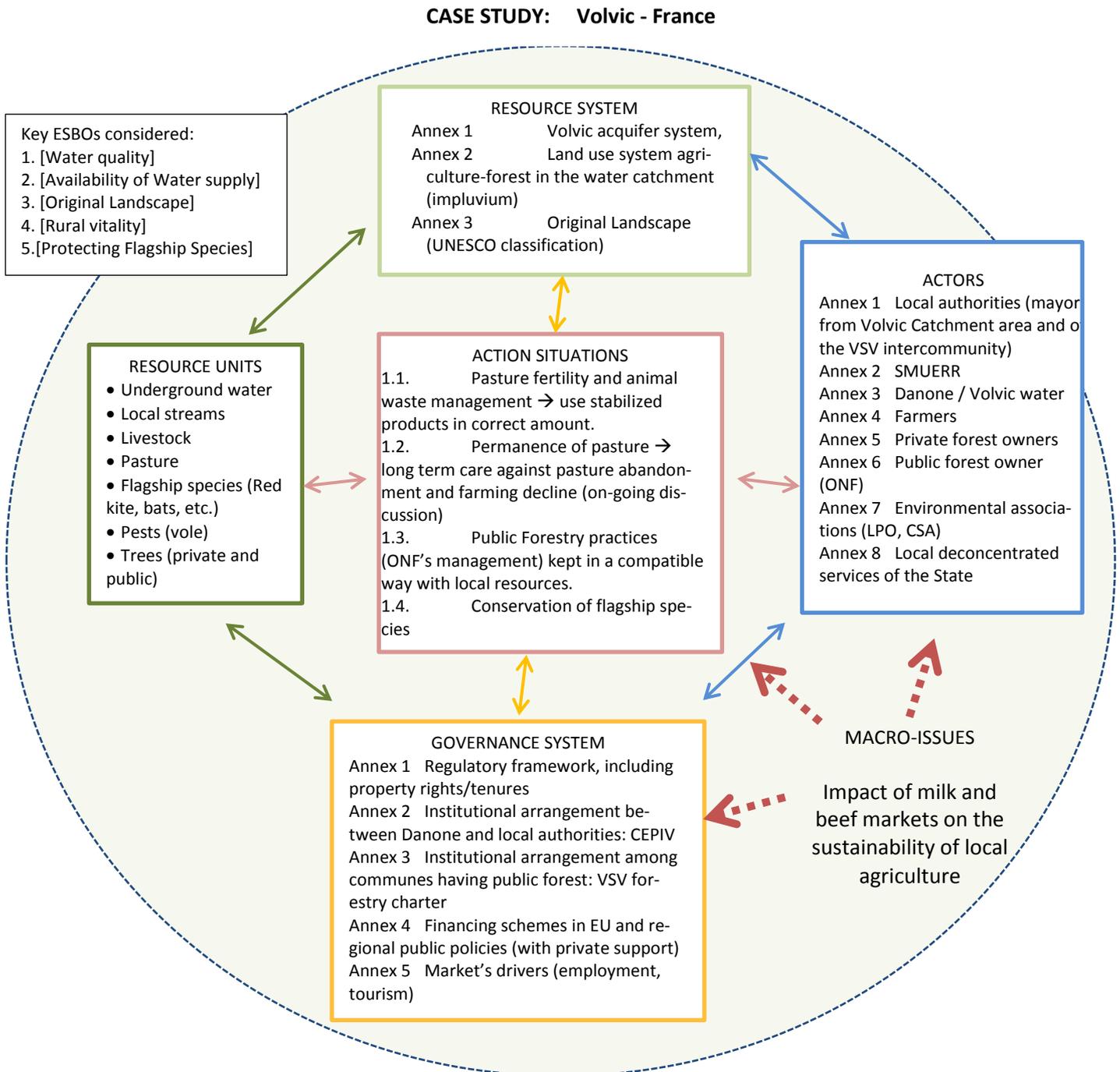


Figure 2:
Summary of the SES framework for VOLVIC case study
 (adapted from Ostrom and Cox 2010; McGinniss and Ostrom 2014)



2.2 Description of the SES

Resource system

The main resource system of the SES is the aquifer, currently exploited by the SMUERR and the Danone Water Company. This ground resource should be considered as part of a larger system composed by both ground and surface resources. Surface resource concern firstly agriculture and forestry activities. Water quality depends on agricultural practices, while water availability is depending on the agriculture-forest equilibrium. These surface resources are embedded in a larger landscape “Chaines des Puys et failles de Limagne”, which was presented twice (unsuccessfully) for being labelled as a UNESCO world heritage label. The specificity of this landscape is the fact that the distribution of land-uses (particularly forest and agriculture) highlights the geological interest of the site (volcanoes, rift). Tourists are also attracted the combination of natural and human areas in the landscape. We can say that there’s mutual dependence between ground and surface resources. Hence, a complex mechanism of human activity’s coordination is needed to maintain this whole system on work. Without going in detail of the governance mechanism, it is important at this step to describe main human activities on the zone, and their interactions with the resource system.

Agriculture

Farmland covers 41% of the water catchment area (so about 1600 ha) and is mainly pasture. There are about 10 Ha of crops only. Beef cattle is the dominant farming system in the water catchment. Current agricultural practices, and more specifically the management of effluents, don’t have any consequence on the quality of groundwater. The average nitrogen pressure is very low (on average 64 Kg / Ha) and generates only very limited risks (12 Kg / Ha maximum). However, this general situation can be threatened in case of a sudden change in practices, and thus recommend to implement risk prevention measures. Available water quality tests seem to confirm these results: levels of nitrates are high as compared to other mineral waters but below thresholds and traces of pesticides are found but at infinitesimal levels.

Forestry

Forest covers 53% of the watershed (2185.6 Ha). It is further composed as follows: 47% of deciduous forest, 23% of coniferous forest and 30% of young forests populated by pioneering species. 86.8% of the forest is private and is mostly unmanaged (only 65Ha have been coordinated under a management plan - GIEEF). The rest is public forest, which is managed by the national forest office (ONF).

Forest cover plays a major role in regard to the water availability in the aquifer. A scientific study showed that an increase of 10 % of the forest area will reduce the flow of downstream sources beyond 2% (LIFE SEMEAU project⁴). This because forests absorb more raindrop water on its surface than pasture does. Forest practices are also important, because converting coniferous forest (425 ha) in deciduous forest could increase the source flow rate of 9%. Changes

⁴ LIFE-SEMEAU (2009 - 2012) is an EU-funded project, which core objective was to model underground and aboveground hydrological systems in Volvic water catchment. Part of the research aimed at modelling the relationship between forest management, agricultural practices, and water quantity and quality. The robustness of the hydrological model was tested against local historical data (precipitation, water flow).



in forest practices, particularly an increase in timber/firewood extraction might induce risks on water quality (increased human motorized activity and risk of hydrocarbon pollution).

The ratio Forest-Agriculture is thus fundamental in the equilibrium of the system. A simulation in the LIFE SEMEAU project show that in case of agricultural decline's pursuit, a 80% territory cover by forest area might reduce the flow of the source of 6%. Conversion of young forest regrowth (390 ha) in extensive grasslands would increase the flow of the source of 5% and would not influence the water quality. Forest tend to increase naturally when agriculture decline.

Tourism

Tourist activities are managed by the regional authority (e.g at a larger geographic scale). Local authorities have invested in consolidating or creating country paths (or road) to facilitate hiking. With agriculture, tourism helps to limit forest development and contribute indirectly to the avoidance of groundwater's scarcity.

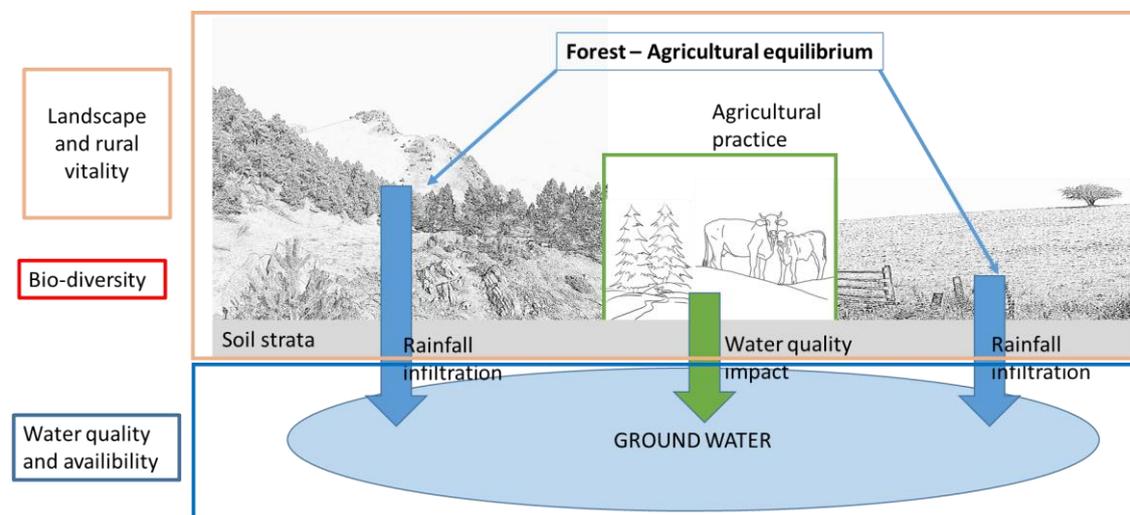


Figure 3: Illustration of Volvic's resource system

Actors

The involved actors are the SMUERR and the Danone Water Company, local authorities from the 4 communes of the water catchment area and from all communes belonging public forests in the VSV intercommunity, farmers, the State and other local public administrations, private forest owners, public forest owner (ONF), and environmental associations (LPO, CSA).

Local authorities pay much attention to the water quality and availability because they are in charge of water supply for local inhabitants. Problems in water quality or availability imply consequences in their legal responsibility, at least in terms of water supply cost (cost of water treatment). From their perspective, preserving biodiversity helps to protect groundwater and also the landscape. Local authorities receive indirect benefits in terms of local tax, local employment, and tourism development.

Danone contributes actively to the preservation of the underground water, but for its own interest. The company is a significant local tax payer (level of tax depends on the number of bottles sold in France) and a significant local employer. The annual tax amount varies around

2-3 million Euros. Danone has progressively paid attention on what happens on human activities and lands in the impluvium. With local authorities, the company co-contributes to their maintaining, such as project of improvement of hiking paths, and on the preservation of biodiversity (through CEPIV's budget). Danone starts questioning the future of farmers since they know that changes in agricultural activities are likely and could negatively impact groundwater. In a close future, the risk is to lose its mineral-water license. Worse case scenarios could theoretically happen in the middle or long-term, particularly in case of agricultural intensification, which would result in the increased use of chemical inputs.

There's 16 farmers in the zone of study. Although being significant water-related ESBO suppliers, upstream land-users are not direct beneficiaries of target ESBOs (water services, biodiversity, landscape). Most farmers produce cattle (dairy and meat) or to a smaller extent poultry (for details on the values-chains, please see section 7.3). We did not notice any significant conflict/tension between farmers and stakeholders distributing the aquifer. They display rather cooperative behaviours. However, we also noticed that this relationship is weak. Indeed, they are not really considered as key partners by Danone. In particular, they are not involved in the new governance arrangements aimed at enhancing the provision of ESBOs, despite being actual ESBO suppliers and despite being generally aware that their practices can eventually have an impact on local employment and income redistribution. Another key feature is that farm economic performance is weak. Thus, the future of agriculture in the area is reported to be uncertain. Farmers maintain their activities thanks to less favour zones payments from the CAP 2nd pillar (ICHN in French). These subsidies are of huge importance for maintaining farming systems in the Auvergne Region. Indeed, the Auvergne Region is, by far, the leading region in terms of ICHN payments with a total of 257 million € for the period 2014-20. Moreover, for the full CAP 2nd pillar, the Auvergne is the region benefiting (in France) the most from the European subsidies estimated at 52 720 € per worker in agriculture.

The issue of economic importance of agriculture and its decline is again a key issue here illustrated in the tables below.

Table 1: Data

Total Agricultural Surface (ha)	1970	1979	1988	2000	2010
63092 - Charbonnières-les-Varennes	1266	1177	957	445	572
63290 – Pulvérières*	771	916	1235	1621	1774
63381 - Saint-Ours	1772	1724	1905	1895	1769
63470 – Volvic	488	571	497	549	383
Total 4 communes	4297	4388	4594	4510	4498

*Note: a large part of Pulvérière's surface is outside of the Volvic catchment perimeter

Source: National Agriculture Census– Agreste, RSA 2010.



Table 2: Overview

Total farmers				
	Year	1988	2000	2010
63092 - Charbonnières-les-Varennes		56	16	16
63290 - Pulvérières		38	30	25
63381 - Saint-Ours		73	57	42
63470 - Volvic		32	23	12
Farmers in Beef / sheep growing				
	Year	1988	2000	2010
63092 - Charbonnières-les-Varennes		33	10	11
63290 - Pulvérières		28	24	19
63381 - Saint-Ours		59	51	33
63470 - Volvic		11	9	7

We can see that agriculture has declined sharply from 1970, both on available surface and on used surface. Data on number of farmers confirm this decline.

Finally *foresters* seem to contribute a little to ESBOs provision, despite its dominance in terms of land-use. As mentioned above, 86% of forest surface are private belonging to 2606 owners. Most of the time, these owners are not present on the territory and their exploitation are unmanaged. Public forester has a more active presence (creation of a public forestry charter), but their actions are quite modest comparing to that of Danone and local authorities. Forest surface tend to increase naturally if other human activities decline, which from a water availability point of view is not a good thing (the objective of Danone is to maintain the current balance between agricultural land and forests).

Governance system

The governance system in our case study has two important aspects. The first one is the property rights regime, which is central in actor's relationships in France. The second one is the construction of collective action mechanism, which regulates the use of Resource system in complement with the legal framework. We make a short description of juridical framework in France at first, before going to the governance structure supporting local collective actions.

In France, private ownership is an exclusive right. It give absolute rights-of-use to land-owners inside the perimeter of ownership (Article 544, Civil Code). This rights concern every movable properties which could exist on land (e.g livestock or crops) or under the land. Hence, land-owners are free to use their property as they want, as long as this use doesn't go against a legal prohibition. For example, non-access rules or chemical input use could be put in Volvic farmland in our case, if the farmer-landowners have willingness to do so.

Water is an open-access resource: everybody could theoretically have access-right to water in France (Article 2, Water Law). But this regime concerns more surface sources than groundwater, which has a confusing status between a *res-communis* and a private ownership. Since



2006, the French water law supports the 1st position (*res-communis*)⁵, but many peoples have still been considering that land ownership prevails on underground resource as a traditional custom (article 552, civil code)⁶. To limit the scope of land ownership, the State can impose a regulation plan - meaning a special legal restriction - to land-owners, in order to conciliate their activities with the protection of groundwater. Such regulation, if existed, covers only a limited area surrounding the point of catchment in reality. It only gives a protection of groundwater's safety, at the access point. In our zone of study, NO restriction of land use exist over the Volvic aquifer.

Other institutional arrangements are then needed to complete uses of groundwater, and to avoid potential conflicts in some manner. The most important governance mechanism identified is the CEPIV, which is the Environment and Protection Comity of the Volvic water catchment. The CEPIV comity gather 3 representatives of the commune of Volvic, 3 other mayors of 3 communes in the watershed, and 3 representatives of Danone. The mission of the CEPIV is to collectively develop suitable policies for the management of the water catchment, in harmonisation with the landscape and the economic development of the zone. Please note that farmers have not been involved in this governance structure. AFarmers' interests are supposed to be represented by one of the CEPIV board members - the mayor of Pulverière – who is a retired farmer.

A second identified governance structure is the public forest charter, which regroups mayors of communes having public forest in the VSV intercommunity. The charter aims to drive forest exploitation in a compatible way with other local resources. Traditionally, forest management in France follows sectorial strategies, which come from the national level. The creation VSV forest charter is the first experience of managing in a territorial approach (meaning with multifunctional objectives). The charter also transfers the management rights of local public forest (municipal owned forests and some public open-access forests) to ONF – the national forest office to facilitate management's performance. The forestry charter concerns only public forest, which stand for only 17% of forest in our study zone. On the contrary, its scope is much larger than the study zone (all the Volvic Source and Vocanno intercommunity).

There's quite no connection between the CEPIV and the forestry charter. The only potential connection is the deputy mayor of Volvic, who is present in both structure.

Other informal links are likely to exist, but are not explicitly mentioned by actor of the participatory workshop. We identified some sponsorship agreements between Danone and the LPO, which corresponds to different ways to organize the demand side of ESBOs and facilitates coordination of activities and the mobilization of ESBO suppliers.

Financial support

The annual budget dedicated by CEPIV to activities contributing improving the management of the water catchment is about 300k€. Danone provides 2/3 of this budget, and local authorities 1/3. Local authorities reported that Danone is able to top up this budget when needed, especially for large projects.

⁵ For example, data on catchment water quality are of free access to the public: <http://www.adeseaufrance.fr/>

⁶ The jurisprudences are lacking, and don't help to clarify



Other activities are funded by public policies, and come as a complement to CEPIV activities. They are: purchase of de-compacting machine (state), support to conversion to organic agriculture to control vole populations (state), biodigester program (VSV). Besides, VetAgro Sup/CEPIV are currently supporting farmers to fill files in order to be eligible to FMSE (National agricultural fund for sharing sanitary and environmental risk) funding for vole control measures.

Farmers in this zone do not receive CAP's territorial agro-environmental payments, but only ICHN – the less favour area payments.

Actions

A number of actions are taken in order to induce changes in agricultural practices. On the other hand, it is worth noting that the forestry sector remains largely untouched so far. These interventions are aimed at reducing the use of chemical inputs in the area and improving the management of cattle effluents:

- CEPIV covers some of the composting costs (windrow turning).
- CEPIV provides subventions to support conversion to organic agriculture, topping up government subventions.
- CEPIV and VSV initiated and are co-funding a communal bio-digester program, which would be fed by effluents from the water catchment farms.
- CEPIV funds drinking trough for cattle along the main stream of the water catchment.
- CEPIV supports measures for organic control of voles: they pay a vole hunter operating in the water catchment, they support the purchase of some communal machinery (de-compacting machine), ...
- CEPIV supports individual investment that would help delivering water services: for example they paid for some options of an effluent spreading machine.

In terms of decision process, these activities are either initiated by the demand side itself (CEPIV and VSV), which promotes models such as organic agriculture and biodigester in a rather top-down fashion; but also, in some case by farmers themselves that share their requests/needs with CEPIV (ex. Vole control, options on individual equipment). CEPIV's approach is rather based on economic incentives and awareness-raising. Indeed, the goal is not to impose its ideas (participation is voluntary), as the expected changes are beyond legal standards (no legitimacy to impose rules). In turn, we distinguish two main approaches: (i) to compensate farmers for the individual extra costs associated with the implementation of pro-environmental practices; (ii) to support investment in equipment /plants that allow improving the provision of ESBO. CEPIV also relies on co-funding from public sources (ex. State subventions for conversion to organic agriculture).

Key drivers

Market drivers play an important role on Governance system. Danone wants to sustain its business while local authorities want to sustain a significant source of local tax and the landscape. The commune of Volvic receives about 2.5 million euros per year from Danone (tax perceived by communes based on the number of bottles sold in France by an enterprise located within their boundaries), the intercommunity VSV receives also a local tax. Besides, Danone is also the main local employer (about 1000 employees on-site), fulfilling one key aspect



of one major political goals, economic development. It is worth noting that other municipalities besides Volvic have less interest in managing the water catchment as compared to Volvic commune as they perceive less taxes (this could be explored further in the next steps of PEGASUS project). For example, while Volvic updated its urbanization master plan to remove plots located inside the water catchment from the list of constructible areas, some others seem to continue urbanizing the water catchment (like Pulvérières for instance; evidence in table on demography: page 15 of this report).

Public policy is another key driver of the governance mechanism, even though it seems to be less powerful than the market driver. As mentioned above, local authorities have engaged in the protection of the landscape and the biodiversity, which are mostly funded by the 2nd CAP pillars. The most important measure is the less favoured area subsidy, which allow farmers to maintain their activities in the zone. Others CAP 2nd-pillar measures do exist without being really mobilized by farmers. They are for example Agro-Environmental Measures, aid for conversion to organic farming, aid to develop quality value-chains. Only one farmer get benefit from the aid for conversion to organic farming. While we haven't got full explanation for this inertia until now, it is interesting to observe that the CEPIV starts to discuss them in its future actions. Discussions seem to come from Danone's initiative. These policies contribute both to EU objectives (rural development policy) and Danone objectives.

Lastly, private interest could also be considered as a driver. Public image is essential for Danone business: the ecosystems and land-uses located in the water catchment have to be perceived as healthy, the water catchment has to look well maintained. Danone is very active in seeking public fund to co-contribute to its public image. Several interviewees confirm that a lot of activities involving the CEPIV are narrowly linked to the communication strategy of Danone. For example, this explains why Danone agreed to engage in a sponsorship agreement for the red kite conservation. They see that these participations are valuable for their public image (link between red kite prevalence and the state of the ecosystem). In result, the red kite is now displayed on the Volvic bottles.

2.3 Levels of ESBO provision, trends and determinants

Water quality and scarcity

Historical data about water quality is available from different sources, mostly public. It includes in particular the state agency for groundwater data (ADES) and the communes / water distributing institutions (mixed association: SMUERR). Volvic's station pumps the water very deep (as compared to other pumping stations for drinking water). There is no available information about the quality of this particular water, besides punctual analysis carried out by WWF and a national consumer association (The "60 millions de consommateurs" association)⁷.

⁷ In a 2015 survey, the "60 millions de consommateurs" Association reported that they found measurable traces of atrazine, a pesticide prohibited since 2001, in Volvic bottled water. Although levels are below legal threshold, it threatens Danone's public image. It seems that meetings were organized with farmers in the water catchment in order to identify the pollution source: it appear to be residual pollution from maize cropping that was formerly carried out in the area.



Public data on groundwater quality show that the state of the water quality table is good although infinitesimal residues of various molecules have been found. Besides, it is worth noting that Volvic water has a high content in Arsenic, which stays above the legal threshold. Public drinking water receives then treatments to be free from arsenic, but we don't know whether Danone does the same (they probably do all the more as this treatment is legal). The presence of arsenic is linked to the characteristics of the geological system and not the result of land-use practices. Please note that the CEPIV was created in order to take in charge this problem. Most of CEPIV spending is to carry out sewage water treatments to filter arsenic.

Historical data about water quantity are available on ADES' website⁸: we haven't had the capacities, resources and time to compile and analyze this raw dataset yet. The EU Life-SEMEAU project uses the historical water flow of the water table to calibrate their hydrological model. This indicator can be used as a proxy of water availability. Its evolution over time show that the observed flow of water was significantly higher in the 70's (550 l/s against 150 l/s in the 90's and 2000's). LIFE-SEMEAU postulates that the decrease could corresponds to measures errors. Since 2000, this indicator has been quite stable. According to LIFE-SEMEAU researchers, variations of water flow are correlated with rainfall patterns, and not to "climate change" or changes in upstream land-uses. In overall, it seems that the level of provision of water services has historically been satisfactory, both from a public service perspective (reports from the public water agency classify Volvic watershed as of good quality) and from a private perspective. The demand for water quality and availability is stable. Interventions to protect groundwater is to manage both future risk of pollution, and current brand image for Danone.

Landscape: The Volvic's landscape is considered to be original. Indeed, it is part of the larger "Chaine des Puys" volcanic area, which applied twice (unsuccessfully) to become a UNESCO World heritage site. Volvic catchment area is located on the piedmont zone of *Chaine des Puys* but is widely associated with this larger landscape. The attempted classification as a World Heritage site is an indicator for and contributes to the awareness of landscape value. It also shows that preserving this landscape has become a politic objective. It is however difficult to measure the levels of provision of this ESBO. In absence of direct indicator for landscape quality, we decide to use a proxy, i.e. the number tourists visiting the area. Another issue is that data is only available at a larger scale than our study zone. We thus provide data for the target area of the Unesco application (Chaine des Puys). This area received 536 300 tourists in 2015. Besides, there are 31 hôtels (754 bed), with 14 camping zones, 418 to-rent accomodations with fonctionnal fouritures, 9 service areas for camping-cars, 71 restaurants, 10 % of local producers and 11 % of service suppliers of the department;

The target area of the UNESCO application stands for 28 % of total number of visiting nights in the department of Puy-de-Dôme in 2015. Concretely, it accounts for 26 % of profit-run visiting nights and 28 % of non-profit-run nights (meaning that night spent without paying for accommodation)

⁸ <http://www.ad.es.eaufrance.fr/ExportData.aspx?Id=06447X0002%2fS&type=2>



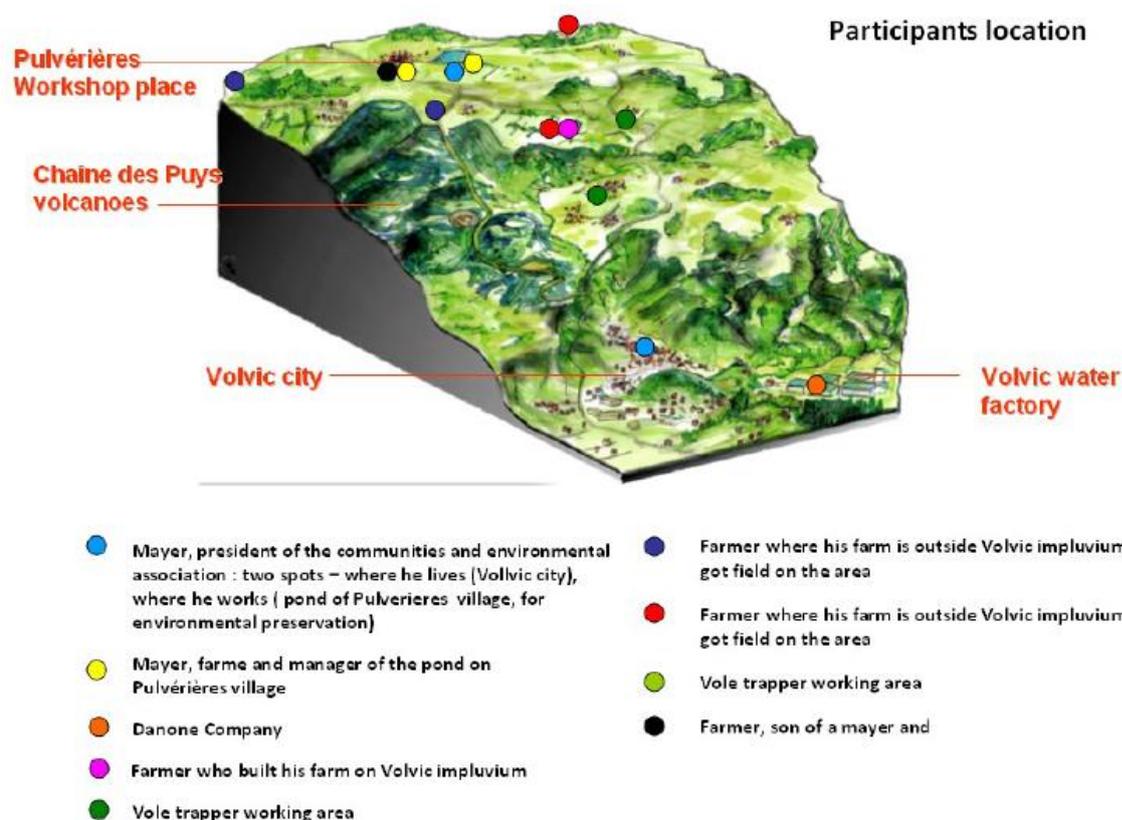


Figure 4: Topography of the zone and location of the PEGASUS's workshop

Estimate of economic impact of the Unesco candidate perimeter in 2015

Table 3: Estimate of economic impacts from tourist sector inside the Unesco zone

Unesco candidate perimeter	Number of beds	Number of nights	Economic impact for the whole area
Profit-run accommodations	13 800	1 300 000	130 000 000 €
Non-profit-run accommodations	13 900	2 900 000	98 000 000 €
Total	27 700	4 200 000	228 000 000 €

Table 4: Share of Profit-run and non-profit run nights inside the Unesco candidate perimeter

Unesco candidate perimeter	Number of nights	Economic impact for the whole area
Profit-run accommodation	31%	57%
Non-profit-run accommodation	69%	43%
Total	100%	100%

We have no idea about expected economic impact of tourism in case that the Unesco's candidate is approved. Finally, one should be cautious considering these figures. Indeed, they are only estimates of current economic significance of local tourism and that they are aggregated at the Unesco application perimeter, not at the Volvic catchment area level.

Rural Vitality

We first use data from the national statistical office to analyse the evolution of population size in the target area.

Table 5: Demography from: INSEE, 2013 – Historical data of municipal demography 2013.

Names of commune	Superficie (in km ²)	Population in 1968	Population in 1975	Population in 1982	Population in 1990	Population in 1999	Population in 2008	Population in 2013
Charbonnières-les-Varennes	32	838	895	909	1177	1215	1478	1627
Pulvérières	15	361	312	293	307	308	361	397
Saint-Ours	56	1011	983	1053	1230	1370	1556	1657
Volvic	28	3030	3253	3587	3930	4202	4594	4425
Volvic Source and Vocanos (VSV) inter-community	167	10503	11149	12893	14355	15323	17396	17368

Data show that the demographic trend is slightly positive, particularly since 1999. Pulvérières is least populated commune and experienced population loss before 1999. The trend for Volvic is quite stable, probably thanks to the settlement of Danone water factory and proximity with the city of Clermont-Ferrand.

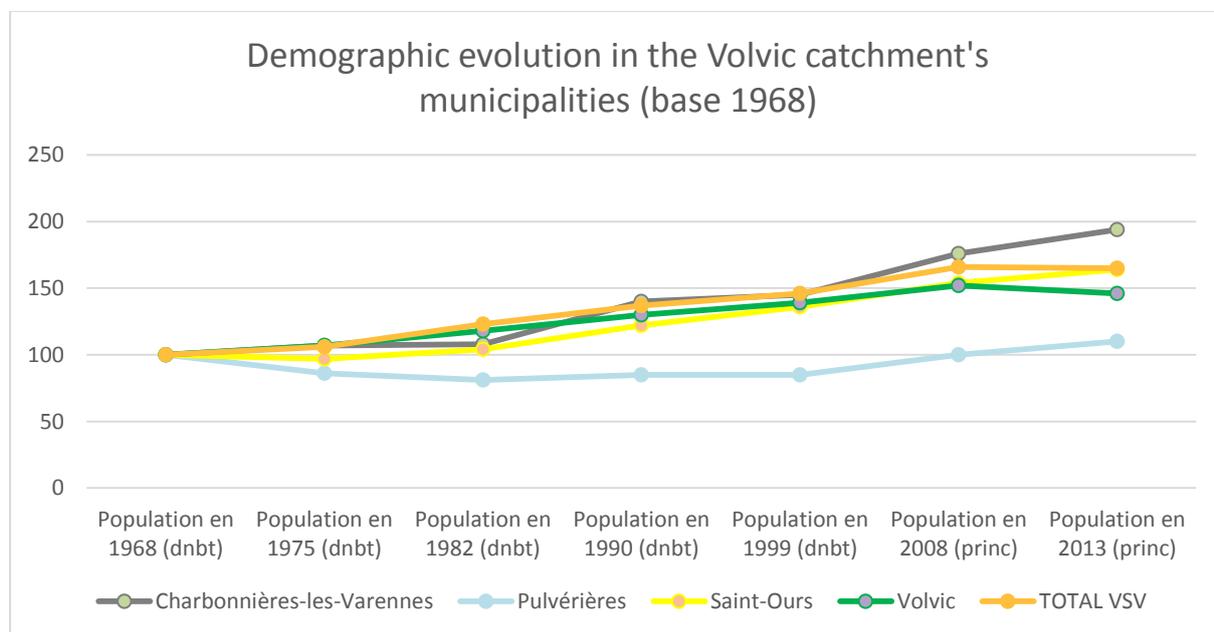


Figure 5: Demographic evolution in the Volvic catchment's municipalities (base 1968)

We don't have access to other data or variable that could be used as proxies for rural vitality, such as number short value-chains or number of EU funded projects in the rural development framework.

Biodiversity

Volvic commune conducted a thorough biodiversity (fauna) survey in 2013: 4400 samples were collected on about 328 species. This initiative was supported by Volvic commune, a national biodiversity fund and CEPIV. The replication of this experience in the whole water catchment is under discussion but faces some reluctance from some local authorities (who do not understand the purpose of it). Specimens of various endangered species in Europe were recorded in the municipality during the biodiversity survey, such as *“cuivré des marais et la petite coronide (des papillons), l’engoulevent d’Europe (un oiseau), le Grand Murin et le Rhinolophe Euryale (des chauves-souris) ou encore le chat forestier”*. Specific monitoring of flagship species is also carried out inside the water catchment and beyond, which allows estimating the potential future re-population of the watershed. Monitoring is essentially organized by environmental organizations, LPO and Chauve-souris Auvergne (CSA). It seems that local population don’t understand the role of biodiversity on local resource. There’s a clear demand for biodiversity conservation (ESBO) on the impluvium; at the beginning, it was addressed by the LPO association but this ESBO has also been considered by Danone in integrating biodiversity into the company’s image. This makes a real economic valuation of biodiversity in their bottles in sale.

2.4 Ancillary economic and social benefits provided ‘on the back’ of ESBOs

No specific information and data provided on this section.

3 Shifting societal norms, collective learning and voluntary actions

Main changes in the perception of local population over environmental benefits occurred and have been identified. Before 2005, local elected people didn’t really understand that the environment is a part of the resource system they have on the territory. When Danone bought the Volvic water company, it also imported the culture of watershed protection from its previous experience in other sites. A local mayor said: *“Danone has brought the Evian enterprise culture to here”*. Evian is the name of another bottled water owned by Danone in the French Alps. This is when local stakeholders (farmers, local authorities, Volvic representatives) became aware of the link between land use practices and water quality/quantity and of the importance of protecting the watershed.

In particular, farmers and local authorities are well aware of the link between watershed protection and the maintenance of local employment in the area. Farmers reported that they are considering the potential consequences of their agricultural practices on local employment when making technical choices because they are aware of the link between groundwater quality and rural vitality.

This social value share explain why farmers work on a cooperating way with the CEPIV despite the fact they are not involved in the mechanism of governance.



4 Mechanisms, (collective) actions and governance arrangements to enhance the level of ESBO provision

4.1 Organisational capacities, leadership, networking and communication

We decided to merger sections 4.1 and 4.2 as things are concretely intertwined (for example it's difficult to analyse in separate sections the issue of organisational capacities and governance arrangements and mechanisms).

4.2 Innovative governance arrangements and mechanisms supporting ESBO provision

The central governance mechanism of ESBO production is the CEPIV. The structure of governance could be described as following:

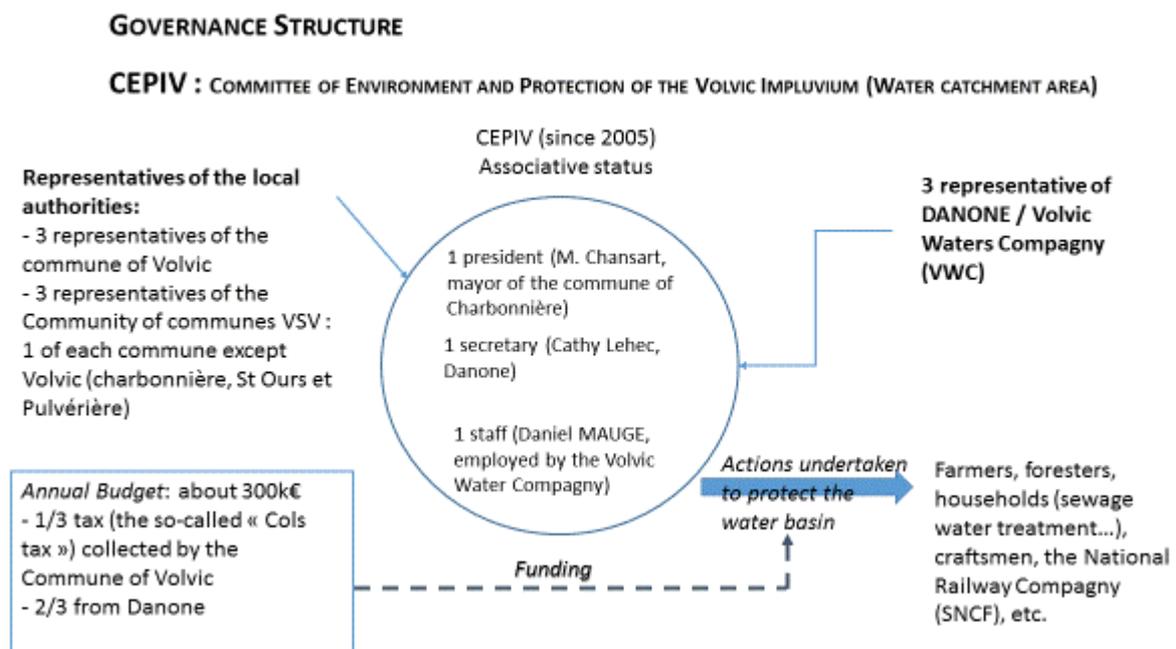


Figure 6: Governance Structure

The CEPIV is organized between two poles: Danone on one hand, and local authorities on the other hand. We were said (*one elected people*) that Danone took the lead to run the CEPIV, despite the fact that representatives of local authorities have a majority of presence (6/9 vs. 3/9). CEPIV was firstly created to handle arsenic filtration's problem. Interviews reveal that projects come from different CEPIV member's initiations. A project of "water trough" has been initiated by a mayor. Another project "biodigester" which is on discussion comes from Danone. However, the protection of the impluvium come from Danone generally. [Insert information from Guilgot interview]

Danone's strategy is to mobilize the institutional arrangement rather than legal framework. For example, they don't want to buy land over the aquifer to have a better protection. Becoming land owners would give a good legal protection but will be very costly from an economic point of view. Besides, forestry and agricultural practices have important role on groundwater,

while Danone would not have necessary competence to manage these activities, even if they were land-owners. A governance mechanism such as the CEPIV is clearly an option for Danone and for every local actors. However, all actors have not been presented in this governance, which raise questions on its long term sustainability.

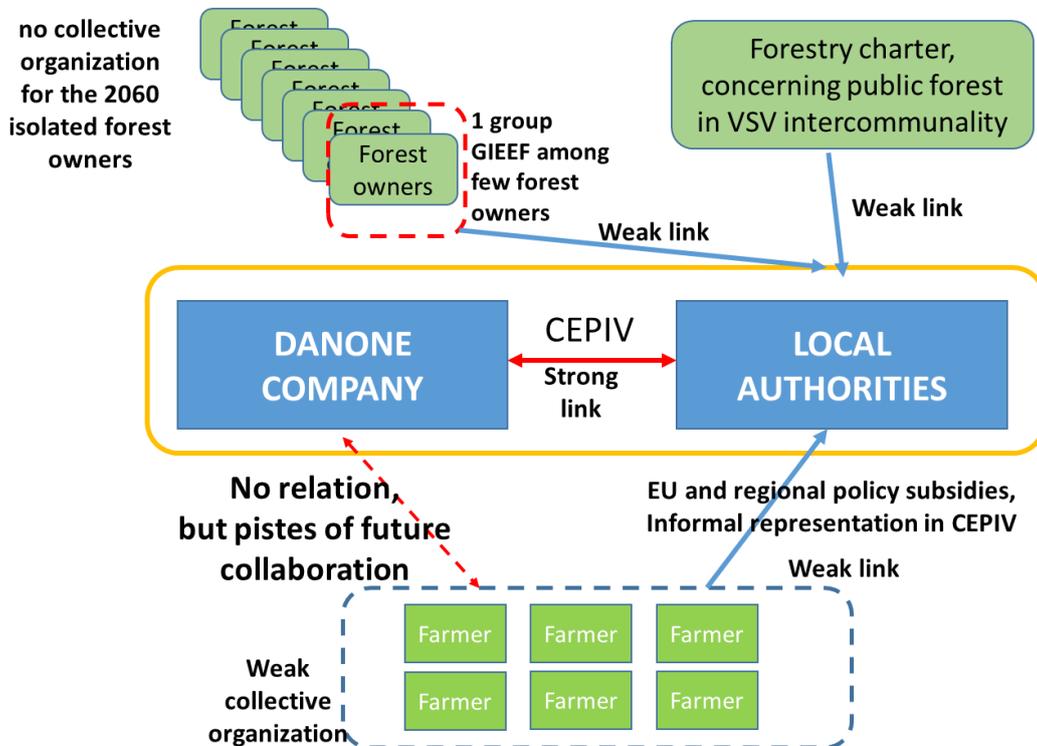


Figure 7: Coordination system among local actors

The scheme (see above) shows the governance system in the study zone. It highlights the fact that farmers and forest owners’ connections to the CEPIV are very weak. Farmers are not directly connected with the CEPIV but rather indirectly through weak link with local authorities. Indeed, farmers receive regional and EU subsidies, particularly ICHN, in which local authorities play a minor role. ICHN come from the Ministry of Agriculture, meaning at national level, while other 2nd pillar’s subsidies come from regional level (Regional council). Hence, local authorities don’t give aids directly: they are only involved in the process as an intermediary actor.

The existence of farming activity in the zone is questioned in the future. Data show that agriculture decline pursues its trend, as competition in EU market of milk and beef meat is very rude. Extensive farming in territory like Volvic become highly inefficient from a pure economic perspective. Farmers obtain low economic return if their products are sold in conventional value chains. During the workshop, farmers said that *“the economic performance of their farm is fragile”*. The weak influence of farmers within the governance system could question its stability in the long run. Under such economic competition and pressure, new discussions should be engaged because some farmers are thinking about changing their farming systems. And we know that if this happens, the groundwater will be immediately affected.

During the workshop, a farmer asked Danone to recognize the positive externalities of agriculture on groundwater's quality⁹, and suggested that farmers deserve to be compensated for these efforts. This position is quite clear, and it shows that farmers (at least some of them – the leaders in a way) understand very well that they contribute to the Resource System but haven't been enough considered in the Governance system yet. The representative of Danone and this farmer have engaged in a small debate over the topic. The Danone representative recognized that agricultural activities provide good (ecological)-services for the groundwater. However, he tried to minimize the issue of compensation saying that *"farmers should not be fully dependent on public subsidies as a patient under perfusion"*. The answer comes immediately after: *"it is not about perfusion, but a fair compensation for services, which are given freely until now"*.

Concerning forest activities, it is a bit amazing to see that they are not organized in the territory, and also not integrated to the governance structure. Public forestry are coordinated inside a forestry charter, which aims to exploit sustainably the forest resource. However, this charter focuses more on forestry topics, and almost nothing on the underground resource like groundwater. We hoped to find out at least a (modest) coordination between the CEPIV and the forestry charter. In fact, these two structures don't have links, and the sole information shared is probably done by the deputy mayor of Volvic, who is representative in both of them. Members of the forestry charter have also very few actions that could be identified as beneficial to the 5 ESBO in this case study.

The workshop reveals that the link between farmers and local authorities is very weak, while the link between Danone and farmers is rather inexistent (see Graphic below). For the moment, we did not identify any informal network. All discussions seem to happen inside the formal framework of the CEPIV.

4.3 The role and impact of policy in ESBO provision

This section could be considered as one of the weak point of our report. We did not really have time to analyze this aspect. In order to better understand the role and impact of policy in ESBOs provision, we have launched a new internship starting in April to investigate more deeply this dimension of the project.

Please see appendix 1 for details on this internship proposal.

Nevertheless, several hypothesis could be put forward.

The first one is about the role played by the CAP. CAP have deeply influenced the farming and livestock system in this (mountainous) Auvergne Region and the Volvic territory. Breeders have long benefited from EU payments in the framework of the second pillar of the CAP (ICHN payments for less favoured zones with a weak density of animals per hectare). This aid suits well local farmers and has likely contributed to sustain their activity on the territory.

⁹ Citation in French « *On travaille proprement* » which could be translated by « *Us [as farmers], our work is clean* »!



The second hypothesis is about the impact of local economic policies that should be analyzed in-depth. Indeed, a fundamental question that was raised by some interviewees is whether induced changes in the SES system actually address an actual potential risk or are just to be used in Danone's communication strategy: according to farmers, the risk that farming systems become intensive is very low. Answering that question would require going into more details into technical aspects, which we did not have time to do. On the other hand, the rate of adoption of new practices and the level of farmers' support to pro-environmental initiatives seem to be heterogeneous: only one farmer is now engaged in a conversion to organic agriculture while most farmers agreed to engage in biological vole control activities. It becomes crucial to understand underlying drivers. Local financing opportunities seems to be a key driver that incentivize farmers to adopt pro-environmental practices. However, these changes are also more likely to receive farmers' support if they are economically/technically interesting/relevant for their farm but also if the process of diffusion/adoption is participatory and guarantees freedom of decision. Once again, although the regulatory framework and public policies framing forest and agriculture land-uses are generally consistent with the objective of increasing the provision of target ESBOs, they do not play a key role in influencing local changes and decisions: the earlier is generally not as strict as the industrial requirements while the latter are rather seen as co-funding sources for local initiatives.

4.4 The role of the private sector in ESBO provision and enabling factors

The main and obvious private driver is the market for bottled mineral water which is of huge economic importance in France and, to a lesser extent, throughout the world. In France, this market represents in 2015 about 2 billion € (source: French Ministry of Ecology 2014). This is a very profitable business with a high growth rate (+7.1% in 2015 announced by Danone for all its Water Brands in the world including Volvic and Evian as the main brands in terms of volume and value-added). The market is also oligopolistic with 2 main big private actors in Europe (Nestlé and Danone), and other smaller national or public-owned companies. Danone itself ranks second in the world with 4.7 billion € of revenue in 2015 with four of the most famous and profitable French brands: Volvic, Evian located in the Alps, Badoit located close to Lyon and La Salvetat located in South of France.





As guardians of the Volvic source, we care for this natural resource responsibly and sustainably. We work with the local communities around Volvic to preserve the purity and quality of our water whilst looking after the ecosystem and the biosphere that surrounds it.

Source: internal document released by Danone: <http://www.danone.com/fr/pour-tous/activites/eaux/strategie-et-chiffres-cles/>

Please see also the Volvic website for UK: <http://www.volvic-is-committed.com/en/>

At last, in the short run, the territory might benefit from the policy conducted by UNESCO under its world heritage programme. Currently, the labelling process is still on-going for the territory.

5 Potential pathways towards an enhanced provision of ESBOs

Among the stakeholders, two visions (at least) were confronting.

(1) A technical point of view defended by Danone, some of the local elected people and CEPIV representatives who tried to solve technically the risks of contamination. Here, the main risks identified and related to agriculture, is the livestock effluents management and the pesticides spread over cereals (maize and wheat).

(2) A more economic point of view defended by the farmers and backed (to some extent) by experts/researchers. Here the main risk identified is agriculture decline and changes in land-use (from agriculture to forest) with a potential impact on water availability.

5.1 The technical vision defended by Danone

Here, the vision is technical and Danone is confident in technical progress to solve the polluting issues in agriculture. In a way, Danone is convinced that it is possible to make the current strategy more effective environmentally speaking by adopting new technologies or technical practices to fight against potential risks of contamination.

The first potential pathway is a better management of livestock effluents. The real risks (nitrates and phosphorus) of contamination of the water resource had been considered as very



weak by a recent study of the Chamber of Agriculture (2012) but “*the lack of knowledge of the regulations and the lack of predictive reasoning (plan of fertilization) can lead to risks of excessive intake on certain plots*” (study Life-Semeau 2012). This explains why, despite the risk is low, Danone promotes technical innovations for farmers to modify the way they manage individually their livestock effluents. After having promoted in vain (only 2 or 3 farmers involved) composting effluents for a few years (at least 5 years), the current project in Volvic is to settle a collective biodigester plant to treat the livestock effluents coming mainly from cows and poultry of all the farms. This project is directly imported from Danone’s previous experience in Evian where the company launched, in 2015, “*Terragr'Eau as the first collective biodigester plant dedicated to protecting water and developing agriculture*” (see Press release, Evian, October 16, 2015 <http://www.danoneaunaturel.fr/>).

The second potential pathway is a drastic reduction of pesticides used in agriculture (nota bene: the use of pesticides by the communes or spread out on railways had been considered in a former programme led by Danone from 2005 and 2012). Here, the main risk is herbicides used for cultivating cereals. The way Danone intends to solve the problem is to conceive and promote the adoption by farmers of a new agro-environmental scheme focusing on pesticides reduction (or ban?) at the impluvium scale. This project is in line with the way Danone acts in the framework of the CEPIV: a technical angle to mitigate a pollution hazard. Although this risk is currently considered as very weak (see the results of the study conducted in 2016 by VetAgro Sup), several factors lead Danone to pay a higher attention to this issue. Actually, one considers that lands cultivated in cereals are likely to increase by a significant rate in the coming years. This could be caused by:

- The impact of climate change: a warmer climate would make cereals cultivation easier for the farmers on the territory; “Here, 15-20 years ago, we could hardly harvest cereals before mid-September though today the harvest can easily starts from mi-August!” (a farmer said);
- The fact that farmers are seeking for autonomy to lower their production costs: this strategy would be achieved more easily in cultivating more cereals on their farms;
- The recent changes in consumers’ behavior illustrated by the fact that French people are slightly shifting their habits in terms of meat consumption (minus 3% over the past ten years; source: <http://www.la-viande.fr/economie-metiers/economie/chiffres-cles-viande-bovine/consommation-viande-bovine>). As a farmer said during the workshop, “whether “BOBOs” (ie a French word meaning rich, hipster and urban people) stop consuming meat and become vegan, then we [the farmers] have no choice but plough our lands”.

5.2 The vision shared by the participating farmers

The vision defended by the farmers who participated in the workshop is more radical. The vision is to shift from a farming practices (technical) focus to a more global reflection on the evolution of the farming system in Volvic. In a way, it’s a kind an ideal scenario where (in the farmers’ opinion) the strategy would be collective and backed (and funded) by Danone. That’s important to understand that French farmers have long focused on income in agriculture and



what they call the “*right [fair] price to pay their work*” including externalities provided for the society (source: FNSEA, the main farmers’ union).

In Volvic, this focus on revenues could be explained by the current livestock crisis in France leading the participating farmers to be convinced that they need to find (local) solutions to raise the price of their products (especially meat). They (at least some of them – the leaders) seem convinced that the city, the urban people, the industry can afford paying more and buying their products at a higher price (compared to the price given today on the market). Given the context, here in Volvic, it’s even more true, and while Danone spoke about “*stopping the subsidies logic in agriculture*” saying that they didn’t want to pay directly the farmers for ages (as it is the case in the framework of CAP), the farmers themselves spoke about “*compensations*” when they debated with the representative of Danone insisting of free positive-effects (ie. Externalities) of their farming activities (landscape beauty, water protection...).

Thus, the main risk identified here by the farmers is agriculture decline and possible changes in land-use (from agriculture to forest) with a huge potential impact on water availability (*as a reminder, +10% of forest on the territory would mean a reduction of water availability by 2%; source: Life-Semeau Project*).

In order to fight agriculture decline, farmers suggested three tentative solutions:

- To make young farmer’ settlements easier and help them to access to land ownership; (more than 50% of the farmers have stopped their activity on the territory over the last thirty years);
- To cut production costs by reducing purchases of raw materials (cereals forage to feed the herds);
- To better valued the products provided by the farmers: one example quoted by a participant is the set-up of a new and original labelling “Volvic Beef Meat” that could be run with the accreditation of an official quality sign (like “red label”).

In conclusion, there is a need to make the provision of ESBOs more effective. Even if it’s difficult to express in quantitative terms the potential increase in the provision of specific ESBOs (in a 10-year period), we can state that a potential of improvement does exist in the view of participants. So far, there is no alternative collective action (apart from the CEPIV) that has the potential to further enhance the provision of the ESBOs. In a way, CEPIV is a new arrangement (set-up in 2005). Its potential has not been fully explored yet in particular with the agricultural sector. Several options (technical and more global and systemic) are considered by stakeholders and it seems obvious (for the participating farmers met during the workshop) that it is the CEPIV role to undertake those actions. A change could happen as the main public actor has recently evolved: VSV community of communes merged in January 1st, 2017 with two other communities, becoming a bigger, richer and more powerful actor of the governance system.



6 Suitability of the SES framework and ‘action-orientated approach’ in the analysis of ESBO provision

The SES framework allows organizing in a systemic manner a complex situation that mixes various governance systems, stakeholders, etc. It was also design to facilitate the analysis of a huge number of case studies. In this sense, it is a relevant methodology for PEGASUS project in general and for our case study description in particular (although more emphasis should be put on better characterize the common-pool / public good nature of target resource systems, including ESBOs).

However, we found it hard to use (at least some of) the second-tier variables and more time should be dedicated to understand how they can be of use for PEGASUS in the light of the research questions targeted. In Ostrom’s research program (Mcginnis and Ostrom 2014), these variables were instrumental in finding regularities in factors affecting the successful local management of a common-pool resource.

7 Main conclusions derived from the Steps 3-4 analysis

Just conclude on the basis of the analysis and discussion in previous sections. The bullet points are only examples of some relevant questions.

7.1 Key findings on the particular SES and the provision of ESBOs

The resource system in Volvic case study is composed by ground resources (aquifer) and surface resources (both forestry and agriculture). Five ESBOs have been identified: water quality, water availability, landscape, rural vitality, biodiversity. They are all interconnected, but water related ESBOs are more depending on the rest. The specificity of this study case is that resource system is used by a private company that understand that groundwater’s value come partly from intrinsic characteristics of water, and partly from the whole resource system (value of the natural environment). That’s why Danone supports the protection of both ground and surface’s resources. Market’s drivers play a central role in the production of the ESBOs. Main contribution of agriculture in the provision of ESBO are the maintaining of extensive agricultural practices, which preserve groundwater’s quality. Agriculture is maintained in the zone thanks to less favor areas subsidies ICHN.

With agriculture, the forest cover largely the land over the aquifer. Agriculture – Forest balance is the key factor to keep resources systems on work sustainably.

- What are the main findings regarding the appreciation and demand side of ESBO provision?

The demand side of ESBO is a relatively stable and predictable, thanks to market drivers. The combination Nature-Agriculture-Forest has a firm market support. Concerning the landscape and rural vitality, the demand is very clear from a politic standpoint, but less clear for an ordinary citizen, especially those who have income problems (farmers for ex.)



- How can the awareness and provision of ESBO be increased in this particular case?

The provision of ESBOs cannot be increased in quantity, and may be no more in quality. The objective of ESBO management is to maintain the current level of ESBO supply and thus to manage the risk of potential harmful changes in the system. The water's quality is of particular local concern (especially when dealing with agricultural land-uses). Awareness about these ESBO has been raised from many years and people know well the ESBO that they benefit from. However, the situation could be degraded in the future, because local farmers face economic difficulty. In case of agriculture decline, the resource system could be seriously affected. Farmers should be involved in the governance system, instead of being isolated as they are at present.

7.2 Key findings on governance arrangements and institutional frameworks

The growing interest about the management of the water catchment, particularly since the mid-2000's resulted in the emergence of new governance arrangements based on public-private and private-private partnerships (CEPIV, the partnership between Danone and the LPO, etc.). These new arrangements organize the demand side of ESBOs and lead to concrete actions targeting farmers. The CEPIV structure appears really original and innovative in the French context (and maybe European).

The impact of new governance arrangements and subsequent interventions cannot be measured in terms of additional effect on ESBOs provision, particularly for water services. The main reason being that preexisting levels of ESBO supply were relatively high and that the main goal of interventions is risk and reputation management.

Recently, the institutional framework changed in France and it has led to the evolution of the key public actor (VSV community of communes). On 1 January 2017, Volvic Sources and Volcanoes merged with the communes of Riom Communauté and Limagne d'Ennezat to create a new community of communes called Riom Limagne and Volcanoes. 31 municipalities are nowadays associated in this new community of communes and bring together 64,907 inhabitants. This is one of the consequences of the latest legislative evolution (law NOTRe of August 7, 2015) with new schemes of inter-municipal cooperation envisage the merger of two communities out of three communes in France. This merger is likely to change the relationship between the private sector and the public one as the new community of communes is bigger, more powerful and richer. *(Issue to be tackled in the next steps of Pegasus)*

7.3 Other enabling or limiting factors

One important limiting factor is the fact that farmers are isolated, with a weak bargaining power and relatively marginalized in the local political game. Moreover, their number is shrinking, their economic importance declines without any collective strategy to enhance their products. For those reasons, farmers are more or less excluded from the governance system. They are a key stakeholder in terms of impacts, activities within the territory but, so far, they have not been associated to the main governance structure (CEPIV) set up to protect the water resource (ie; the CEPIV).



The issue of economic importance of agriculture and its decline is again a key issue. To go further, just have a look at farmers' main productions and commercial strategies to understand more deeply the issue (please see table just below).

In fact, among the 16 farmers cultivating lands and breeding cows on the territory, a very small number of them (only 2) have developed a real and clear strategy to enhance their products outside the traditional supply chains (meat and milk) in order to get a higher price compared to the standard market price.

Table 6: How farmers have tried to better valued their production?

Farmers	Main productions	Specific Supply Chain and Official Quality Sign	Additional sources of income
		  	
F1	Beef meat	none	Part time position (volvic plant)
F2	Beef meat	none	
F3	Beef meat and milk	none	
F4	Beef meat and cereales	none	
F5	Beef meat	none	
F6	Beef meat and poultry	Label rouge "poultry"	
F7	Beef meat	none	
F8	Beef meat and cereales	none	Short-term-Contracts (points abreusement) with CEPIV
F9	Beef meat	<i>OF conversion (under discussion)</i>	
F10	Milk	none	
F11	Beef meat and poultry	OF (on-going / conversion) Label rouge "poultry"	Alternative food network
F12	Beef meat	<i>OF conversion (under discussion)</i>	
F13	Beef meat	<i>OF conversion (under discussion)</i>	Part time position (truck driver)
F14	Beef meat	none	Wood seller
F15	Milk and sheep	none	
F16	Beef meat and cereales	none	

Three ways have been followed by those farmers:

- Converting the farm to organic

So far, only one farmer (beef breeder) has converted his farm to organic. Actually, the conversion process is on-going (for 2 years) and has not been achieved yet. Surprisingly, though most of the farmers (listed in the table above) are close to the European organic code of practices,



only one farmer has converted to organic (conversion process has been engaged for two years). However, three more farmers think of converting their farm to OF and the initiative is encouraged by CEPIV/DANONE (only in words!).

- Enhancing the product by adopting a specific and constraining codes of practices (The official quality and origin signs)

Two farmers have been accredited “Red label” which is a guarantee that the product is of superior quality and adopted (at the same time) a protected geographical indication “Auvergne Poultry”. This enables those farmers to get additional revenue by breeding poultries during the winter period where the agenda is quieter for them.

- Seeking additional sources of income



One farmer currently participates in an alternative food network enabling the sale of its products (essentially beef meat and poultries) directly to consumers. This is the same farmer who converted his farm to organic. *(See the picture here showing the farmer website used to sell its product – it is explicitly mentioned on the webpage that animals breed on the farm benefited from the protected and natural environment of the Volvic Impluvium)*

Four farmers have undertaken additional activities (outside the farm) like part-time position working in local plants or directly employed by Danone or selling woods to local people to heat their houses.

In conclusion, pathways to enhance products (to better valued the products) do exist for farmers. Three options have been explored so far (OF, official quality signs, additional activities). But few of farmers have really engaged their farm toward a clear strategy in this line. This explains that so far, no collective strategy has been set up by farmers or encouraged by Danone; we see individual trials to enhance local products but no real collective effort and reflection to find a new economic model to sustain local agriculture.

7.4 Contributions to EU strategic objectives

Here, it has not been possible, so far, to assess how the Volvic initiative and the related provision of ESBOs through agriculture and forestry contribute to the EU objectives by creating employment, enhancing sustainability or strengthening innovative capacity.

That would mean that we still need to explore the existence of concrete data/evidence and cross-reference relevant studies at the impluvium scale or/and at a broader scale.

For instance, evaluation could be done on jobs creation linked to ESBOs. We think in particular of farming activities, jobs in tourism sector (accommodation and restauration) or jobs related to the Volvic plant itself. This case study is an example about how the involvement of private



sector and more specifically a public-private partnership can contribute to enhance water protection or at least prevent from a risk of degradation in situations where both public authorities and private companies share common interests. It is worth noting that private sector plays a leading role in this case

7.5 How about the transferability of the approach/mechanism used?

One obvious transfer of the approach of water protection and governance system developed in Volvic is for Danone itself. Indeed, as stated earlier in the report, apart from Volvic, DANONE owns three of the most famous bottled water brands in France: Evian, Badoit and La Salvetat.



For instance, in La Salvetat, DANONE launched in 2013 the PEP'S association (standing for Policy, Environment, Protection, Salvetat) dedicated to the protection of the impluvium.

The governance rules are very similar to the CEPIV ones in Volvic with representatives from Danone and local elected people without associating explicitly farmers in the structure (VetAgro Sup, 2016b).

Further researches led us to understand that this approach has actually been developed by *DANONE France Waters* for each sources of bottled water belonging to the company (interview with Cathy LeHec, head of Danone France Waters, March, 2016). Of course, differences exist between local contexts. If Evian was the first experience in this field in early 2000 with highly productive and polluting dairy farms located on the impluvium, Volvic was the most recent and successful experience followed recently by La Salvetat and Badoit. This policy followed by DANONE has been reinforced since 2013 with successive scandals on drinking water contaminations (with pesticides especially) highlighted by a French consumers association (<http://www.60millions-mag.com/2013/03/25/qualite-de-l-eau-potable-difficile-d-echapper-aux-polluants-7854>).

Actually, the transfer of knowledge is twofold in the case of DANONE:

- A technical transfer: for example, the biodigester experience in Evian is transferred to Volvic;
- A transfer in terms of how to govern the technical change and intervene in the local political game: the governance structured set-up in Volvic from 2005 is now developed in Badoit and La Salvetat.

Moreover, in a broader reflection on drinking water protection in France and in Europe, the approach developed by DANONE could be beneficial for local public policy-makers. On the contrary of Nestlé in Vittel (see Chia, Brossier and Benoit 1992), DANONE has not engaged a PES (direct payments for ecological services) approach which is a very costly policy (about 25 million € invested in Vittel by Nestlé waters to protect an impluvium equivalent in size), not affordable for local public policy-makers. Indeed, a recent report released by the French Ministry of Environment (2014) estimates the damages caused by farming activities (mainly nitrates) to the water resources management (used mainly for tap-water) up to one billion € per year.



At last, this experience could be particularly useful in cases where there is a strong private interest for water quality: industries such as thermal water or other pharmaceutical companies could be interested. However, it would be useful to explore other case studies where private sector involvement in watershed management is going on.



8 References (including projects docs, evidence reports etc.)

8.1 Appendix 1: List of stakeholders interviewed

- Jean-Christophe GIGAULT, permanent member of CEPIV, director of LPO regional office, deputy-mayor of Volvic commune (4 meetings: August 28, 2015; January 7, 2016; June 10, 2016; February 24, 2017)
- Pr. Yves MICHELIN, VetAgro Sup ; professor in geography, expert for the Unesco World Heritage project, conducts research on vole pullulating in Volvic water catchment (2 meetings: May 31, 2016; June 9, 2016)
- Elodie PERROT, PhD student in ecology working on vole management in Volvic catchment area, DANONE and VetAgro Sup (1 meeting in January 2016)
- Marie FORET, Director, Union Régionale des communes forestières (1 meeting on June 5, 2016)
- Yves POSS, former public servant at ONF (administration in charge of the management of public forests), researcher in social science on forest use (1 meeting on June 6, 2016)
- Jacques BARBECOT, farmer, mayor of Pulvérières, treasurer of CEPIV (1 meeting on June 3, 2016)
- Patrick LACHASSAGNE, hydrogeologist, Danone, coordinator of LIFE+ SEMEAU project (1 meeting on June 15, 2016)
- Daniel MAUGER, Danone, in charge of the sustainable management of Volvic water catchment (1 meeting on April 27, 2016)
- Group Meeting at Communauté de communes de “Volvic Sources et Volcans”: Cécile CHAPUT (in charge of economic development), Noémie FAVRE and Lucie VAESKEN (in charge of environment, including forest management) (1 group meeting on June 13, 2016)
- Jean-Michel HERMENT, farmer in Pulvérières (1 meeting on 19/07/2016)
- Florent TIXIER, farmer in Charbonnière les Varennes (1 meeting on 20/07/2016)
- Bernard PRANAL, farmer in Pulvérières (1 meeting on 22/07/2016)
- Alain ROBERT, vole/mole buster (1 meeting on 25/07/2016)
- Frédéric LANTIER, in charge of tourism at CONSEIL DÉPARTEMENTAL DU PUY-DE-DÔME (one phone-call on February 22, 2017)

8.2 Appendix 2: References

PEGASUS Reports quoted

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Chervier C., Déprés C., 2016. Volvic Water Catchment Case Study - Intermediary report National Report – FRANCE. Deliverable WP4.1. Pegasus, H2020 project, Grant agreement No 633814, 25 pages.

Claire P.-H., Déprés C., 2017. Workshop Report - WP4 Volvic Case Study. Pegasus, H2020 project, Grant agreement No 633814, 53 pages and annex.



Regulations, Projects documents, evidence reports

Arrêté n°2015-155 portant sur l'obligation de lutte contre le campagnol terrestre dans certaines communes.

Programme de développement rural 2014 – 2020 de l'Auvergne.

Le plan régional pour une agriculture durable Auvergne (2012) : présentation générale et plan d'action (2 documents).

Projet d'aménagement et de développement durable (SCOT Grand Clermont).

Natura 2000 - Formulaire standard de données - FR8301052 - Chaîne des Puys.

Birard C., Soulier A. (2011) – Document d'Objectifs du Site Natura 2000 Chaîne des Puys « FR8301052 ». Parc Naturel Régional des Volcans d'Auvergne, Aydat (63970), 122 p.

Orientations Régionales de Gestion et de conservation de la Faune sauvage et de ses Habitats (ORGFH) – Auvergne (2005).

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Bernard M., Durand H. (2015). Stratégie régionale pour la conservation des chiroptères Auvergne 2016-2020. DREAL Auvergne Conservatoire d'espaces naturels d'Auvergne, Chauve-Souris Auvergne.

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Defrance, Pierre, et Sophie Bertin. « Etude Socioéconomique du projet LIFE+SEMEAU - Site de Volvic ». LIFE-SEMEAU, 2013.

Gigault, Jean-Christophe, et Jean-Jacques Lallemand. « Réserve naturelle régionale des cheires et grottes de Volvic - dossier de classement ». LPO, 2014.

Humbert, Pascale, et Jean-Pierre Pouzoulet. « Mission d'appui au préfet de la région Auvergne concernant la maîtrise des populations de campagnols terrestres », 2015.



Le Gleau, Leslie. « Analyses comparées de l'eau du robinet et de l'eau en bouteille ». WWF, 2011.

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ONF, et CRPF. « Schéma directeur de desserte forestière - Communes de Charbonnières-les-Varennes, Pulvérières, St-Ours-les Roches et Volvic ». LIFE-SEMEAU, s. d.

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LE HEC Cathy, Patrick LACHASSAGNE, Simon ROUQUET (2012). Le principe des politiques de protection des Eaux Minérales Naturelles de Danone. Comment intégrer politiques de gestion forestière, changement climatique et changement d'occupation des sols ? Le cas d'étude de Volvic. Conférence internationale SEMEAU, Vulcania, le 18 octobre 2012

Studies on forestry

Le site du projet life SEMEAU où l'on trouve toutes les informations collectées lors de ce travail notamment les actes du colloque. <http://www.life-semeau.eu/actes-du-colloque>

VetAgro Sup (2011). Modalités de valorisation des châtaigniers et des vergers dans la communauté de communes de Volvic Sources et Volcans. Diagnostic de territoire réalisé par les étudiants de l'option "Agriculture, Environnement, Territoire". Clermont-Fd (rapport + annexes 67 pages).

Other studies (in particular dealing with governance...)

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9 ANNEX: Reflections on the case study methodology used

9.1 Objectives and activities undertaken with initiative/stakeholders

Apart from individual interviewed carried out during summer 2016, we set up a participatory workshop in December 2016 gathering a good number of stakeholders living and working within the water catchment area (essentially farmers, DANONE and CEPIV representatives).

Table 7: Methodological itinerary

<i>Tools used</i>	Exploratory inter-views / visits / field trip	Individual meet-ings and interviews (semi-structured)	Workshop
<i>Period</i>	Early 2016	Summer 2016	Late 2016
<i>Objectives</i>	To be in touch with local actors	To survey and meet farmers and local policy-makers	Participatory process (workshop)
<i>Staff and/or stakeholders involved</i>	C. Déprés mainly	C. Chervier mainly and C. Déprés	All the team, students and Claire (facilitator)
<i>Data provided/output</i>	Interviews reports	WP3 report France Intermediary report on the Volvic CS	<i>See below</i>

Participants of the workshop

Stakeholders

- Farmers (4)
- CEPIV (2)
- Elected people (1)
- Representative of Danone (1)
- Involved Staff and scholars
- Christophe Déprés, PhD in Economics (Volvic CS coordinator)
- Marielle Berrriet-Sollic and Hai Vu Pham (Pegasus French Team, WP4 coordinator)
- Claire Planchat, PhD in Geography, VEDI Agency Director
- Colas Chervier, PhD in Economics (3-month contract on the project)
- Elodie Perrot, PhD Candidate in Geography (permanent staff at VetAgro Sup working with farmers around Volvic)
- Pr. Yves Michelin (grand témoin), Pr. Geography (permanent staff of VetAgro Sup)
- Elora Sepulcri, master student in Agronomy
- Marie Vigneau, master student in Agronomy
- Corentin Fuéri, master student in Agronomy



Supporting documents (produced before the workshop in order to frame the debate)

- Facilitating guidelines
- Workshop agenda (including schedule and unfolding of the evening)
- Observation sheets
- Pictograms (referring to farming practices)
- Invitation mails to the workshop

Raw material collected during the 1st participatory workshop in December

- Pictures (about 30 pictures taken during the workshop showing participants discussion)
- Pictograms and diagram of the territory (stakeholders)
- Individual notes (by researchers)
- Observation sheets (filled by students and researchers)
- Vocal recordings

Secondary data collected:

- Complete transcription of the vocal recording (in French)
- Maps/Cartography
- Workshop Report 06/02 (written by Claire Planchat) (in English)
- Report on agriculture development trends on the territory (students from VetAgro Sup) (in French)
- Leaflets (to be sent to the participants after the meeting) (in French)

9.2 Outcomes and further steps

The outcomes of the process (documentation, strategic plans, etc.)

A comprehensive overview of the process (and its outcomes) is available in the report quoted in appendix (Planchat and Déprés 2017)

Further steps in terms of research

Two steps are considered for early 2017

1. A trainee employed from April 2017 to collect data on policy drivers and carrying out interviews with local state agency and local public authorities
2. A 2nd workshop

After the 1st workshop in December, participants agreed to contribute to a 2nd workshop during the spring time.

Objective: to enlarge the audience and involve more farmers and participants. The objective is to share ideas debated during the 1st workshop and open the discussion to further issues and potential environmentally-friendly changes with beneficial impacts on the water resource.

Three options have been considered by the participants (still in progress) with different degrees of ambitiousness (from the lowest one to the highest one):



- 1) A workshop focused on technical solutions to be promoted in the future at the farm scale
- 2) A workshop focused global solutions to be elaborated in the future at the territory scale to better valued agricultural products (meat especially)
- 3) A workshop at a broader scale focusing a concrete action to develop an alternative food network linking Volvic employees and farmers. This workshop could be held in May-June 2017 and would be entitled a “Consumption Actors Workshop”. Indeed, the potential for a local value-chain is huge as the main Volvic plant employed about 1.000 employees on-site.

How will the results be used after finalisation of the case study?

So far, the CS (including participatory approach) has been used by DANONE as a mean to trigger discussions with farmers on “hot” (sensitive) issues for them: agriculture decline, polluting practices, impacts on water, farmers’ reluctance to adopt new practices promoted by DANONE (like composting effluents), etc.

That’s clear that the connection between DANONE and the farmers could be improved in many ways, including from a technical point of view. We were puzzled for instance to know that the representative of DANONE in charge of CEPIV administration is not at all agronomist. He lacks knowledge about agriculture realm and do need external expertise. Clearly, the research team played as a tierce-party facilitating the dialogue.

9.3 Judgement on the process

Expectations of actors towards the process

After the workshop, farmers had the feeling (maybe shared by all of the participants for the first time) that Danone and elected people really listened to them and understood their problems. Consequently, they want CEPIV to pay attention to their difficulties and not only the problem of water quality as, in their view, agriculture has a weak productivity (*repeated several times by farmers during the debate*) and does not pollute the environment at all. They would rather like Danone/CEPIV to tackle the problem of economic decline of agriculture instead of still debating of pollution hazards.

The added-value, in our researchers’ view, of the participatory approach

A participatory appraisal leading to a common understanding of the key issues and main ESBOs. Apart from water quality and biodiversity, farmers insisted a lot on the scene beauty of this territory and the fact that they are proud of living and working there. Wastes were often quoted as a problem as well.

The workshop reinforced the mutual confident between farmers, stakeholders and researchers.

The workshop enabled to overcome the reticence of Danone since “PEGASUS” (and its research team) has been seen from the very beginning of the project as a new “insider” in the bargaining process with local authorities and the farmers.



From a research-oriented point of view, we would also say that the participatory workshop was an opportunity to rebuild or formalize in concrete words and graphics the implicit relations and networks between stakeholders (see in annex the report of the workshop; Planchat and Déprés 2017). To some extent, the current governance (around the CEPIV) and existing coordinating devices had to be explicated and debated during the workshop.

In terms of research, one important lesson is that the process of understanding the CS is still in progress. Indeed, several unsolved key questions need to be tackled in the following months.

The most important of them are:

- Why farmers are not represented in the current governance and CEPIV association although the objective is to protect the impluvium from potential contaminations especially from agriculture (pesticides, nitrates)?
- Why technical improvements or technical changes (like composting of livestock effluents, biodigester, organic farming) promoted by Danone, CEPIV and experts are not really adopted by farmers? Which rationale for farmers' choices? (Economic, environmental, agronomic?)
- Why doesn't exist a collective dynamic among farmers settled on the territory? (or the contrary, why should you think that a collective dynamic could have been emerged here?)

9.4 Supporting data and statistics

We access to data freely and available from the French agricultural census

<https://stats.agriculture.gouv.fr/disar/>



10 APPENDIX

10.1 Internship proposal (from April 2017)

February 14, 2017

Internship Proposal - 6 Months - Master or Graduate Students

Territorial Plan and Governance of the Volvic water catchment area

Dans le cadre du projet européen H2020 PEGASUS, VetAgro Sup Clermont propose un stage universitaire de niveau Bac +5 en partenariat avec l'UMR CESAER de Dijon.

Contexte

Depuis un certain nombre d'années, l'Union Européenne soutient à travers la Politique agricole commune (PAC) les pratiques agricoles qui, en synergie avec leur environnement naturel, produisent des bénéfices pour la société. Le concept de bénéfice socio-environnemental (ESBO) renvoie aux avantages sociaux et environnementaux que l'agriculture produit avec son écosystème. Le projet européen PEGASUS cherche à comprendre plus finement le processus de production des ESBO par l'agriculture et la forêt en Europe. Une des études de cas d'étude de ce projet porte sur la gestion des ressources en eau de Volvic en région Auvergne-Rhône-Alpes. L'hypothèse qui sous-tend l'étude est que le mécanisme de gouvernance territoriale joue un rôle central dans la définition des règles d'usages « raisonnables » de la ressource. Il impacte ainsi directement le niveau de production de l'ESBO.

Objectifs du stage

L'objectif du stage est de comprendre les modes de gouvernance qui sont susceptibles de définir ou qui contribuent à définir les règles d'usage autour des ressources en eau de Volvic. Les usages principaux sont l'exploitation privée de l'impluvium de Volvic (sources exploitées par DANONE), l'agriculture (principalement l'élevage extensif) mais aussi l'exploitation publique par un syndicat de distribution d'eau potable. Plus concrètement, il s'agit d'inventorier les principaux dispositifs de gouvernance ou de planification territoriale existants sur le territoire (PLU/PLUi, SCOT, PCET, SRCE, SAGE, Charte PNR, agenda 21 etc...) susceptibles de conditionner, d'encourager ou de mettre en difficulté la gouvernance des acteurs publics et privés du territoire autour de la ressource en eau de l'impluvium. Ces dispositifs touchent soit directement à la question de l'eau (comme le SAGE), soit indirectement comme ceux régissant les activités agricoles, les infrastructures urbaines (habitat, transport), la protection des ressources naturelles (SRCE...). Il s'agira enfin d'analyser la pertinence de ces dispositifs, dans la perspective de la production de deux ESBO principaux sur le territoire de VOLVIC :

1. La conservation d'une bonne qualité des eaux souterraines
2. La pérennisation d'une agriculture (élevage) durable sur la zone d'étude



Missions:

- Recensement et analyse des principaux dispositifs de gouvernance et de planification territoriale qui existent : analyse à faire des stratégies et orientations des documents de planification, de la compatibilité des orientations entre échelles territoriales concernées, etc.
- Identification des acteurs clés de la gouvernance territoriale et enquêtes auprès de ces acteurs (DRAAF, DREAL, Agence de l'eau, Parc Naturel Régional, chambre d'agriculture...)
- A partir des comptes rendus d'entretien, production d'une note de synthèse relevant la pertinence de chaque dispositif et la manière dont ils s'articulent (ou non) pour favoriser (ou pas) la production des ESBO étudiés.
- Une note de synthèse en anglais pour le projet scientifique H2020.
- Une note didactique, c'est-à-dire destinée à communiquer les résultats de l'étude aux acteurs du territoire.

Conditions

- Période du stage : 6 mois au cours de l'année 2017 à compter de début avril
- Le/la stagiaire sera basé(e) à VetAgro Sup sur le campus de Clermont-Ferrand, accueilli au sein de l'UMR Territoires
- Indemnité de stage de l'ordre de 550 €/mois
- Possibilité d'utiliser un véhicule de service ou de se faire rembourser ses frais kilométriques ou trajets SNCF (pour les entretiens)
- Encadrement : Christophe Déprés (contact ci-dessous) en collaboration avec Salma Loudiyi (maître de conférences en géographie)
- Accueil : département « territoires et sociétés » de VetAgro Sup campus de Clermont

Profil

- Master 2 en géographie, aménagement, développement rural/territorial, science politique, économie ou ingénieur agronome ;
- Bonne connaissance des dispositifs de planification territoriale ;
- Compétences et goût pour les techniques d'enquêtes ;
- Intérêt pour les enjeux d'aménagement, les politiques de l'eau et de gestion des ressources naturelles ;
- Capacité à rédiger en anglais (notes de travail à rédiger dans le cadre du projet H2020)
- Permis B souhaité (mais pas indispensable).

Contacts

Envoyer lettre de motivations et cv à:

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