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**Regional Water Regimes in Switzerland:
Comparision of the Vallmaggia
and the Seetal Valley**

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1. Introduction

Due to the fact that precipitation in Switzerland is approximately twice the average European value, that some six percent of Europe's total freshwater stock is stored in Swiss water bodies, and due to its geographical position in the central European Alps, Switzerland is described as the «water tower» of Europe. Nevertheless, water management in Switzerland currently faces several challenges. The most important ones are: (1) the problem of increasing competition of (mostly heterogeneous) rival uses of water; (2) the problem of water quality (related to diffuse pollution); (3) the question of minimum residual flows (mainly in the context of hydropower production); (4) the problem of the increasing imperviousness of soils in settlement areas; and (5) the question of natural hazards relating to water and of protective measures respecting ecological needs.

The Swiss political system is characterised by direct democracy, its distinctive federalist structure and its political and societal pluralistic system. Even if over the past century, tasks have been increasingly assigned to the Confederation, the Swiss cantons still exercise a great deal of influence and power in the political arena since the implementation of most of the public policies regulated by the Confederation is assigned to the cantons, often with considerable room for manoeuvre. Thus, the main public actors in Swiss water policy are the Confederation, the cantons and the local authorities.

The emergence of regional institutional water regimes in Switzerland, their impact on the relevant actors' behaviour and on the state of the resource itself, in a second phase, was investigated by means of two case studies: the Valmaggia and the "See-tal" valley. In the first phase, the national determinants of these regional water regimes had been analysed and, at the level of the Confederation, three main issues in water policy had been identified: «protection against water» (i.e. flood protection), use of water for energy production, and the protection of water (cf. Mauch / Reynard 2002). The two case studies cover all of these main issues.

The following section describes the national context of regional regime development (chapter 2). In chapter 3 and 4, the two case studies are described with respect to the evolution, the triggers and the impacts of regime change at regional level. Chapter 5 then presents an analytical comparison of the two case studies. On this basis, in chapter 6, conclusions are drawn with respect to the emergence and the impact of the Swiss institutional water regimes.

2. Three branches of Swiss water policy: substantial integration and persisting institutional fragmentation

The Swiss regulative system (*property and use rights*) is mainly defined at three levels : the Swiss Civil Code (enacted in 1912), the Federal Constitution (Cst), and federal laws. Rights to the ownership and use of water are regulated by the two general principles of «private property» and «state sovereignty». The principle of private property is defined in article 667 of the Swiss Civil Code (CC) which extends the possession of land to the areas below and above it. The principle of state sovereignty with respect to water (*Gewässerhoheit*) restricts private property by reason of the prevailing public interest. Furthermore, the Swiss Civil Code makes a distinction between public water bodies (article 664 Civil Code) and private water bodies (article 704 Civil Code). The public water bodies include surface waters (rivers, streams and lakes) as well as glaciers and firs. The cantons are responsible for the regulation of

use rights to surface waters (article 664 CC and article 24bis Cst). Thus, the surface waters in all cantons are considered public property.¹ Water sources are basically considered private waters since they represent an integral part of the ground on or under which they are located. However, sources rising from a glacier, some major sources of general interest and sources at the head of a river or stream are all considered public property. Similarly, underground waters are now generally considered as public property (Leimbacher & Perler 2000: 260). In general, use rights to a resource under state sovereignty are assigned by means of permits (e.g. for sailing events on lakes), licences (e.g. for fishing) or concessions (e.g. for hydroelectric power production), mostly by the cantons or local authorities.

For historical reasons, Swiss water policies have mainly developed along three different branches of *water policy* during the past century (cf. Mauch et al. 2002, Reynard et al. 2000). As a first issue, after several catastrophic floodings in the second half of the 19th century «protection against water» (i.e. flood protection) was regulated at the level of the Confederation, followed by a national legislation relating to the use of water for energy production in the beginning of the 20th century responding to technical evolution. With the emergence of water quality problems in many parts of the country due to growing population density and industrialisation mainly after the Second World War, protection of water was introduced as a third issue in water policy in the 1950s. These three branches still form the basic structure of Swiss water policy today which is mirrored in three respective administrative branches at the level of the Confederation² and in the cantons as well.

The analysis of the (national) determinants for (regional) regimes resulted in the identification of a last major *phase of change* extending from 1975 to 1991 (cf. Mauch et al. 2001, Reynard et al. 2000, Mauch et al. 2000). In legislative terms, the beginning of this period is marked by the adoption in 1975 of a new article in the Federal Swiss Constitution which added a quantity dimension (mainly involving residual flows) to the existing protection of water quality. The end of the phase is formally marked by the adoption of the new Federal Law on the Protection of Waters in October 1991 which finally substantiated the principles defined in the constitutional article of 1975. However, in the case studies, this time frame is extended to the end of the 20th century as the (national) determinants of change are expected to require some time to become operational at local level. After the phase of transition from 1975 to 1991, the range of goods and services regulated at the national level reached a very high level as, with the exception of those involving the preservation of water quantities, which were exempt from the intervention of public policies up to 1991, all of the goods and services provided by the resource, which are known to date, were affected. Through the introduction of the Federal Law on the Protection of Waters, the gap which existed during the previous phase was finally bridged in the 1990s as actors drawing water for quantitative uses (e.g. irrigation, hydroelectric power) and farming activities as source for diffuse pollution were now also considered as target-groups of the Swiss water policy.

There was no formal modification of ownership rights as defined in the Swiss Civil Code during recent decades. The only change in the *regulatory system* during this

¹ With the sole exception of the canton of Glaris where surface waters are considered private property (Leimbacher & Perler 2000:262).

² To date, the respective mainly responsible administrative branches at federal level are : The Federal Office for Water and Geology (*BWG*, located in Biel) for «protection against water» (i.e. flood protection), the Federal Office for Energy (*BFE*) for the use of water for energy production, and the Water Protection and Fisheries Division of the Swiss Agency for the Environment, Forests and Landscape (*BUWAL*) for protection of water (cf. Mauch et al. 2000: 2).

phase took place at the level of the organisation of use rights. Following the introduction of a major new restriction on users of the resource water under article 24quater of the Constitution of 1953 on the protection of water bodies against pollution, the protection of water bodies applied to all kinds of water, irrespective of their property status – private or public. The revision of Article 24bis of the Constitution in 1975 added new restrictions to the use of water, particularly with respect to hydroelectric power, by instituting the principle of the quantitative protection of the hydrological system. In 1991, the Federal Law on the Protection of Waters substantiated this by imposing an obligation to maintain suitable residual flows for water bodies. The 1997 revision of the law saw the formal introduction of the “polluter-pays” principle into Swiss water protection policy.

The development of the *objectives* in *water policy design* reflects the evolution of its three main branches (i.e. protection against water, water use, water protection). The adoption of Article 24 of the Constitution in 1975 marked an important turning point, since for the first time it enshrined the principle of the “unity of water management” and, thus, dealt with the three branches of water policy simultaneously. Formally, the main means of using the resource water were connected to each other by means of placing restrictions on one use “in the interest of” other uses. For example, the drawing of large quantities of the resource for the purpose of hydroelectric power production was newly restricted under a protection objective relating to the hydrological cycle³ and nature conservation considerations.

With respect to the *instruments* existing at the national level during this period of change, financial means and subsidies were generally only applied for protective objectives.⁴ In contrast with the aim of protection, in general the economic use of water was regulated by means of property rights arrangements (e.g. licenses, permits) which guaranteed the role of the state in the exploitation of the resource (state sovereignty, public waters). There is, however, one major exception to this rule: the economic aims of agriculture received indirect financial support by way of subsidies for drainage and other improvements throughout most of the reference period up to the early 1990s. It was not until the later decades of the century that further restrictions on specific economic uses were introduced (hydroelectric power and agriculture, e.g. water protection zones, restrictions on fertiliser use).

The *target groups* in the policy design have evolved in accordance with the changes in the causal hypothesis. The prevailing hypothesis for this period (“If water is protected globally, its sustainable use is guaranteed”; cf. Reynard et al. 2001) only took effect very gradually during the later decades of the period. In the 1970s, actors producing “concentrated” pollutant loads (industry, households and public bodies) represented the target groups of the water protection policy whereas, from the early 1990s, all users having an impact on water quality, the preservation of sufficient water quantities and the hydrological system were regarded as the target groups of the new Law on the Protection of Waters. Thus, the scope of the target groups was extended and diversified and also agriculture became an important target group.

All in all, it is possible to observe a distinct reinforcement of efforts to establish coordination between the different policy fields, particularly from the early 1990s. Increasingly, the articles in specific laws relating to water and affecting other policy fields were simultaneously introduced into the regulations governing the related pol-

³ “*Haushälterische Bewirtschaftung der Wasservorkommen*”, i.e. economic management of water resources.

⁴ Protection “against” water and later also “of water”, first for wastewater treatment plants and later also subsidies for other measures.

icy field.⁵ By this means, far-reaching co-ordination efforts were consciously implemented and institutionalised. These interpolicy co-ordination measures can be interpreted as institutional attempts to resolve rivalries between the different uses of water. A cursory analysis of the political decision-making processes leading to the new water regulations at national level during the last decade reveals the following rivalry issues as the most contentious (cf. Mauch et al. 2001): hydroelectric production vs. nature conservation and landscape protection (mainly residual flows); hydroelectric production vs. fishery and tourism (residual flows); nature conservation and landscape protection and tourism vs. flood prevention; drinking water and nature-protection vs. agriculture (diffuse pollution); flood prevention vs. agriculture.

Even if Switzerland has not yet become a member of the European Union, as a result of strong economic and trade relations with the EU, Switzerland is somehow 'silently' and gradually adapting to European standards and directives. This also holds true for water-related issues and the European Water Framework Directive is taken as an important guideline for further developments in water policy.

The following sections describe two Swiss case studies investigating water regime change at a regional level and their impact on the sustainability of the resource uses. For each sub-case, its location and context and the existing water uses are described, followed by an overview over the main use rivalries in the region and the respective elements of the institutional regime. On this basis, the change of the regional regime is analysed with respect to its impact on the sustainability of the water uses.

3. Inventing quantitative water protection: The Valmaggia case⁶

3.1. Water uses in a southern alpine valley

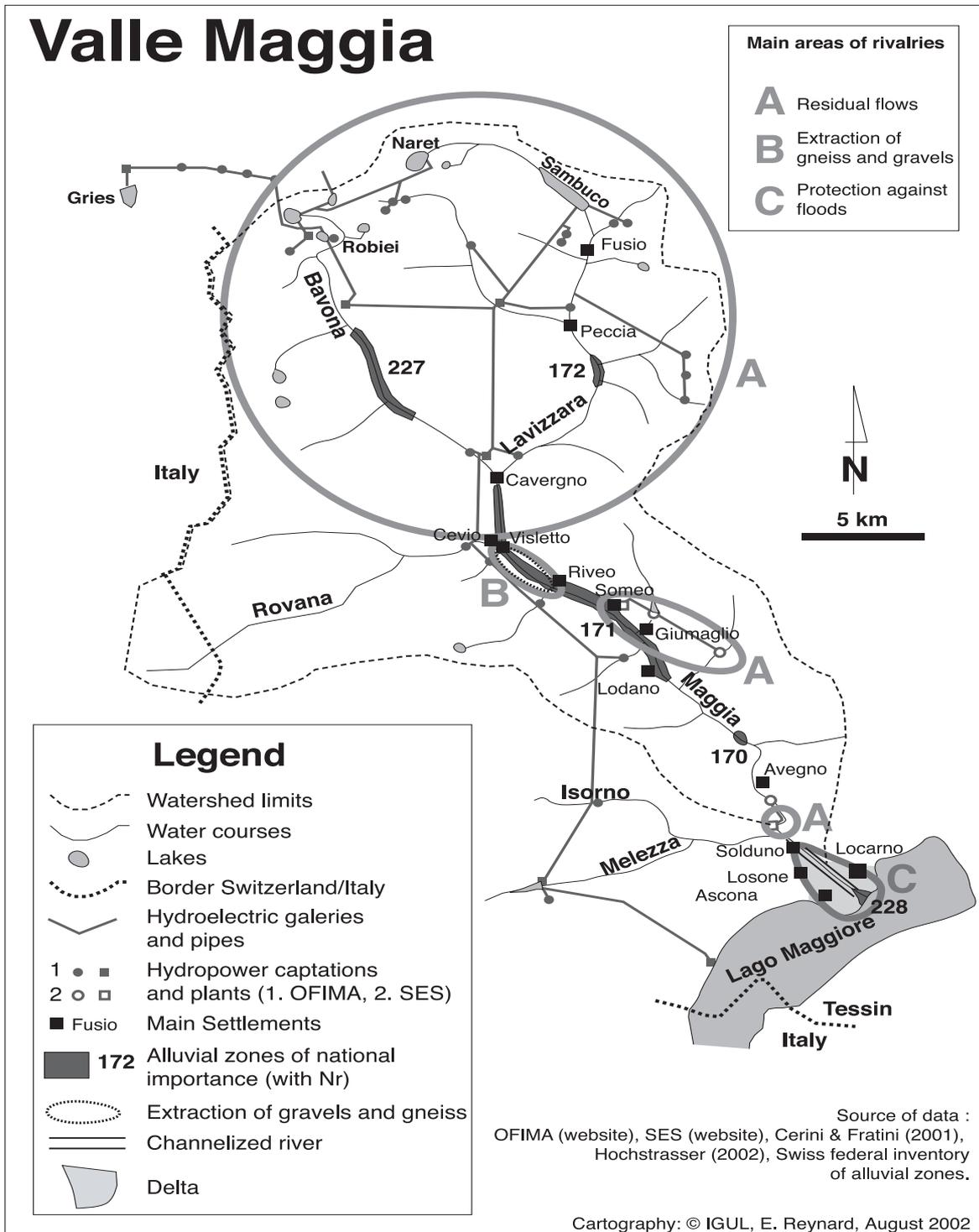
The Valmaggia valley lays in the canton of Ticino in the southern part of Switzerland. It incorporates 22 municipalities. The upper Valmaggia consists of three tributary river valleys and the lower part ends in a vast delta plunging into Lake Maggiore at the mouth of the Maggia river. In this delta, two towns (Locarno and Ascona) frame the river, as it is channelled into its final stretch. Economically, the valley is exploited by means of tourism; stone, which is quarried to make construction materials; and, finally, water, which is used to produce energy. There are no significant municipalities in the Valmaggia itself as the population density is very low (less than 20 inhabitants per km²). Finally, agriculture plays only a very minor part of the economy, as the morphology of the terrain, hemmed in by steep hills, is inhospitable to this activity. The water basin of the Maggia covers an area of approximately 930 km². The course of the river runs along about 50 kilometres from the Naret lakes, at an altitude of 2,240 metres, to Lake Maggiore, at 193 metres. Its main tributaries are the Lavizzara, the Bavona and the Rovana in the upper part of the water basin. Two other tributaries, the Melezza and the Isorno, flow into its waters at its final stretch. Its last deltaic section is heavily dyked to protect the inhabitants and the infrastructure. The rates of flow are strictly linked to the pluviometry. They reach their peak in April and May, ac-

⁵ E.g. Federal Law on Agriculture, Federal Law on Fishery, Federal Law on Nature Conservation, Federal Law on the Policing of Dams, Federal Law on the Protection of the Environment, Federal Law on the Use of Hydroelectric Power .

⁶ This section relies on the Euawareness-report « First case study for Switzerland : The Valmaggia » by A. Thorens, delivered to the EU in Spring 2002 (cf. also Thorens 2002).

centuated by the melting snow; values are also very high in October. In terms of quality, we should stress that the waters of the Maggia count amongst the cleanest in the canton.

Figure 1: Overview over the Valmaggia water basin with its main elements relating to the resource water, its various uses, and its institutional regime.



The main water uses in the Valmaggia consist of hydroelectric production, transport of sediments, support for recreational activities, and natural habitat.

In terms of *hydroelectric production*, two hydroelectric companies operate using the waters of the Maggia. The private company SES (Società elettrica sopracenerina SA) carries out its sampling in the lower part of the valley and has two relatively small plants. The second much larger company OFIMA (Officine idroelettriche della Maggia SA), a joint venture with 20% owned by the canton of Ticino, runs six power plants. It releases the waters tapped in the upper part of the Valmaggia directly into Lake Maggiore which causes a significant drop in residual water flows over the whole course of the river. Since the advent of hydroelectric power production here, the Maggia has lost about three quarters of its initial volume of water.

With respect to *geomorphological processes and natural risks*, the flow of the Maggia can be dramatically increased. The flood of August 7, 1978, following exceptionally violent precipitations, affected the whole region, causing catastrophic damage and costing many lives.

The most important *recreational activity* in the Valmaggia is fishing. Other recreational activities include canyoning and canoeing, diving from the rocky cliffs and swimming, but also hiking. With respect to *natural habitat for plants and animals*, several zones have been listed in both cantonal and federal inventories for their ecological value. The Valmaggia is the site of two *quarrying operations*: *gravel and granite*. The average amount of gravel taken from the riverbed is 75,000 m³ for the last ten years. The granite quarries are located mainly in a limited area between Riveo and Visletto on the two rocky slopes on either side of the river, however the stone-processing operations take place on the banks where the largest plants and logistical structures are located. The annual yield from the quarries on the Maggia is in the region of 70,000 m³ of natural stone. The waste (35,000 m³) is partly used in the re-processing facilities in the quarrying area or it is dumped, in particular around the edges of the river bed. Other uses for the water resource include the consumption of drinking water, as well as provision of the strategic reserve for fire fighting and irrigation.

3.2. Three main fields of rivalry

The main rivalries in the Valmaggia related to the resource water during the recent decades concern hydroelectric production, gravel and granite quarrying activities, and protection against floods.

Hydroelectric production

In 1965, the first signs of damage to the hydric system and to the landscape due to the production of hydroelectric energy were noticeable in the Valmaggia. The water was extremely scarce, especially in summer, and the ground water level fell, creating problems with drinking water suppliers. The main reaction came from fishermen. After several studies aiming at defining minimum residual flow rates acceptable to the companies to avoid claims for compensation had been completed, the canton and OFIMA entered into a provisional agreement between 1969 and 1973 and the first minimum residual flow rates became effective, without, however, any specific basis in law. Nonetheless, the public and political debate continued. Cantonal parliament members denounced the excessive use of the water resources to the detriment of the local population citing the „energy barons“ as the only beneficiaries. In 1975, the Fisherman's Federation launched a Popular Initiative to introduce a new article into the *Cantonal Law on the Use of Water* which would force the canton to guarantee sufficient minimum residual rates when it grants a concession, taking into account

drinking water needs first and foremost, but also fishing, the protection of the water and the natural environment. The Initiative passed with ease in December 1976. From then on it was a question of accurately defining the residual water flow rates to be imposed on the ground. With OFIMA's agreement, the Council of State (executive) proposed increasing the minimum residual water flow rates by 1%, without compensating the hydroelectric companies. However, in October 1982, the parliament instead passed a statutory order setting the increased residual water flow rates at approximately 2% for current and future concessions. All concessions were then re-specified and the residual water flow rate modified for each catchment. September 1983, saw OFIMA submit a legal action in the Federal Courts demanding compensation from the canton. There ensued a legal dispute which has been settled by a judicial agreement finalised before the Federal Court in June 1996. In this agreement, the canton acknowledges that the reductions imposed in 1982 were part of the watercourse rehabilitation measures, which anticipated the measures provided in the new *Federal Law on the Protection of Water* of 1991. The corresponding loss of production for OFIMA was 2.4%, for which no compensation was provided. Nonetheless, compensation will be paid for any additional rehabilitation measures. The *Federal Law on the Protection of Water* imposed a new minimum residual water flow rate in the early 1990s. This new minimum is very low (minimum of 50 litres/second), but is compulsory for all watercourses and must be imposed when concessions are renewed. In regions which are part of the national inventories listing areas of high ecological value, further rehabilitation measures can even be demanded. Such negotiations are taking place between the canton of Ticino and the hydroelectric company, SES, at the time to redefine the parameters of the concession for the Avegno tapping stream. The initial attempt to reach agreement encountered opposition from the WWF and the Fisherman's Federation which are demanding accurate calculations of the minimum residual water flow rates.

Gravel and granite quarrying

As far back as the 1980s, the Rivo-Visletto sector drew the attention of the canton of Ticino due to the problem of the mineral waste deposits from the granite quarries. This debris had been deposited directly at the edge of the Maggia, without any authorisation whatsoever, and in contravention of the existing legislation in force for the protection of the riverbanks. Nevertheless, for quite some time, at cantonal level, policy has provided a regulatory framework for the conflict between gravel and granite quarrying and other uses. Finally, during the 1990s, this „greening“ of policy intensified with the *Federal Law on the Protection of Water*, which underlined the importance of geomorphological issues over mining activities, the *Inventory of Alluvial Sites of National Importance*, which designates the Riveo-Visletto as a site of ecological value, and the federal and cantonal legislation on fishing, which protects the natural habitat of the fish. In addition, the canton regulates quarrying in the framework of the *Cantonal Law on Building*, which requires a detailed planning authorisation and a plan for restoring the area for all mining or quarrying activities. In short, the complete process of developing a more environment-friendly policy should have resulted well before the 1990s, but in reality, in the Riveo-Visletto sector, authorisations were granted for decades in a more or less informal fashion and without any related requirements.

In 1997, the Someo town council, worried about the situation, requested a meeting with the director of the cantonal planning department. Aware of the gap mentioned, he commissioned a firm of engineers to conduct an in-depth survey of this sector to assess the environmental impact of past and present operations. In fact, with the re-

ports completed in 1998 it became evident that the problem of granite waste deposits is not the only problem in this sector. Other issues to contend with are gravel quarrying, which proved to be excessive, as well as the protection of listed alluvial zones. These conflicting interests are concentrated in a small area and are intimately inter-linked. The reports illustrate that the various activities existing in parallel are marked by an absence of co-ordination, both on the part of the local authorities and the companies involved. The two reports are implacable in their conclusions: the ecological situation in the area is alarming. The vast majority of current authorisations, generally covering short periods of one year, have been suspended by the canton in the interests of the general public in the end of the 1990s. It now remains to find a solution for ceasing this activity that will not spell economic disaster for the region.

To date, there are several solutions under negotiation. This follows a process of consultation extended to all actors involved in a climate of reciprocal co-operation. Re-processing and grinding of the quarry waste to make it re-usable in the place of the gravel quarried from the river is one of these ideas. There is now an agreement between the gravel and granite quarry operators and the procedure seems to work well. Finally, the gravel-quarrying sector could be used in the works related to hydraulic safety.

Protection against floods

During the 1980s, plans were drawn up for a complete reclamation project for the Maggia, but due to the sparsity of population in Valmaggia, the project was put at the bottom of the queue. When the project was reviewed, the problem of minimum residual water flow rates and an awareness of the environmental importance of the river took precedence and the plans were definitively abandoned.

There is a long history of flooding in the lower part of the valley, affecting the area of Locarno first of all, but also reaching Ascona. Despite extensive precautions such as channelling and widening the deltaic river stretch of the Maggia during the previous decades, the catastrophic flood of 1978 devastated the Locarno deltaic stretch. To prevent catastrophe on this scale, the area needed to re-design and re-build the protective infrastructures. Whereas it is true to say that nobody questioned the need for the subsequently planned protective structures, the new project has not met with equal enthusiasm among all the local people. In fact, if policy design has long promoted structures to channel the rivers, especially at cantonal level, it nonetheless gradually integrated competing uses and provides a basis for safeguarding the natural habitat and maintaining the natural river dynamic. 1978 saw the recognition of the need to maintain the riverbanks as a natural habitat, in both federal and cantonal regulations.⁷ At that point, environmental organisations were critical of the linearity imposed on the river and the downgrading of its banks caused by the very geometric stepped bank built along it, especially where the natural habitat could still be conserved. A compromise was finally reached with the building of more natural mosaic-style banks. This can be interpreted as an arrangement between the informal „use rights“ to the flora and fauna, defended by the WWF, and the need for hydraulic safety, for which the canton is responsible and which unites all actors. Work began on this stretch in 1979 and was completed in 1982, without any further objections. The second section from the Solduno bridge to the lake was more problematic. The municipality of Locarno was especially concerned about the impact of the structures on the landscape. It also disputed the height of the safety bank. Furthermore, the

7 Federal law on the Protection of Nature, the Landscape and Cultural Heritage, Regulation in application of the Statutory Order of January 16, 1940 on the Protection of the Natural Heritage and the Landscape.

WWF opposed felling the large trees and even insisted on planting more on the strips of public land bordering the river. It was particularly insistent on protecting the nature reserve it manages at the mouth of the Maggia and is of the opinion that the safety levels demanded by the project are exaggerated. In 1985, a compromise was finally agreed, after seven years of discussions.

However, two years later, the owners of the Delta camp site and of a hotel complex, just behind the natural reserve area managed by the WWF, submitted objections. They stated that their land was insufficiently protected against water. A breach which had appeared in the unsinkable bank on the left bank was discovered and was repaired in 1989. A further demand was that the insubmersible banks be extended on the left bank. The WWF is opposed to this addition to the banks and the municipality of Locarno is divided between these two conflicting demands. In 1995, the suggestion of the construction of banks behind the nature reserve met with approval from both sides of the argument. Work commenced in March 1997 and was completed in early 2000.

3.3. Regime change in the Valmaggia

In all three subcases, we can observe the solution of rivalries between heterogeneous uses through a gradual introduction of interests of other uses into the regime regulating one specific use between the 1970s and today. With respect to hydroelectric production, a change in policy design introduced the quantitative protection of the water resources at cantonal level in advance of other legislation as a result of the Fisherman's Federation's Popular Initiative. By this, hydroelectric companies' use rights were restricted in favour of the other functions of the water, i.e. landscape, natural habitat and fishing. In the case of gravel and granite extraction, the policy design increasingly incorporates uses that compete with quarrying. In some respects, the various projects constitute a transfer of the use rights to new areas of use, even if the same companies are involved. They no longer simply produce a construction material, but also recycle the granite waste, thus ensuring the hydraulic safety of the riverbanks. By the renaturation work, they are also contributing to renewing the natural habitat. In the field of flood protection, protection against water remains very much to the forefront, but it must accommodate other uses, such as natural habitat or landscape functions. The plans for the development of the riverbanks gradually became more environment-focussed as environmentalists fought their corner.

Thus, we can observe an enlargement of the extent of the regional institutional regime and an increase in its coherence due to several co-ordination and integration measures at the substantial level of the policy design (e.g. higher residual flows, prescription of natural river banks in flood protection). On the institutional level of the regime, such a tendency also appears (e.g. co-operation of the various actors involved with respect to extraction of materials) but however, remains restricted to rather informal strategies (no change in formal administrative structures). All in all, the institutional water regime in Valmaggia has generally developed into a direction of more integration.

3.4. Conclusions for the Valmaggia water basin

As to the contribution of these changes in the institutional regime to the *sustainability* of the resource uses in the Valmaggia, we can observe a general improvement. With respect to the ecological dimension, we can fairly safely assert that the introduction of quantitative protective measures for water has had a real impact on the ground. An improvement of the condition of the Maggia was perceptible immediately after infor-

mal minimum residual water flow rates were set in place, especially in terms of the ground water level. Still, their precise determination remains a major challenge and the Maggia is still short of water today.

With respect to gravel and granite quarrying, it is very difficult to draw any conclusions regarding its contribution to the sustainable use of the resource, since actual change at the level of the water basin is a very recent phenomenon. The environmental impact study mentions several criteria. To date, these various conditions have not been fulfilled.

In the third sub-case, the technical compromises achieved as a result of pressure from the WWF have clearly improved the situation from the point of view of ecologically sustainable solutions. In terms of the impact on the socio-economic dimension of sustainability, we may at least state a constant situation respectively a slight overall improvement for several reasons. Firstly, in cases where compensation is paid out according to federal legislation, this will compensate for the loss of production caused by the limits placed on the hydroelectric companies' use rights. Secondly, in the quarrying sub-case, in fact, transferring use rights enabled the region to avoid an economic disaster, creating a new niche for local businesses. And thirdly, economic and social sustainability was guaranteed for the towns of Locarno and Ascona, seriously threatened by the Maggia's floods. A dyke project that would excessively compromise protection against water in favour of competing uses could not be described as sustainable.

There are similarities across the three sub-cases in terms of *conditions* favourable to fostering change. These conditions include: Visibility and evidence of conflicts of use and their negative consequences; existence of relevant scientific information; effective dissemination of information to those involved (especially through the local press, which mobilised public opinion); involvement of organised bodies with legitimate use rights at water basin level; spirit of co-operation between the actors and the incorporation of non-state and other users involved; existence and use of several resources in the Swiss political system; parallel developments in the regimes for other resources (e.g. land or natural heritage); support at federal level for the implementation of change. Without question, the simultaneity of these diverse variables coupled with a change in attitude in favour of protecting the environment enabled changes in the institutional regime governing water towards wider integration at water basin level.

4. Fighting against water pollution: the Seetal case⁸

4.1. Water uses in a lake valley in the central plateau

Lake Baldegg and Lake Hallwil, are located in the Seetal valley in Switzerland's Central Plateau. Lake Baldegg and its water basin lie entirely in the canton of Lucerne, whereas the southern part of Lake Hallwil lies in the canton of Lucerne and the northern part in the canton of Aargovia. The Seetal valley has experienced a remarkable growth of population in recent decades, mainly at the Lucerne end and in the lower valley municipalities. To date, the Seetal water basin has approximately 24'500 inhabitants. Apart from the regional centre Hochdorf, where industry and trade activities dominate, mainly the Lucerne part of the water basin is characterised by intensive agriculture.

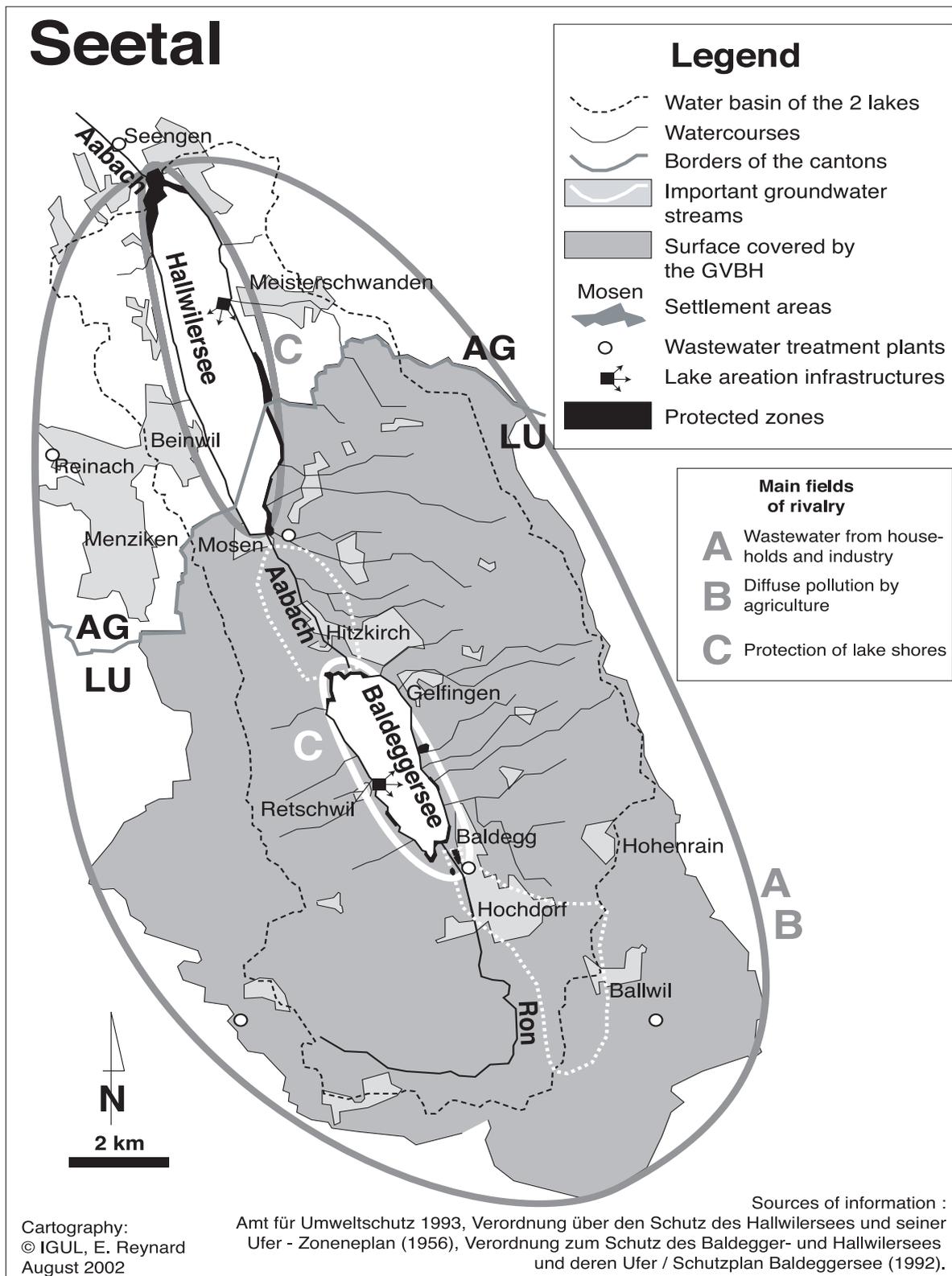
⁸ This section relies on the Euawareness-report « Second case study for Switzerland : Lake Baldegg and Lake Hallwil » by C. Mauch, delivered to the EU in Spring 2002 (cf. also Mauch 2002).

The total surface of the water basin of the lakes is approximately 143 km².⁹ Four fifth are situated in the canton of Lucerne (23 municipalities) and one fifth lies in the canton of Aargovia (10 municipalities). The location of the lakes with the surrounding mountains result in very weak natural circulation of the lake water and, hence also, a low self-purification capacity. Lake Baldegg is supplied by the river Ron and it drains into the river Aabach. After a river stretch of 3 kilometers, the Aabach joins Lake Hallwil and flows out of it at the north end towards its conjunction with the river Aare. Both lakes and their tributaries are supplied by a large number of medium-sized and small creeks.

Under the laws of the cantons of Aargovia and Lucerne and the Federal Swiss state, Lake Hallwil is a public water body. In contrast to this, Lake Baldegg has been the property of Pro Natura (previously known as the Swiss Association for Nature Conservation, SBN) since the early 1940s and is, therefore, a private surface water body, which in Switzerland is generally the exception.

⁹ With an average of 170 inhabitants per km².

Figure 2: Overview over the Lake Hallwil and the Lake Baldegger water basin with its main elements relating to the resource water, its various uses, and its institutional regime.



With respect to the goods and services provided by the resource water in the Seetal valley during the past three decades, water as a *living environment* gained significantly in importance, both with respect to surface water bodies, the quality of which improved, and to natural shores and wetlands. Most of these ecologically valuable areas are located at the northern and southern ends of the lakes. In the Seetal valley, in terms of quantity the *drinking water* function decreased over our investigation period. This is the result of both a decrease in consumption and the discovery of large stocks of groundwater in the area between the two lakes. In terms of quality, existing problems with nitrogen in groundwater decreased and levels are now constant (albeit rather high). The importance of *water for economic production* in industry and agriculture has rather decreased due to technical improvements. Despite the difference in the circumstances that prevail today, the function of *transport and absorption* of substances did not undergo a significant change during our investigation period and remains very important. Following the discharge of large volumes of pollutant loads into the lakes in the 1970s in the form of nutrients in wastewater, the situation completely changed in the 1990s. Over a period of around 15 years, pollutant loads from this source were reduced by a factor of almost four. However, within the same period, pollution stemming from agriculture increased fivefold due to intensification in agricultural practices. *Navigation* has greatly increased in significance since the 1970s, mainly due to an increase in tourism and leisure uses. The importance of *fishery* (professional and sport) has also increased due to the improvement of the water quality over the past 25 years. Apart from the good and service “living environment”, the most significant increase in the use of the lakes since the 1970s is for *recreational purposes*. The demand for it and related pressure on the resource is manifest, on the one hand, through the increasing number of people seeking recreation in the Seetal area and in the growing variety of uses (swimming, diving, sailing, surfing etc.), on the other.

4.2. Three main fields of rivalry

The main rivalries in the Seetal valley relating to the resource water during the recent decades concern discharge of wastewater from settlements, diffuse pollution from agriculture, and the protection of lake shores.

Wastewater from settlements

Both Lake Baldegg and Lake Hallwil have a long history of pollution. Due to strong economic development, mainly in the municipality of Hochdorf, this trend continued for the first half of the 20th century. In 1940, the whitefish population completely collapsed and this prompted the owner of Lake Baldegg, a professional fisherman, to decide to sell the lake to a nature protection organisation. In order to reduce the input of polluting substances into Lake Hallwil from household and industrial wastewater, in the early 1960s the canton of Aargovia constructed a sewage system around the Aargovian part of the lake and a wastewater treatment plant in Seengen, which, at the time, represented a pioneering development in Swiss water policy. Due to the insufficient success of these measures, in 1976 the Aargovian municipalities launched a petition to the cantonal government requesting that efforts to eliminate the pollution of the lakes also be undertaken in the canton of Lucerne. This resulted in the decision that the two cantons would work together in the future. They commissioned the Federal Swiss Institute for Water Research (EAWAG) to carry out a study and propose measures for the rehabilitation of the lakes. The study stated that, in addition to the existing practice of promoting the construction of sewage systems and wastewater treatment plants by gradually increasing federal subsidies, efforts to re-

duce phosphorus loads through lake-external measures and the implementation of additional recovery measures in the lakes themselves were essential. The technical solution proposed involved the direct introduction of oxygen into deep water in summer (lake aeration) and the forced circulation of the water in the winter. The resulting system, which was known as “Tanytarsus”, was tested first on Lake Baldegg and implemented also in Lake Hallwil after the mid-1980s. Following the construction of five more wastewater treatment plants, the sewage system in the water basin was completed in the early 1980s.

In the canton of Aargovia, the lake rehabilitation measures were implemented and financed by the canton from the outset. The situation in the canton of Lucerne is very different. Since here, according to the cantonal *Introductory Law to the Federal Law on Water Protection* of 1974, the implementation of water protection policy is the responsibility of the municipalities, the canton initiated the foundation of the Lake Baldegg and Lake Hallwil Association of Municipalities (GVBH) in 1984, of which all of the Lucerne municipalities which lie within the water basin are members. The association’s aim is to achieve the rehabilitation of Lake Baldegg and Lake Hallwil. It developed a rehabilitation concept comprising four lake-external measures (information for the population, implementation of measures to eliminate the causes of pollution in built-up areas, peripheral regions and in agriculture) and one lake-internal measure (“Tanytarsus” system) as main points for action. The GVBH’s initial activities were financed by the municipalities (approx. 55%), the canton (approx. 42%) and also by contributions from Pro Natura (2-3%).

The new *Federal Law on Water Protection* (GSchG) in 1991 brought several changes to the regional regime. Firstly, subsidies for local wastewater treatment plants, which had been extended since the mid-1970s at federal level, were eliminated in 1998 under the new objectives of the polluter-pays principle. Secondly, Art. 28 of the GSchG of 1991 introduced an obligation for cantons to implement additional measures in the water bodies themselves if it proves impossible to comply with the prescribed quality standards by means of other measures. This regulation actually duplicated what had already been implemented in Seetal at national level. And thirdly, according to art. 62a, which was introduced into the GSchG in 1998, subsidies for lake-external water protection measures in agriculture could be received from agricultural policy resources; thus, the agricultural authorities will now also assume a share of these costs.

Diffuse pollution by agriculture

In the 1970s and 1980s, agriculture was a target group of water policy mostly in the context of technical measures, in particular the cleanup of slurry pits. In the years following the enactment of the *Federal Law on the Protection of Waters* of 1971, the federal administration passed several regulations relating to agricultural practice. However, most of these regulations were formulated on a voluntary basis and the extent of their implementation was in the hands of the different cantons. After the collection of wastewater and its treatment in the wastewater treatment plants had been more or less fully implemented in the Seetal water basin, due to its exploitation practices and the erosion of surplus nutrients, agriculture remained the dominant source of pollution of the water bodies.

In the case of Lake Baldegg, by the mid-1970s, phosphorus loads originating from agriculture had reached approximately 25% (2.2 t/a); this increased to 82% (11.9 t/a) in the 1990s. In the case of Lake Hallwil, the ratio of phosphorous originating from agriculture has undergone a similar increase. In the context of this evolution of pollutant loads, the implementation of lake rehabilitation measures in the 1980s was ac-

accompanied by a concept for so-called lake-external measures, of which the measures concerning agriculture were the most important. From 1986, based on its “Concept for Protective Measures in the Shore Belt of Lakes Baldegg and Hallwil” and working in collaboration with the cantonal agricultural authorities, the GVBH developed an environmental consultancy for agriculture. In the Lucerne area of the Lake Hallwil water basin, according to cantonal legislation, the measures were the same as those implemented for Lake Baldegg and, here too, they were implemented and partly financed by the GVBH. When it comes to the Aargovian area of Lake Hallwil, however, the situation is rather different. Here, the responsibility for all measures lay entirely with the canton.

In 1992, changes in the *Federal Law on Agriculture* (Article 31b) saw the advent of a new provision for the payment of subsidies to farmers on the basis of ecological criteria. This system has been implemented in the Seetal valley since 1993 and has resulted in the adoption of “integrated production” methods by approximately 90% of the farmers in the water basin of Lake Baldegg. Five years later, the adoption of Article 76¹⁰ of the *Federal Law on Agriculture* of 1998 offered the federal authorities the option of paying subsidies from agricultural policy resources to promote ecological measures in agriculture in regions where the targets for water quality can not be achieved through other measures. Since this is the case for both Lake Baldegg and Lake Hallwil, a corresponding so-called “Phosphorous Project” has been under way for Lake Baldegg since 2000 and a similar project for Lake Hallwil started in 2001. The projects consist of the setting up of agreements between the canton (in the case of Aargovia) or the GVBH (in the case of Lucerne) and the individual farmers with respect to restrictions on uses (e.g. fertiliser use) in specific areas. Thus, the farmer is paid a certain sum per area and year for reducing the intensity of land use and, hence, decreasing the dispersion of nutrients from the soil into the water. In the case of Lake Baldegg and the Lucerne part of Lake Hallwil, these measures are implemented by the GVBH, for the Aargovian part of Lake Hallwil, the agricultural section of the cantonal authority acts on instructions of the environment division. The lake-internal and lake-external measures led to a gradual improvement of the state of the resource but, not, however, to its complete recovery.

Protection of lake shores

The shores of both Lake Baldegg and Lake Hallwil were placed under protection already at an early stage and, as a result, they were largely preserved in their natural state. At the time, the main aim was to protect them against construction. In the canton of Aargovia, an initial *Decree on the Protection of Lake Hallwil and its Shores* passed in 1935. Its success can be measured by the fact that, today, 75% of the Lake Hallwil is surrounded by natural shore. The decree was replaced by a new one in 1956. It defined protected areas with varying protective provisions on and around the lake. Strips of shore of between 10 and 50 metres in width were defined as restricted zones in the entire shore area of the Aargovian area of Lake Hallwil. This was further encircled by a protection zone belt ranging from approximately 200 to 700 metres in width. These provisions were, however, not binding on the private owners of the land. In the Lucerne area of the Seetal, two decrees – one on the protection of Lake Baldegg and its shores and one on the protection of Lake Hallwil and its shores of 1961 and 1962 were enacted. Thanks to this initial legislation and the private ownership of the lake by a nature conservation organisation, also the shores of Lake Baldegg remained largely free of buildings. A 1974 report by the planning delegate of

¹⁰ Introduced to the GSchG of 1991 as art. 62a.

the Federal Council described it as the lake with the highest proportion of open shoreline (i.e. not built on) in all of Switzerland. In 1977, Lake Hallwil was included in the federal inventory of landscapes of national importance.

In 1986, a new Aargovian Decree on the Protection of Lake Hallwil replaced the 1956 decree, where landscape protection issues were intensified. The fourth part of the Law on Regional Planning, Environmental Protection and Construction of 1993 represented the introduction of proper nature conservation legislation and a new order for the regulations governing water bodies. These sections were produced under pressure of a popular initiative in the area of nature conservation. In 1996, it builded the basis for the new Direction Plan which defined a Lake Hallwil Special Area encompassing the Aargovian part of the Lake Hallwil water basin where the cantonal government is implementing its external measures.

In the canton of Lucerne, the nature conservation organisation then known as SBN compiled an inventory of wetlands which are worthy of protection in the mid-1970s. These were included in the federal inventory compiled in accordance with the *Law on the Nature Conservation* of 1966 in 1977, albeit in a slightly reduced form. The zones form a belt of 20 m to 1 km in width around Lake Baldegg.

In order to reduce the discharge of nutrients and contaminants from the lake shore areas, in their "Concept for Protective Measures in the Shore Belt of Lakes Baldegg and Hallwil" of the mid-1980s, the association of municipalities defined four zones (A to D) with varying risks of nutrient erosion and use instructions of varying stringency (and the corresponding compensation). Zone A is a nature conservation zone in accordance with the cantonal *Decree on the Protection of Lakes Baldegg and Hallwil and its Shores* of 1992.¹¹ For the ban on fertiliser use compensation is paid in accordance with the cantonal nature conservation legislation, however, based on an agreement between the individual farmers and the canton. Zone B (restricted fertiliser use) is based on agreements between the individual farmers, the local municipality and the GVBH. CHF 10 per m² is paid in compensation for the resulting reductions in yields, financed from the budget of the GVBH. No subsidies are paid for Zones C and D as reduced yields are not expected.

The Lucerne cantonal direction plan of 1986 contains the provisions for Lake Baldegg that the entire immediate area around the lake belongs to the landscape protection area. The regional planning for Seetal is allocated the task of developing a special plan and concept for the lake and its surroundings. The path around Lake Baldegg is one of the topics dealt with in the cantonal direction plan for walking/hiking paths.

Thus, in the area of shore protection, the policy design in the Seetal of the past three decades did not give rise to any extension of the protected areas. Instead, the trend was to intensify the protection of existing areas. However, a shift from protecting shores from being overbuilt can be observed to protection from other uses, mainly due to the growing significance of recreation (landscape, leisure, sport) at Lake Hallwil and increasingly also at Lake Baldegg which sharply intensified the rivalry with the water as living environment over the course of the study period.

4.3. Regime change in the Seetal valley

The most important conflict between uses in the Lucerne and Aargovian areas of the Seetal appears to centre on the antagonism between water as a living environment,

¹¹ Under the terms of this decree, the area was divided into water, nature conservation, landscape protection and leisure zones with varying use regulations and restrictions.

on the one hand, and its function in the transport and absorption of pollutants, on the other. Thus, this conflict between different uses is a *qualitative* one.

In all three sub-cases, the rivalry between different uses has increased (for the most part) significantly over the past three decades. Regulations have been adopted which primarily targeted a specific rivalry situation. With respect to the co-ordination of levels and scales, our investigation period saw the advent of certain efforts to take the water basin into account in its entirety. This took the form, firstly, of the foundation of the GVBH which covers the Lucerne part of the Seetal water basin as a whole and, secondly, the development of the Phosphorus Projects for Lake Baldegg and Lake Hallwil in the early 21st century. In this context, federal legislation obligates the cantons to define an area covering the entire water basin of a water body as a condition for the receipt of subsidies for further measures aimed at fulfilling the quality standards defined for water in the federal legislation. However, compared with certain developments at EU level, consideration of water basins in their entirety still appears to be very weak in Switzerland to the present day. Furthermore, non-public actors rarely assume an important role in the policy design.

The extent of the regime has been enlarged in the Seetal valley mainly due to the reinforcement of the use of the resource as a living environment, the inclusion of farmers' activities as a target group in association with restrictions on use rights and stricter regulations regarding recreational uses of lake shores. The external coherence between the regulative system and the policy design has been increased, firstly, due to the identification of farmers holding (indirect) use rights to water (transport and absorption) as target groups, secondly, the obligation to implement rehabilitation measures on the lakes¹² and, thirdly, the reinforcement of restrictions on use rights to the owners or the users of lake shores in the interest of nature and water protection objectives. With respect to the internal coherence in the regulative system, there has been only a slight increase in the case of lake Baldegg due to the admission of Pro Natura (owner of the lake) to the GVBH, albeit in an advisory capacity. The land buying policy of Pro Natura has also brought a slight increase due to a further overlapping of the lake owner and the holders of use rights to water (transport and absorption). The internal coherence in the policy design also appears to have experienced a certain increase, mainly due to further co-ordination efforts between nature and water protection policies and other uses (e.g. recreation, agriculture), on the one hand, and between the two cantons, on the other. Formal administrative structures have, however, not been fundamentally changed into an integrative direction and the three traditional branches of water policy still exist more or less separatedly in both cantons. All in all, the extent and coherence of the regime, have both undergone an increase in various dimensions. Thus, the regime at the level of the Lake Hallwil and Lake Baldegg water basin moved towards greater integration in the course of the study period.

In the Seetal valley, public policies appear to rely very heavily on public (in contrast to private) organisations and resources for policy implementation. In all three sub-cases, the policies are largely implemented by the cantons or municipalities, even if they are organised in the form of an association of municipalities as in the case of the GVBH. The regulatory capacity of the property rights holders appears to be rather subordinate in the regime development, since Pro Natura, as the owner of Lake Baldegg, has very little influence on the management of the uses which pollute the lake

¹² In the case of Aargovia, the owner of the lake Hallwil and, in the case of Lucerne, the holders of use rights to polluted water, i.e. the municipalities.

or harm its natural location in any other way. On the contrary, it exerts some influence through property rights to land as opposed to water.¹³

In the area of qualitative water protection, throughout and beyond the study period, the debates and conflicts always centred on money. In the first phase of the promotion of the construction of domestic sewage systems and wastewater treatment, due to the inadequacies in municipal implementation, the federal subsidies for sewage projects and wastewater treatment plants were gradually increased and extended to other activities (cf. Mauch et al. 2001, Reynard et al. 2001). This finally promoted widespread implementation. The situation with respect to measures in the area of agriculture is similar. In this case, the first step involved the cleanup of slurry pits which was mainly paid for by the state and the cantons. In the following phase, voluntary incentives, initially simple advice, were quickly followed by payments for special ecological services.¹⁴ These (financial) incentives proved to be too low in the Seetal to bring about effective improvements within a sufficiently short period. They were subsequently increased, at national level with Article 62a *GSchG* and in the Seetal area with the launch of the phosphorous projects based on this legislation and also with a project initiated by Pro Natura which, in accordance with the federal legislation, increased the subsidies by half within the framework of agreements with farmers.¹⁵ As all of these measures are based on voluntary participation, it can be assumed that the use restrictions arising from altered agricultural practices are compensated with the payments. From a property rights point of view, this phenomenon can be interpreted as the state purchase of use rights to water from the respective holders of the rights in order to protect water quality.

4.4. Conclusions for the Seetal water basin

The evaluation of the regime change and its effects in each case is intended to be based on three economic, ecological and social indicators for sustainable use. Even if it was not always possible to find reliable “hard” data (especially regarding the economic and the social dimension of sustainability), we were, however, able to identify some trends regarding these two dimensions in a rather qualitative way which also allow a certain judgement of the overall trend in the Seetal. The evolution of the indicators¹⁶ reveals a tendency towards greater sustainability in the uses and in the state of the resource in the Seetal valley from the 1970s to the end of the last century.¹⁷ The best sustainability performance was observed in sub-case 1 (wastewater from settlements), and the least improvement appeared in sub-case 3 (protection of lake shores) which, however, started from a good state already at the beginning of the investigation period. We can, however, observe some variation between the different dimensions of sustainability, since its *ecological* and the *social* aspects reveal the clearest improvement, whereas the *economic* aspects show more indicators with a

¹³ Policy of buying ecological valuable plots around the lake, becoming involved in organisations for the improvement of land through the ownership of land within the relevant perimeter.

¹⁴ According to Art. 31b of the *Law on Agriculture*.

¹⁵ The project was co-financed by Pro Natura, the Swiss Agency for the Environment, Forests and Landscape (BUWAL) and the Swiss Landscape Foundation.

¹⁶ For further details regarding to the indicators cf. Mauch 2002a and Mauch 2002b.

¹⁷ Out of nine indicators per sub-case (three for each dimension of sustainability, i.e. ecological, social and economical), the three sub-cases show an evolution towards more sustainability in 17 dimensions, a deterioration in 4 dimensions, in 3 dimensions the evolution was neutral and in 3 dimensions no reliable information was available. (Mauch 2002a, Mauch 2002b)

decrease and, here, improvement¹⁸ and deterioration¹⁹ more or less equalize. The extent to which this development can be explained entirely by the regime evolution observed for the three sub-cases remains, however, open.

The main *trigger for regime change* in the Seetal appears to be the perceived problem pressure, i.e. the state of the resource. In all three sub-cases, we were able to identify an impact from specific characteristics of the Swiss political system, mainly the possibilities of intervention through the instruments of direct democracy (petition, popular initiative). In fact, the owner of Lake Baldegg, the nature conservation organisation Pro Natura, could only influence the evolution of the regime and the measures to protect its property, which was threatened by pollution, as a non-public pressure group in the policy system and not due to its property status.²⁰ The adoption of various measures in the different fields of regulation related to the resource led to an increase in the complexity of the regime. In a later phase, attempts were undertaken to establish the integration of the regulations relating to the different uses. These appear to have been mainly promoted by the top-down impact from federal legislation and the change in the national determinants of the water regime. However, the particular case of the Seetal also shows some bottom-up trends in terms of impacts from local approaches to the solution of problems²¹ to the subsequent federal regulations. Integration at the level of the water basin was somewhat forced by the canton of Lucerne and only occurred later in the canton of Aargovia on the basis of the new agricultural policy requirements.²²

5. Analysis of the Valmaggia and the Seetal valley cases in their context

The following section, firstly, compares the two case studies regarding to central dimensions of the analysis of institutional regimes and, secondly, draws some conclusions on the impact of the change in the national regime determinants on the regional institutional regimes in the Swiss case studies.

5.1. Comparison of the Valmaggia and the Seetal cases

The Valmaggia and the Seetal case studies vary with respect to several aspects. First, their geographical location in Switzerland is very different. The Seetal represents a typical Central Plateau valley, a region which was directly affected by the population growth, industrial and societal development of the past decades. In contrast, the Valmaggia stands for a steep alpine valley with very low population density and modest economic productivity where mainly tourism has evolved significantly. In parallel to these different geographical, social and economical structures, also the uses of the resource water vary. In the Valmaggia, its use for hydropower production,

¹⁸ E.g. water consumption per inhabitant, offer of tourist infrastructure and activities.

¹⁹ E.g. Costs for wastewater treatment plants and the rehabilitation of the lakes, costs for protection of restricted areas.

²⁰ Apart from its policy of buying land around the lake which is a policy concerned with the resource soil rather than water.

²¹ Rehabilitation measures on the lakes, offer of advisory services to farmers by the institutions responsible for water protection at regional level.

²² Obligatory definition of the water basin area in its entirety and development of a strategy for this whole area according to art. 62a of the federal GSchG.

which had emerged at the end of the 19th and was further developed in the second half of the 20th century, dominates. Considering the fact that the Maggia is a mountain river which, heavily depending on the precipitations in the area, can evolve into a furious torrent within a very short time, also protection from floods becomes a very important feature in the region of its river mouth, a (rare in this region) plain area suitable for human and industrial settlements. In contrast, these two uses are of rather little or even no importance in the smooth Seetal valley landscape where intensive agriculture and settlements dominate, activities which on their hand become a heavy burden to the two standing waters with low circulation capacity, i.e. Baldegg and Hallwil Lakes. Even if, relating to the general socio-economical development with growing demands in terms of number and heterogeneity, in both cases an increase in the extent of water uses can be observed over the past 30 years, rivalries still have evolved differently. However, in both cases they center around the characteristics of the main uses in the region. For the Valmaggia this is its quantitative aspects and for the Seetal, it is its threat in terms of quality.²³

At the level of the actors and institutions involved, in both cases, the local population makes use of instruments closely related to the specific Swiss political system. In the Valmaggia, fishermen and local people fight against too low residual flows in the rivers by means of a popular initiative, and in the Seetal the local population in Aargovia urges their government to cooperate with the canton of Lucerne by means of a petition. In the Valmaggia and the Seetal as well, such activities emerge in the context of, firstly, the most fierce conflict on water uses in the region and, secondly, two cases of scarcity which become obvious and perceptible to the population (dried up rivers in Ticino, fish kills and overproduction of algae in the Baldegg and Hallwil lakes). In both cases, under this “bottom-up” pressure, protective measures standing in opposition to economic uses (hydropower production, gravel and granite quarrying, industrial and agricultural production) were introduced by state authorities, be it the cantons or – subordinate to their institutional and regulative framework – the municipalities. We can observe a process of acting on existing use rights on water²⁴ through policy measures in all six sub-cases. In this process, existing use rights gradually are newly defined and are later again “stabilised” on another level.

In both case studies, we have encountered administrative institutions at the level of the cantons which are divided along the three main branches of water policy we had already identified at national level.²⁵ The basis of these administrative structures has not changed in neither case over the past decades. However, we can observe the arrival of more and more steps towards co-ordination and integration efforts in specific problem situations. In the Valmaggia, this was the case with the establishment of an interdisciplinary working group dealing with the quarrying problem case and in the case of the solution of the flood protection measures in the Maggia delta. Such co-operation attempts also arose in the hydropower sub-case due to a judicial agreement finalised before the Federal Court in 1996, where differing interests were balanced. In the Seetal case, such co-ordination and integration efforts seem to have

²³ This difference was taken as a selection criteria for the case studies in order to cover various use and rivalry situations which are relevant in Switzerland.

²⁴ Water concessions for hydropower production, quarrying concessions, “right to protection of areas from floods”, wastewater discharges, storage capacity for liquid manure and overfertilisation in agriculture causing diffuse water pollution, free use of lake shores.

²⁵ I.e. protection from floods, hydropower production, water protection.

emerged less often, but are now, however, of a certain importance in the field of water protection from diffuse pollution by agriculture and also in lake shore protection.²⁶ We may, therefore, state that at the level of policy implementation *in situ* (i.e. substantial aspects of the policies) we can find increasing activities of integration between rivalrous uses, but, however, at the institutional level these changes do not really seem to be backed up, and traditionally separated institutional structures persist. Nevertheless, we would like to stress the possibility that – in contrast to the national level where the Swiss political system is well known for its slow processes - at local level, actors might act more rapidly, i.e. adapt (local) institutions and regulations more quickly to new problem situations (e.g. new rivalry situations between different uses of natural resources).

With respect to the impact of the observed regime changes on the sustainability of the water uses, the Valmaggia and the Seetal case as well show a clear improvement in the ecological dimension. In both cases, the improvement in terms of social and economic sustainability, even if also present, show less clear evidence. One interesting finding with respect to the different ownership structures to the resource results from the fact that we were not able to identify any clear difference in the impacts on the sustainability of the resource uses between the case of private ownership of Lake Baldegg and the other, publicly owned, water bodies (Lake Hallwil and Maggia river). This result appears to stand mainly in relation with a specific characteristic of the resource water, i.e. its dynamic character. Private ownership of the Lake Baldegg does not prevent its owner, Pro Natura, from having it polluted, be it by wastewater from settlements, or, more acute in the recent decades, from diffuse pollution by agriculture. Due to the dynamic and moving nature of this resource, its (polluted) parts enter Lake Baldegg through the hydrological cycle and, hence, one central characteristic of private ownership, i.e. its exclusivity respectively the exclusion of other actors than the owner from its use, can actually not be maintained.

In terms of conditions fostering regime change, the comparison of the two Swiss cases draws the following picture. In both cases, Valmaggia and the Seetal valley as well, the visibility of rivalry respectively its negative consequences, the existence of relevant scientific information, the involvement of motivated people at the water basin level, the use of instruments of Swiss direct democracy, parallel developments in other resources' regimes towards more environmentally friendliness, and – at least at a later stage - the support at federal level, proved to promote regime change into a direction of integration. We can, however, observe at least one rather striking difference in the process of regime development in the two cases. Whereas in the Valmaggia, a spirit of co-operation between the actors and the incorporation of non-state and other users involved in the conflict in appropriate structures appears to be an important issue, we must, in the case of the Seetal valley, state that this was not the case. On the contrary, in the Lucerne part of the water basin, for example Pro Natura, even if it is the owner of Lake Baldegg, seems to have been systematically excluded from the association of municipalities (GVBH) committee for a long time, a situation which now appears to be softened only very slowly and in very small steps. In the canton of Aargovia, mainly due to the single responsibility of the canton as the lake owner for the lake recovery measures, other actors did hardly appear on the scene.

²⁶ Activities and negotiations in the association of municipalities GBVH; weighing of interests in the regional planning group regarding to tourist infrastructures, especially the hiking path around Lake Baldegg.

5.2. Evolution of the national determinants and of the regional institutional regimes: extent and coherence

During the past century, at national level especially the *extent* of the goods and services regulated has been enlarged. In a first phase (last decades of the 19th and first decades of the 20th century), this enlargement has mainly occurred in the field of exploitation uses (protection from floods, then hydropower production). Furthermore, it was significantly property rights driven (e.g. assignment of use rights to hydropower producers through concessions). At its later stage, the enlargement has mainly occurred through protective issues and was policy driven.

This increase in the extent at first hand led to an increase in the differentiation of the regulations and, hence, a decrease in the *coherence* within the regime determinants. Even if we can observe a growing interrelation between different water policy fields²⁷, this co-ordination appears to remain more or less on a substantial policy level, and does not come into action to the same extent on the institutional level.²⁸ The fact that in Switzerland the institutional arrangements are generally implemented by the different cantons (which assigns them a great importance in the policy design) may serve as an explanation here. The Confederation's capacity to generate coherence, therefore, remains low within the Swiss federalist political system.²⁹ The *internal coherence in the policy design*, therefore, has to be judged rather low (low on the level of institutional aspects, even though high on the level of substantial aspects). With respect to the regulative system, in practical terms 'unclear' definitions (*Unschärfen*) occur in the public policies and in the related definition of property, disposal and use rights. In this respect, for example the prescription in the water protection law of 1991 which urges the cantons to rehabilitate water courses, from which large quantities are drawn and where residual flows are not guaranteed, even before the end of the concession period as far as no duty for compensation arises, represents an unclear definition, since the law does not define from what amount of reduction of water quantities on this holds true. Thus, the *internal coherence of the regulative system* tends to be low at the national determinants' level, at least at the beginning of a policy cycle.

However, at regional level, e.g. agreements concerning the definition of residual flows could be found in the Valmaggia at the time, and, hence, the situation with respect to coherence generally appeared to be more favourable in the case studies, mainly in the context of specific regional problem solution strategies. Thus, the situation regarding to institutional regimes at regional level appears to differ from the national determinants' level. We might interpret this difference as "temporary coherences" emerging at regional level, i.e. specific local regime arrangements centered around specific local problem situations which reach beyond the structures given from the national level. We, therefore, can observe the flexible emergence of "*instable integrated regimes*" at regional level which succeed in producing (temporary) integrated institutional regimes focusing exclusively on the solution of concrete problem situations.

²⁷ I.e. between exploitation and protection policies (e.g. with the instrument of the General Water Discharge Plans (GEP) in the water protection law of 1991).

²⁸ This is an observation which particularly results from the two case studies, Valmaggia and Lakes Hallwil and Baldegg, and could not at first hand have been expected on the basis of the national screening.

²⁹ In the European context, this appears to be unlike to the situation e.g. in France and the Netherlands but similar to the Italian Situation.

6. Conclusions: “problem basin approach” in Switzerland

In the next chapter, several conclusions are drawn from the analysis of the case studies with respect to interactions between the public policy and the property rights dimensions of the institutional regimes, the emergence of institutional arrangements in the policy design along rivalrous uses, and possible explanations promoting change towards more integration in the regime in Switzerland.

6.1. Interaction between the public policy and the property rights system

At the demarcation line between a legitimate “concretisation” of water uses (e.g. limitation by a public policy), where no compensation payments are owed, and the situation of legally accepted material expropriation with financial compensation, the public policy and the property rights system interact. Up to this line, users of a resource are urged to tolerate the limitation or decrease of their use rights (for example) in the public interest. Beyond this line, they have a right to compensation.

The process of interaction between the public policies and the property rights system might be described as follows: With the arrival of a new public policy, use rights to the resource are newly defined. A debate on the limit to a “real” material expropriation, i.e. where compensation payments are owed, starts. Once the new structure is institutionalised by the new public policy, further limitations may come into force some years later through a court decision restricting use rights even further.³⁰

Thus, at the demarcation line between property rights and public policies the property rights system is ‘mobilised’. This is due to the fact, that every intended impact of any public policy related to the resource water needs to influence the behaviour of the actors actually making use of the resource in order to change it. Hence, with the emergence of every new good and service regulated, the limits between the public policies and the property rights system respectively the definition of the property rights system in terms of concrete use rights (rights to make use of the resource in this or another way) has to be newly defined. At a later stage, this *destabilisation of the property rights system* first leads to a new stabilisation on another level and then to a new clear-cut definition of use rights.³¹

In Switzerland, we have identified a phase of high extent of the institutional regime (IR) from the beginning of the 90s onward, but we can not actually identify a convincingly high level of coherence. This is, on the one hand (regulative system), due to the fact that unclear definitions will exist up to the moment where e.g. a court decision on the limit up to where the use rights may be restricted without a need for compensation is taken. On the other hand (public policy), it is a consequence of the specificities of the Swiss political system (strong position of the cantons which define most various regimes at the regional level). Therefore, the national determinants of the regional regimes tend to give room for highly varying institutional regimes at regional level - a tendency which we assume to be clearly stronger for Switzerland than for the other European countries due to the specific federalist Swiss political system. Furthermore, with respect to the fact that in Switzerland changes in property respectively use rights on water have generally been implemented through public policies

³⁰ This limit to « real » material expropriation, e.g. with respect to the rehabilitation of watercourses according to article 80 of the Swiss Law on Water Protection of 1991, has not yet been generally determined, neither by court decisions, nor by a legal doctrine. Experts in general demand for a judgement of every single case. However, in any case they consider productivity losses up to 4% to be free from a need for compensation (cf. Eckert 2002 :152).

³¹ This also means that, in a first phase of the arrival of a newly regulated good or service, the internal coherence of the property rights system will be newly defined.

and not through the regulative system during the past decades, we might assume that here, the property rights system appears to be ‘stronger’ respectively more stable than the public policies due to a traditionally strong position of property rights in Switzerland. Regarding the comparison of the six country cases, we would for the same reason state that the destabilisation of the property rights system through the arrival of public policies appears to be stronger in Switzerland than in the other countries.

6.2. Institutional arrangements along rivalrous issues

Both, the country screening and the case studies as well, have revealed that in Switzerland institutional arrangements in the water policy field are strongly organised around and, hence, separated along the three different traditional fields of water policy, i.e. flood protection, utilisation of water (mainly hydropower), and water protection. As a matter of fact, these three branches focus on the main rivalrous uses of water and are, furthermore, strongly mirrored in the institutional structures of these policy fields. They actually form three different “policy communities”. These institutional structures appear to be very persisting and tend only to change, to open up towards each other under very strong pressure of rivalries respectively conflicts between various uses (first at the local / regional level).

This observation builds an obvious contrast to the water basin approach aspired for in the EU-member countries. In Switzerland, such an approach could actually not be identified in any of the case studies, respectively only very recent and shy approaches in this direction towards the end of the 20th century. The approach found in Switzerland rather appears to be some sort of a (virtual) “*rivalry basin approach*”, i.e. the “basin” is rather formed around existing rivalrous respectively conflictuous uses than by a geographical area.³² Another effect of this kind of “pragmatic” approach seems to be that interpolicy and inter-resource aspects appear to gain a more decisive importance than in other countries due to the focus onto concrete problems in a certain area (e.g. nature protection and water protection). This means that in Switzerland the regimes are formed around specific goods and services which actually exist in a certain area, i.e. they depend on a concrete problem situation. Thus, generally speaking only goods and services which are standing in a rivalrous relationship are covered by the institutional regime.

Within the observed bottom-up processes, where local problems are first solved at the local or regional (or cantonal) level and then “transferred” to the national level,³³ the subsequent “recognition” of (former) local problem solution strategies through federal legislation offers a further legitimation to these regional regimes.³⁴

We might, therefore, state that Swiss water regimes are *integrated by rivalries* (“rivalry basins”) rather than with respect to the resource as an entirety. One impact of this, observed in the case studies, is that inter-resource aspects have a stronger position in the regime than might be the case in a situation where the water basin approach dominates.³⁵ However, the question still remains on the table whether the “water basin” or the “rivalry basin” approach will finally guarantee more sustainability of the uses.

³² E.g. fishermen vs. hydropower producers in the Valmaggia, users of the water for transport and absorption (i.e. settlements and farmers) vs. water protection in the Seetal valley.

³³ E.g. cattle limitation in the Seetal, minimal residual flows in the Valmaggia.

³⁴ E.g. definition of minimal residual flows in the Federal Law on Water Protection of 1991.

³⁵ Cf. for example France where the regime is strongly basin oriented but interresource aspects do not seem to be important.

6.3. Possible explanations

With respect to possible explanations for these observations, we would like to propose three particularities of Switzerland. Firstly, the observed bottom-up effects result from the specific Swiss *federalist system* where cantons often function as “laboratories” for national solutions. Local problem solution approaches are “legitimated” through subsequent national legislation.³⁶ Secondly, the *heterogeneous geographical structure* of Switzerland (Alps, Central Plateau, Jura) leads to very different solutions due to very different problem situations. And, thirdly, the *complexity of the Swiss political system* (direct democracy with its instruments) allows for a better acceptance of specific rivalry issues.³⁷ Generally speaking, these aspects lead to a rather “unsystematic” way of promoting water regime related topics in Switzerland, a way which appears to be strongly determined by specific goods and services in certain areas.

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³⁶ E.g. the minimal residual flows existed in Ticino and later were introduced into Swiss legislation; similarly, the cattle limitations per area existed already in the Aargovian and Lucerne Seetal before entering national legislation.

³⁷ Cf. the Valmaggia case where visible aspects of the quantitative water problems were able to mobilise the fishermen and launch a political process; or the (visible) pollution of the Seetal lakes which resulted in a popular petition. In both cases, public opinion was crucial.

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