ECOLOGICAL ECONOMICS 68 (2009) 798–809

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ANALYSIS

Institutional Resource Regimes: Towards sustainability through the combination of property-rights theory and policy analysis

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ARTICLE INFO

Article history:
Received 6 March 2007
Received in revised form 20 June 2008
Accepted 25 June 2008
Available online 30 July 2008

Keywords:
Institutional Resource Regime
Policy analysis
Institutional economics
Property rights
Resource use
Sustainable resource management

ABSTRACT

Although the concept of sustainable development is gaining increasing political acknowledgement, despite the implementation of environmental policies specifically intended to solve problems in this area, environmental degradation resulting from the recurrent problems associated with the over-exploitation of natural resources remains an important concern for most countries. How can this situation be explained? This article postulates that a combination of approaches from the political sciences (in particular policy analysis) and institutional economics would enable the identification of the most relevant regulatory dimensions which can explain the (un)sustainable uses of resources. Based on this starting point, it develops an innovative theoretical framework, i.e. that of the Institutional Resource Regime (IRR).

The adopted approach facilitates the analysis of the regulatory measures and resource management practices associated with complex and competitive heterogeneous use situations from a perspective of sustainability. Indeed, the two dimensions of "extent" and "coherence" enable the definition and categorization of the IRR of a given resource. The extent of an IRR refers to the total number of goods and services in use that are actually regulated by the regime at a given time, while the coherence measures the degree of coordination of the various user-actors within the regime. One of the major contributions of the IRR framework is its ability to describe the different configurations of regimes, both theoretically and empirically, and to predict their effect on the sustainability of a resource based on the hypothesis that high levels of regime extent and coherence are necessary preconditions for sustainability.

By doing this, the IRR framework also enables the analysis of the actual use rights to the goods and services provided by resources as the result of the political strategies of actors who mobilize different legal provisions, which stem either from formal property rights to resources or from policies that regulate the use and protection of these resources.

Having developed the central research hypotheses and the empirical research procedure, we present the lessons drawn from the first campaign of field research which was mainly

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doi:10.1016/j.ecolecon.2008.06.013

conducted in Switzerland from 1999. Based on the evidence from these initial findings, it is suggested that the scope of the IRR framework could be far broader than evidenced by its application in the case of Switzerland where it was initially developed.

1. Introduction

The concept of sustainable development has been gaining political recognition for over 15 years now (WCED, 1987). However, environmental degradation resulting from recurrent problems surrounding the over-exploitation of resources such as soil, water, landscape, air etc. remains an important matter of concern for most countries (McNeill, 2001). Given the implementation of environmental policies specifically intended to solve these problems, the question arises as to how this situation can be explained.

This article addresses this question by adopting three objectives. First, it proposes an analytical description of the basic constitutive elements (actors, institutions and resources) of the process involved in the management of natural resources. Second, it develops an innovative theoretical framework – the Institutional Resource Regime (IRR) framework – that enables the analysis of the regulation of the complex and competitive heterogeneous (joint) use of natural resources from a perspective of sustainability. Third, it presents the central research hypotheses and the empirical research procedure associated with the IRR framework. It also discusses the lessons drawn from the first campaign of field research mainly conducted in Switzerland since 1999.

The IRR framework builds on the postulate that a combination of approaches from the political sciences (in particular policy analysis) and institutional economics (of property rights) enables the identification of the most relevant institutional dimensions which explain the (un)sustainable use of resources. It insists particularly on the need to analyse the formal elements of these institutional dimensions (e.g. policies and civil codes) because, in political regimes based on the rule of law, codified or commonly accepted practices are one of the crucial characteristics of environmental management. While focusing on formal institutions, the IRR framework also enables the indirect highlighting of informal ones as the existence of powerful informal arrangements is often the result of weak or incoherent formal regulations. Moreover, discrepancies between actual use rights and formal property rights or policy norms often constitute a clear sign that the definition of use rights is influenced by other informal factors (such as social norms).

The IRR framework aims to take into consideration significant issues which often remain overlooked, such as the extreme entanglement of resource uses in real life, the problematic reduction of multidimensional goods or services provided by the environment to commodities (monetarization issues) and the unsustainable uses made of resources which are mainly due to the uncoordinated distribution of use rights to resources. A resource-wide approach to sustainability needs to consider the resource uses in a broader social, economic and political context.

2. Basic elements: resources, actors and institutions

The analysis of the interface between human societies and their environment has been formalized in numerous ways by different social science disciplines (see, for example, the abundant literature on common-pool resources: e.g. Ostrom, 1990). In order to identify the dimensions necessary for the analysis of the regulation of environmental resource uses, our conceptualization includes the characteristics of the resource system, the distinctions between the different users of the resource in question and the institutions which guide their actions.

2.1. *Resource unit and perimeter*

Every natural resource gives rise to different goods and services that change in terms of time and space based on the requirements and desires of the resource users. Schematically, the quantities of resource units available (to satisfy the needs of the users) depend on the size of the stock and the (variable) reproductive capacity of the (regional) resource systems (yield). The stock and its reproductive capacity are capable of being influenced by technology and institutions.

The withdrawal or extraction of these goods and services may lead to situations of exclusion and rivalry or, conversely, to simultaneous, complementary and non-rival uses. The goods and services extracted or produced can be listed for every natural resource (see Knoepfel et al., 2001 for soil, water and forests; Rodewald and Knoepfel, 2005 for landscape). Based on these lists, researchers can then identify precisely the uses made, the users and the rules that regulate these uses. The overall regulation of a resource leads to sustainability if the uses of individual goods or services are not carried out at the expense of other uses and if all uses considered in total do not deplete the stock of the resource (global quota).

The sustainability policies that emerged over the past decade undoubtedly constitute an important initial step in the direction of sustainability. However, in the majority of cases, they are not in a position to truly promote the sustainable management of natural resources. There is a significant risk that the pursuit of social, economic and even ecological sustainability at the level of selected goods and services will ultimately lead to the unsustainable management of the resource as a system (Knoepfel et al., 2007a). This is the case when the extraction and distribution of the goods and services produced by a given resource are carried out on the basis of the simple logic of the limitation of pollution or internalization of negative externalities (such as the “polluter pays” principle), i.e. independently of the estimated reproduction capacities of the different resource systems.

2.1.1. *Implications for the IRR framework*

The sustainability postulate necessitates a clear distinction between the sustainability of a resource (system) and the ecological, economic and social sustainability of the uses of the different goods and services it provides. It is only possible to exploit the goods and services provided by a resource sustainably if its reproduction capacity is not put at risk. Such an objective can only be attained if policies undergo a fundamental conversion from a logic based on the control and restriction of pollutant emissions (management and internalization of negative externalities) to a logic based on the balanced management of the stocks and reproductive capacities of resource systems. And this objective can only be attained, in turn, if all of the users jointly ensure that the quantities they extract or withdraw from a resource do not reach the limit of the reproductive capacity of the resource system. This objective is often only attainable if clear limits are set for all appropriators and users in relation to the quantities of goods and services that they extract from the resource, or if new incentives are created to encourage them to contribute actively to its conservation through investments based on human, manufactured or cultural capital (World Bank, 1995).

2.2. *Resource users*

The consumption of goods and services provided by a resource relates back to different use configurations which differ from each other in terms of the number of actors involved and the homogeneous or heterogeneous nature of the uses they make of the resource in question (Table 1). The transition from a situation of "single use" to that of "joint use" implies an increase in regulatory complexity. The analysis of *joint use situations* requires the consideration of more than the basic property-rights order, because, in the European context at least, such uses are also regulated by an increasing number of policies. A compelling example of such a joint use situation is provided by Knoepfel and Wey (2006) who compile an inventory of policies with a potential spatial effect and show that, in Switzerland, more than 70 federal policies produce specific implementation acts (i.e. policy outputs such as planning permission, the banning of chemical substances, subsidies for agriculture etc.) with a direct impact on the resource soil. Each of these implementation acts is dedicated to the regulation of specific goods and services used by quite heterogeneous communities of actors. Such policies are implemented by state agencies on various levels, thus reflecting the varying geographical spread of such communities of users (local, regional, national and even international).

The different actors involved in the joint uses may act in the pursuit of private interests (e.g. commercial use, the strategic stance of a local authority in support of its financial holdings) or the general public interest (e.g. non-profit NGO, patron of the arts, traditional state actions). Furthermore, actors can pursue local (within the perimeter of the resource), regional, national or even global use interests. Finally, actors may be either individuals or corporate bodies. In the case of the latter, their leeway for action also depends on internal procedures and decision rules.

2.2.1. *Implications for the IRR framework*

Hitherto, many analyses of resource uses have focused on homogeneous use situations (e.g. the literature on fisheries and aquifers). Due to their relative simplicity, these settings have facilitated the development of models that require only a relatively limited number of variables. However an analytical framework that aims to understand a more representative range of resource uses must be capable of portraying the complexity of heterogeneous use situations (Edwards and Steins, 1998; Steins and Edwards, 1999). As a matter of fact, despite being the most problematic to analyse, these situations are also the most common and challenging. Thus a realistic analytical approach should be able to incorporate the different regulatory procedures of all of the various resource uses in one and the same framework. This is the reason why

Table 1 – Classification of use situations (based on the example of water) and relevance of the IRR approach (Knoepfel et al., 2001, p. 16, after Young, 1992, p. 103)

Number of users	Types of uses	
	Homogeneous uses: Use of a single good or service	Heterogeneous uses: Use of multiple goods and/or services
Single user (or group of users)	"Single use": Exclusive use of a stream for the production of drinking water by one single facility	"Multiple uses": Building of a dyke protecting the community against floods and guaranteeing water reserves
Multiple users (or groups of users)	"Common use": Sharing of a stream between farmers in the context of an irrigation system → Self-organized common pool resources (CPR) regime (as described by Ostrom, 1990)	"Joint use": Definition of minimal residual flows to be respected by a hydroelectric plant in order to guarantee the protection of riparian biotopes and the supply of irrigation and drinking water of the same stream → Institutional Resource Regimes (IRR)

This table must be understood as a typology presenting the typical study objects of the aforementioned analytical frameworks. The complexity of the use situation increases from the top to the bottom and from to left to the right. For example, commons scholars tend to focus primarily on relatively simple institutional situations, producing case studies of successful community management of coastal fisheries, forests, pastures, irrigation and ground water (Agrawal, 2003).

from the very outset of our research we had to introduce policy analyses that enable the conceptualization of use rights or legally protected use interests rooted in policies. We argue that the IRR approach is actually able to inform us about these complex heterogeneous use situations by simultaneously taking into account all of the regulations that actors mobilize to defend their particular uses – be they protective or exploitative – of the resource.

2.3. *Institutional rules*

In all political systems based on the rule of law (i.e. characterized by a federal or central state claiming the legitimate monopoly of physical violence), the regulation of resource use depends on rules that are formalized and institutionalized to a greater or lesser extent. Without denying the importance of informal rules and regulations, the IRR framework focuses in particular on formal rules (e.g. policies and the civil code) because: (1) the latter impact strongly and directly on the behaviour of resource users and owners; (2) they contribute to the structuring of the conditions governing the emergence, development or redefinition of (existing) informal rules (local arrangements); (3) they are by far the clearest expression of the collective will relating to the management of natural resources within a given society and therefore constitute the basic elements of political regulation. More specifically, we are interested in the *political processes* that lead to their definition, monitoring, implementation, change and evaluation in terms of their effect on the sustainable or unsustainable uses of the resource.

In this article, we content ourselves with a classification that distinguishes between institutional approaches centred on the role played by state-run public institutions and those highlighting the institutional capacity of civil society to self-organize.

2.3.1. *Policy-centred approaches*

Environmental policies, the first generation of which was developed during the 1960s and 1970s, contain all of the elements relative to the programming and implementation of the different protection policies that affect the management of a resource. The different constitutive elements of environmental policy are (Knoepfel et al., 2007b, pp. 113 ff.):

- The *political definition of the different collective problem(s) to be resolved*: the design of environmental policy is often the product of a historical process involving the accretion of the successive interpretations and definitions of the collective problems to be resolved (e.g. threats to public health, ecological equilibrium, climate).
- The *logics of intervention* which change according to the definition of the problems to be addressed: these logics define the actors (*target group*) considered responsible for the existence of the problem and the *policy instruments* (regulatory bans and obligations, incentives, levies and tax relief, persuasive information campaigns etc.) believed capable of producing the desired changes in the behaviour of the target group(s).
- The *political-administrative arrangements* created for the implementation of the policy instruments: these arrangements usually consist of a configuration of public and sometimes private actors who are characterized by a particular portfolio of various policy resources (e.g. personnel, money, information, organisation, law, time etc.).
- The formal implementation acts (*policy outputs*): the policy outputs take the form of individual concrete acts involving the implementation of the policy (e.g. granting of planning permission and water pumping concessions, banning of chemical substances etc.).

At the same time, empirical studies on environmental policies clearly document the predominant role of the property rights to land and means of production in terms of the explanation of policy implementation failures (e.g. Gottfried et al., 1996; Kline et al., 2000; Langpap, 2006). The conflict between public interests and private property, which is well documented by lawyers, has assigned considerable importance to the court decisions which have resulted in the creation of extensive bodies of jurisprudence on environmental policy implementation. A typical example of this phenomenon in Switzerland is the role played by the courts in settling the conflicts arising from public claims to residual water flows downstream of hydroelectric power plants in accordance with the Swiss Federal Law on the Protection of Water (Varone et al., 2002). Another typical example is the setting of legal precedents by the federal courts in relation to the compensation of landowners for the withdrawal of development rights following the implementation of land-use planning policy (Moor, 2002; Nahrath, 2005).

Furthermore, policy analyses have demonstrated for a long time that in many cases the ecological condition of natural resources depends as much on specific environmental protection policies as on the effect of an increasing number of non-environmental policies intended to regulate other activities that affect the quality and sustainability of natural resources, e.g. agriculture, energy and transport policies. Sustainability indicators assessing the impacts of these use policies (e.g. ecological footprints, resource and material flows, environmental accounting) have always been a prominent theme of the journal Ecological Economics (Hezri and Dovers, 2006). In practice, use policies often render specific environmental policy efforts ineffective. Thus, policy analysts studying the regulation of the competitive uses of natural resources must inevitably take into account both protection *and* use policies which are usually developed without explicit regard for the associated implications for nature.

2.3.2. *Approaches that focus on property-related institutions*

The new institutional economics tends to analyse the efficiency of the institutional mechanisms regulating the competitive use of scarce resources by individuals under conditions of incomplete information and bounded rationality (North, 1992). Property-rights theories opened up a field of research in relation to institutions, actors' strategies and (social or political) processes of resource management. Thus, institutional economics considers property and use rights as key steering factors. Coase (1960) assumes that the internalization of external effects can only be achieved through individual bargaining with the precise (re-)definition of use

and property rights. More recently, Bromley (1991: 22) stressed that "it is essential to understand that property is not an object such as land, but rather is a right to a benefit stream that is only as secure as the duty of all others to respect the conditions that protect that stream."

Property rights (PR) to natural resources with similar characteristics are referred to as a property-rights regime or system. The classification of these regimes is based on different criteria which include title to property, the organization of exclusion, access control and decision-making processes within the regime (Ostrom, 1990; Bromley, 1991). Bromley formulated the distinction between four classical types of regimes: no property, common property, state property and private property. There is no theoretical or empirical justification for the belief that the private property system *per se* is better than the other PR systems when it comes to the prevention of the overuse of resources (Bromley et al., 1992; Ostrom, 2002); free access (res communes, "non-property") is the only regime that is unanimously condemned in this respect. In any given case, the appropriateness of a PR regime must be appraised in relation to the economic, political, cultural and geographical context of the resource system as well as with its physical characteristics.

Historically, the pursuit of stability in the rules regulating the relationships between citizens in connection with the goods in their possession represented one of the first fields of action of modern states, the enforcement of property rights being basically *guaranteed by the state*. While codifying the attributes of property, this effort led the states to specify the rights of citizens in their relationships with each another. As Steiger (2006) puts it, "ironically, mainstream economics applies the term 'property rights' to mere possessory rules", which are defined as rules referring to the (non-legal) material use or control of goods and resources. In this article, we refer to property rights as *de jure* claims (Cole and Grossman, 2002). A *property right* in the sense based on the civil code transforms possessory rules into possessory rights regulated by law.

A property right grants the owner the right to access his/her land, to harvest its fruits, to manage it, to exclude other potential users, to sell it and to burden property titles by taking out mortgages against them (Ostrom and Schlager, 1996, p. 133; Heinsohn and Steiger, 2002). The landowner is free to use the resource owned (and all the goods and services it provides) in accordance with his/her own volition – and even to destroy it– as long as no legal norm based on a given policy or derived from the civil code restricts this liberty. According to the Swiss Civil Code for example, "the owner of a thing has the right to use it freely, within the limits of the law" (Art. 641).

2.3.3. *Implications for the IRR framework*

Environmental policies can be benchmarked with respect to institutional economic perspectives: according to the latter, environmental policies suffer from two major flaws which contribute to the reduction of their efficiency. First, in many cases, the intervention logics of environmental policies only aim to reduce the negative effects of the use of a particular good or service supplied by a natural resource. Such policies focus on particular problems rather than on the husbandry of the resource as a whole ("problem-centred" policies rather than "resource-centred" ones). Moreover, resource uses are regulated by policies governing both use, such as use and infrastructure policies, and the protection of the resource. Thus legal provisions appear scattered throughout different bodies of public law and, due to the resulting difficulty in coordinating the different actors in charge, this is prejudicial to the regulation of the resource. Second, traditional environmental public policies, which are based on wide-ranging sectoral protection regulations, make *no explicit reference to property and use rights* (the addition of which corresponds to the overall use quota of a resource). However, use or protection regulations directly influence the impact of property and use rights by legally protecting certain kinds of interests at the cost of others (e.g. by promoting the protection of a good supplied by a resource rather than its direct use). Thus, all changes in these regulations also alter the use rights enjoyed by the policy actors.

Institutional economics perspectives make an important contribution to the analysis of resource management in drawing attention to the function of property rights. However, overall it would appear to be difficult to apply these approaches to the "joint use" situations that characterize resource uses in (European) liberal democracies, the regulation of which is based on property-rights regimes based on the rule of the law (Kirchgässner, 2000). It ignores some important variables associated with the legal and political systems of these countries. First, use and property rights need to be analysed in the context of the resource-relevant protection and use policies. Second, many of the institutional economics analyses are based on the assumption of a homogeneous demand for local goods and services — or at least of simple use situations with a view to modelling. Third, self-organizational behaviour is facilitated by the structuring role played by state regulation – the shadow of the state (Scharpf, 1994) – and it may even be provoked by the same shadow.

3. Institutional Resource Regimes (IRR): a framework for the combination of property-rights theory and policy analysis

The concept of the *Institutional Resource Regime* (IRR), which refers to the ownership and rights to a resource and to the policies regulating the use and protection of the resource, enables the integration of policy analysis and institutional economics and considers all of the aforementioned dimensions – i.e. resources, actors and institutional rules – in one and the same analytical framework. The central postulate of the IRR approach assumes that the two steering dimensions are complementary and that both must be considered simultaneously to facilitate the understanding of the actual uses made of the goods and services provided by a resource. Thus, the exploration of the IRR primarily aims to provide an analytical framework for understanding actual resource management practices. However, this framework can also be used in a normative context for the promotion of sustainability while improving the extent and the coherence of the regulation (both in terms of formal property rights and policies) affecting the different goods and services provided by resources.

The IRR framework is based on the following three propositions:

(1) Resource users can obtain use rights in terms of access to benefit streams through the acquisition of property rights or through the advantages bestowed by specific policy implementation acts (policy outputs) that allow the use of certain goods and/or services of a given resource at a given time (e.g. air pollution, building). For example, planning permission implicitly incorporates a presumptive use right to the absorption capacity of the atmosphere for heating (CO_2 emissions) or one or more cars (car park). For analytical reasons, the two dimensions of *property rights* (PR system) and of *public policies* (PP) are presented separately below, although it is precisely the relationships that bind them that play an important role in the definition of the rules governing the use of resource.
(2) A right can only be considered as such if institutions exist that protect its holder against other users who are potentially interested in the same "benefit stream". In states based on the rule of law, this means that a close analysis of the *legal foundations of the PR system* in force is necessary. In this context, the analysis will concentrate on private law (e.g. civil codes) which defines the scope of each right.
(3) Together with other explanatory variables (values and social norms), the IRR has a direct influence on the condition of the resource in defining the range of authorized actions that the holder of rights can undertake in terms of the use of goods and services provided by a resource. Thus the IRR framework postulates a *causal relationship* between the IRR and the sustainability of the resource system.

The concept was a heuristic device (i.e. an analytical framework) from the outset and remains so. It emerged and evolved as we sought to work out a system for understanding and analysing the struggles and conflicts surrounding resources in a particular social, legal and political setting. Because the initial evidence would suggest that the scope of its relevance may be far broader than the specific case of Switzerland where it was developed (for an application to water basin management in European countries, see for example Bressers and Kuks, 2004; Kissling-Näf and Kuks, 2004), we are now publishing it to synthesize its conceptual development and to propose its applicability to the analysis of other resource conflicts and struggles taking place under different institutional settings.

The main difference between the IRR framework and other attempts to formalize the relationship between human "communities" and natural resources (e.g. Sen 1984, 1985; Drèze and Sen, 1989; Ostrom, 1990) are: (1) It stresses the importance of formal rules and considers that informal rules emerge in the gaps between and deficits in formal rules. Following Bayart (1989, 2008) in his convincing presentation of the role of the state in Africa, the authors share the conviction that, even in countries characterized by lively informal institutions, state institutions fundamentally structure political phenomena whose existence results either from the state action or in reaction to it. In any case, the state remains a central explanatory variable of political phenomena concerning natural resource allocation (see also Hagmann, 2007). (2) The IRR framework enables the appraisal of the coherence of the regulatory regime and links it with the sustainability of the resource (see below). Very often, when case law or informal rules are produced, it is a sign of an incoherent regulatory regime. (3) Finally, the framework clearly demonstrates that use rights are mainly the result of the combination of the regulatory effects of policies and property rights.

The IRR framework is close to the "environment entitlement framework" developed by Leach et al. (1999) who also place actors' strategies at the centre of their analysis. However, the IRR framework goes further, taking into account the political processes leading to the definition of the legal context of resource uses. It integrates the lessons of property-rights theory into a political science approach.

3.1. *Public policy vs. property rights*

In Roman–Germanic legal systems, a clear distinction is made between private law, which is typically codified in a civil code, and public law. Private law constitutes the part of the legal system that deals with relationships between individuals, e.g. the law of contracts, torts, property law, family law and inheritance law. In this, it differs from public law which deals with the relationships between persons (i.e. individuals, business entities, non-profit organizations) and the state, including regulatory statutes, penal law and other law that affects the public order. This distinction between private and public law is less prevalent in countries based on common law: for this reason the terminology used in the IRR framework may still appear to be very Eurocentric, although the basic idea of the framework is certainly also relevant for other political contexts (Hagmann, 2007).

Property rights are the legal expression of the guarantee of access to a benefit stream in the context of a given legal, political and social order. They can only apply to a "thing", i.e. a material object.[1] In this sense, an element of the world which has no material reality cannot be the subject of such a property relationship. Thus, in the current legal order, there cannot be formal property rights to resources such as the landscape or the air (there are, of course, indirect means of appropriation means, mainly through policies).

Property rights must be distinguished from the use rights attributed by policies because the former last much longer and are far more stable. In Switzerland their definition is based on the civil code which has not fundamentally changed since its introduction in 1912. On the other hand, policies, which are based on public law, frequently modify, concretize or restrict use rights based on private law, sometimes in exchange for

[1] Literary and artistic works cannot be protected unless they have been fixed in some material form. Copyright law only covers the particular form or manner in which ideas or information have been manifested; it is not intended to cover the actual idea, concepts, facts, styles, or techniques which are embodied in or represented by the copyright work (1971 Berne Convention for the Protection of Literary and Artistic Works).

compensation. Private law itself creates opportunities for various limitations of formal property rights (law of nuisance, servitude). Conversely, the withdrawal or modification of use rights established on the basis of policies (e.g. immission – i.e. environmental impact – licenses, car licenses etc.) is usually much easier and does not require the payment of compensation.

Disposal rights concern the terms under which the formal property title is transferred: they include the right to sell, rent out, mortgage, bequeath as a legacy or even give away the property title to an object that is owned. The disposal rights are normally rooted in formal property rights, in the sense that the person who has formal ownership of an object is also authorized to dispose of it. Nevertheless, legal instruments exist for limiting the capacity of owners to dispose of the object to which they hold the title: e.g. prohibition on dividing or selling agricultural land in order to maintain the viability of a farm, prohibition on the disposal of assets by foundations etc.

Use rights (including management and withdrawal rights) reflect formal property rights in the sense that they represent their concrete manifestation. The definition of use rights often results from the combination of norms stemming from both private *and* public law. While private law establishes the basis for absolute ownership, public law tempers this absolute ownership by imposing restrictions on potential uses. Use rights are more specific than formal property-right titles in the sense that they usually concern only one good or service provided by a natural resource. Not all use rights however are rooted in formal property rights: they can also result from a policy which creates such rights and attributes them to beneficiaries that may not be legal owners. This situation is common in the case of resources for which no formal property rights exist.

The formation of *access rights* (as a specific category of use rights) follows the same logic. The owner of a plot of land has the right to exclude outsiders. In some cases, however, the right of exclusion is limited by public law (e.g. the "allemansrätt", i.e. universal right, to access land granted by the Swedish constitution) or by private law (e.g. transit rights relating to access of neighbours or the general public to

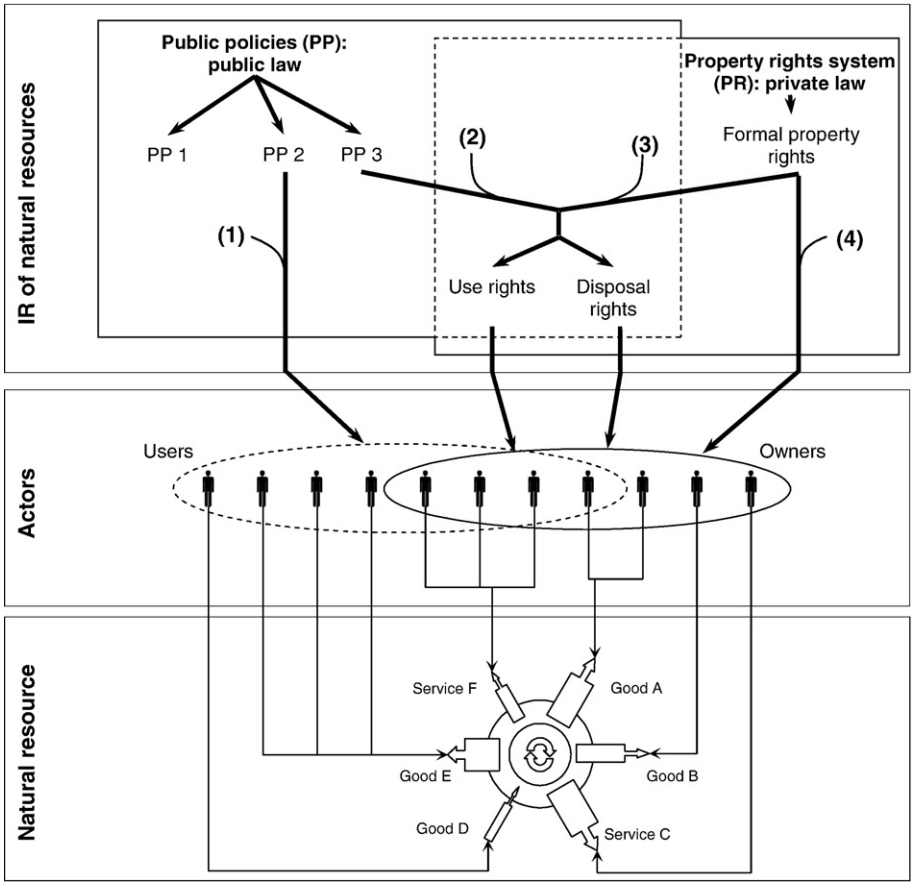

Fig. 1 – Regulation model highlighting the relationships between the Institutional Resource Regime (IRR), composed of a property-rights system (PR) and public policies (PP) (*upper box*), the actors who use the resource (*middle box*) and the condition of the resource (*bottom box*) as suggested by the IRR analytical framework. The thickness of the arrows representing the goods and services provided by the resource is proportional to the intensity of their use (or restoration in the case of the arrow pointing toward the good D). In a sustainable use situation, the capital (stock) of the resource (central circle) is not affected by the overall use. Actors are influenced in their action vis-à-vis the resource by the rules in force, irrespective of whether they originate from PP or the PR.

specific plots specified in the land registry). In many countries minimal access rights are guaranteed by constitutional rights, such as the freedom of movement, at least as far as public lands are concerned (e.g. streets, places, waterways).

3.2. Regulation modes

Fig. 1 provides a graphical representation of the different elements that make up an IRR and, by highlighting the relationships that link them together, demonstrates the possible ways in which uses can be regulated. Four main ways of regulating the uses of a resource can be identified:

(1) *Regulation through policies with no impact on the content of property rights*. This involves the implementation of incentive-based instruments that do not have any impact on the content of the property and use rights of a resource's owners and/or users (e.g. information campaigns, subsidies or tax relief to prompt desired behaviour on the part of resource users).
(2) *Regulation through policy with an impact on the value and content of property rights*. This involves the implementation of policy instruments with impacts on the disposal and/or use rights of actors by means of the clarification of the content of these rights. Examples include restrictions on development, on the emission of atmospheric pollutants or liquids, on harvesting (wood, rare plants and game) and on rights of access (to lakeshores, forests and fragile biotopes).
(3) *Regulation through the re-definition of the institution of property rights (mostly civil code)*. This involves different types of modifications to the substantial content of property rights that will have an impact on the scope and content of the disposal and use rights of all holders of such rights. In Switzerland, the most significant example of this type of regulation arose with the introduction of the Swiss Civil Code which created a unified definition of property rights at federal level and abolished the old use and disposal rights (e.g. common property regimes) in one fell swoop. A more recent example includes the introduction of the law of condominium ownership into the Civil Code (1965).
(4) *Regulation through the re-definition of the structure of the distribution of property rights*. This may consist of both an intervention as radical as privatization or nationalization (of land, water, forest etc.) for all kinds of reasons (greater economic efficiency, security of supply, efforts to counteract speculation etc.) and more punctual and limited intervention consisting of formal expropriation (e.g. for the implementation of infrastructure projects).

We observe that use and disposal rights are more robust and stable when they are based on the PR system (3rd and 4th ways of regulation) because the civil code is politically more difficult to modify than other forms of legislation. Indeed the civil code is very often considered to be a cornerstone of the political system.

3.3. The extent and coherence of IRRs

Institutional Resource Regimes may be defined and categorized on the basis of the dimensions of "extent" and "coherence". The absolute extent of an IRR refers to the total number of goods and services regulated by the regime at a given time. The related concept of *relative extent* describes the proportion of goods and services regulated in relation to which are *actually in use*: if this quotient is smaller than one, it means that not all of the goods and services used are regulated by the regime.

The criterion of coherence depends on the content and connection of the different regulations established by the regime. Incoherences between these regulations will be more likely to emerge as their number increases (i.e. elevated absolute extent). They may be due to regulations originating in the property-rights system, the public policies or the connection between the two:

- The *internal (in)coherence of the property-rights system* describes the degree of precision of the definition of the property rights or the use rights arising from them. For example, incoherences in the PR may originate from situations where there are more entitled claimants for a single resource or a single good or service than resource units available (e.g. the unregulated free pumping of water from the water table for private bore holes).
- The *internal (in)coherence of the public policies* describes the degree of coordination between policies governing the use and protection of natural resources. In the 1990s, this coordination was frequently very weak and sometimes even non-existent (e.g. the contradiction between agricultural and environmental policies or between the energy saving policy and the policy for the liberalization of the electricity market). Conversely, contradictions within the same policy — for example, between the problem definition, the logic(s) of the adopted intervention hypotheses, the choice of target groups, the definition of intervention instruments, the capacity for action of the political-administrative arrangement etc. — are more rare. Incoherent policies usually produce use regulations that are incompatible with each other.
- *External (in)coherence* describes the mode of connection between the two components of an IRR. It particularly depends on the correspondence between the target groups of the PP and the holders of rights in accordance with the PR system. This correspondence is lacking when policies address target groups that do not have use rights and whose eventual changes in behaviour do not have any real effect on the actual uses of the resource (e.g. minimum flow rehabilitation orders aimed at local governments which are no more owners of the water property-right titles because they conceded them to electricity power companies). Other external incoherences consist in the relatively common case whereby policies simply do not have sufficient coercive power to actually restrict the use rights of the users of a resource. An example of this is the capacity of land owners to resist the implementation of zoning in the context of land-use planning. Empirical research shows that a good indicator of the external incoherence of an IRR is the amount of case law produced by the courts to punctually connect the two components of the regime

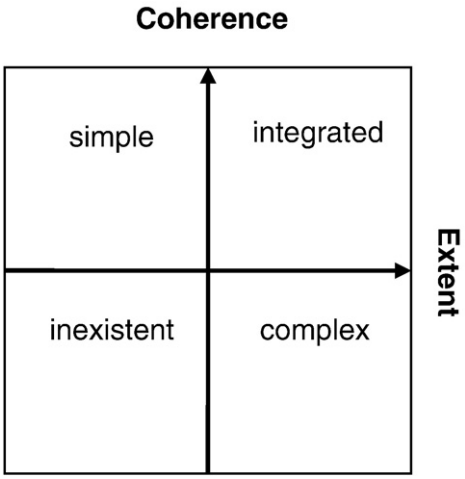

Fig. 2 – Typology of Institutional Resource Regimes according to their extent and coherence. Source: Knoepfel et al. (2001, p. 38).

(Nahrath, 2005). Like court decisions, informal local arrangements may re-establish coherence within increasingly complex Institutional Resource Regimes.

3.4. *IRR typology*

One of the major contributions of the IRR framework is its ability to describe the different configurations of regimes both theoretically and empirically. A simple typology differentiates between four different types of regimes according to their relative extent and (external) coherence (Fig. 2).

3.4.1. *Non-existent regime*

Situation whereby the resource does not have any kind of property right associated with it, or whereby its goods and services are not subject to any kind of regulation. Such a situation prevails, for example, when the need to regulate a resource has not been politically acknowledged despite the fact that it is subject to a range of uses (e.g. as was the case for genetic resources until recently).

3.4.2. *Simple regime*

Situation whereby a limited number of goods and services are regulated in a coherent way; the coherence of the regime results specifically from the low number of regulations in force and, hence, the low risk of contradiction between them. Such a situation can arise, for example, following an initial effort to regulate a resource by attempting to coordinate the uses of the resource that have led to rivalries between users. Moreover, in many cases, the *raison d'être* of such regimes is not the protection of the resource, but instead that of guaranteeing access in the long term in order to allow its economic use or the amortization of the operational installations required within a concession regime.

3.4.3. *Complex regime*

Situations whereby the majority of the goods and services actually used are regulated, but in a way that is incoherent in part. This situation corresponds to most of the resource regimes that existed in Switzerland in the late 20th century due to the extensive development of largely uncoordinated sectoral use and protection policies from the 1950s. Unlike simple regimes, complex regimes are essentially the outcome of political mobilization which aims to deal with problems surrounding resource rivalry and reproduction, the resolution of which lies in the introduction of more regulations governing the goods and services of the resource in question. These regimes all involve attempts at a more or less advanced stage to formulate emission restrictions by use sector, at least at the level of the goods and/or services regulated (e.g. imposing coercive air pollution emission reductions to polluting industries).

3.4.4. *Integrated regime*

Situation whereby all of the goods and services produced by a resource are regulated in a coherent way. Such regimes remain very rare in the early 21st century. They are found where resources are largely in public ownership (e.g. forests)

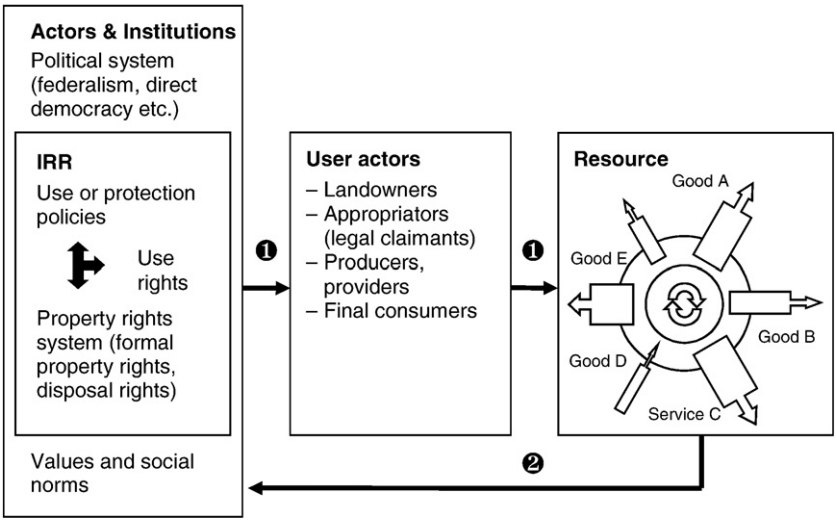

Fig. 3 – Hypotheses of the IRR framework. Adopted in slightly modified form from Kisslin-Näf and Varone (2000, p. 238).

or under the control of a powerful collective actor (e.g. self-governing common-pool resource institutions [Ostrom, 1990] like a corporation or nature conservation organization, such as a nature trust). Examples can be found in Switzerland in the areas of forests (Bisang and Schenkel, 2003, pp. 198 ff.), specific landscapes (Rodewald and Knoepfel, 2005, pp. 347 ff.; Gerber, 2006, p. 333) and water (in the course of getting more integrated; Varone et al., 2002).

3.5. *Central research hypotheses*

Two central hypotheses in relation to the causal relationships between institutional regulation and the (un)sustainable use of a resource can be derived from the IRR framework (Fig. 3).

The first hypothesis (see arrow 1 in Fig. 3) is based on the regime typology presented in Fig. 2. It presupposes the existence of a causal relationship between the regime type (i.e. its extent and coherence), on the one hand, and the sustainability of the uses made of the resource and the reproductive capacity of the resource system, on the other. Thus, *the closer a resource regime moves towards integration, the greater the likelihood is that sustainable use conditions for the resource will be created*. Conversely, *the lower the level of coherence and relative extent of a regime, the greater the risk of over-exploitation of the resource*. More concretely, this first hypothesis can be divided into two secondary hypotheses dealing respectively with (1.1) the "extent" and (1.2) "coherence" of the regime. Hypothesis 1.1 is based on the idea that the lack of regulation of user behaviour through the more or less specific description of use rights via policies and/or property-rights risks engendering strategic behaviours that can lead to the over-exploitation of the resource during times of scarcity. Hypothesis 1.2 is based on the idea that gaps or incoherences in the policies or property-rights system (internal coherence) and between the two components of the IRR (external coherence) constitute a major cause of the over-exploitation of resources.

The *second* central hypothesis (see arrow 2 in Fig. 3) deals with the converse causal relationship which tries to explain the dynamic of the historical development of an IRR and the major causes of regime change. This hypothesis stipulates that *the greater the threat to stability of a resource, the more it will be perceived as a relevant collective problem to be resolved and the more likely it is that attempts will be made to increase the extent of the IRR (new regulations for new uses) or improve its coherence* (by introducing increasingly coercive mechanisms to coordinate the actors with regard to their use activities).

3.6. *Empirical research procedure*

The field research procedure for the application of the IRR framework can be described in six steps:

1. The resource: Physical description of the resource and its perimeter according to physical criteria (not administrative boundaries). Example: Water catchment.
2. Uses and rivalries: Identification of the actual uses (in terms of goods and services) and users of the resource in the perimeter studied. Analysis of the interactions between the various groups of users. Examples: Farmers and irrigation, fishermen and aquatic ecosystems, industrial effluents and bearing capacity of the catchment.
3. The resource regime: Analysis, on the level of each good or service provided by the resource, of all regulations observable in either the relatively stable PR system or in changing PP, for the purpose of identifying existing (or non-existing) use rights attributed to specific user groups. Identification of ongoing changes of the extent and coherence of the IRR. Example: Incoherency between water concession for hydroelectric plants (PR system) and federal regulations on residual water flows (PP).
4. The implementation of the regime: Analysis of the interaction between the various groups of users and the political-administrative actors responsible for the regulation of the resource in order to highlight attempts to regulate rivalries and institutional mechanisms of (more or less coercive) collective cooperation. Example: Conflicts between the different levels of state authority (cantons vs. central government) concerning the control over the resource.
5. The impacts of the regime on the resource: Analysis of the level of the resource sustainability (reproduction capacity) and of the economic, ecological and social sustainability of the uses of the various goods and services (by means of commonly recognized indicators and related data mostly provided by local or regional administrations or corporate private actors). Example: Destruction of valuable aquatic ecosystems downstream from hydroelectric dams due to insufficient residual water flows.
6. Temporal changes: Repetition of steps 1 to 5 for the different phases of the evolution of the regime, identified over a long period of time (sometimes up to hundred years).

4. Initial empirical evidence

This IRR framework has been systematically applied in several empirical research projects mainly conducted in Switzerland (resources water, air, land, forest and landscape — Knoepfel et al., 2001; Knoepfel et al., 2003; Nahrath, 2005; Rodewald and

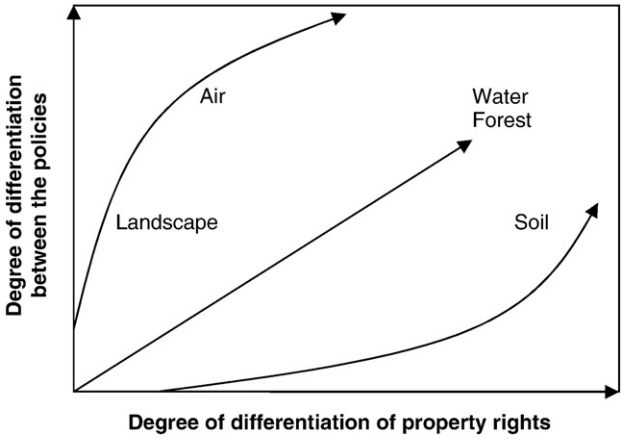

Fig. 4 – Historical path of the institutional regimes of the main resources in Switzerland. Source: Kisslin-Näf and Varone (2000, p. 239).

Knoepfel, 2005; Gerber, 2006) since 1999. It has also been empirically tested and developed further in the context of a European project on water management (Bressers and Kuks, 2004; Kissling-Näf and Kuks, 2004).

The two basic research hypotheses have largely been confirmed by the empirical evidence. Our results demonstrate in particular a clear-cut relationship (as stated by hypothesis 1) between regime change (from no regime to simple regime or to complex regime) and positive change on the level of the indicators for the sustainability of the resource uses (maintenance of the reproduction capacity). All in all, we could not find many shifts from complex to integrated regimes, as most resource regimes remain rather complex in nature. Nevertheless, a comparison between the resources water and forests, whose regimes are currently moving in the direction of integrated regimes, and the resources land or air, whose regimes remain highly complex, confirms concomitant shifts between regime change and sustainable development of the resource. Furthermore long-term regime analyses show that, despite being less coherent, complex regimes are more favourable to sustainability than simple ones, i.e. a lack of extent has far more negative effects on sustainability than a lack of coherence (exception: landscape, where our results show the opposite).

Concerning hypothesis 2, we can observe clear-cut "path dependencies" rooted in pre-existing institutional constraints (in particular: PR system) and socio-historical data such as values, ideas and collective representations incorporated into social practices. These factors lead to one of the following three possible forms such changes might take (Fig. 4): (1) *property-rights-driven* change whereby new regulations basically consist of modification of the PR system (soil); (2) *policy-driven* change through the increasing regulation of use rights by all kinds of policies (air, landscape); and (3) *parallel* change which involves the adjustment of the both the PR and PP (forest, water) (Kissling-Näf and Varone, 2000, p. 239).

5. Discussion

In our view, the IRR approach presented in this article can be considered as a fairly robust conceptual framework for the analysis and explanation of key elements depicting the degree of sustainability of natural resources uses in Switzerland and Southern and Central European countries. It has proven applicable to the description and explanation of increasingly joint use resource situations in (European) liberal regimes based on the rule of law. It overcomes the limits of (mainly sectoral) policy analysis approaches which often fail to consider the actual influence of non-environmental use policies along with property, disposal and use rights as explanatory variables for the degradation of resources. Furthermore, the application of the IRR framework forces analysts and practitioners to look closely at the policy regulations and actual use rights at work, because, despite the fact that analysts tend to lump them all in the same rather fuzzy category of "property rights", they often differ from each other. Indeed, in reality, use rights with greater or lesser degrees of resistance exist, the modification of which may or may not lead to claims for compensation. Such use rights can, therefore, be more or less effective in terms of blocking the implementation of policies.

By considering simultaneously the use rights rooted in property rights based on private law and in public policies, the IRR framework stresses their diversity but also demonstrates that they are closely linked. They are two faces of a same coin which together explain the regulation of the sustainable use of natural resource, the adequacy of which can vary. The joint consideration of these two dimensions not only makes it possible to bring scientific and practitioner communities together, which normally act very separately (e. g. real estate managers and land-use planers; private and public law practitioners; policy analysts and institutional economists), but also opens up ways for practical regime engineering which inevitably cannot simply prioritize the reform of property rights by disregarding policies governing the same resources or, conversely, focus exclusively on the reformulation of policies. Indeed the IRR framework can also be used normatively to propose more coherent regulations to policy makers (e.g. regulation based on resource boundaries rather than administrative ones, the simultaneous consideration of protection and use policies, resource-wide use quotas rather than quotas defined for each good and service provided by the resource, the importance of use rights based not only on private law, but also public law etc.) The Swiss Federal Office for the Environment is currently applying the IRR framework in a pilot project for the improvement of river flow management in the canton of Thurgau in Switzerland.

Further research will be necessary to refine and complete the presented framework. Such a need exists in particular with regard to the sometimes controversial relationship between local, regional, national and international use regulations, which are built into policies with varying degrees of fragmentation or internally incoherent multi-layered property-rights systems (local definitions of existing use right titles vs. – deviating – national or international definitions). Furthermore, applications of the concept in countries with a more recent tradition in the rule of law highlight the need for the more thorough integration of informal regulations (Hagmann, 2007).

Acknowledgments

All of the projects on which this synthesis is based were financed by either the Swiss National Science Foundation or by the 6th European Framework Programme. The authors would like to thank D. Bromley and three anonymous reviewers for their constructive comments. Many thanks also to Susan Cox for editing the English language. An earlier version was presented at the Conference on the Human Dimensions of Global Environmental Change, "Resource Policies: Effectiveness, Efficiency, and Equity", Berlin, Germany, 17–18 November 2006.

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