Working Paper

Historical Analysis of Institutional Resource Regimes in Switzerland. A Comparison of the Cases of Forest, Water, Soil, Air and Landscape

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Abstract

The increased use of goods and services based on natural resources - be it in the form of raw materials for production or goods for direct consumption, as a sponge for the absorption of pollutants, as an immaterial consumer commodity or ecological services for a biological system - have resulted in competing use, increasing scarcity and destruction of resources. The use of such threatened resources can be institutionally influenced and managed with the help of *Institutional Resource Regimes (IR).* Accordingly, there is a need for studies on institutional change and for information on the generation and alteration of IRs and the effects of different IRs on the actual use of resources.

As we understand it, an IR is a combination of factors such as formal property and use rights (= *regulative system*) and the prominent programme elements of resource-specific protection and/or use policies (= *policy design*), whose policy design comprises specific aims with respect to protection and use, intervention instruments, actor arrangements etc.

The paper examines if and how regimes adjust to changes in the structures of users as well as to increased use of resources and to scarcity. By comparing the historical development of IRs for five resources (forest, water, land, air and landscape) in Switzerland, we gain initial insights into the triggers of the emergence and changes of IRs. It is particularly important to identify the *transition periods*, i.e. those historical moments when the IR actually changed, as well as the entire *development trajectories* of the IR for a specific natural resource. Thus, the empirical studies will concentrate on the changes in the central elements of the policy design and property and use rights.

Methodologically, the diachronic study for each resource will combine legal (which property rights?), policy (which protection and uses policies?), economic (which goods and services?) and scientific (which evolution of the stock of the resource?) analyses. By applying the outlined theoretical framework, we propose to examine the interaction and interlinkages of property and use rights and the relevant public policies. The purpose is also to develop the theoretical framework and to integrate institutional aspects in political guidance theory. The analysis of IRs also provides intial information about the time frame we should respect for a diachronic analysis. Furthermore, the comparison of IRs over time will offer a better understanding of the dynamic relationship between various resource uses, property and use rights, public policies and factors in the political context generating IR shifts.

1 Introduction

Any number of examples can be provided to demonstrate the ongoing degradation of natural resources. The use of such threatened resources can be institutionally influenced and managed with the help of *Institutional Resource Regimes (IR).* As we understand it, an IR is a combination of factors such as formal property and use rights (= *regulative system*) and the prominent programme elements of resource-specific protection and/or use policies (= *policy design*), whose policy design comprises specific aims with respect to protection and use, intervention instruments, actor arrangements etc. The central postulate of this new approach assumes that the two steering dimensions are complementary and must be considered to achieve sustainable resource management.

The starting point of our reflection is the question as to how institutions affect individual behaviour and resource management. The proposed paper examines if and how IRs adjust to changes in the structures of users as well as to the increased use and scarcity of resources. By comparing the historical development of IRs for five resources (forest, water, land, clean air and landscape) in Switzerland, we gain initial insights into the triggers of IR emergence and change. To be able to analyse the development of the different IRs, it is first necessary to define what is meant by a natural resource (Chapter 2) and the resource management deficits identified by traditional economic and political-scientific approaches (Chapter 3). On this basis, we identify the different constitutive elements of an Institutional Resource Regime (IR) and propose an initial typology of IRs and an ideal-typical presentation of various development trajectories (Chapter 4). These new theoretical concepts (basic elements, IR typology and development trajectory) are then explored on the basis of five resources (Chapter 5). In the final chapter (Chapter 6), we discuss the theoretical and practical usefulness of the proposed IR approach.

2 Resource definition and resource degradation

We define natural resources as natural and man-made components of nature that are important to people[1] (Wiesmann 1995: 13; Siebert 1983: 2). Socio-economic and socio-cultural factors play a key role in what is and is not defined as a natural resource (O'Riordan 1971; Grima and Berkes, 1989: 33). The historical point in time and spatial reference (local, global) are also important here. A distinction is made between the resource stock and its fruit/sustained yield. When we refer to a natural resource, we intend both its stock and its sustained yield (Ostrom 1990: 30f.).

The time taken for renewal provides information about whether it is a renewable or non-renewable resource. Depending on the existing resource stock, renewable resources can renew themselves within decision-making periods that are relevant to humans without targeted human intervention (Endres/Querner 1993: 3).

Resources provide different goods and services. Resources give rise to either direct use (e.g. as input factors in production processes or the direct consumption option), indirect use (e.g. adsorption sink for pollutants, ecosystem services) or immaterial use (e.g. in the form of landscape, "amenity/aesthetic/cultural values") by people (Young 1992:8-10; Perman et al. 1998).

The resource situation can be characterised by the number of beneficiary groups and uses. It is very common for different beneficiary groups to compete for different uses (Young, 1992). A distinction is made between the owner, appropriator and final consumer of a resource. The disposal and use of the resource stock, the sustained yield and the goods and services based on the resource can be subject to different regulations with respect to property and use law.

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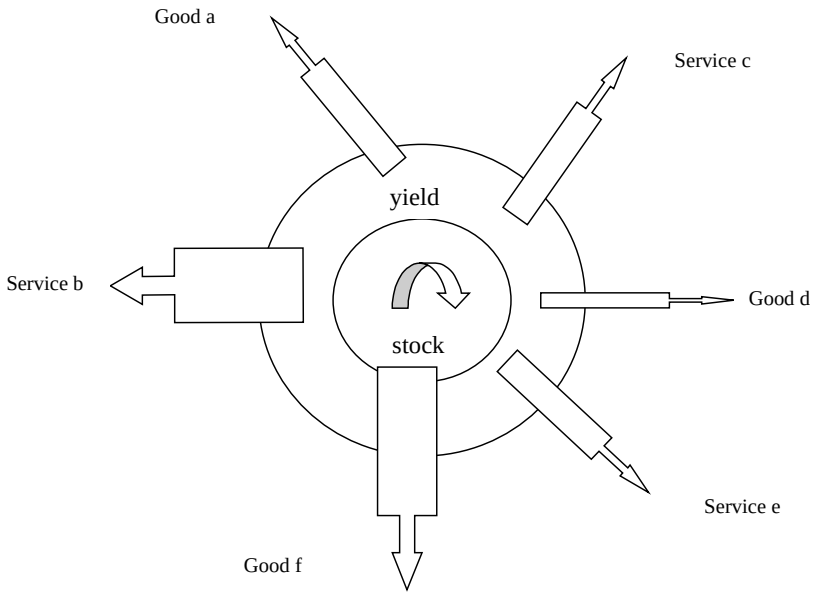
[1] The Internet is an example of a non-natural resource.

Graph 1: Resource stock



From an institutional perspective, it is significant that numerous uses, property and use rights and beneficiary groups exist. All of the institutional regulations which influence the behaviour of the different beneficiary groups and owners and their rights can be defined as an IR. Whereas owners have actual ownership of a piece of land and enjoy the rights associated with this ownership, appropriators have clearly restricted use rights relating to specific goods and services of a resource (e.g. concessions for use of wood in forests). Final users are those beneficiaries who actually consume the acquired goods, e.g. firewood.

3 Conventional approaches to resource management

How can the degradation of resources and destruction of the environment be halted? Institutional economics and political science have provided important contributions on this issue and we draw, in particular, here on the theories of property rights and public policy. Before proposing an integrated approach, we would like to present the remedies proposed by both traditional perspectives and explicitly examine their shortcomings.

3.1 Property and use rights

Central economic concepts focus on the internalisation of external effects and the design of institutional mechanisms for coping with social dilemmas. We will specifically examine property and use rights in detail.

a) Property Rights

In contrast to the Pigouvian Tax solution (Pigou 1962), Coase (1960) assumes that property and use rights must be clearly regulated to enable effective and efficient use and management of resources. In his opinion, it is irrelevant who actually owns these rights as the use which yields most profit will always prevail.

Institutional economics considers property and use rights as key steering factors. The internalisation of external effects can, therefore, be brought about through the (re)definition of property and use rights. Different types of property rights exist for natural resources. When these property rights have similar characteristics, they are referred to as a property-rights regime[2]. Their classification is based on different criteria (Bromley 1991; Libecap 1993; Ostrom 1990) which include title to property, organisation of exclusion, access control and decision-

[2] Devlin/Grafton (1998: 39) have the following to say on this matter: "Often property rights that have a similar set of characteristics are called property-rights regimes. The nature of these regimes is determined by the institutional setting, technology, and the aspect of the environment over which they are held."

making processes within the regime. A distinction is made in the literature between four classical types of regimes: no property, common property, state property and private property.

In the case of private property, exclusive title to property is in the hands of private individuals or corporations and this must be respected by all others who are interested in the use of this property. The enforcement of the rights is guaranteed by the state. In the case of no property ("res nullius"), we have a classical case of resources, for which access is not formally regulated. Common property and open access ("no property") were thrown together for a long time in the literature and this led to the misleading conclusion that collective ownership in the sense of the "Tragedy of the Commons" (Hardin 1968) would lead to the destruction of the resource. It has now been established, however, that in such cases of collective ownership, the resource in question is controlled and managed by an identifiable group. Moreover, the group establishes rules governing the use of the resource. Thus, common property can also be described as group private property.

The institutional economics literature also shows that there is no theoretical or empirical justification for the belief that the private property system per se is better than the other regulative systems[3]. Devlin/Grafton (1998) state that there is no "best" regulation and that a mix of regimes can be found in most cases and environmental destruction can be found in all regimes. However, it is possible to identify conditions for the success of specific regulative systems[4].

b) The limits of the economic approach

Institutional economics makes an important contribution to the analysis of resource management in that it draws attention to the function of property rights as steering factors and examines the effect they have on the more or less sustainable use of resources. In our opinion, however, this predominantly static institutional perspective also has its limitations which are indicated below:

- *The consideration of regulative systems alone is not sufficient for a comprehensive analysis of resource use and management; it must also be analysed in the context of the resource-specific public protection and use policies.*

State regulation of the production and/or consumption of certain goods and services provided by a natural resource is a common occurrence in everyday political life (cf. hunting regulations in the Swiss cantons, residual water regulations for Swiss hydro-electric power plants). In most cases, there are several public policies which regulate the use of a resource and which can result in the degradation of that resource due to their insufficient co-ordination (cf. water protection and degradation of ground and surface water due to the promotion of intensive agricultural policies). Thus, consideration of the regulative systems alone is not sufficient for the analysis of the institutional framework. In fact, the influence of all relevant public policies on a specific commodity or the entire resource, and their interaction with the given property and use right arrangement, should be given explicit consideration (Bättig et al. 1999).

- *The emergence and change of institutional regimes should be the focal issue: a dynamic perspective is required.*

In our opinion, institutions should not merely be understood as given frameworks, within which actions are carried out. Like public protection or use policies, they too are the product and integral components of the political process. Most of the literature concentrates on the analysis of the regulative systems which exist today. Lesser emphasis will, therefore, be placed on the perspective dealing with analysis of the process. In order to avoid further degradation of resources, it is, however, important to know when and under what conditions in the political process the institutional regimes can be changed and how this can be brought about and managed.

- *Specific public policies are becoming increasingly important due to the fact that resource use requirements are becoming more heterogeneous and self-organisation will not suffice as a form of problem resolution.*

Ostrom's earlier approach (1990) focuses on common-pool resources and - particularly in the earlier studies on irrigation - is based on the assumption of a homogeneous demand for local commodities and services. In this instance, it was possible to prevent the degradation of resources on the basis of voluntary co-operation, i.e. without state intervention. Although this can be viewed as a very efficient strategy from an economic perspective,

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[3] "It should never be assumed that private-property systems are superior to common-property or state-property systems in either an economic, ecological or social sense". (Devlin/Grafton 1998: 39)

[4] Devlin/Grafton (1998: 138) state: "The key to success is to set up an incentive structure for individuals that is compatible with both the characteristics of the resource and institutions." Thus, there is no sense in introducing private fishing rights in Africa when a collective system already exists.

this kind of solution is probably uncommon in highly developed societies characterised by increasingly heterogeneous demands and an expanding scope of effects - factors which dictate against a local and regional solution such as common property. Thus, guidance of heterogeneous, growing and increasingly rivalrous use demands is required.

- *Self-organisation was sometimes facilitated by the fact that the negotiations were held in the shadow of hierarchical authority, i.e. rules were backed up by hierarchy.*

In some cases, it is impossible to find any formal traces of state intervention, nevertheless self-organisation was only possible in the shadow of hierarchy (Scharpf 1993: 145). In this context, self-organisation, i.e. the generation of rules, is intertwined with public policy: the spectrum ranges from self-governing rules backed up by the state to an ineffective common-property regime combined with a successful public policy.

- *Actual use regimes are the result of interaction between the ownership structure, state intervention and management practice.*

Empirical examples demonstrate that the actual use regime is not only dictated by the selected ownership structure but results from the combined interaction of the ownership structure, state intervention and management practice (Kissling 2000). Thus, constancy of structures is not a reliable indicator of the actual management status**.** Structures can be stable while changes take place in the wider external environment, resulting in a shift in the motivation of the resource users as is the case, for example, in extensive areas of the Swiss Alps.

The above considerations necessitate the development of a wider concept of the IR which will: (1) add the steering dimension to regime analysis; (2) take into account the influence of use and protection policies, as well as the emergence and transformation of the relevant policy design; (3) incorporate the demands of heterogeneous user groups; (4) consider the influence of management practice as a consequence of individual rationality and changed external environment.

3.2 Protection and use policies

Classical policy analysis has mainly focused on the implementation of state measures (e.g. protection and use policies) and on the evaluation of the resulting effects (e.g. on sustainability of natural resource). In contrast to these empirical studies, little research has been done in the area concerning the actual programme to be implemented (or policy design). No coherent and empirically founded theory has hitherto been developed to explain why a particular aim, instrument or institutional arrangement was selected under a specific policy (Linder/Peters 1989; Varone/Landry 1997). Hence, policy design has enriched and transcended public policy analysis.

a) Design of protection and use policies

Here, we understand policy design to be all formal legal regulations, informal co-ordination clauses and institutional structures of a public (protection or use) policy, which policy makers (parliaments, governments) and social actors (competing user groups) deem necessary to regulate the use of a natural resource which is politically perceived as being scarce. A policy design always includes substantial and procedural, material and symbolic dimensions. Here, we suggest that a distinction be made between the five constitutive elements defined below (Knoepfel et al. 1997a: 83ff; Schneider/Ingram 1997: 81ff).

1. *Aims* include the social condition to be aimed at in the area of the collective problem to be resolved (e.g. sustainable use of resources). On the level of legislation, such aims are often formulated in very abstract terms (e.g. "sufficient" biodiversity in the landscape).

2. *Instruments* comprise the measures to be implemented to achieve the defined aims and the procedural rules for their implementation. They define the intensity of intervention involved in a policy design (e.g. information campaign, financial incentives, rules/bans) and the procedural form to be taken by the exchange between the relevant administrative authorities and resource user groups (e.g. obligatory consultation, legal right of appeal).

3. *Target groups* are social actors whose behaviour is considered by the protection or use policy as relevant to the resolution of the problem in question. State intervention is intended to transform or stabilise this target-group behaviour in order to achieve the desired aims.

4. *Institutional arrangements* define the authorities and offices responsible for the implementation of instruments. In addition to this area of competence, they are also charged with decisions concerning the public resources (e.g. money, infrastructure, personnel, time, information, consensus) at the disposal of the identified implementing actors.

5. In order to realise the desired effects, each policy design is based on a *rationale*, which comprises hypotheses on the effect structure behind the collective problem and the possible forms of state action. The *causal hypothesis* responds to the question as to who or what is to blame or is objectively responsible for the unacceptable use of the resource. This gives rise to the political definition of the target group in the policy design. The *intervention hypothesis* responds to the question as to how the behaviour of the target groups can be influenced in such a way as to achieve the defined aims

Policy analysis shows that such policy designs are often incomplete or incoherent, that they are only partly implemented and/or that the effects achieved only partly correspond to the defined aims. Thus, it is imperative to examine the extent to which the concrete use and management of a natural resource depends on the internal coherence and degree of implementation of such policy designs.

b) The limits of the policy approach

Like the institutional economics approach to resource use and management, policy analysis has also some shortcomings which are described below:

- *By focusing mainly on policy implementation the traditional policy analysis has an inherent "conservatism bias". There is a need to question the internal coherence of policy design in order to anticipate foreseeable policy failures and to propose innovative and effective IR.*

As policy analysis mainly focuses on the implementation of existing policies, it is (at least potentially) somewhat conservative. It may try to improve the implementation of existing policies marginally/incrementally with its empirical-analytical conclusions and prescriptive recommendations (e.g. adaptation of an instrument, extension of the implementation arrangement) but it does not really question the policy design and action logic behind them. The *ex ante* analysis of the coherence of certain policy designs demonstrates, however, that in many cases, implementation deficits and undesired policy effects are or could be completely predictable from the outset. To take this into account, policy analysis should also systematically examine the causal and intervention hypotheses of a public policy.

- *"Resource-protection" policies which are normally investigated by the traditional policy analysis concern only one aspect of sustainability and integrated resource management.*

Environmental policies are generally conceived to protect a natural resource (or one or more parts thereof). The concept of sustainability is ultimately concerned with taking into account, combining and adjusting both protection and use measures. A comprehensive analysis of the public policies, which together influence the sustainability of a natural resource, should, therefore, also include infrastructure policies in its perspective. At present, the simultaneous and integrated analysis of protection and use policies is either non-existent or extremely exceptional.

- *In many cases, sectoral policies are "one use" policies. Such a fragmented perspective is an insufficient basis for comprehensive and integrated resource management.*

Environmental policies usually fight the negative effects which arise from a particular use of a resource (or of goods/services deriving from a resource, e.g. pollution of water by nitrates). This sectoral approach proves incompatible with the aim of global and integrated resource management (i.e. all goods and services should be considered simultaneously). In addition, the accumulation of several sectoral policies requires extensive co-ordination (intra-policy and inter-policy, vertical and horizontal etc.) as different sectoral policies are implemented by different specialised administrative authorities. The transaction costs resulting from this "piling up" of official policies increase with time and can become unsustainable. Similarly, the target groups of these different/numerous public policies sometimes receive incoherent and even contradictory messages and action incentives from the state. Hence, it makes sense from the perspective of state actors and social groups to co-ordinate the policies at the level of the policy design and IR.

- *Traditional policy analysis makes no explicit link between public policies and property and use rights. But - as already stated before - the definition of property and use rights is frequently put in concrete form through public policies.*

De facto (if not *de jure)*, public policies distribute specific (even exclusive) use rights to the actors, whose behaviour is to be influenced by the state intervention. Even if the formal property and use rights are no longer being questioned, their material/substantive content is rendered concrete and restricted by public policies. Thus, each policy change involves a redistribution of these use rights. This redistribution explains why it is difficult to alter the *status quo* and identify new winners and losers. Moreover, individual public policies do not take into

account the global quota of a resource which is also supposed to satisfy needs which have not yet been discovered/articulated (i.e. goods and services that can be derived from the resource). Hence, an explicit analysis of the relationships between all actors (i.e. also the newcomers), the existing property and use rights that are being redefined by the public policies and the global control and management of the resource is essential.

The above-mentioned limitations suggest the development of an IR concept which will: (1) adopt a resource perspective that is much broader than the sectoral perspective of environmental protection policies that is focused on one or a few goods and services; (2) take into account the logical coherence and practical feasibility of the different rationales of exploitation and protection policies; (3) explicitly consider the indirectly/secondary (re)definition of use rights through public policies.

4 Institutional Resource Regimes: A New Approach

As previously suggested, the management of resources can be controlled through resource-specific policies and order-policy interventions: the institutional framework in a broader sense is defined in terms of the ownership and use rights to a resource and the restrictive provisions of special policies for the exploitation and protection of resources. The central postulate of the new approach assumes that the two steering dimensions are complementary and must be considered to achieve sustainable resource management. Furthermore, a comprehensive view of the regulations affecting different goods and services is required. We refer here to *Institutional Resource Regimes* (IR) for the use of natural resources which promote sustainability.

Before presenting the analytical concept (4.1) and the IR typology and development trajectories (4.2 and 4.3), we would first like to briefly define what should be understood by the term institution. Institutions are usually understood as a set of rules which structure the relationship between individuals by determining the range of possible reactions to certain situations and designing the relationships between individuals in such a way that the - predictable - outcome is equilibrium. Scott (1995: 33) states in this context that "Institutions consist of cognitive, normative, regulative structures and activities that provide stability and meaning to social behaviour." Thus, as a concept “institution” is highly equivocal: institutions can refer to formal rules, behavioural standards, economic and political structures or framework conditions. For our purposes, the focus is mainly on the formal rules, i.e. we are interested in their definition, monitoring, implementation, change and evaluation.

Institutions are both the result of past actions and the framework within which their new activities take place. Institutions and, hence, IRs can change over time and become increasingly differentiated. Thus, the definition and classification of IRs shall be carried out from a historical perspective. This requires a combined analysis of the regulative system (legal distribution of ownership and use rights to the resource) and political factors which are contained in the resource-specific public policies (e.g. protection of waters, air pollution control). We work on the assumption that - as stated by Scharpf (1997: 151) - the IR embodies an absolute minimum in terms of institutional guidance.

4.1 The analytical concept

Resource policy interventions are combined and formed along with (existing or consciously modified) property and use rights in the process of the development of the differentiation of subsystems and public policies. We define an IR as an institutional framework which combines the prominent programme elements of a resource-specific protection and/or use policy (= policy design) with a specific arrangement of the formal property and use rights for the goods and services provided by a natural resource (= regulative system). While in the case of the analysis of property and use rights, it is possible to avail of the classical research on property-rights regimes undertaken in institutional economics, the political factors will be examined with the help of policy (design) analysis. Theoretical and empirical studies shall therefore concentrate on the identification and changes in the central elements of the policy design and of the property and use rights. These constitutive elements are listed in Table 1.

Table 1: The central elements of an Institutional Resource Regime (IR)

Institutional Resource Regime	
Policy Design	***Property and use rights***
Political aims	Possession of title
Instruments	Organisation of exclusion
Target groups	Access control
Institutional (implementation) arrangement	Decision-making processes in the regulative System
Causal and intervention hypothesis (rationale)	

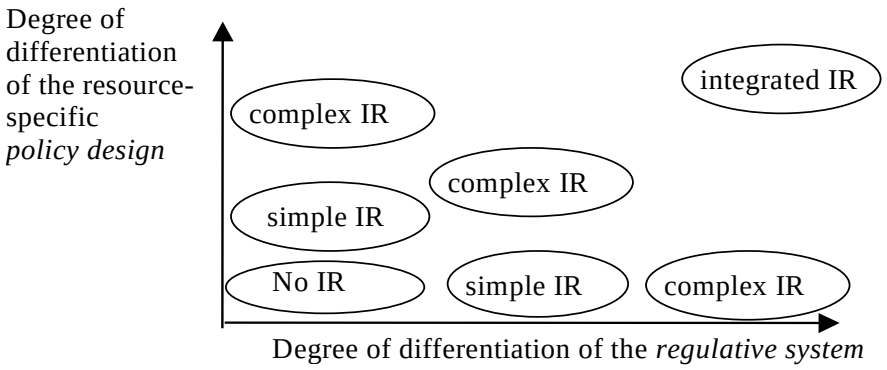
From an empirical point of view, the analysis of the transformation and effects of an IR would imply the identification of the above-mentioned constitutional elements of the IR. The diachronic analysis will make it possible to make a statement on the breadth of the IR and will reveal the goods and services for which the use of the resource was regulated using specific public policies, or by means of the introduction of property and use rights over time. The coherence of the IR can be evaluated by combining the policy design and property and use rights.

In the empirical analysis, a distinction should be drawn between the formal legal nature of state interventions and title to property and the actual incentives set for individual behaviour in relation to the goods and services provided by the resource. Hence, it is completely possible for the use rights to be rendered concrete or new property rights recognised through public policies. As a component of public policies, the instruments which are relevant to use rights affect the regulative system. New use rights, such as the access right, may have been introduced, however the formal change may have been the result of the redesign of the protection and use policy.

4.2 The typology of Institutional Resource Regimes

It is very difficult to classify IRs at present. As a heuristic assumption, we postulate a variable degree of differentiation (on the basis of the goods and services provided by the resource) of the property and use rights and of the design of the relevant public policies for different natural resources (see Figure 1). Different stages of the development of an IR development can be identified from a theoretical point of view:

Figure 1: Gradual differentiation of Institutional Resource Regimes



- From a theoretical point of view, we speak of a *"no IR situation"*, in cases where neither property and use rights nor public policies exist. Chances are in this instance that a resource or its services and goods have not yet been discovered. This was the case for biodiversity until recently.
- If the use rights are formulated either directly in detailed regulative systems (e.g. new definition and application of property and use rights) and/or at least indirectly through an initial policy design (e.g. general police clause for protection of use rights or bans and licence reservations), this can be referred to as a *"simple IR situation"*. We suspect that this kind of simple IR emerges when the

central actors observe scarcity in connection with the predominantly homogenous use of one or several goods or services provided by a given resource and this becomes a collective problem because of the risk of local, regional or global overuse.

- In a *"complex IR situation"*, we can already observe differentiation on the basis of the specific uses of the resource (goods and services provided by the resource) and the combining of the (clarified, redefined) property and use rights with more detailed policy design in terms of substantive content of the corresponding protection and use policies. The differentiation of the aims of natural resource protection and use policy designs will probably move from negative statements such as "no environmental nuisances" (= general police clause) towards more quantitative, positively formulated prescriptions on the desired quality of the resource (e.g. ambient air quality standards) and, in the next step, in limiting the consumption of specific goods and services in time and space in terms of general quantitative consumption quotas. The now mainly heterogeneous demands and the sum of the diverse (private-)use rights could lead to a crisis in and possibly even the collapse of the complex IR. Examples of such rivalrous and excessive uses can be found in the area of land (agriculture, construction zones, roads/railways etc.), water (fishing, energy, agriculture etc.) and forest (biodiversity, recreation, timber etc.). It is safe to assume that this situation, which is characterised by increasingly inefficient and more complex IRs for various natural resources, can, at least, be found in Switzerland today.
- One key theoretical and empirical question is whether it is possible to establish an IR which can take account of these varied heterogeneous demands and regulate the totality of threatened uses in such a way that it is possible to maintain the capacity of the whole resource in question for the production of all the goods and services provided by the resource. We refer here to an "*integrated IR situation"* with use of natural resources which promote sustainability. Integrated IRs make it possible to guarantee the transparent satisfaction of the heterogeneous use requirements and to conserve the resource stock.

4.3 The development trajectories (development path) of Institutional Resource Regimes

In our opinion, the historical emergence of an IR and the detection of different stages, as well as their resulting effects on the natural resource, are important topics for future research on resource sustainability. By referring to the concept of a trajectory, patterns of timing and sequence are emphasised and the development path of IRs studied. With this procedure we implicitly assume that the capacity of actors to design of optimum institutions (as behaviour incentives) is limited and historically conditioned. Path dependence is by the way used to support the key claim, "that particular courses of action, once introduced, are often virtually difficult or impossible to reverse even if their consequences prove to be disastrous" (Pierson 1997: 1).

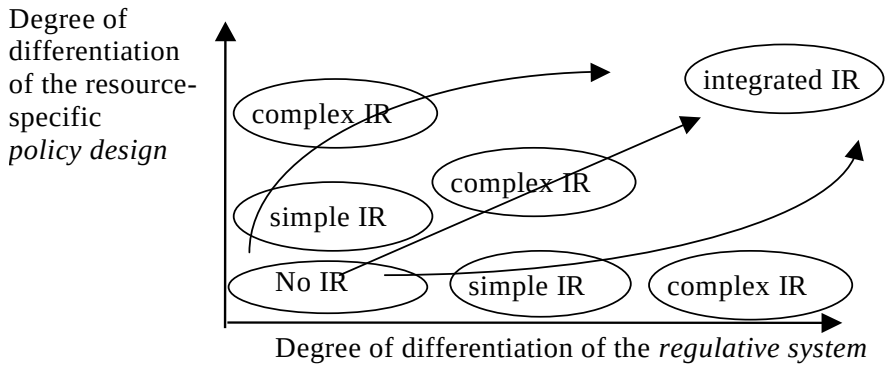
From a methodological perspective, the analytical concept of the IR can be defined as both a dependent variable (which factors influence the emergence and change of IRs?) and an independent variable (what are the effects of a particular IR on the users and sustainability of a natural resource?). Hence, two types of hypothesis are required to explain the historical development of IRs and natural resources (as, according to our main postulate, both elements are related). Without making any claim of being comprehensive, the following exemplary hypotheses can be formulated on the genesis and transformation of IRs as well as on the effects of IRs:

1. Existing property rights are hardly ever basically questioned when a regime is changed but redefined on an incremental and resource-specific basis through changes in the policy design (e.g. through a change in perimeter or simple property restrictions).
2. If the intervening protection or use policy is too weak and incapable of producing enough social commodities, the change in regime directly affects the regulative system (e.g. Holland: purchase of forests; Greina: compensation for loss of water use).
3. The more differentiated and coherent a resource regime is, the more sustainable the use of the resource will be, given heterogeneous demand.

To summarise this heuristics, research on the historical IR change aims to examine when, whether, under what conditions and in what form IRs are established which can regulate all of the use demands and thus react to the growing scarcity of individual goods and services or the destruction of entire stocks of a given resource.

As we previously defined the different types of IR, it is now also possible to identify ideal-typical historical development trajectories. Figure 2 provides an overview of such ideal-typical development paths.

Figure 2: Development Trajectories of Institutional Resource Regimes



Policy-driven trajectory: This type of development trajectory means that public policies are conceived and implemented in the absence of explicit and clear property rights and their legal definition. It should, however, be noted that the various policy designs can define very well determined use rights (i.e. to a few goods and services provided by the resource), even if only indirectly. However, actual property rights are only clearly formulated and officially/legally distributed among the target groups of the relevant public policies at a later stage.

Parallel trajectory: In this case, there is parallel development of property and use rights and policy design. This means that certain property and use rights are formally defined and distributed while simultaneously setting clear limits with respect to the contents of these rights through different policy designs. The opposite situation is also plausible: if different policy designs are introduced, this provides an opportunity to clearly define and distribute the formal property and use rights which are touched on by the public policies. Hence, it is not necessary to know whether the property and use rights or the policy design are the driving force. It is important, however, that both elements are co-ordinated in terms of both form and content (like identical or Siamese twins).

Property-rights-driven trajectory: With this type of development trajectory, property and use rights are defined and distributed in the absence of the conception and implementation of policy designs. Hence, ownership of a resource or the goods and services it produces are almost absolute and unlimited. With this scenario, policy designs which limit the content of use and property rights or distribute them among various owners, appropriators and final consumers are not developed until a later stage.

Non-linear trajectory: It is important to note that exceptions to the three above-described development trajectories may occur. Some IRs may deviate from the assumed parallelism or clear priority in the historical evolution of the degrees of differentiation between regulative systems and policy designs or from the assumed priority of one element over the other one. Thus, a highly differentiated policy design could become radically simplified if legislation introduces a more sophisticated property and use rights arrangement which is considered as sufficiently guaranteeing a more sustainable use of threatened naturally produced goods and services (e.g. privatisation of previously state-owned resources or the opposite movement towards nationalisation). The same appears even more likely in the case of changing degrees of policy design differentiation in the absence of a corresponding (explicit) change of the regulative system, such as can be observed in the case of many clean air policies in some European countries over the past decade (e.g. increasingly differentiated policy designs including more and more polluting substances and ambient air quality standards without visible changes to the attribution of the actual permits among different emitter groups).

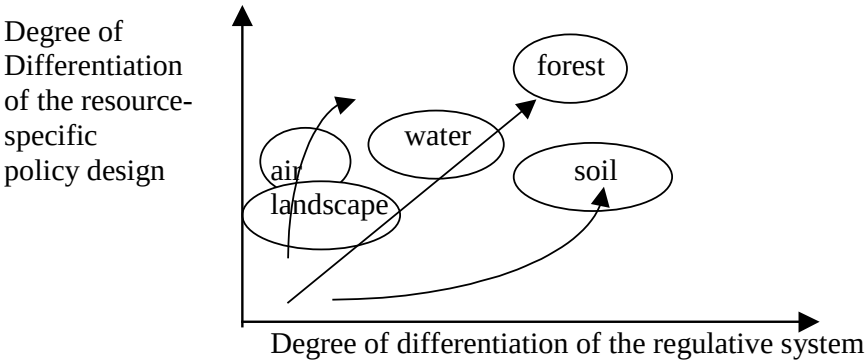
5 Initial Empirical Evidence from Switzerland: The Steering Potential of Existing Regimes and Regime Change

5.1 Institutional Resource Regimes in Switzerland

The examples from Switzerland show a vast spectrum in terms of IR differentiation. Analysis of the legislation revealed that in Switzerland, formal property and use rights are often based on federal civil or (additional) cantonal civil or public law, whilst the public protection and use policies can for the most part be formally associated with what is known as the federal or cantonal public law. The Swiss regulative systems have their legal basis *inter alia* in the Swiss Federal Constitution (property guarantee: Article 26) and the Swiss Civil Code (general definition of property: Article 641). Moreover, property restrictions are also increasingly regulated in the special federal public legislation and/or the corresponding cantonal introduction acts (e.g. environmental protection, construction and regional development legislation, general and special police restrictions of ownership). Finally, there are formal and informal rules and regulations in the sense of common-property, whose significance should not be underestimated and which render the task of classification in terms of different property types extremely difficult.

The following descriptions of IRs are provided as examples of particular combinations of regulative systems and specific protection and use policy designs. Figure 3 shows a graphical presentation of its application to the resources soil, water, forest, air and landscape in Switzerland at the end of the 20th century.

Figure 3: The gradual differentiation of IRs for five resources in Switzerland



We would now like to discuss the existing IR types as well as the development trajectories for the five resources landscape, air, water, soil and forest in Switzerland. For each resource we shall discuss the goods and services provided by the resource, its property regulation, the policy design and regime type.

a) Landscape (between a simple and complex regime)

Goods and services: If natural resources are defined as valuable components of nature to be used to satisfy human needs over time, landscape can also be considered as a natural resource. However, in comparison with other resources, in this instance the resource stock is composed of several other resources, such as soil, forest, water etc. There is no consensus as to how landscape should be defined. Ecologists define landscape as "a complex of geographically, functionally and historically interrelated ecosystems" (e.g. Doing 1997), social scientists stress the function of living space and the necessity of indicators based on personal preferences. Landscape has been defined by the Swiss Environment Agency (SFA/SAEFL 1998: 19) as follows: "*Landschaft umfasst den gesamten Raum, innerhalb und ausserhalb von Siedlungen. Sie ist das Entstandene und Werdende natürlicher Faktoren wie Untergrund, Boden, Wasser, Luft, Licht, Klima, Fauna und Flora im Zusammenspiel mit kulturellen, gesellschaftlichen und wirtschaftlichen Faktoren.*"[5] The harmonisation of the different existing definitions is not only a demanding scientific task, it is also crucial and necessary for the raising of public awareness and development of sustainable regimes.

Whereas in the case of forests the flow - in terms of wood or protection - can easily be recognised, it is difficult to describe and quantify the resource units provided by a landscape. A tangible property is not given. Examples for the services provided by the resource landscape include biodiversity services, water regulation, aesthetic

[5] "Landscape includes all areas within and outside settlements. It includes existing and future natural factors, e.g. subsoil, soil, water, air, light, climate, fauna and flora, in their interaction with cultural, social and economic factors."

values, leisure amenities, cultural heritage etc. In many cases, therefore, it is a question of goods and services which are multiply linked with the perception of consumers - the object is not really tangible.

Property Rights: The historical analysis of landscape regimes shows that, with one exception, direct regulation of landscape only exists at the level of resource policy. Property and use rights have not been formulated through civil law.

Private property rights (independent of the basic ownership situation) appear to be emerging (bought by means of visitors' taxes at health resorts/spas, access fees etc.). There is also a movement in the direction of state or even world property rights (UNESCO) to landscapes composed of plots which are privately owned. New forms or bodies for landscape maintenance are emerging in areas of significant ecological value which lack management. Maintenance could be assured through the self-organisation of non-owners.

Policy Design: The creation of a Swiss national park in the early 20th century can be identified as the precursor of nature conservation policy. The first protective measures were private in nature. The financial involvement of the Swiss Federation was regulated as early as 1914. The land still belonged to the local authorities, however, the national park area was regulated by means of contracts between the owners and the public-law foundation "Schweizerischer Nationalpark" ["Swiss National Park"]. A national park is a nature reserve in which nature is protected against all human intervention.

Landscape protection really came into being in Switzerland with the inclusion of nature and habitat conservation in the federal constitution which was further concretised in the Federal Law on the Conservation of Nature and Habitats of 1967 (NHG). The protection of nature and habitats is, however, the responsibility of the cantons. The state assumed a subsidiary function and was only to be involved when cantonal efforts fail to achieve the desired aims. It also had sole authorisation to enact provisions in the areas of fauna and flora. In this first phase of nature conservation, the main priority was to protect Switzerland's valuable natural and cultural heritage. Implementation of the 1967 act was very gradual, a fact which can probably be explained by the selected mix of instruments. The NHG contains provisions for the recording of objects worthy of conservation in national inventories. However, the concentrated protection of objects contained in the inventory is not absolute. If this is opposed by intervention interests of national importance, it is possible to override this provision, however, the decision-making instance must obtain a report from the relevant and independent commission (Eidgenössische Natur- und Heimatschutzkommission) [Swiss Commission for Nature and Habitat Conservation). (Leimbacher/Perler 2000: 183ff) The state can, moreover, provide support for nature and habitat conservation in the form of financial instruments, guarantee it by means of contracts or acquire them by means of expropriation.

This conservation-based philosophy changed during the 1970s as a result of the influence of ideas from regional development. The Federal Law on Regional Development marked an important departure for the preservation of the landscape in that it introduced the distinction between settlement and non-settlement areas. The "orderly settlement of land" introduced in the regional development legislation defined how land should be used. The planning of protective zone in accordance with this legislation became an important instrument for landscape protection. In the 1970s, urgent state measures forced the cantons to classify as temporary conservation areas, areas in which construction was to be restricted for reasons of landscape protection, to ensure the preservation of sufficient leisure amenities and protection against the elements.

This concept of protection was further expanded in the 1980s. The protection and viability of ecosystems and the natural balance assumed increasing significance. This "paradigm change" can be explained in terms of the environmental protection legislation and the introduction of moor protection as well as ecological compensation payments. Initial approaches for the protection/conservation of living space or habitats can be found in Article 18 Paragraph 1 of the Federal Law on the Conservation of Nature and Habitats, whereby fauna and flora were to be protected from extinction through the preservation of sufficiently large habitats. However, these provisions proved inadequate when it came to the effective protection of species. This is also the reason why with the enactment of the environmental legislation in the early 1980s, protection of biotopes was developed and riparian sites, reeded areas, moors and rare forest societies were viewed as particularly worthy of protection. With the adoption of the indirect counterproposal to the Rothenturm Initiative, biotopes of national significance were integrated into the Federal Law on the Conservation of Nature and Habitats. Article 18a provided the basis on which the upland moor, lowland moor and alluvial sites decree were later enacted. The intention was to ensure the protection and maintenance of biotopes by means of agreements with and compensation of land owners.

The adoption of the Rothenturm Initiative brought about further intensification of measures for the protection of moors. There is now an absolute ban on changes to moor landscapes of national significance and particular beauty.

Moreover, the protection and use policy formulated on the level of landscape components such as water, forests, agriculture etc. is an indirect impact of the legislation. In addition to the introduction of more stringent protection policies, in some cases there has also been a shift in the focus of regulations, in that the owners' use rights are not merely restricted but obligations (remunerated and non-remunerated) have been imposed with respect to renaturing, measures to maintain the landscape and compensatory services established (based on the model of forestry legislation).

IR type: We define the landscape IR as simple to complex as despite the fact that differentiated instruments and objects of protection have emerged over the decades, a certain one-dimensionality exists with respect to the protection/conservation of biotopes and landscape. The regime is determined by landscape policy design and the regulations governing the legal ownership of other resources. It is an indirect regime which due to the lack of a tangible object starts with the authorities responsible for the resource soil as opposed to appropriators and users.

b) Air (complex IR)

Goods and services: The goods and services provided by the resource air include energy (incineration processes and wind energy), raw materials production (for industry), pollutants sink (absorption), support for transport (air traffic, radio waves, telephone), protection and insulation (temperature and radiation insulation layer, means of livelihood for people, animals and plants), leisure (health resorts, spas) and freedom (wind sports, tourism).

Property rights: In terms of private law, air belongs to the res communes omnium and is, hence, withdrawn from ownership. Air is not property (in accordance with the definition in the Swiss Civil Code): it is neither delimited nor tangible. The direct reference to air in the Civil Code concerns the respective interests of neighbours (Article 684 Swiss Civil Code) and stipulates that land owners must refrain from uses which produce environmental impacts or immissions that affect their neighbours (e.g. smoke, bad smells). It should be noted that certain cantonal clean-air regulations have - in part - adopted this right of neighbours to undisturbed co-existence. However, this principle has not yet been significantly expanded (for example in the aftermath of the Chernobyl disaster) and air merely features here as the landowners' medium of action. Moreover, air space merely plays the role of a complement to a landowner's area of dominion in terms of the three-dimensional extension of land ownership (Article 667, Paragraph 1 Swiss Civil Code). Finally, a system of emissions certificates, which was introduced on an experimental basis in the cantons of Basle-Town and Basle-Country, does not create a comprehensive and absolute property right for air but only the right to use the air in a certain way, namely as a pollutant dump.

Policy design: It is possible to identify three different types of air policy in Switzerland (Knoepfel and Varone 2000). In the 1960s, air pollution was perceived as a neighbourhood and later as local problem involving smoke, soot and, at a later stage, sulphur dioxide, which in the event of unfavourable weather conditions (inversion) could cause damage to health and, in extreme cases, increased mortality. The causes included outmoded commercial and industrial plants and coal and oil-fired domestic heating systems whose emissions were ejected into the atmosphere at low levels. The aim of this policy which focused on environmental impacts or immissions was the paradigmatic "Blaue Himmel über der Ruhr"["Blue Sky over the Ruhr"] (Brüggmeier/Rommelspacher 1992). The central intervention hypothesis for these clean-air policies was the necessity to bring about an improvement in the spatio-temporal distribution of pollutants in the air (transmissions hypothesis). Correspondingly, the famous industrial chimneys, regional planning divestment (transfer of industry from urban areas) and smog alarm policies were developed. The aim of these policies was, therefore, to control the sources of emissions in space and time. They implemented agglomeration-specific fuel regulations for the large group of domestic heating emitters and individual orders for increases in chimney heights for the relatively small number of large-scale emitters. The central instrument consisted in police orders and prohibitions.

During the next phase in the air regime trajectory from around the mid-1980s, air policies were extended to include the area of emissions. Science and politics increasingly engaged in ecosystem-based arguments, and the question of material flows through various environmental media moved centre-stage. According to this approach, all emissions of pollutants not only cause dangerous impacts or imisssions in the surrounding airspace but also cause damage at a considerable distance from the source of the emissions through polluted precipitation (acid rain) and can, therefore, result in the pollution of surface waters or ground water carriers and ultimately cause damage to soil ecosystems. The main triggers for this new perception was the acidification of Scandinavian and Canadian surface waters and Waldsterben which was mainly observed in northern Europe (mid-1980s). The aim of these clean-air policies consisted in defining the global volume of pollutants emitted (SO_2, NO_x and organic pollutants) and reduce them by means of suitable control measures. Typical for this policy is, for example, the target formulation by the Swiss Federal Council, whereby SO_2 and NO_x emissions were to be reduced to 1950 or 1960 levels. All emitters of air pollutants were now viewed as air polluters. "... irrespective of the imission

situation all over the country" emissions were to be reduced ("prevention principle" in accordance with Article 11, Paragraph 2 of the Federal Law on the Protection of the Environment of 1983). Emitters from agglomeration areas, however, were also subject to additional obligations to reduce emissions reductions if it proved impossible to observe the relevant imission limit values (Article 9 of the Clean Air Decree of 1985). Initially the transport sector was excluded here. Orders and prohibitions remained the preferred instruments. However, the provision of technological information (persuasive mode of intervention) and direct promotion of new clean-air technologies and their use through financial incentives (incentive modes of intervention) assumed greater importance. Conversely, direct regulative intervention was increasingly abandoned in favour of contract-like agreements between authorities and companies.

In the 1990s, the problem of air pollution was finally perceived as an agglomeration-specific mobility and global climate problem and the emphasis in clean-air policy now shifted to transport and traffic. It was observed that little or no reduction had been achieved in NO_x pollution and the recently discovered health risk of PM_{10} particles and ozone pollution in urban areas, even in countries (including Switzerland) which introduced mandatory catalytic converters for their vehicles in the course of the 1980s, as any reductions achieved by means of technological developments were outweighed by increases in the volumes of vehicular traffic. Control of the emissions structure by means of regional development is increasingly being adapted in efforts to resolve local-supralocal air pollution problems (development of settlement areas on the outskirts of town centres). In addition, a wide variety of direct interventions in private and goods traffic has been implemented ranging from orders and prohibitions (traffic regulation), incentive systems (traffic tax, road pricing etc.) to direct infrastructure services (development of public transport with a view to changing the modal split). The heterogeneous group of motor vehicle users, which can no longer be controlled using individual measures, is becoming the object of efforts to establish collective regulation (vehicle fittings, fuel composition) as well as incentive systems and campaigns.

IR type: we define the IR for the resource air as complex because the policy design has become highly differentiated over time - new target groups and additional instruments were added - and because initial attempts were made to define and distribute use rights (see example of environmental certificates in the two Basle cantons or the proposed CO_2 and non-renewable energy taxes). Property and use rights are still not properly defined.

c) Water (complex IR)

Goods and services: The goods and services provided by the resource water include a living environment for plants and animals (food and reproduction), drinking water, water used directly or indirectly for the production of economic goods (e.g. irrigation, water-cooling for nuclear plants, drainage, mineral water), hydro-electric power (particular form of water use for the economic production), water purification, support for economic production and recreation (e.g. navigation, gravel extraction, fishing), recreation (leisure and tourism), medical uses (e.g. water cures) and geomorphologic changes and protection (natural hazards). All these goods and services could be theoretically regulated by public policy and/or property and use rights. Water management in Switzerland currently faces five main challenges: (1) the problem of increasing competition or rival uses of water (in most regions, the spectrum of water uses has become more heterogeneous over the past last decades); (2) the problem of phreatic and lacustrine water quality (related to diffuse pollution); (3) the question of minimal residual flows; (4) the problem of increasingly impervious soils (waterproofing) in settlements (general water planning at a local-authority scale); (5) the question of natural hazards related to water (floods, permafrost and glacier degradation, debris flows). These five types of problem do not affect the entire country with the same intensity (e.g. water quality problems in lakes are typical of the rural areas of the Central Plateau; the question of minimal flows or some climatic hazards are more common in the Alpine belt; increasing competition between uses is typical of urbanised and tourist areas, etc.).

Property Rights: Around 1850, regulations concerning water rights were the almost exclusive preserve of cantonal civil law. The Swiss Confederation did not have exclusive competence to pass civil laws for all of Switzerland until 1898. Prior to that, the individual cantons were responsible for their own civil law. After the introduction of the Swiss Civil Code in 1912, the cantons could only pass civil law regulations concerning property in exceptional cases. In general, however, the legal distribution of property and use rights to waters was not completely uniform. Springs, small sources of ground water and artificially created water bodies constitute part of basic property in accordance with the principle of accession (Article 667 Swiss Civil Code). Large lakes, streams or rivers do not, however, observe site boundaries. Thus, in the case of other water bodies, the basic assumption is that jurisdiction lies with the cantons (Article 76 Paragraph 4 Swiss Federal Constitution). This is not based on a private legal concept of property but on the constitutional allocation and definition in accordance with Article 664 of the Swiss Civil Code, whereby there is no private ownership of public water bodies. In cases where the jurisdiction for water bodies of the common good is applied, private individuals are excluded from use

of the waters. In this instance it the obligation of the cantons to authorise private legal positions and water uses, where applicable (Article 664, Paragraph. 3 Swiss Civil Code), and this has occurred in some cases. Otherwise, rights to the public water bodies arise through concessions which allow acquired rights to water use to emerge which can only be rescinded through expropriation.

Policy design: Initial investigations (Leimbacher/Perler 2000) show that there were no significant changes to property rights to water during the 20th century. In contrast, significant developments were observed with respect to public policies and these took place in three main phases.

Policies regulating *protection against water* (river corrections, alluvial valleys drainage, mountain torrent corrections) were created at the turn of the century. The major river correction projects of the 19th and 20th centuries were mainly concerned with the protection of people, the land and other goods. Hydraulic engineering structures were mainly intend to provide protection against mountain torrents, erosion and landslides and this was the motivation behind the combination of hydraulic engineering and forest police concerns in the mountain regions (Federal Law on the Hydraulic Engineering Police of 1877; *WBPG* based on Article 24 Swiss Federal Constitution of 1874).

Water use policies (particularly concerning energy production) increased during the first part of the century. The use of water heat from surface and underground lakes and rivers by means of heat pumping systems and the use of water for the production of hydro-electric power resulted in the awarding of concessions (Federal Law on the Use of Water Power of 1916; *WRG* based on Article 24 bis of the Federal Swiss Constitution of 1908).

Finally, the period from the 1950s saw the development of *water protection* policies (both qualitative and quantitative) (Article 24^{quater} on protection of waters of 1953). Increasing population density, industrialisation and economic expansion meant that water suddenly needed protection. The aim of the redefinition of Article 24 bis of the Federal Swiss Constitution of 1975 - as the last step at constitutional level - was the co-ordination of all efforts and the recording of the entire water cycle: household use, protection of water sources and prevention of damaging effects to water. Various federal acts and the practice of the federal courts also made provision for the co-ordination of the different aims: for example, an environmental impact study for larger hydro-electric power systems or hydraulic structures, for cases involving concrete intervention in the ecological system or for the awarding of concessions for use of water with a number of exceptional and additional authorisations. The qualitative and quantitative water protection acts were included in the revision in 1991 of the older water protection acts (*GSchG*) of 1955 and 1971 (introduction of regulations on residual water volumes in addition to the existing care and redevelopment obligations, sewage treatment plants, limit values for toxic substances etc.). In 1996, a “Landscape Centime/Franc” was also introduced as a new instrument of water use legislation for the direct financing of landscape protection (Revision of the Water Power Act of 1916: new Article 49). Finally, the Protection of Waters Decree of 1998 formulates ecological aims for water bodies and makes provision for the implementation of planning instruments (water protection areas, water protection measures, ground water protection areas for drinking and service water) as well as specific measures (e.g. fertiliser use that is compatible with protection of waters).

The main impact of this evolution has been a redistribution of the relationships between the various goods and services produced by the resource water (e.g. water policy at the beginning of the century did not recognise the service of water as a living environment for plants and animals; the preservation of this service is one of the main objectives of the current Federal Law for Water Protection adopted in 1991). Given the knowledge currently available, the problem of the impact of such regime changes on sustainability is an open question. There is no integrated water policy (i.e. one that integrates all the goods and services produced by water) in Switzerland.

IR type: We define the IR for the resource water as complex because not all aspects of the property and use rights and the policy design are co-ordinated. Although Switzerland is often called the "water castle" of Europe, in the area of water management, clear shortages still result from the competing demands of different user groups. The overuse of flowing water for the production of electricity and agricultural irrigation have led to damage to biotopes at local and regional level and a reduction in fish stocks. To counteract this, a special water use policy was introduced in 1991 (residual quantities imposed on hydroelectric power plants). The opposition to this measure that was expressed in the mountain cantons (particularly Grisons) shows that this system involved the introduction of significant changes to the basic regulations in the area of water use. In the case of rural protection of waters, the relevant policy design remains incomplete (due to lack of co-ordination with agricultural policy) and lacking in coherence (weak design). In the case of the use of water for energy purposes (residual water regulations), policy designs should show greater internal coherence (strong or at least partial design). Finally, it should also be mentioned that the polluter-pays-principle was not introduced at decree level until 1999.

d) Soil (complex IR)

Goods and services: As a preliminary comment, it is important to reiterate that all natural resources are (in)directly associated with soil (soil as a filter in the water cycle, as site for forests, as a "carrier" of landscape components, as absorption sink for air pollutants etc.). The goods and services provided by the resource soil include construction land (for industry, commerce, settlement and public infrastructure), natural habitats for biodiverse plants and animals (moors, national park, hunting etc.), sites for waste deposits (all kinds of waste, including nuclear), production of raw material (gravel, minerals etc.) production of biomass (agricultural area, forest, meadows etc.) and filter (for substances in air and water).

Property rights: Soil is the central resource for Swiss property law (right of disposal and use in accordance with Article 641 Paragraph 1 and object of property in accordance with Article 655 of the Swiss Civil Code). The "principle of accession" (Article 667 Swiss Civil Code) states that all objects which are connected to the soil in such a way that their spatial situation cannot be changed without substance, shall share the legal fate of the site in question. Ownership of the soil was also formally secured in constitutional terms in 1969 (Article 22ter aBV, Art. 26 nBV. Hence in Switzerland, there is de facto not a single square inch of land that is not governed property and use rights which have not been defined (in terms of content) by different public law regulations (particularly regional development). Nowadays, however, there are no official statistics on the division of the soil in terms of state and private property and in terms of construction, agricultural and protected zones. Partial data is, however, available with respect to the effective use of soil in 1995: approximately 38% of Swiss soil is used for agricultural purposes, 30% is used by forests, 25% is unproductive and 6% is accounted for by settlement and infrastructure (Duvanel/Goujon 1995). It should also be emphasised that the construction areas and their prices doubled between 1950 and 1995. Property title is distributed as follows: 61% of agricultural zones are the property of private owners with professional or family ties in agriculture, while in 1995, state ownership was at around 7.5% (the figures for 1955 were 79% and 9% respectively). Approximately 74% of forests are state-owned. In towns, cities and settlement areas, the local authorities are the main owners (e.g. 59% in Basle Town, 51% in St Gall and 60% in Zurich) (Rohr 1988). In general, it emerges that state ownership is concentrated in urban areas, forests and unproductive areas, while private ownership dominates in agricultural and peri-urban settlement zones. Most of the conflicts and rivalry between private owners can also be found in these areas.

Policy design: It is possible to identify three successive soil policies (Knoepfel and Varone, 2000). As a result of the expansion in settlement and infrastructure and the unrestricted freedom of land owners to build on their property, the problem of land availability and use was first recognised in the 1940s. The battle surrounding soil/land (as a mobilisable and available value) mainly took place in central Switzerland. Soil-consuming uses (buildings and plants) had reigned unrestricted there for decades and as a result, most of the most suitable agricultural soil was destroyed. Only forest land was able to withstand the pressure as the basic regulation for the "preservation of the forest" had been legally established since the beginning of the century. The fundamental land reform of 1969 (simultaneous passing of Article 22ter aBV guarantee of ownership and Article 22quater aBV national, regional and local planning) and initial regional development efforts implemented by the state can be interpreted as a response to this relative scarcity. The constitutional objectives of this land policy were formulated as "expedient use" and "ordered settlement of the land". This necessitated a clear delineation between agricultural and construction zones. Police-law instruments (zone planning and definition) were the main instruments used to prevent cheap agricultural land from being transformed into lucrative construction land. As the first regional development law, which contained provisions for such regulative modes of control, was rejected by the public (1974), the desired "out-zoning" was carried out under the auspices of the revised Federal Law on the Protection of Waters (1972). After this, a distinction was made between construction land and other land. The first soil/land policy tried to prevent "construction activity" or restrict it to certain areas and hence control it using authorisation criteria.

From the mid-1970s, the focus in the soil/land debate shifted from pure availability and use of space to a more comprehensive development planning. As in other areas, initial ideas about environmental protection were being taken into account in soil/land policy. This gave rise to a soil/land policy for quantitative protection (e.g. soil sealing) and against soil pollution (e.g. fertilisers). The objectives were, therefore, the more economical use of soil/land, the co-ordination of activities involving space and the orientation of these activities around individual spatial development objectives (Federal Law on Regional Development of 1979). This policy is based on the "principle of concentration", i.e. on planned use allocation. The regional planning regulative instruments (plans, cadasters and police-law permits) enabled the clear delineation of construction, agricultural and protected zones. Regional development is primarily the responsibility of the cantons (cantonal development plan) and the local authorities (local-authority use plan), direct state intervention is restricted to the compilation of inventories of protected objects of national importance.

The first two policy generations can be defined as "land use at the ecological zero rate" (Knoepfel et al. 1996:305-309). In contrast, the next generation of soil policy promoted qualitative protection (e.g. moor landscapes) and fought against physical pollution (e.g. traffic infrastructure). Substances which are dangerous to the environment, waste and landfills, erosion, compaction and the increasing sealing of the soil (particularly due to state transport infrastructure) were now perceived as urgent environmental problems. The triggers for this extended political problem definition included the adoption of the "Rothenthurm Initiative" on the protection of moor landscape (1987), initial reports about contaminated abandoned waste sites and the international biodiversity debate in the context of the concept of "sustainable development" (Brundtland Report). Soil policy now aimed to fight the destruction of living space and loss of biodiversity which were the results of all kinds of land conversions. The aim of the protection of soil in general is, therefore, the long-term preservation of soil fertility and hence also the preventive limitation of emissions at source (in line with the Federal Law on the Protection of the Environment of 1983). This soil protection policy is based on the intensification of previous regional development, environment and nature conservation policies (uses within and outside construction zones that promote the protection of soil) as well as the introduction of ecological equalising mechanisms ("compensation principle"), an instrument that had been familiar for some time in forest policy. The modes of control combine traditional regulative instruments (limit values, inventories and zoning) with additional incentive-based modes of control. The general services provided by agriculture in the fulfilment of ecological functions in rural areas are rewarded by direct payments. The state and the cantons pay make ecological compensation payment for the implementation of special methods of production and farming (fertiliser balancing, ecological compensation areas, valuable arable and recreation landscapes), which are implemented on a voluntary basis (in accordance with Article 18b Paragraph 2 of the Federal Law on the Conservation of Nature and Habitats of 1987 and Article 31b Paragraph 2 of the Federal Law on Agriculture of 1992).

IR type: We define the soil IR as complex because the aim is to guarantee a sustainable policy which will regulate and halt the disappearance of ecologically valuable natural soil ecosystems as a result of their ongoing transformation into transport, settlement, industrial and commercial areas, which are of low value in ecological terms. The aim is to eliminate emissions that are harmful to soil in these areas using environmental planning measures. The desired interpolicy co-ordination requires the return of ecologisation in the areas and the systematic integration of soil protection policy into regional development. Hence, what is needed is better co-ordination of property and use rights (which are associated with land ownership) and policy designs (which are not necessarily associated with specific land owners).

e) Forest (integrated IR)

Goods and services: The goods and services provided by the resource are manifold and include wood, protection against avalanches, leisure and recreation activities, ecological amenities etc. Most forest products are not provided by markets and in comparison with other countries, in Switzerland a large amount of public money has been invested in the production and maintenance of non-market benefits. In mountain areas for example, forests are critical for the protection of human settlements and infrastructure against avalanches, landslides and rock falls. Furthermore, forests are home to 35% of all flora and fauna species. Leisure activities are also of great importance. A previously significant private commodity, wood has partially relinquished its importance over the past two decades. Since 1987, public forest enterprises in Switzerland can no longer cover their expenditure with subsidies and income from timber sales. One strategy that has been promoted by state actors and the Swiss forest association is the marketing of external effects and design of new forest products. (Limacher et al. 1999: 13)

Property Rights: The ownership structure of Swiss forest was quite stable during the last century. About three quarters of the forests belong to the public sector and one quarter is privately owned. 90% of the publicly owned forest belongs to local authorities, municipalities and local public corporations. The average size of private plots is quite small (1 hectare on average), publicly-owned land amounts to 237 hectares.

The regulative system for forests has its legal basis in the Federal Swiss Constitution and in the Swiss Civil Code, and mainly in forest law. The constitutional article of 1874 on the forest police in high altitude areas authorised the Federal State to preserve the country's forests. The Swiss Civil Code of 1907 states that the public has free access to all forests, whether privately or publicly owned (all irrespective of the ownership of the forests, Swiss Civil Code Article 699). The public has also free access to mushrooms - up to a certain quantity - and free access to berries, whereas game is state property. In case of unsustainable use, cantons can restrict the gathering of berries or mushrooms.

Thus, propriety and use rights are strongly restricted by law. With respect to the right of alienation, the old law on forest police stipulates (Article 33) that partitioning of forests is subject to authorisation by cantons. These

regulations were intensified in 1945 (Leimbacher/Perler 2000: 235). The new Law on Forests (Article 25 *WaG*) states that the sale of forests belonging to local authorities and corporations as well as partitioning of forest are still subject to cantonal authorisation and can only be granted when forest functions are not endangered. Deforestation is prohibited (Article 5 *WaG*) and forests must be managed so as to ensure that they function in a sustainable manner (Article 20 *WaG*). Even harvesting of trees is subject to authorisation by forestry services (Article 20 al. 1 *WaG*).

Policy Design: The policy design defines use aims and policy instruments (e.g. afforestation plans), describes administrative structures and, thus, modifies the basic regulations. The resource forest is interesting in that, as in many other European countries, it is a very old policy field with a corresponding abundance of regulations and changing levels of scarcity with regard to the goods and services based on it. Major catastrophes, such as landslides and large-scale flooding, as well as the pressure of population growth and newly established industries led to the decimation of Swiss forests during the 19th century and to the adoption of a new article in the Federal Constitution in 1874. Whereas the forest police law of 1876 protected forests in high-altitude areas, the law of 1902 affected all forests in the country and remained in force until the late 1980s.

Preservation of the forest cover was and is an official policy goal, and as a quantitative objective, forest area may not be reduced. The above-mentioned policy goal is enforced by a strong legal definition of forests, prohibition of deforestation, a ban on clear-cutting and an obligation to provide compensation in kind for deforested areas. The purpose of the new Federal Law on Forests is broader and aims to ensure conservation of forests in their present volume, protect them as natural environment, ensure their capability to fulfil several functions and develop forestry and protect the population from natural catastrophes (Article 1 *WaG*). Thus, the objectives take the interests of environmental organisations and forest economy into account.

From the outset, forest policy used a mix of instruments. Whereas at the beginning, regulative and organisational instruments were dominant for the preservation of forest cover, greater emphasis was later placed on financial incentives. Since the mid-1980s, subsidies have become the most important steering instrument for the maintenance of forests. (Kissling/Zimmermann 1996: 60ff.) With regard to the form taken by the latter, financial aid and indemnities have been allocated for preservation of forest lands and infrastructure. In the early 1980s, due to the consequences of *Waldsterben* (i.e. “forest death”), financial support was also provided for the maintenance and tending of Swiss forests. This is the motivation behind the multiplication of federal subsidies over the past fifteen years (from SFr. 60 million in 1984 to SFr. 270 million in 1990) (Kissling et al. 1996: 64).

IR type: The forest regime is characterised by the integration of heterogeneous resource uses in such a way that it should be possible to maintain the capacity of the whole resource. Harvesting does not exceed the sustained yield (Article 20 *WaG*). Regulations with regard to different user groups and products are co-ordinated by the forest law. There is no discrepancy between protection and use policy, between the regulations for different goods and services of forests or between the prescriptions for different target groups. The new Federal Law on Forests stresses the protective, social and economic functions of forests and the necessity for their co-ordination. Thus, the forest regime can be considered as an integrated IR.

5.2 IR changes and Development Trajectories in Switzerland

It is possible to observe regime changes on the level of the regulative system and policy design. The development trajectories for the five resources differ significantly.

a) Landscape and Air (Policy-driven Trajectories)

The historical development of the IRs for the resources landscape and air can only be identified along the policy design dimension. In reality, there has not been any formal or substantial definition of property or use rights for goods and services of both resources. However, the aims for landscape protection can only be attained if existing and rival use rights are restricted. Thus, in both cases, the development trajectories are clearly policy-driven.

b) Water (Parallel Trajectory)

The historical development of the IR for the resource water can best be identified along the policy design dimension. In reality, there has been little formal change to property and use rights (after the introduction of the Swiss Civil Code in 1912) but the substantial content of ownership title was strongly concretised and restricted through use and protection policies.

The first and most important IR change was most certainly the reorientation of the IR from its focus on water use (from 1916) in favour of water protection (from 1955). Thus the use of water to generate power was based on the awarding of water rights, a water rights concession (in accordance with Article 43 *WRG*), to which, however, there is no automatic right. In this case, the state awards the concessionary a position which is similar to that of the private owner. This clearly excludes third parties and even replaces the regulative system. In return, the concessionary must pay a so-called water levy. The opposite situation emerges for water protection (action logic): the property and use rights (which shall be understood as well-earned rights) were once again restricted. Accordingly, unpolluted water should seep to preserve ground water sources, while polluted water must be treated.

The second and incremental IR change involved the addition of quantitative aspects (from 1991: residual water volumes, volume-based preservation) to the qualitative water protection (from 1955). This last measure to be adopted as part of water policy also promotes the aims of nature conservation.

As early as the coming into force of the Swiss Civil Code, restrictions were applied to the private ownership of water and these were intensified in the course of time due to the urgency of public interests in terms of water sources for use and water protection. This can be seen in almost all of the above-described changes to the constitution and legislation. The successive changes of the public policies - and hence the content of the ownership of water – can be interpreted as reactions to the scarcity of "clean" (drinking) water and later of water bodies as landscape elements and *Lebensraum* for animals and plants.

c) Soil (Property Rights-driven Trajectory)

The debate during the first half of the last century centred on the basic principles of ownership of soil and its sale: the key issues here were ownership, transmission, expropriation, purchase, sale, mortgages, leasing, usufruct. The political struggle surrounding the resource of soil was clearly a symbolical and economic one (private versus state ownership). Moreover, the regulation of the disposition and ownership of soil/land embodied a perennial theme throughout the last century. Hence, clear - formally absolute - property and use rights were defined as part of land reform (Land Reform of 1969).

Restrictions in disposal and use rights were not imposed until a later stage by means of public policies: worthy of mention here are the Law on the Protection of Waters and regional development policy which was extremely influential as a result of its introduction of construction and non-construction zones (Land Law Article 1969; *AFU* 1972, *LAT* 1979). Further interventions in the ownership and disposal of land were imposed through the Federal Law on Environmental Protection, the Rothenturm Initiative and the Federal Law on Agriculture. While initially the emphasis was on the quantitative protection of soil, subsequent public policies were mainly concerned with qualitative protection (Forest Law 1992: Biodiversity, Federal Law on the Reform of Agricultural Land 1994, Revised Law on Environmental Protection Act 1997, Direct Payments Decree 1998, Revised Law on Regional Development1999). The development trajectory can be described as property rights, whereby, from the 1970s on, the use and property rights were increasingly concretised through sectoral policies.

d) Forest (Parallel Trajectory)

With a few exceptions, the changes to the forest regime rights have been minor. Ownership structure has remained quite stable. The introduction of the Swiss Civil Code in 1907 with the general definition of property and the public access right can be considered a major change. With the new Federal Law on Forests, the duty to manage forests has been slightly extended and now also applies to private forests (Leimbacher/Perler 2000: 228). Partitioning is still subject to authorisation but it is no longer an explicit objective of forest policy to reduce plotting and change the ownership structure.

At the end of 20th century, protection was no longer exclusively quantitative in nature but also included qualitative aspects. The new Federal Law on Forests stresses the qualitative protection of forests: the purpose of this legislation is "to protect the forest as natural environment" (Article 1 al. b *WaG*). Up to 50% financial support is provided for protective measures for the upkeep of forest reserves by the federal authorities (Article 38 al. 3 *WaG*). In Article 38 al. 2b *WaG*, financial support is also allocated for "measures within a set term such as the tending of forests, harvesting and hauling, when the total costs incurred are not covered or are exceptionally high for reasons to do with the protection of nature".

Particular attention should be drawn in this context to biodiversity which was supposed to have been promoted by means of subsidies since the mid-1990s. Forest protection and use policy is intervening in the use rights of

private and public owners by compensating owners for not using forests commercially and subsidising maintenance measures. On the one hand the financial support can be understood as compensation for the loss of commercial revenue while on the other, compensation payments could also be understood as the purchase of certain elements of the environment on behalf of the Swiss people. Bromley would speak of an institutional change "in response to new collective perceptions of what (he) call(s) the full consumption set – for instance, institutional change, that focuses on the environmental aspects of certain commodities purchased in the market" (Bromley 1997: 53).

The goals of Swiss forest policy have been extended over time and multifunctionality has been stressed. Thus, the instruments for the implementation and fulfilment of the different tasks have also been adapted. Differentiation and development of the legal framework have followed the logic of the first forest law and can be described as an incremental process. A more or less parallel development of the policy design and the regulative system can be recognised.

5.3 First Comparison

A comparison of the different resource regimes and their development leads to the following conclusions:

- Both the development and status of the resource regimes differ considerably for the five resources studied. While there was no regulation requirement for air and landscape in the last century, regimes and incentive structures were created at a very early stage for the resources water, forest and soil.
- The regulative system in Switzerland was mainly established in the 19th century. This processes was completed with the standardisation of civil legislation at national level. The differentiation of the institutional framework took place in the 20th century, for the most part through public policies, with little formal change to existing property titles. The restriction and concretisation of use rights, in contrast, were implemented subsequently, mainly through the sectoral policies.
- The trajectories are either more strongly influenced by order policy or sectoral policy provisions, depending on the beginning of legislation process . It must be assumed in this context that the order policy regulation was completely acceptable up to the mid-20th century, after which state objectives were increasingly achieved via sectoral policy interventions. Hence, it is possible to identify different development trajectories which were more strongly oriented towards property rights or policy design.
- Sectoral policy regulations for resources differ with respect to the extent to which the instruments concerning use rights were used. The regimes in turn differ in terms of the way in which the regulative system and sectoral policy are co-ordinated and the sectoral policies, and hence the claims of different user groups, were co-ordinated. Whereas for forest, there was co-ordination between ownership rights and sectoral policy, there is no corresponding co-ordination in this form for soil.
- The trend towards the increasing restriction of property rights was halted at least tentatively in the 1980s. Thus, for example, as the compensation payments for nature conservation values show, disposal of the latter is added to the owner's property. The only way its use can be influenced is through compensation payments.
- The path dependence of IRs should be extremely important for the current form of the IR "In a world of purposive actors, it may indeed be the case that the effects of an institution have something to do with an explanation for its emergence and persistence. Arguments about path dependence, however, suggest the large dangers in any assumption that an existing institution arose or continued to exist because it serves some particularly useful purpose." (Pierson 1997: 39) The concept of path dependency places the historical explanation centre-stage. In this context, path dependency means that events or shocks can have completely different effects, depending on the sequence of events. For example, all natural resources were affected by the economic boom of the post-war period. The effects with respect to regime control were, however, very different, depending on the existing regulations.
- Both property rights and policy instruments have a significant influence on actors' behaviour. Therefore, the synopsis of an institutional economic and policy analysis perspective is very useful and does increase the steering capacity of resource management by revealing discrepancies (between user groups, uses and rules) and by inducing harmonisation of needs and rules.
- This initial empirical comparison of the IRs for the five selected resources in Switzerland shows that a an empirical variance exists which is extensive in some cases. Hence, it would appear essential that this variance be explained in theoretical terms. For future research, therefore, hypotheses shall be formulated and

concretely tested to make it possible to explain the emergence, development and effects (on the resources) of different IRs (the initial approximate indications for possible hypotheses are formulated under 4.3).

Moreover, we have demonstrated that the proposed IR concept can be applied empirically (for very different resources), reveals new research questions and could lead to a critical examination of previous hypotheses. Before such a research programme is developed, as a preliminary conclusion, we will now briefly summarise the added value of the IR approach.

6 Conclusion: The Usefulness of the IR Approach

The advantages and added value of the IR approach can be summarised as follows:

- Study of heterogeneous uses instead of (single) homogeneous use: one limitation of the CPR theory is that it focuses on a single use (cf., for example, the criticism of Steins/Edwards 1999). An approach based on the multiple-use IR is much more realistic in industrialised countries. It also stresses the redistributive effects of IR change between different user groups (social dimension of sustainability).
- Resource perspective (stock and flows) allows consideration of all the goods and services provided by a resource, including those goods and services that have yet to be discovered. This facilitates a parallel consideration of protection and exploitation/use policy.
- The integration of resource policies and order-policy intervention (cf. comments on Figure 2) makes it possible to draw a distinction between formal/legal property rights (private law) and informal but real use rights (public law, self-regulation).
- The gain in insight associated with this combined concept can be demonstrated as follows: for example, if one examines the property and use rights alone, the regulative system for the resource soil emerges as being "better" (related to the horizontal axis) than that for the resource water. If the policy design is examined in isolation, the policy design for the resource water emerges as being "better" (related to the vertical axis) than the soil policy design. These contradictory conclusions are merely partial and can be overcome if the two dimensions of each IR are considered in conjunction.
- With respect to practical utility, the combining of public policies and property rights gives rise to an enlargement or broadening of the steering potential of natural resources. As a result, it helps us to conceive new directions for the sustainable steering of natural resources (comprehensive and integrated management for resources). The comparison of the regimes reveals possibilities as to how control, and hence the institutional framework of the resource management, can be improved. Whereas, for example in the case of soil, co-ordination between the different policy areas would represent an urgent priority, in the case of air and landscape, the creation of property rights would be an option. The proposals must be conceived in such a way as to allow new possibilities for sustainable use in the form of incremental development. Property rights changes can only be provided if windows of opportunity are available.
- Insights into the status and the conditions of the formation of IRs also allow the consideration of the external factors of the Common Pool Resources (CPR). Whereas many studies on CPRs describe the design principles of the management system itself, the external ecological, socio-economic and - in particular - the political-institutional context are neglected. Futhermore, the IR concept considers the frame set by sectoral policies as important for the use of resources.
- The identification of triggers will facilitate improved treatment of rival uses of public and mixed goods. This should provide further insights into where, when and on the basis of which political conditions the resource regimes change under the influence of politically perceived scarcity.
- The examples from Switzerland show that in addition to their historical evolution, the IR features for the chosen resources differ (e.g. quantitative protection and the qualitative protection for the resource forest; qualitative protection and then quantitative protection for the resource water). The short discussion above also suggests that the more differentiated the IR, the better the protection provided for the natural resource. As already stated, taking into account only one dimension of the IR concept (design or property rights) will not give the same results.

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