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Understanding Natural Resource Management

An Introduction to Institutional Resource Regimes (IRR)
and a Field Guide for Empirical Analysis

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Acronyms

ETH	Swiss Federal Institute of Technology, Zurich
idheap	Swiss Graduate School of Public Administration, University of Lausanne
IAD	Institutional Analysis and Development framework
IR	Institutional Regime for one resource (the output of the IRR framework)
IRR	Institutional Resource Regimes (the analytical framework)
LRA	Local Regulatory Arrangement
NARP	Natural Resource Policy Group at ETH
NRM	Natural Resource Management
sanu	Swiss training centre for nature and environment
SNSF	Swiss National Science Foundation
UNIL	University of Lausanne

Foreword

sanu durabilitas is a private Swiss foundation which acts as a think tank on sustainable development in Switzerland and abroad. Its council is mainly composed of academics and experts from Swiss and foreign universities, the Swiss federal authorities, and non-governmental organizations who are actively involved in the social, environmental and economic aspects of sustainable development. The foundation was established in 2012 and promotes a resource- and actor-oriented concept of sustainable development aimed at maintaining and further developing the reproductive capacity of all of the collective resources that may be considered as seriously threatened in the early 21st century. The concept of "Institutional Resource Regimes", which combines property rights considerations and public policy analysis and was developed by social scientists originating mainly from French-speaking Switzerland, fits perfectly with the foundation's general approach. Hence it gives us great pleasure to publish this practice-oriented document as the first volume in our durabilitas.doc series.

Based on experience we know that the conceptual tools presented in this document facilitate the concrete analysis of resource-related sustainability issues – not only in the field of natural resources (as demonstrated in this publication) but also in relation to the design and implementation of other resource-related policies in the fields of manmade resources and social and human resources. The foundation's working groups cover all three resource groups. The text presented in this volume demonstrates the applicability of the IRR approach and the related guidelines to all three areas of main concern to sanu durabilitas in the context of empirical studies – irrespective of whether they are carried out in Switzerland, other European countries or other parts of the world.

We would also like to thank the Public Policy and Sustainability Unit of the Swiss Graduate School of Public Administration (IDHEAP) for its co-editorship for this volume.

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Introduction

The Institutional Resource Regimes (IRR) framework is a tool for explaining the institutional complexity of natural resource use or, in other words, the question as to how institutions influence resource management. The framework was developed by academics over the last 15 years (1999 to 2014).

Various socio-economic drivers influence the use of natural resources: economic demand, demographic pressure, technology and infrastructure, etc. They are all framed by institutions which influence resource use to varying degrees.

For example, land-use planning regulations restrict settlement development and other economic uses of land in a given area.

Measuring the impact of the institutions on actual uses may appear problematic. This impact is often summed up using vague expressions like 'political will', 'regulatory constraints', etc. In contrast, the IRR framework provides a systematic approach which aims to untangle this complexity.

The IRR framework is based on the lessons learned from environmental policy analysis over the last 30 years in (and around) the Public Policies and Sustainability research unit of the Swiss Graduate School of Public Administration (idheap) at the University of Lausanne. The framework was developed through the repeated comparison of the literature with field evidence. All of the researches involved in the development of the IRR framework have a common denominator: they are empirically rooted. Researchers spent a lot of time in the field in the attempt to understand the reality they face. This was possible because the IRR framework has been largely used in the implementation of commissioned research studies, mainly on behalf of the authorities responsible for environmental and resource management in Switzerland. The Swiss National Science Foundation (SNSF) also funded a number of research projects and programmes dealing with more basic research issues.

However, up to now, the IRR framework has mostly been communicated in scientific contributions (books, book chapters, articles, international conferences, workshops and training courses). Hence the literature lacks a guide that has been compiled with the needs of practitioners and environmental scientists in mind. This guide has been produced for them. To facilitate practical dissemination, the traditional presentation of the framework has been adapted extensively. The guide is divided into two parts: a general introduction (Part I) and a field guide (Part II). Examples of summarized case studies are also presented in the appendices. The "*References*" section provides indicators for essential reading for those who are keen to explore the scientific discussion in greater depth.

It is our hope that this document will become a tool for use by people who wishing to clarify the complexity of the institutional context which influences their activities and research.

Part I: An Introduction to Institutional Resource Regimes (IRR)

Background

In this introductory chapter we present some basic information about natural resource management and justify our understanding of it. The individual elements are developed in far greater detail in other publications (see essential reading in the "*References*" section). In this context, we attempt to keep the presentation short without omitting key issues and questions.

This chapter opens with a few words about the social science perspective on natural resource management. We then explain the growing importance of the resource-centred approaches. From there we move on to the essential tools of Natural Resource Management (NRM): i.e. institutions. We then explain our focus on a limited number of institutions before presenting the roots of our analytical frameworks.

Our perspective on natural resource management

The challenge of managing limited resources in a context of growing demand generates tension when natural limits are confronted with human behaviours. This tension explains why natural resources management is a field of research, in which many disciplines meet.

Our social science perspective does not prevail in the NRM literature. Accordingly, it is useful to provide a brief justification of this approach as a complementary one: first, the designation 'natural resource management' seems inappropriate as it is not the resources that are managed but the uses made of them (Figure 1). The topic addresses the identification and analysis of human behaviours in relation to resources. The challenge is to adapt these behaviours with a view to making them compatible with what the resource can produce. Overexploitation and rivalries are seen from an anthropogenic viewpoint, and we believe that the social sciences are well equipped to answer such questions.

Natural resource management

Justification of a social science perspective

Figure 1: Deforestation is (also) a matter of human behaviour management.

The resource-centred approaches

Resources are limited by nature, however the demand for them is almost unlimited. This tension creates the problem of *scarcity* which is central to the different NRM approaches. If withdrawals exceed the production capacity of a resource, its renewability is under threat. Consequently, the first challenge consists in limiting excessive withdrawals.

A second challenge concerns *allocation* in multiple-use situations, which can be observed with most resources. A resource produces a variety of goods and services that are used by various actors. Homogeneous rivalries occur when several users wish to access the same good or service, and heterogeneous rivalries arise when the different uses made of the different goods or services provided by a resource are incompatible (see Figure 2).

> *For example: In the case of irrigation using a water course with a given flow rate, the question concerns the sharing of the water among users. A homogeneous rivalry may arise when it comes to deciding the share of the irrigation water to be allocated to different plots (who gets what?), and heterogeneous rivalries may be observed with other downstream users of the river (domestic tasks, fishing, etc.)*

The regulation of such rivalries is necessary to conserve the resource. Without a mechanism for limiting excessive withdrawals, the renewability of the resource and, accordingly, the goods and services produced may be at risk.

> *For example: Excessive fishing puts the survival of the aquatic system as a resource at risk.*

The situation is different for each resource, depending on its quality and evolution. It may constitute a renewing fund (e.g. biotic resources) or a finite stock (e.g. fossil fuel). The availability of goods and services could differ as a function of time and space, and may evolve if essential characteristics change (expansion or contraction, destruction or restoration of the resource). In addition, technical changes could create, eliminate or modify uses and, therefore, have a fundamental impact on the resource.

> *For example: Groundwater potential differs depending on the ground and precipitation characteristics. Technical solutions could involve the resolution of local water scarcity issues (drilling of wells, etc.).*

The limits to the traditional sectoral approach to environmental policy analysis became obvious with the increase in the significance of sustainability. In fact, most resources are influenced by multiple public policies. Hence, a holistic approach is required. Economists promoted a useful resource-centred approach, which is now shared by a number of social scientific NRM approaches, including ours. We believe that this is necessary for our analysis and thus accept the following statement:

A resource is characterized as a system of renewable elements producing limited numbers of goods and services (Figure 2). These goods and services are used by actors, whose consumption needs to be managed in order to insure the renewability of the resource itself. If rival uses are not regulated, the resource could be endangered. The existence of regulation does not mean, however, that sustainability is guaranteed.
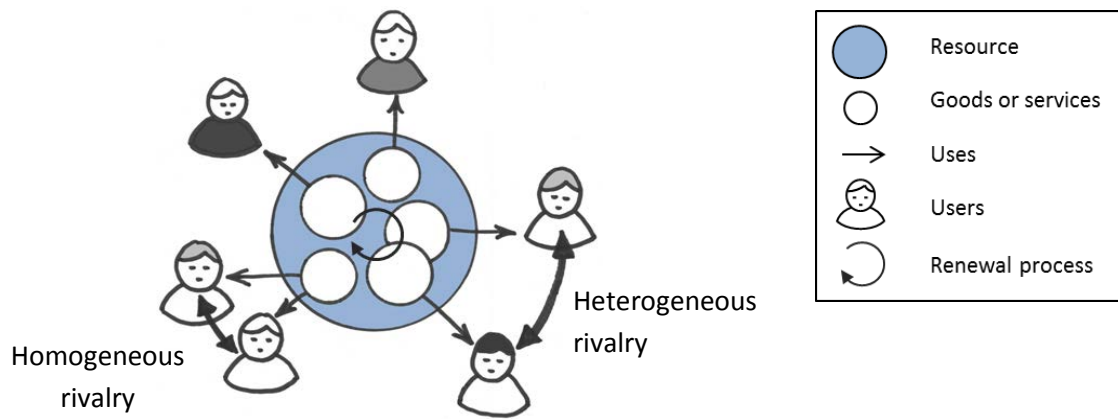
Figure 2: Resource-centred approach

Understanding the role of institutions in NRM

The challenge in implementing NRM is adapting user behaviour effectively. To achieve this, those responsible for the management of the resource(s), commission and/or activate 'institutions'.

For example: Watershed management requires data on flow rates, however the real management begins when use rights are defined (irrigation quotas, hydropower licences, minimal discharge requirements, etc.) and influence actual human uses.

These institutions must not be confused with organizational structures. They constitute constraints on and incentives for human uses which are produced by other humans. Much literature is devoted to the definition of institutions. North defines them as *"humanly devised constraints that structure political, economic and social interaction"* (North, 1991, p. 97).

For example: Unlike people, migratory birds cross international borders without restriction. To protect them and facilitate their journeys, we use institutions to modify human activities that affect the birds' migratory routes: e.g. the prohibition of activities in important rest areas, the re-establishment of wetlands, the limitation of artificial lighting, etc. None of the measures target the birds directly.

Institutions surround almost all human activities. In concrete terms, the number of institutions that exist is extremely large; they cover both informal customs and formal ownership titles, public regulations, contracts etc. No analytical framework makes it possible to take all of the institutions into consideration. Therefore, it is necessary to differentiate, first, between the different types (or families) of institutions. Williamson (2000) presents a simple but clear distinction between four levels of institutions (Figure 3).

A key distinction factor is the rate of change, which reveals the stability of the institutions. The idea is that more stable institutions influence more adaptive ones (top-down on Figure 3), while the latter generate feedback (bottom-up on Figure 3). This distinction is not the only one that exists, however it coincides with our empirical observations of actor strategies.

The analysis of these different institutional layers clearly requires different competences. While anthropology and sociology focus on deep-rooted institutions which operate on the highest level (Level I, Figure 3), neoclassical

The challenge of NRM is adapting human behaviour

What are institutions?

Which institutions are we interested in?

How to differentiate between institutions?

Different disciplines focus on different institutions

microeconomics questions immediate decisions observable at lower levels (Levels III and IV). Institutional economics and policy analysis give more importance to the intermediary levels (Levels II and III).
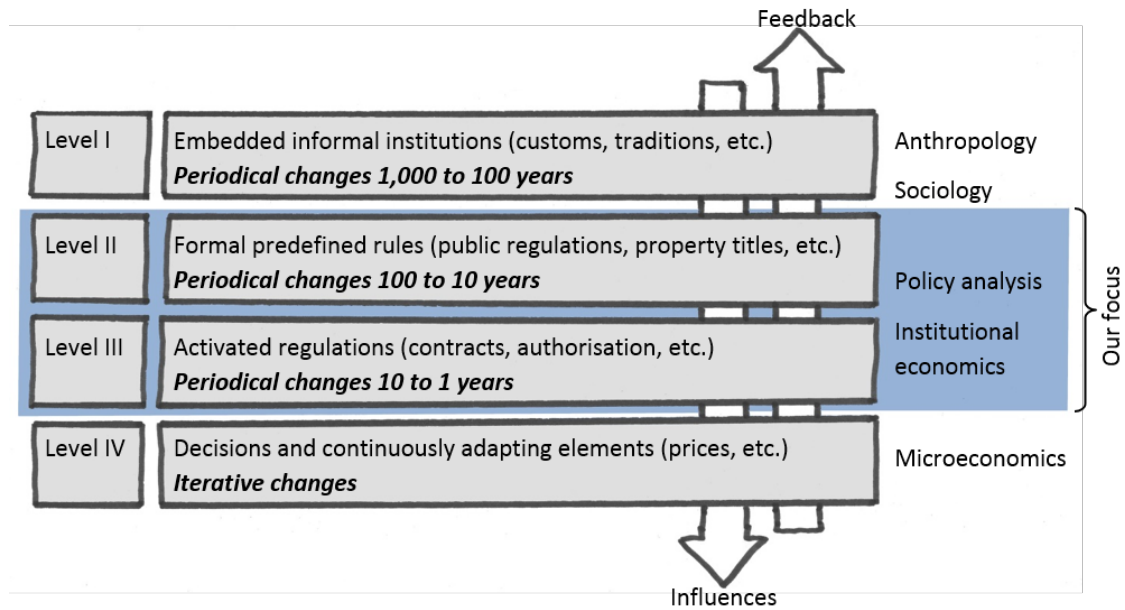
Figure 3: Four levels of institutions (inspired by and adapted from Williamson, 2000)

In the following paragraphs, we will explain why the IRR framework focuses on the intermediary levels (Levels II and III).

Understanding actor behaviour in NRM

As specified above, we are interested in 'resource management' in terms of the adaptation of user behaviour. To do analyse this behaviour, we consider all users as interdependent actors. We observe synergies between uses, but also rivalries when the uses are incompatible. Regulating these rivalries is understood as necessary for sustainability. Thus, the regulation of rivalries is an essential element of NRM.

NRM and the regulation of rivalries

> *For example: Multifunctional forestry might involve timber production and the maintenance (or reinforcement) of erosion and avalanche protection in the same area. More aggressive logging reduces the protective effect of the forest, putting the inhabitants of locations below it at risk.*

Until now we have presented institutions as instruments that target human behaviour, but it is equally important to consider these institutions as humanly devised. They are the outputs of processes which actors try to influence. Public rules are results of the legislative process, in which members of parliament discuss the norms to be enacted. Proposals for the legislation are prepared in advance in the context of expert commissions, politics and lobbying. Once promulgated, the legislative texts are usually defined in greater detail in ordinances, directives or, in the case of federal states, regional regulations. All of these processes which take place in advance of implementation are subject to the influence of actors.

Institutions are humanly devised

In the political sciences, the neo-institutionalist school considers that actor behaviour is influenced by institutions and actors simultaneously influence institutions. It is important to note that this approach rejects the determinism of

Rejection of determinism

traditional institutionalisms. In other words, studying institutions is not sufficient to understand and explain effective resource management.

The individual and collective bodies that influence the process are actors. Not everyone is an actor. Being recognized as an actor is a crucial issue for them and a condition for participation. Actors often represent interest groups and their rationale is linked with their perception of the issue at stake. When it comes to understanding the decisions made, diverging points of view and collective actions repudiate the simple aggregation of individual rationales (Scharpf 1997: 12).

A valuable metaphor for understanding this process is the 'game' (Bardach, 1977; Scharpf, 1997). Basically, actors play in the same space (arena) and mobilize action resources (finance, staff, infrastructure, responsibilities, time, information, political support, etc.) in order to influence the design and implementation of the institutions. They may do it early in the development stages (parliamentary lobbying, etc.) or later on when it comes to enforcement.

The game follows rules that constrain an actor's strategy. All of the predefined (generally formal) rules form the institutional context faced by all actors involved in the same game. Thus, the analyst needs to identify and understand the rules of this game. This is a condition for understanding an actor's strategy.

Actors have action resources which they mobilize in the rule-making process and during implementation in order to activate their rights. Their portfolios differ, however: some have staff, infrastructure, political support and extensive funding, while others have limited action resources and/or difficulties in legitimizing their action, and this makes the game more difficult for them.

For example: Various actors with unequal endowments of action resources (small NGOs with no staff and large business corporations) have various advocacy powers during the parliamentary phases of the revision of a legislative act. This will obviously influence the contents of the regulation.

Although the respective portfolios of action resources are important, their management is a key factor (production, use, exchange and combination of action resources). Analysts observe modest actors who manage their action resources efficiently with a view to organizing and influencing public policies.

For example: Despite the opposition of the hydropower producers and agriculture lobbies, Swiss fishermen cleverly managed their limited action resources to achieve the rehabilitation of river beds.

Justification of our position

Based on the previous statements, our approach focuses on the understanding of actors' games in NRM. The following elements are crucial: (1) their capacity to be present (represented); (2) their capacity to manage their action resources; and (3) their capacity to mobilize them to influence the definition of institutions. This will greatly affect the way that actors will be able to activate their use rights and hence influence the resource uses.

Having learned from the implementation studies of the 1980s, which focus on the actor-institution relations, we do not limit ourselves to governance structures and policy designs. We firmly believe that the analysis must go further, right down to the implementation and activation processes that take place in the field. Observation shows how power relations modify the implementation process by reshaping the actors' game. This position roots our analysis in the political sciences. Based on our experience, and in contrast to the currently dominant institutional economic analysis, we reject the rational choices theories.

Even if our epistemological position differs from that of institutional economics, our focus on selected types of institutions is similar. We consider that all institutions influence actors, however by different means. As already indicated, various disciplines developed appropriate tools for analysing specific types of institutions (or Levels, see Figure 3). Our approach concentrates on Levels II and III and omits Levels I and IV. The reason for this is that the described games mainly take place on these two levels. Other scientists, who investigate other aspects of the influence of institutions on human actors, could complement our approach.

This justification of our limited focus on specific types of institutions does not reject what others do better using different tools. It is obvious to us that our analysis could be refined using other approaches. In summary, we focus on the most evident and relevant institutions for understanding actors' games in NRM (on Levels III and IV in Figure 3). In concrete terms, the rules in question in industrialized countries are formal rules, while in less developed countries, informal local regulation could be crucial. In both cases, we refer to predefined rules of the game which local actors know and anticipate when developing their strategies.

Roots of the IRR framework

Based on conclusions drawn from institutional resource economics, some environmental policy analysts attempted to analyse ownership rights (*private law*) and public regulations (*public law*) simultaneously. The interconnection of these two types of rules appears crucial to understanding how ownership constitutes and obstacle for environmental policies, on one hand, and how ownership rights are limited by public constraints, on the other. This led to the conceptualization of the IRR analytical framework which structures the analysis of the "resource regime" (Bromley, 1992).[1]

The IRR framework is rooted in political science or, to be more precise, environmental policy analysis. It is designed to produce a systematic analysis of the institutional context that influences actor behaviour and the use of natural resources.

The approach was initially developed to structure the study of institutions in the continental European civil law context, in which public law and private law (rooted in Civil Codes) have distinct pivotal influences on use rights. This explains why the IRR framework lends so much importance to formal regulations (in particular public rules).

Other institutional analysis tools (e.g. the institutional analysis and development (IAD) framework) are rooted in common law, a context in which the distinction between public and private law assumes less significance. They are also used in more frequently developing countries (weak formalized institutional settings)

We identify a complementarity here as IRR only provide a limited explanation in the common law context. In contrast, these frameworks do not appear convincing to us in the context of civil law countries (see map on figure 4) where public regulations are essential.
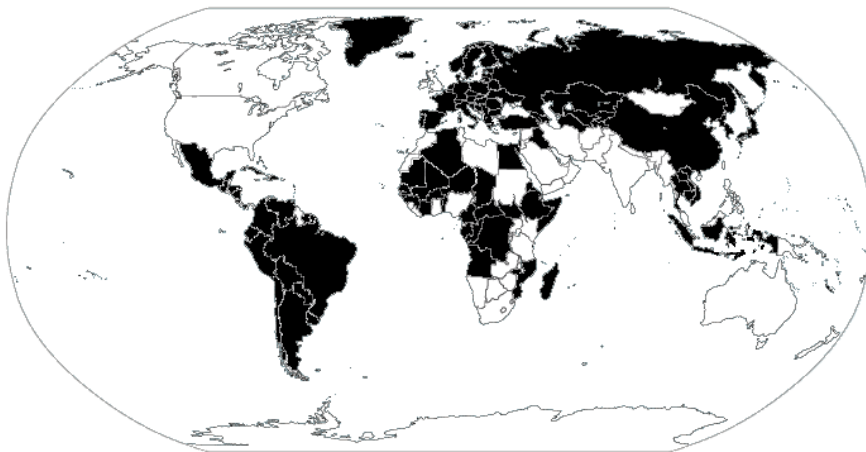
Figure 4: Map of the world with civil law countries in black.
Source: categorization established by the University of Ottawa

Based on this initial ambition, various attempts have tended to extend the scope for the application of the IRR framework from continental Europe (highly complex civil law context) to cases characterized by weak institutional contexts (developing countries) and common law contexts (UK, USA, AUS, NZ, etc.).

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[1] "*A natural resource regime is an explicit (or implicit) structure of rights and duties characterizing the relationship of individuals to one another with respect to that particular resource*" (Bromley, 1992: 8).

An initial overview of the IRR framework

In this section we present a general overview of the IRR framework. We start by presenting the IRR approach itself and then focus on its main interests and functioning.

A resource-centred analytical tool

The standard use of IRR framework takes the resource as the unit of reference. This means that the object under investigation is not the activity (e.g. logging) or the sector of activity (e.g. forestry), but the resource in question as a system (e.g. forest) in the context of a multiple-use approach. As presented above (see Figure 2), the resource produces a limited number of goods and services, which are used by actors. The consumption of these goods and services needs to be regulated to prevent rival uses that could endanger the resource by threatening its sustainability.

Sectoral approaches are of interest when the research question focuses on a single policy. Noting the increasing importance of inter-policy connections in continental Europe, analysts have preferred to 'zoom out' with a view to understanding the transverse influences. This shift has been documented since the 1980s, but became predominant in the 2000s. In concrete terms, understanding the actors' interactions and power relations in a single sectoral arena is no longer sufficient to explain the evolution of the regulations governing a resource under investigation.

For example: The use of forests in Europe is influenced not only by forest policy but also by agricultural policy, water policy, land-use policies and energy policy.

Concretely, this approach also implies that the volume of data required increases because our analysis takes a larger number of institutions that influence the use of a single resource into account. To overcome this complexity, the IRR framework proposes a step-by-step approach. The researcher starts with the general institutional drivers and digs progressively deeper. The quantity of data available and the time involved determine how detailed the output will be. Researchers could apply the IRR framework to refine an object and a PhD student could use it to investigate the undocumented aspects of the topic in detail.

Main interests of an IRR analysis

To help you identify whether the IRR framework is relevant to your research, a list of its main interests is provided below:

i. Unravelling institutional complexity

Natural resource uses are influenced by a large number of interdependent institutional drivers. In order to understand the interactions between actors, resources and institutions, the IRR approach focuses on a limited number of institutions. This is feasible using the IRR approach, even for non-specialists. It enables the identification of the institutional regime, the presentation of its evolution and the comparison of different institutional settings.

A feasible approach

ii. Discussing the issue of sustainability

A condition for sustainability is the regulation of the rivalries between the uses made of the goods and services provided by a resource. In this case, the IRR approach goes beyond sectoral environmental policy analysis and approaches the resource as a unit. Unlike other frameworks, the IRR approach is not limited to common-uses (homogeneous uses), but also addresses joint-use situations (heterogeneous uses) as commonly observed in the field.

The IRR framework can address all uses of a natural resource

iii. Recognition of the role of rivalries in human interaction

In addition to the use of natural resources, conflicts and power relations also structure human interaction. Thus, the IRR framework questions the capacity of regulations to frame and stabilize these relations. In this context, instead of taking a naïve stand focussing on consensus, the IRR framework addresses conflict and power issues. Institutions may generate rivalries because they are also a result of the power game between actors.

Conflict and power issues have a profound impact on the structure of uses

iv. Understanding actors' strategies

Institutions influence actors' games and are developed by actors. Thus institutions are not an ideal construct developed in vacuum. Content-related and process-related strategies can be observed (Dente, 2014). The former target the substantive uses of the resource, while the latter, which are often underestimated, concern the definition of rules of the game. Both are essential for resource managers for explaining actors' decisions.

Actors' games have a dynamic influence on NRM

v. Highlighting gaps and inconsistencies in the rules

Observers may note the inadequacy of some institutional settings in relation to management objectives. It is necessary to understand this issue to develop concrete corrective instruments which fill the gaps and resolve inconsistencies in and between institutions. The IRR framework identifies and explains gaps and inconsistencies, which are too often considered as failures.

Regulations are imperfect but perfectible

vi. Identifying implementation gaps

Predefined institutions are rarely implemented in full. Implementation gaps are, therefore, normal and understandable. The researcher can identify and explain such gaps by focusing on both sides – i.e. enacted rules and effectively implemented arrangements. They are weaknesses that might be used (or even created) by predatory users to overexploit the resource. Conversely, these gaps create opportunities for local actors for crafting their own arrangements which ideally suit their complex reality. Thus, they can be viewed negatively or positively, but in most cases they are created deliberately and need to be explained.

What is predefined is not what is implemented

How does the IRR approach work?

The IRR approach aims to unravel the institutional complexity which influences the uses of a resource. It does not concern all institutions and all uses, but only those that are specific to the resource under investigation. Taken together, the institutions regulating the uses form the *institutional regime* (IR) of the resource. This 'package' is a result of the application of the IRR framework. The two (IR and IRR) must not be confused.

When establishing the IR, the researcher is free to start from either the predefined institutions (in the legal texts) (section A below) or the uses observed (in the field) (section B). We present both, and then show how the two approaches meet and are complementary (section C).

A.   Starting from the legal texts (top-down)

To understand how institutions influence uses of a given resource, the first step involves identifying the relevant institutions (Step 1 in Figure 5, below). Main drivers are rapidly identified as are the initial interactions between the different regulations and use rights (Step 2). More in-depth examination will reveal the entire complexity of the regime to the researchers (Step 3). In undertaking this process, researchers re-construct a regime that appears to be tangible enough to enable its discussion (Step 4). This analytical reconstruction is the first output of the systematic approach proposed by the framework.

This heuristic process can be compared with an action that would add lenses to allow the observer to focus on a blurred reality (Figure 5). A tangible resource regime emerges, step by step. This result is not a reality, however, but an intellectual construct created by the analyst. Thanks to the systematic analysis, however, this regime is solid enough to be discussed and compared. Having achieved this, the researcher will have a detailed understanding of the relevant institutions and their interconnections, which actually shape reality. This is a crucial outcome.

Step 1: Identification of institutions
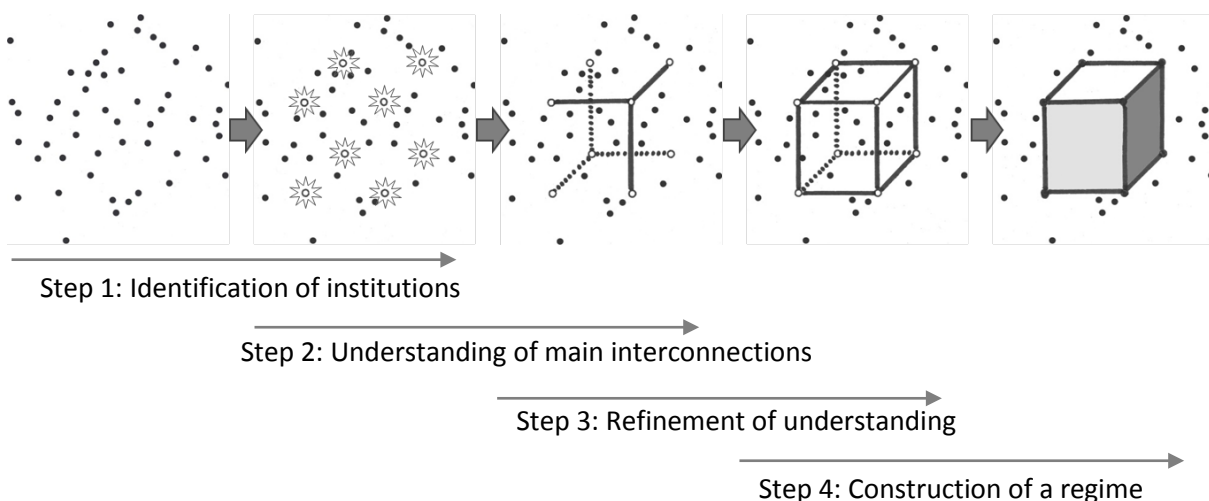
Step 2: Understanding of main interconnections

Step 3: Refinement of understanding

Step 4: Construction of a regime

Figure 5: Four steps from the blurred institutional reality
to the construction of a tangible regime

The identification of institutions in the legislative texts may prove challenging for scientists and practitioners who are not used to dealing with legal documents. An alternative (and complementary) approach involves starting with the observation of uses in the field.

In this case, we start by defining the resource and listing the goods and services that it produces (Step 1, Figure 6). Based on this initial identification, we inventory the uses and users (Step 2). In doing this, we notice that some goods or services are not used (any more), that most are complementary and that some are rival (Step 3). We then add to this inventory the implemented institutions that constrain uses or institutions, which the actors activate to legitimate their uses (Step 4).

Through this systematic inventory process, the researcher will identify regularities and understand the connections between the main regulations in use. S/he will also identify gaps and inconsistencies, for example unregulated or overregulated uses, conflicting norms, inapplicable legal requirements, etc. Based on this, the researcher will then be able to re-construct the activated institutional regime. Going one step further, the researcher will then be able to identify predefined rules behind each activated regulation: i.e. the institutional regime (IR). This reconstruction process is not a subjective analysis, but a systematic undertaking which requires lucidity on the part of the expert.

Step 1: Definition of the resource and its products

Step 2: Inventory of the uses and users

Step 3: Identification of rival uses

Step 4: Inventory of the implemented institutions
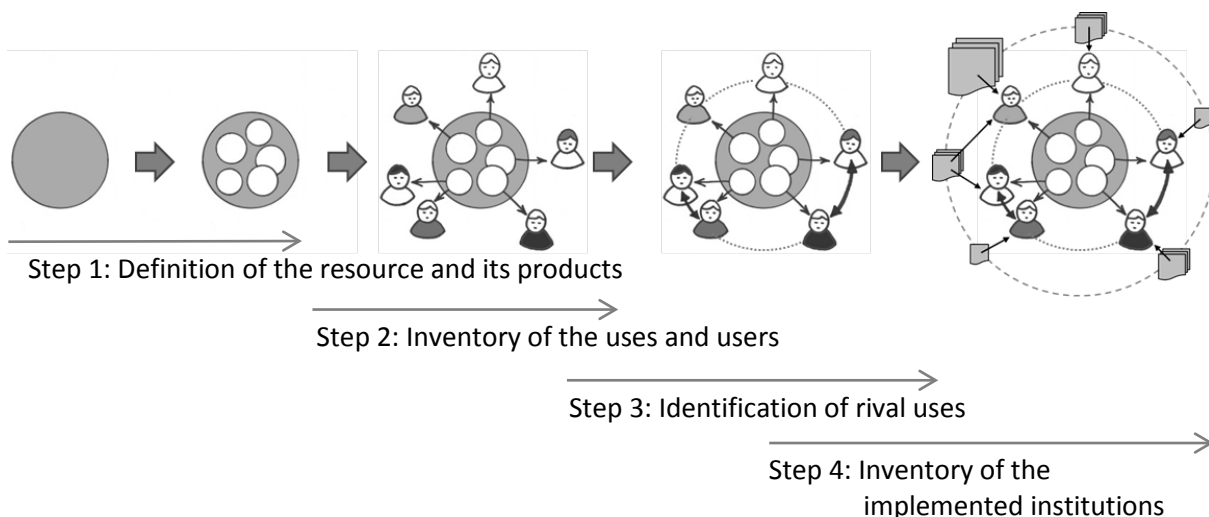
Figure 6: Four steps from the observation of a resource to the identification of the implemented regime

It is important to note the following regarding Step 1. The definition of the resource may prove tricky and have a significant influence on the results. The researcher must justify his/her position here and defend it (see Part II: A Field Guide to the IRR Framework).

For example: The definition of the resource forest, which may appear obvious a priori, differs from that of woodlands, the statistical definition of forest and the legal zoning, which is affected by the forestry bylaws. The process is even more difficult with a resource like landscape, climate or biodiversity.

In the second part of this document, we will present the mixed approach which we consider the most relevant one based on our experience. The idea is not to exclude either of the two approaches presented above.

The process is the following: starting with the texts, the researcher identifies the most important regulations. At the same time s/he conducts exploratory visits to the field to list the most influential uses. S/he then tries to understand how the connections between the predefined legal institutions influence the resource uses and the power relations between the main users and actors.

Through this repeated movement back and forth between the texts and field observations, the researcher rapidly distinguishes between the predefined (in the texts) and activated (in the field) institutional regimes (see Figure 7). This double picture may be differentiated to a greater or lesser extent, however the emergence of a gap in the comparison is normal. The essential element of this approach is to focus, first, on similarities (and not only on the implementation gap). Some elements will appear crucial in terms of explaining the resource uses and others will remain marginal. Understanding this helps with the further investigation of what drives the uses of the resource.
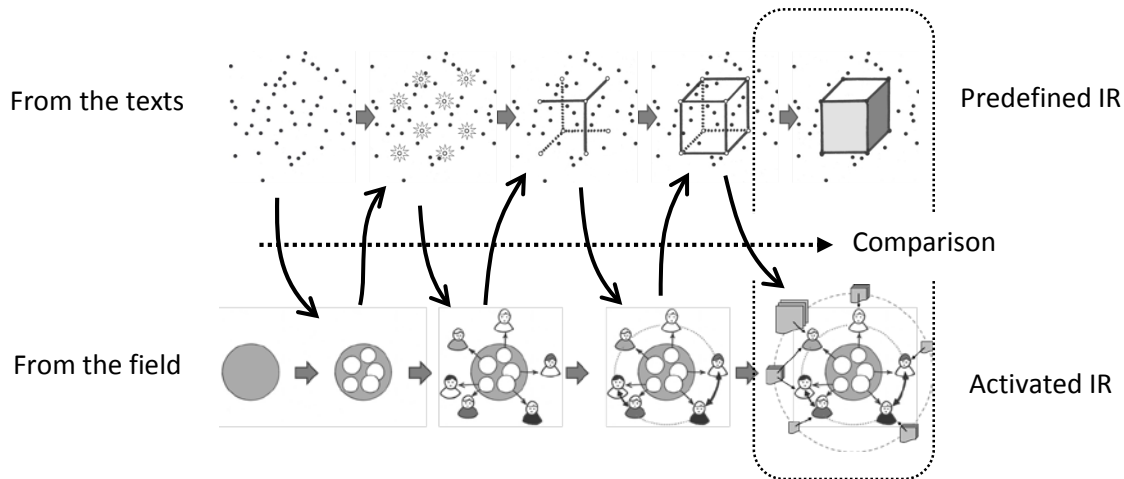
Figure 7: Mixed approach with repeated movements back and forth leading the researcher from the texts (predefined IR) to the fields (activated IR) and *vice versa*.

The identification of an implementation gap allows the researcher to eliminate a (often expected) causal relation between an institution and concrete uses. An explanation is then required: Why does such a predefined regulation not produce effects in the field? Answers are commonly found in inconsistencies (internal or between conflicting norms) or in the way the actors avoid, circumvent or divert regulations. Even when institutions explicitly regulate uses, actors retain a margin for manoeuvre outside of the substantive regulation and in the implementation process (see "Leeway of action available to the actors"). Actors should not be underestimated. They show innovative capacities (sometimes involving real institutional engineering) for maintaining their position and use rights. All of these observations are crucial to understanding the complex influence of institutions on natural resource management.

Data collection

Our data constitute information regarding the uses and users of the goods and services provided by a resource. The application of the IRR framework requires data concerning the *actor configuration* and the *institutional settings* that influence the resource uses:

- To describe the *actor configuration* it is necessary to know who the actors are and the policy resources at their disposal. Concretely, we wish to know who the owners, exploiters, opponents, beneficiaries, etc. are, and which administration(s) is (are) in charge. In order to understand the power relations between them, we also need to identify their endowment of policy resources.
- To describe the *institutional settings*, we try to understand the rules of the game as presented above. Actors have rights of use to the goods and services provided by the resource. What we aim to establish here is what are those use rights, where do they stem from and to what extent they actually produce effects?

The IRR approach considers use rights that are predefined and specific to the resource under investigation but not all use rights. The analysis is applied to the two most common types of conflicting rights: the use rights arising *from ownership rights* (private law) and those rooted in *public policies* (public law).

- *Ownership rights* establish a direct relation between owners and their belongings. The rules regulating ownership are enacted in the Civil Code, a centrepiece of the civil law system. In short, ownership is considered as a fundamental right, exclusive and absolute "in the framework of the law". Hence such use rights are not unlimited, even if the owners benefit from a robust position.
- *Public policies* regulate the use and protection of resources. Concretely, they are formal rules, for example the constitution, laws, bylaws, ordinances, etc. They are the product of legitimate collective policy processes and are generally enacted by either the legislative body (parliament) or the executive. These use rights are formulated in general and abstract terms and need to be individualized and substantiated for specific cases.

Both types of rights are distinct in nature and must be differentiated. However, they also interact (in complementary or conflicting ways) and must be seen as interdependent constituents of the institutional context. Thus, a focus on only one type is reductive. This distinction and interconnection is further developed below (see, "Distinguishing between the use rights").

Data collection takes place in the context of case studies. The researcher examines documents and visits the site to gather primary data. S/he then conducts semi-structured interviews with local stakeholders and authorities. These secondary data provide a basis for verifying the relevance of the primary data and balancing the importance of the institutional drivers. By doing this, the researcher triangulates and, thus, validates the findings.

Data analysis

In concrete terms the institutional regime is akin to an ensemble of mechanisms, including a list of institutions and their contents and a description of their interconnections. It will also present gaps in areas where uses are not fully regulated, and inconsistencies in areas where conflicting regulations are identified.

Analysis is carried out by means of two attributes:

- The *extent* refers to the number of goods and services that are regulated. It is maximal when all effective uses are regulated and minimal when many actual uses are not regulated.
- The *coherence* refers to the interconnection between the regulations governing the use of the goods and services provided for use.

The extent and the coherence are intrinsically linked because any increase in the number of regulations tends to generate inconsistencies. Conversely, when only a few uses are regulated, the coherence is likely to be much greater. (Both attributes and their relations will be further developed below).

This initial analysis allows the researcher to qualify the IR that s/he is reconstructing: IRs usually have a limited extent and a high level of coherence or an extensive extent and low level of coherence. The first are designated as '*simple regimes*' and the latter as '*complex regimes*'.

The IRR framework considers two other types of regimes: the '*integrated regime*' describes a situation with an extensive extent and high level of coherence, and the '*inexistent regime*' refers to cases involving a limited extent and low level of coherence. In fact, perfectly integrated regimes, in which all uses are regulated in a coherent way, or inexistent regimes, in which uses are regulated by few and inconsistent norms, are rarely observable. As a result, we consider them as ideal types.

In summary, the IRR framework identifies the following types of institutional regimes:

- *integrated regime*	high extent & high coherence	ideal type
- *complex regime*	high extent & low coherence	observable
- *simple regime*	low extent & high coherence	observable
- *inexistent regime*	low extent & low coherence	ideal type

This qualification of the IR is a result of the application of the IRR framework. In itself the labelling is not primary in its importance, however it enables the spatial and temporal differentiation and comparison of regimes. This may be crucial in helping analysts to understand, for example, why some instruments can be implemented more efficiently in one type of regime than another.

Another interest is linked to the issue of sustainability, from which the framework originates and to which it aims to contribute. The initial belief was that integrated regimes are more likely to ensure sustainable resource use, while the absence of extent or coherence would mean that the resource is at risk. This hypothesis has been refuted due to the complexity of the implementation process which evades any deterministic interpretation. Nevertheless, the idea behind it remains relevant and is confirmed by the empirical evidence: opportunistic actors use the gaps and inconsistencies in the regulations, create rivalries and put sustainability at risk. An improvement in the institutional setting

may contribute to reducing the rival uses and thus boost sustainability. In short, the nature of the institutional regime matters.

By way of a tentative synthesis, the possible regime types can be presented as a continuum rather than separate boxes. The idea of continuity emerged from study of the evolution of regimes, which traditionally unfolds from *inexistent* to *simple* then *complex* and, ideally, *integrated* regimes. Such developments, which take place over decades, have been studied in diachronic (same area at different times) comparative applications of the IRR to natural resources (these *historical screenings* are listed in the references section). Recently, synchronic comparative studies (same time in different areas) have demonstrated the relevance of such a presentation in the comparison of different regimes for one and the same resource in different contexts.

The idea is to position the different types of regime on a segment that runs between two extremes with the inexistent regime at one end and the integrated regime at the other. Depending of their degree of integration, from simple to complex regimes (see Figure 8), the observable types of regime are placed on a vertical segment. The degree of integration is defined by the attributes of extent and coherence from a relative point of view (rather than an absolute one). The task is to determine whether an additional unit of regulation would increase extent more than coherence (simple regime) or coherence more than extent (complex regime).

A second horizontal segment presents the field of possible actions by the actors. This leeway (or margin for manoeuvre) decreases when the degree of integration increases. In an inexistent regime (at the bottom in Figure 8), the leeway is maximal and it declines until all uses are adequately regulated in the case of the integrated regime (on the top in Figure 8).
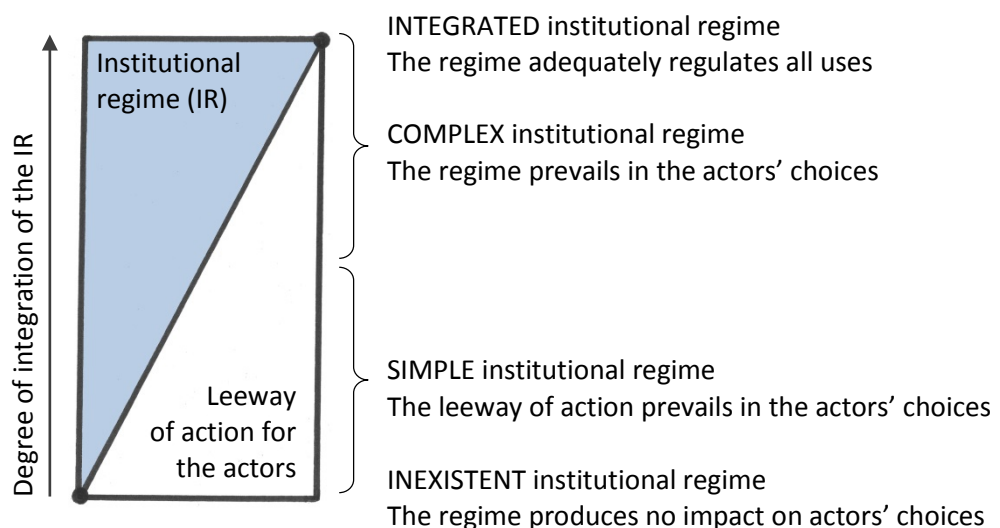

Figure 8: The four regime types and actors' leeway

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A more detailed presentation

Following the general presentation of the background, the focus of interest and the functioning of the IRR framework, it is now necessary to go into the details. The challenge here is to provide enough information to make the framework understandable for non-specialists without venturing too far into its conceptual complexity. The objective is to enable the application of the IRR framework using the field guide provided in the second part of this document.

Thus we will deliberately avoid entering into too much detail about the theoretical and conceptual discussion. Much has already been written about this by the authors of the IRR framework (see references).

We present different types of use rights and their interconnections here. We then detail the five analytical sub-dimensions of the two attributes *extent* and *coherence*. The following step explains how users activate their rights. This enables the analyst to identify their strategies (both substantive and procedural).

Distinguishing between the use rights

The IRR framework makes a clear distinction between different types of use rights. In particular, use rights arising from public policies or ownership are analysed separately initially and then together with a view to understanding their interdependence. This distinction is at the heart of the IRR framework and needs to be justified.

Use rights arising from public policies

In civil law legal contexts (see above), public regulations play a prominent role in the use of natural resources. Any action of the state must be legitimated on a legal basis. Hence the role of public regulations is to establish the basis, thereby making the rules of the game anticipatable by all actors on a *general* and *abstract* basis beyond any *individual* and *concrete* cases (as lawyers would express it).

Public law is the expression of collective power and it is developed on the basis of well-defined procedures. Unlike private contract law, public regulations cannot be produced by just anybody. Generally, laws are products of the legislative assembly (parliament), however ordinances may be enacted by the executive body (government). Jurisprudence helps with the interpretation of the rules. However, unlike the common law system, it does not create rights outside of specific cases.

These public regulations are predefined mechanisms which actors may assert to activate use rights (or restrictions). In short, they can be assimilated into the rules of the game, which are identical for all players, depending on their status.

For example: Land-use planning limits the uses made of land by its owners. Each plot of land within a given perimeter is regulated by the same planning principles, which are substantiated in local plans. These instruments are developed by legislative bodies. They set the common rules of the game for the land owners (planning permission, etc.).

Use rights arising from ownership titles

Policy analysts understand ownership rights as defined in the legal sense in the Civil Code. They cannot be likened to the concept of *property rights* as used by institutional economists, which have a much broader sense.

Unlike the use rights arising from the public policies presented above, for legal analysts, ownership rights come under the category of private law rights. Ownership expresses a direct unilateral link between the owner (private individual or a corporation) and his/her object (*res* in Latin). We differentiate between immovable property (plots of land) and movable property (objects).

In the civil law context, ownership is generally described as *exclusive* and *absolute* within the framework of the law. This means that the owner may exclude others and that s/he can use (*usus*) and benefit from the goods and services of his/her property (*fructus*), and sell, or even destroy it (*abusus*), but only as long as this does not contravene the public regulations.

However, ownership rights are considered as fundamental rights and are guaranteed by the constitution. Thus, public authorities have an obligation to protect the owners' rights and follow strict conditions when restricting ownership rights.

For example: An expropriation (involving the total or partial loss of rights by an owner) requires compensation.

The definition of the extent of ownership rights depends very much on the resource under investigation. While it is quite clear regarding land use, it is much more complicated when it comes to groundwater, air, wind and landscape.

A widely accepted principle is the *principle* of *accession,* which states that anything included in the ownership above and below the ground, within the limits of the plot, is considered as part of the property and belongs to the land owner. However, based on technical developments, limitations have been imposed in terms of depth and height to prevent excessive claims on underground resources (water, oil, gas, minerals, thermal energy, etc.). The analyst will need to clarify this for the specific national context of his/her research.

For example: The fruits of a tree belong to the land owner, as do the wood from the tree, its roots, and the ground below it. The ownership of mineral wealth varies, however, according to specific contexts and countries.

In previous texts on the IRR written in English (Gerber et al. 2009; Knoepfel (2007); etc.), authors referred to 'property-rights' in the sense of 'ownership rights' as used in this text. The terminology has been adapted and 'property rights' in the former texts should be read as 'ownership rights'. This is merely due to a translation issue and does not change the content and the meaning of the concept. Hence the concept of *property rights* (as used by institutional economists) refers to a much broader ensemble of rights than the above-defined concept of *ownership rights*.

Use rights: influences and interaction

Decades of observation and analysis of institutional complexity underpin the development of the IRR framework. Actors develop institutional strategies of varying degrees of complexity (activation, passivity, circumventing, etc.). In their identification and analysis, understanding the interactions between institutions - and not only the effects of institutions on the uses of the natural resources - has emerged as crucial.

Interconnections between the various use rights

As already mentioned, ownership rights are limited by public law. This allows the public authorities to limit excesses in the general interest. Thus it is normal to consider that private owners are not free to do whatever they want.

For example: Land-use planning restricts the possible uses of (privately and publicly owned) land. Urban development regulations limit the height of buildings and, hence also, the potential financial yield for the landowner. Heritage protection regulations influence the scope for conversion projects, etc.

On the other hand, public law does not admit any restrictions. If a new limitation is imposed, the owners may defend their rights and ask a court to oblige the state to indemnify them based on the constitutional guarantee.

For example: The enforcement of a strict environmental restriction (e.g. closure of a factory causing pollution) may be considered as a limitation of the owner's ownership rights by a court. The latter may then impose a compensation payment, thereby limiting the capacity of the state to implement the environmental objective de facto.

In summary, the lessons drawn from 40 years of environmental policy analysis in civil law countries (mainly in continental Europe) highlight the importance of this interconnection and its complexity. Based on this, the developers of the IRR framework place it at the centre of their approach with a view to clarifying (and demystify) it. The fact is that use rights arising from both, public policies and ownership are conflictive (Figure 9) and perceived differently by the actors. Nevertheless, ownership is typically seen as more resistant than public policies. Thus, actors adapt their strategies based on the distribution of types of use rights among the actors affected by the issue under investigation.

For example: Rather than demanding the strict enforcement of a law, an environmental NGO might buy a plot (within the perimeter of, or bordering on, the exploited resource) in order to be fully included in the debate. Another classical example is the willingness of operators (mining, water catchment, infrastructure building, etc.) to conclude agreements preventing the activation of third-party rights. Many such examples demonstrate a real institutional ingenuity on the part of actors.

All institutional analysis should be aware of this interdependency between the different types of use rights in order to explain the actors' uses of the goods and services, which ultimately constitute the key issue in natural resource management.

The interconnections between the two types of rights, and within them, are taken into account by the two attributes of the IRR framework (presented above): *extent* and *coherence*. To enable systematic analysis, they are defined with greater precision in the following five sub-dimensions:

- *Absolute extent* designates the number of uses of goods and services provided by a resource that are regulated. The absolute extent generally increases over time with the enactment of new regulations.
- *Relative extent* refers to the number of uses regulated in relation to the effectively exploited uses. It demonstrates gaps in the regulation or situations involving over-regulation which are causing difficulties.
    - *Internal (in)coherence of the ownership rights system* challenges the quality of the definition of the ownership rights to the resource. A classical case of incoherence would involve multiple claimants and unclear rights allocation (for example in irrigation systems under conditions of water scarcity).
- *Internal (in)coherence of the public policies* refers to the coordination between the various policies affecting the resource. Typical internal inconsistencies are the inter-policy contradictions between exploitation and protection policies applied to the same resource. Internal contradictions can also exist, of course, within the same policy.
    - *External (in)coherence* designates the fundamental interconnection (and often confrontation) between the two types of rights: one arising from public policies and the other from ownership.

Figure 9 presents the three sub-dimensions of the attribute 'coherence'.
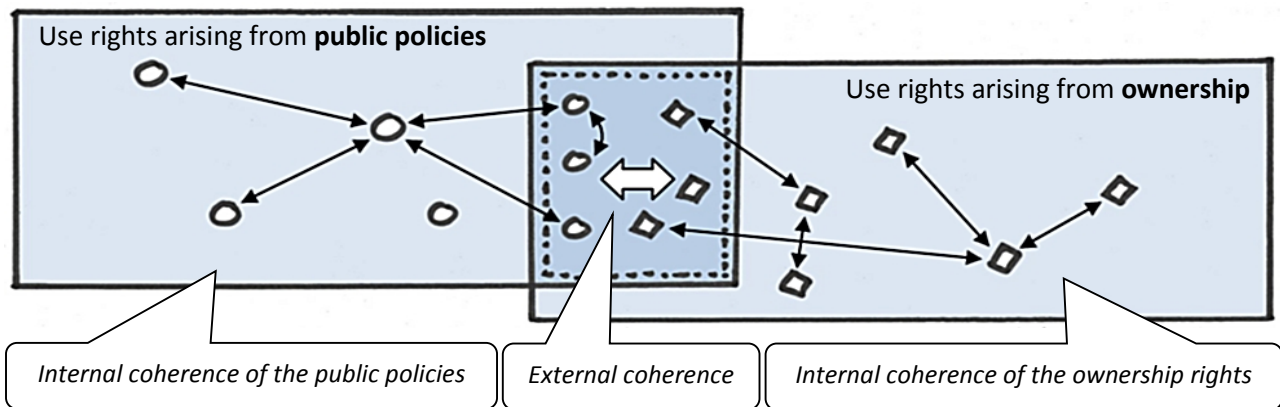
Figure 9: Coherence of the interconnection between the different types of use rights

The attribute 'extent' is often likened to a quantitative criterion and coherence to a more qualitative one. Both are interdependent: an increase in the extent of the regulation (quantity) generates tensions on the coherence side (quality) of the regime. This point is further developed below (See: *"The relation between extent and coherence"* below).

The relation between extent and coherence

Activation process

Laws and ownership titles predefine rights, however they do not have any effect without being activated.

> *For example: A land owner may not be aware of the precise boundaries (or even the location) of his/her property, or may not be aware of the use being made of the land. Despite the title, his/her rights have no effect on the uses. In terms of public policies, an example here would involve a weak environmental NGO condemning a use without being able to activate an existing predefined right to block the activity.*

The activation process is far from obvious. Various level of activation may be observed. Some actors may sue their opponents immediately while others merely refer to their rights with a view to initiating negotiations. In the first situation, actors rely on external arbitration (court) while in the second they try to avoid it. Hence, the activation process cannot be described as an '*on/off*' decision.

When the researcher applies the IRR framework to the legal texts (top-down approach) s/he focuses on the predefined rules applied immediately prior to activation. In contrast, a field researcher (bottom-up approach) will observe activated rights (rules in use). Both documents substantiate institutions that might be considered as stabilized at a given moment in time: the *institutional regime* (IR) and the *local regulatory arrangement* (LRA):

- The IR designates the ensemble of predefined regulations which are specific to one resource (and not all predefined regulations).
- The LRA is the result of the activation process that is effectively used by the actors to stabilize their uses of the resource. It is always worded in concrete terms which allocate use rights to one (or more) well-defined actor(s).

> *For example: In the case of the construction of infrastructure, the LRA would be the planning permission. The IR would refer to ownership distribution, land-use zoning, environmental requirements, safety standards, etc. which are essential conditions for obtaining planning permission.*

The IR and LRA are clearly interdependent. However, the activation process is far from linear. Evidence shows that deterministic conceptions - linking a legal amendment with a direct change in use - are often contradicted by reality. We consider implementation gaps as normal and implementation theories have been providing a convincing explanation of them since the 1980s (see references).

Hence the content of the LRA can only be partly anticipated on the basis of the IR, and it is very difficult, if not impossible, to deduce the complexity of the IR from the LRA. Nevertheless, based on the awareness of the distribution of predefined rights among actors (in the IR), the analysis of the IR helps to identify the outputs of the activation process (in the LRA) and to understand the interaction between actors. On the other hand, observing activated rights (in the LRA) helps to identify the range of relevant regulations to be included in the IR. Thus the distinction is not contradictory and fits perfectly in the analytical framework.

Actor strategies

We have shown that rights-holders do not systematically activate their rights on every occasion. This passivity is a strategy which exists alongside a variety of other strategies that have been identified by field research: application (enforcement); non activation (passivity); misapplication (diversion); circumvention (avoiding enforcement), etc.

For example: An actor who has use rights to a resource may be confronted with a newcomer who affects his/her use. In such cases, s/he can call on the responsible authority to stop the newcomer, thereby invoking his/her right (application). S/he may prefer not to involve the state administration and decide that the other use is not harming him/her enough to do anything (passivity), or contact the newcomer with a view to reaching a consensus (bilateral agreement). Such an agreement might rely on the predefined rights or on other elements, e.g. a financial transaction, exchange of services or continuity of the current uses. For his/her part, the newcomer may wish to avoid law enforcement, not only in the context of this arbitration process, but more generally to circumvent a legal mechanism. In such cases, local actors might benefit directly (payments, service, etc.) from not activating their rights.

Implementation gaps can produce both positive and negative effects compared with standard implementation and enforcement. They can be positive when actors use them as an opportunity for developing endogenous regulations that are better tailored to the local natural and socio-economic constraints and thus produce better results in terms of sustainability. On the other hand, unfortunately, they often offer an opportunistic way of undermining the implementation of environmental policies and can put the renewability of a resource at risk.

Observations show that actors, having access to both types of rights, vary the activation of them. Ownership is seen as the easiest type of right to activate and the most robust (century scale in the European context). Rights arising from public policies appear more difficult to activate and their content is perceived as less stable (decade scale). As a result, the adaptability of public regulation might be seen as a weakness in the context of long-term issues.

For example, when creating a nature reserve, environmentalists favour land acquisition or easement on ownership title to public zoning based on a land use plan developed by a public administration.

Based on this perspective, owners have a clear advantage and actors' strategies depend very much on ownership rights distribution. As we have seen, however, these ownership rights can be limited by public regulations or voluntary agreements. In summary, activation is not easy in terms of time, competence, information, finance, etc. When rivalries occur, activating use rights and defending them can even be costly for actors. Thus actor strategies are also highly dependent on the actors' capacities.

The actors' action resources

Policy analysts are interested in power relations between actors (Knoepfel & al. 2011, chap IV, pp. 67-94). The latter operationalize their capacities in accordance with their portfolio of *action resources* (or *policy resources*). The following factors are taken in consideration:

- Law or the *legal resource*. This is an important source of legitimation. It includes objective law (substantive norms) and subjective rights (right to sue).
- Personnel or the *human resource*. This is a source of competency, including technical expertise. Lack of personnel and qualifications constitute classical limitations on activation capacities.
- Money or the *financial resource*. This is one of the most obvious action resources because it can easily be used to substitute for other action resources in form of salaries, mandates, rents, etc.
- Information or the *cognitive resource*: Knowledge is an important asset for decision making and the justification of claims. Information is also crucial in terms of communication and has a strong influence on the management of other resources and other actors' decisions.
- Organization or the *interactive resource*. This resource influences (re-)action capacity and the quality of the service provided. Structures with greater or lesser degrees of flexibility alter the individual action which might encourage or limit activation capacities.
- Consensus or the *confidence resource*. Being able to obtain support is essential when dealing with rival uses that might be conflicting. It is also a condition for the conclusion of agreements.
- Time or the *temporal resource*. When actors are confronted with delays due to internal or external factors, time is a crucial factor. Bargaining power could easily be reversed in urgent cases.
- Infrastructure or the *heritage resource*. Possession of tangible goods, such as the ownership of land and logistics, could support one type of use-right activation. It allows actors to provide a service and exchange it.
- Political support or the *majority resource*. In democratic countries, political majority is the source of *primary legitimacy*. All too often, researchers mention a '*lack of political will*' to explain a policy failure, but without making it explicit. Political support is necessary, for example, for putting a problem on the policy agenda and expecting subsequent state intervention.
- Force or the *violent resource*. Despite being more evident in dictatorial regimes, force (including the threat of force) is also observed in many conflicts surrounding the use of natural resources. The use of this resource is highly sensitive as it could have a negative effect on the other resources (consensus, political support, etc.).

Management of the action resource portfolio

Actors have unequal endowments of action resources. Needless to say, the activation process is more difficult for some actors than others. The 'richest' are not systematically better off, however. The management ability of the actors is a crucial factor here. It is possible to observe not only the production of action resources, but also their exchange in the form of combinations and substitutions which modify the actors' portfolio of action resources fundamentally.

For example: Researchers produce information used by actors (and not only by decision-makers) to alter a consensus and, sometimes, gain more time to collect additional data. This could lead to financial support which will enable the hiring of staff and thus increase the organizational resource. Based on this process, a controversial operating licence (water catchment, mining, logging, etc.) may ultimately be withdrawn or come with additional restrictions.

Action resource management is not always sustainable. Some actors are able to increase their endowment through the adoption of a smart activation process, while others merely consume their stock of action resources. Management ability is crucial when rivalries are repetitive. This has a direct effect on the actors' strategies which ultimately alter the use made of the goods and services produced by natural resources.

Substantive and procedural activation strategies

Actors activate not only *substantive rights* (i.e. the access to the resource) but also *procedural rules* (i.e. participation in the policy process, action resource management, etc.). The former targets the uses made of the resource, while the latter involves an indirect strategy which aims to modify the rules of the game.

While substantive activation is obvious, procedural activation indicates that the actors have a precise understanding of the rules of the game.

The activation of procedural rules often plays a crucial role in explaining the subsequent steps of the activation process. A typical case of procedural activation involves the enhancement or prevention of the mobilization of action resources by other actors and thus influencing their activation capacities.

For example: If an actor mobilizes financial resources to obtain political support, his/her opponent might mobilize legal resources in the form of an anti-corruption act so as to delegitimise the participation of the former in the policy dialogue. Another example could involve the attempt by an actor who does not have access to the resource to be involved in the evaluation of the policy process. This opens up new opportunities for influencing the redistribution of substantive use rights in the next revision of the policy.

For example, in addition to a smart way of managing the action resources, this is a classical way for the weak actors (with a limited portfolio of action resources) to beat richer actors in the game. It also justifies our rejection of determinism and highlights the existence of opportunities even for the weakest actors.

Brief intermediate summary

As we have seen, NRM is a matter of human resource use, which is influenced by various types of institutions. The IRR framework focuses on the two most prominent of these: public policies and ownership rights. Their distribution and potentially contradictory definition is the object of analysis. The IRR authors believe that unravelling this complexity is a necessary condition for understanding how these regulations concretely influence the individual and collective use of natural resources.

The first output of the IRR framework is a fine-tuned description of the institutional settings - the *institutional regime* (IR). However, to produce effects, this ensemble of predefined use rights needs to be activated by actors. The rights 'in use' are observed in the field and documented in the *local regulatory arrangement* (LRA). Even if it is channelled by the predefined regulations (in the IR) and the action resources of the actors, this output of the activation process is not predictable. The LRA depends on actors' strategies and their ability to manage and mobilize their action resources to activate use rights in accordance with a given set of rules of the game.

Hence, institutions not only have an impact on the goods and services provided by the natural resources (*substantive issue*), they also influence the interaction between actors. They influence indirectly but clearly the latter's capacity for activation and even the redistribution of rights among actors (*procedural issue*).

Evidence shows that actors perceive this multi-layered complexity which bounds their rationality. Those elements appear crucial to understanding and explaining how actors follow *substantive* and *procedural* strategies, which ultimately explain their use of the goods and services produced by natural resources.

Open issues around the IRR framework

The recent results from IRR field research have identified new challenges in terms of coordination (sharing the same definitions) and coherence (questioning recognized concepts based on new inputs). The debate within the small IRR community is lively and future adaptations of the framework may be expected. Some of the issues that are still under discussion are presented below. They demonstrate the ongoing process of reflection and refinement, in which your participation is welcome.

The following topics are discussed below: the role of informal regulations; the relationship between the two attributes (*extent* and *coherence*); the scope for action available to the actors; the definition of the LRA; and, finally, the supposed causal relation between the IR type and sustainability.

The role of informal regulations in the IRR framework

The authors of the IRR framework only deal with formal regulations. Policy analysts see informal regulations as unpredictable and problematic to document. In Figure 3, we limited the field of investigation to Levels II and III. Informal institutions like customs, traditions, etc. (Level I) require other analytical tools (anthropology, sociology, etc.).

The question of the exclusion of informal regulations from the IRR

Nevertheless it appears that some informal institutions have a crucial influence on natural resource management. Customary regulations are play a crucial role in less developed institutional contexts and are difficult to ignore without abandoning explanatory factors.

One proposal for resolving this issue involves in the inclusion of informal institutions that are similar to public policies and ownership rights in the IRR. We refer here to customary use rights arising from a locally legitimated legislative process (village assembly) and informal land tenures. The latter are *de facto* ownership rights which are materialized by fences, paths, crops, etc. They even have specific alienation content that is transferable across generations.

A proposal for selective inclusion

In some institutional contexts, these informal rights are more legitimized locally than any formal regulations and, as a result, they are more influential. A study undertaken in such context that would deliberately avoid them would miss the point.

The criteria for their inclusion in the IRR analysis are:

- they are *specific* to the use of the resource;
- they are *known, legitimated*, and *anticipated* by the local actors;
- the analyst is able to *document* and express them in *words*.

If all of these conditions are fulfilled, the corresponding informal regulations might be suited to IR *extent* and *coherence* analysis as has already been tested in empirical research.

The relation between extent and coherence

We presented the interdependence between the two analytical attributes of the IRR (*extent* and *coherence*) earlier stating that any increase in the extent of the regulation (quantitatively assessed) generates tensions on the coherence side (qualitatively assessed) of the IR. This relation is not linear: the initial regulations increase the *extent* without altering the *coherence* much (in simple regimes). In complex regimes, any additional regulation has a strong effect on *coherence*. This interdependence can be represented by a decreasing curve (Figure 10), which highlights the marginal effect of any institutional change.

In Figure 10, the different types of regimes are placed along the curve, depending on its slope: in A, at the bottom of the curve, we find the ideal type of the non-existent IR, in which coherence and extent are absent. Between points A and B, we place the simple IR. Any additional regulation would also increase largely the coherence. Between points B and C, additional increases in extent will produce less and less coherence. The complex IR is located here. An ideal type of integrated IR would fit at the top of the curve at point C.

Thus the slope of the curve is infinite (vertical) in A, equal to 1 (45°) in B and equal to 0 (horizontal) in C. In Figure 8, this slope is used as a metric for the 'degree of integration' (vertical segment).
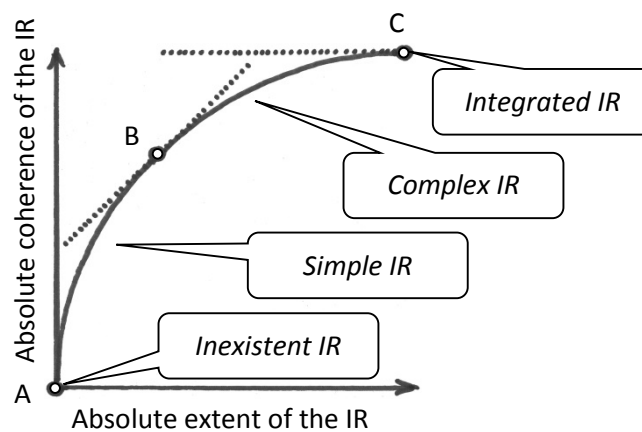

Figure 10: Interaction between the two attributes of the IRR framework

The relevance of this kind of presentation is still under discussion and it is presented here for illustrative purposes only. On the plus side it accommodates a dynamic understanding of the historical development of the IR of a given resource. However, it also supposes that the uses of the resource are static. If this is not the case, any new use will modify the shape of the curve.

Attentive readers would have noticed a discrepancy between Figure 10 and the IR typology. According to the framework, a simple IR is defined by a low extent and a high coherence, however in Figure 10 it has a low coherence. Similarly a complex IR is defined by a high extent and low coherence, but has high coherence in the curve. The reason for this is that we consider different types of coherence here. In Figure 10 we use the *absolute coherence* (in reference to the fully coherent integrated IR), while the typology uses *relative coherence* (in reference to the actual IR). Thus there is no contradiction, however an explicit definition is needed.

Leeway for action available to the actors

We saw in Figure 8 that actors have a margin for manoeuvre and that it depends on the IR type: i.e. it is more influential in simple IRs than in complex IRs. In the ideal-type integrated IR, actors have no leeway for action because all uses are regulated in a coherent way. Hence, the leeway is defined in negative terms and refers to deficits or inconsistencies in the IR.

Field observations show that actors often try to evade the expected effects of the IR on the uses they make of a resource. Thus they develop alternatives that can be described as deliberate circumventions of the IR. These can range from a simple agreement to very complex institutional engineering. Any inconsistency between the various regulations may be used to circumvent the predefined rules.

> For example: Two neighbours might bargain for the non-activation of their rights. In repetitive situations, such non-activation of the IR may even become a modus vivendi for avoiding state intervention.

Furthermore, this margin is not an institutional vacuum, but a space where many regulations exist without being specific to the resource (and are situated, therefore, outside the IR). Obviously, its identification depends on the description of the IR and, like the IR, it is a pure construct of the analyst.

This leeway for action should not be confused with another margin of manoeuvre that arises during the activation process: when the IR (specific regulation) is activated (and not the leeway for action), but in a diverging way that alters the purpose of the IR. This is the case when public policies are activated by and favour actors who were not initially expected to be beneficiaries of protection or support.

> For example: Once they have settled in an area, new suburban inhabitants may activate a land-use policy for the protection of rural areas against settlement, commuting traffic, paving over, etc. In such cases the policy that would have previously prevented their settlement is now activated to maintain privileges. Even if implemented, the target is missed.

The fact that the influence of the leeway for action varies according to the regime type is important. The influence of the leeway decreases gradually with the increase in the level of integration (see Figure 8). This interpretation has been described as intrinsic to the IR definition. However, its conceptualization and observation in the field is an important step for understanding how actors play with it. Accordingly, the consideration of the IR without a margin for manoeuvre would appear to be highly problematic (beyond the ideal type of the integrated regime).

Definition of the LRA

The distinction between predefined rules and implemented regulations is a traditional one: lawyers differentiate between *decisions* and *rules*; resource economists between *institutions* and the *rule-in-use*; and institutional economists between the *institutional environment* and the *institutional arrangement*. In the IRR framework, the *local arrangement* is conceptualized first, then the *regulatory arrangement* and then other types of *arrangements*. The *local regulatory arrangement* (LRA) is the label most commonly accepted today.

These different terms do not encompass the same definition. In a pragmatic way, the LRA takes all arrangements that are used to regulate uses of the goods and services provided by the resource under investigation into consideration. This means that all results of the activation process are taken into account. It includes the activation of the IR (resource-specific) and activation of the leeway (not resource-specific) (Figure 11). Hence, not every use-right documented within the LRA is based on the IR.

In accordance with Figure 8, in the case of a complex regime, the LRA will be influenced mostly by the IR when, in the case of a simple regime, the LRA will depend mostly on the leeway for action.

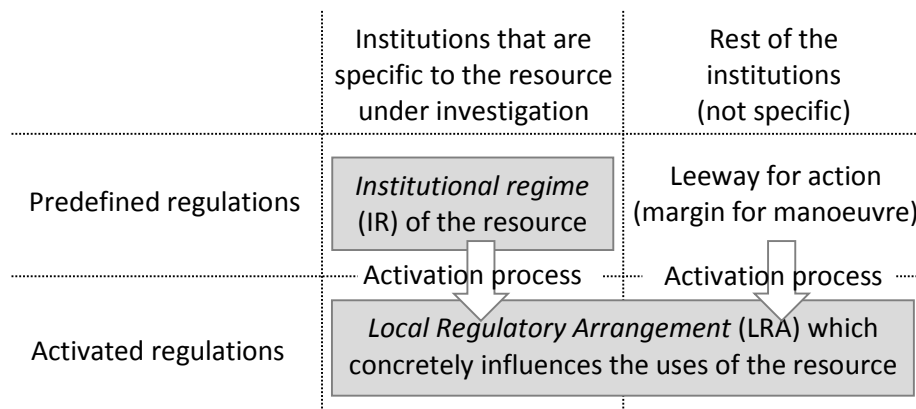|	Institutions that are specific to the resource under investigation	Rest of the institutions (not specific)
Predefined regulations	*Institutional regime* (IR) of the resource	Leeway for action (margin for manoeuvre)
	Activation process	Activation process
Activated regulations	*Local Regulatory Arrangement* (LRA) which concretely influences the uses of the resource	

Figure 11: Definition of the LRA in relation to IR and the leeway for action

About the causal relation between IR type and sustainability

The IRR framework was originally developed to tackle the question of the regulation necessary to achieve the sustainable management of natural resources. For a long time, the central hypothesis of the IRR framework assumed a causal relation between the integration of the IR (in terms of high extent and coherence) and the sustainable management of the resource. This direct link has since been dismissed based on the complex nature of reality. Nevertheless, gaps and inconsistencies in the IR have been repeatedly identified as opportunities for unsustainable activities. Thus, although the hypothesis appears to be too deterministic, it cannot be rejected out of hand and should be refined.

In fact, predefined use rights (within the IR) do not necessarily have an impact on resource use because actors only activate selected elements of the IR. In addition, as presented above, the IR may be activated in an unexpected way if actors re-interpret and alter it to support their interests. Thus, the hypothesis should focus instead on a causal relation between the LRA (post-activation) and the sustainability of the uses made of the resource.

We have seen that the LRA includes also use rights arising from the activation of leeway for action (outside the IR). Actors may use this leeway for action positively (to regulate uses and improve the regime) or negatively (to circumvent the regulation), and thus enhance or endanger the sustainable management of the resource.

One assumption here is that the deliberate regulation of the uses (based on various types of institutions) is a necessary condition for the sustainable management of the natural resource. This management is also necessary due to the evolution of resource use. Some uses fall into disuse without putting the renewability of the resource at risk while new uses appear simultaneously. This dynamic generates trade-offs, including and excluding users (consumers or producers). Thus, the central issue behind the question of the sustainability is that concerning the renewability of the resource. If a use (or uses) put it at risk, then the entire range of uses of the goods and services produced is endangered. The management of such rivalries is absolutely crucial here.

This raises the question of the consumption of non-renewable resources on a human timescale. We consider them as a stock (e.g. oil, minerals, etc.) rather than a flow (e.g. aquifers, forests, etc.). Can the management of a stock be sustainable? Is it not smarter to consider it as an ongoing process of arbitration within an allocation process? Each unit consumed is gone and increases scarcity. This is a distribution rather than sustainability issue, and is based on ethical criteria rather than environmental ones. This question is an open one, but the relevance of an IRR analysis remains. The adoption of an ethical or environmental point of view alters the interpretation of the results, but not the institutional mechanisms documented.

Part II: A Field Guide to the IRR Framework

In Part I, we presented three points of access to the IRR framework: from the institutions to the field; from the field to the institutions, and the mixed approach (back and forth) (see section "*How it works*" above). We decided only to present the latter approach here as it appears to be the most productive across a broad analytical spectrum. Based on our step-by-step presentation, the researcher will have no difficulty in adopting a more top-down or bottom-up approach. Before presenting it, we question the definition of the object under investigation and highlight various practical applications of the IRR framework. We then discuss the need to define a level of analysis before presenting some basics in relation to methodology.

Defining the research object

Resources are the traditional objects of analysis and thus need to be clearly identified. The IRR framework was originally designed to explain how natural resource management influences sustainability. It was subsequently applied to less materialized natural resources (air, landscape, etc.), to manufactured resources (infrastructure, collective housing, etc.) and, finally, to social resources (information, heritage, etc.). To what extent are these objects resources? It is necessary to answer this question to justify the use of the IRR framework. This is also an important preliminary step in the analysis of traditional tangible natural resources as their definition is not self-evident either.

Application of the IRR framework to various types of resources

> *For example: When the research question concerns the issue of deforestation, an explicit definition of the resource 'forest' is required. A wooded area and a legally defined forest area may be dissimilar.*

More recent applications of the IRR framework focused on inter-resource services (environmental services) and on activities that rely on more than one resource (use of land and water in mining activities). Although the analysis is activity-centred rather than resource-centred, the IRR framework has been successfully applied here (see next section: *"Various applications of the IRR framework"*). The object of analysis (the resource or the activity) must be clearly defined in these cases, however.

Recent activity–centred applications

Some expertise is required to formulate a clear definition of the object under investigation. Hence, it is perfectly normal to have trouble with this at the very beginning of a research project. The definition of the research object can be considered as a preliminary output of the research itself.

Definition of the research object as part of the analysis

The definition process can be initiated from the text or the field based on the different points of access provided by the framework:

How?

- From the text (top-down): the researcher identifies the interconnections between the policy processes and current issues to show how the resource/activity is (or has been) publicly defined (or eluded).
- From the field (bottom-up): the researcher documents the evolution of the resource uses (new and abandoned) to outline the resource/activity 'in-use' as defined from a socio-economic perspective.

A combination of the two would obviously solidify the definition.

Various applications of the IRR framework

The IRR framework has been used in multiple ways. Two typical applications are: (1) the spectrum of all the uses of one resource and their regulation and (2) the assessment (*ex post* or *ex ante*) of the impact of a new activity on pre-existing uses and their regulation.

Spectrum of all uses of one resource and their regulation

Numerous institutions limit the use of the goods and services of a single resource. The IRR framework clarifies the institutional complexity of their interconnections. This practical use can support environmentalists and practitioners in monitoring this complexity when producing recommendations for the management of the resource.

The challenge behind this application of the IRR framework is to guarantee the sustainability of the existing uses without putting the renewability of the resource at risk. This is at risk when the bio-physical state of the resource or the socio-economic uses made of it change (drought, scarcity, population increase, etc.). In such situations rivalries (re)appear between uses and adaptations are required. A perfect understanding of the institutional complexity is crucial here to enable effective recommendations to be made.

Effects of a new activity on existing uses and their regulation

When a new activity arises, other uses of a resource may be affected positively or negatively. In such situations, it is necessary to know how the existing regulations will influence the emerging use (or not). Changes ((re-)distribution of use rights, new procedures, etc.) may be required which will interact with the existing regulations. Here, again, a clear understanding of the interconnection between institutions is necessary for the production of effective management instruments.

The analysis of all affected uses involves the consideration of multiple resources. Thus the analytical reference point is not the totality of uses of a single resource (as is usual with the IRR approach), but all of the uses affected by the activity (see Figure 13). Hence, this practical application of the IRR framework cannot assess the management of the resource but only that of the activity.

This application can be seen as an institutional impact assessment and is useful for either the authorities, who must adapt the regulations, or the promoters of the new activity, who try to anticipate potential sources of opposition. Promoters often propose agreements to rights-holders with a view to alleviating rivalries. By doing this, they avoid their regulation by the authorities and develop the LRA themselves.
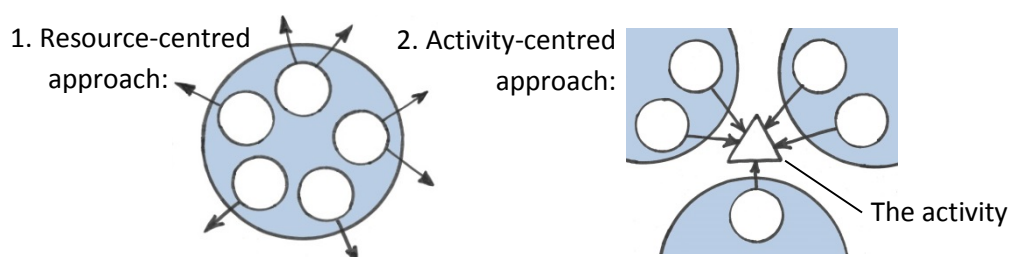

Figure 13: Two practical applications of the IRR framework

Defining the level(s) of analysis

Regulations are observed at all levels from international to local. The challenge is to determine which levels are relevant to the analysis. The multilevel governance literature stresses the interdependence of the various levels. This is essential in non-centralized countries where sub-national units might produce their own regulations (i.e. in federal states). In reality, responsibility for the multiple uses of a resource may be distributed among various levels and actors.

For example: Water rights for irrigation may be a matter of municipal responsibility, while flood prevention is a regional one and the allocation of licenses for hydropower production is a national one. Thus, multilevel coordination is needed to manage the interdependences of a river that provides all of these services.

The IRR framework provides a systematic approach. After inventorying the uses, users and regulations (see section *"Step-by-step application of the IRR framework"* below), it is essential to clarify the distribution of responsibilities. The hierarchical relation between the levels may be explicit here or, conversely, vague or even incoherent. Some local authorizations may even be illegal in terms of the nationally applicable rules. The IR shown Figure 14 below is composed of interdependent sub-regimes.

This question concerns the scope of the research: Is the analysis of the local regime relevant to an understanding of the resource use, or should it take regional, national, and international levels into consideration? The answer depends on the object under investigation. It is useful to establish a general overview first and then focus on the most relevant level. It is essential to understand how actors activate and enforce the various levels of the IR. It is also important to identify possible implementation gaps between the IR and the LRA. Unexpected activation strategies could emerge that involve the circumvention of one level and activation of rights from other levels.

Figure 14: Various possible levels of analysis
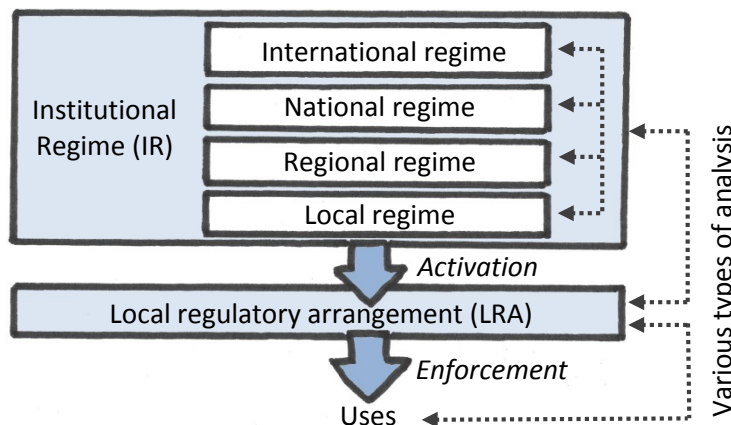
The targeting of the study is essential as it defines the level of analysis which is important for comparison. Nevertheless, it may be inappropriate to compare different cases which encompass various levels. To control the variation between cases here, we recommend that only the same level(s) be compared so that all of the compared cases have the same *unit of analysis*.

Some methodology basics

In this brief section, we present some very basic elements of methodology for practitioners and researchers who are not familiar with methods in the social sciences. The aim here is not to provide a course in methodology but to prevent the use of misleading approaches in the initial stage of application of the IRR framework. A research design that is developed initially in a coherent way can be further refined (or adapted) at a later stage, if required.

The first challenge for the researcher is to formulate a general research question which answers other sub-questions: What is the issue? What is the scope of the research? What is the expected output (descriptive, explanatory, prescriptive, or prospective)? In summary, a good research question provides information and defines the approach.

To justify the use of the IRR framework the research question should partly match the purpose for which the IRR approach was designed (and mostly used): *explaining the institutional complexity of (natural) resource management and proposing institutional adaptations.*

The approach proposed by the IRR framework is a systematic in-depth analysis of institutional complexity from a qualitative perspective. A robust qualitative analysis is not merely an interpretative discourse, it is based on strong data that provide evidence in complex multifactorial situations. The use of quantitative data sets may provide an efficient contribution, however purely quantitative analysis is not relevant to the application of the IRR framework.

Qualitative case studies are recommended when the object is difficult to distinguish from its context. This occurs when the researcher wishes to unravel the institutional complexity which hinders (or boosts) the effect of a regulation relating the use of a resource. Comparison makes it possible to test the hypothesis and provide explanations and not just describe the complexity. Hence, comparative research design is frequently used with the IRR framework for the identification of solutions.

Different variables need to be presented based on the first draft of the research question:

- The *dependant variable* is what the researcher wishes to analyse (variable to be explained). It features in the research question.
- The *independent variables* are the elements that the researcher will use to provide an explanation (explanatory variables).

In the case of the IRR approach, the independent variables are: the institutions and their interconnections; the actor configurations and their action resources. They are analysed either as static elements (snapshots of the predefined rules of the game, actor configuration and action-resource endowment) or dynamical ones (rules activated by some interacting actors using mobilized action resources).

Once the researcher has a precise research question that justifies the use of the IRR approach, the different pieces of the research design can be put together. If they do not fit perfectly like a puzzle, further refinement is necessary. Its formulation is a repetitive refinement process.

Step-by-step application of the IRR framework

Although analysts tend to root their application of the IRR framework within a bottom-up or top-down approach, the mixed approach presented above is the easiest and most commonly used. In this guide, we consider this as a practicable and recommendable point of entry to the IRR approach, in particular for the first use of the framework. This step-by-step process can be divided into four successive phases: the exploratory, descriptive, explanatory and prescriptive phases.

I. Exploratory phase

In this phase, the researcher sketches a broad initial overview with a view to framing the issue at stake, defining the resource and identifying the users. Data collection is carried out through field visits and document analysis.

Step 1

Inventory of uses

The researcher observes and inventories all of the resource uses. S/he begins by listing the goods and services produced by the resource. S/he then links them to the observed uses. Some goods and services will be linked to more than one use and this may generate complementarities or rivalries between uses (Figure 2). Other goods or services are not used by humans but contribute to ecosystem services (biodiversity, nutrient cycles, etc.) and are thus important for human well-being.

Step 2

Inventory of users

The researcher inventories the users involved in various real cases. Their identification is particularly important when rivalries and complementarities are observed. *Promoters, opponents* and *third-parties (winners or losers)* should be identified. Each should be associated with their use rights (owners, beneficiaries of public policies, etc.). In the case of ecosystem services, indirect users and their use rights should be identified.

Step 3

Inventory of responsibilities

The (public) authorities often play the role of regulator: by predefining rights and procedures; by distributing permits, bans, limitations, incentives and derogations; and, finally, by facilitating arbitration when rivalries occur. Thus, even if concurrent responsibilities are often observed, the allocation of responsibilities is crucial for determining the role of the different authorities. The clarification of the distribution and extent of the respective responsibilities is essential here.

Step 4

Inventory of regulations

The researcher inventories the existing regulations governing the identified uses. The predefined regulations (in the texts) and activated rights (observed) are identified.

Step 5

Definition of the resource (or activity)

Based on these inventories, the researcher defines the object of the investigation: 'his/her' resource or 'his/her' activity. This definition limits the field of research and may require the further refinement of the research question.

II. Descriptive phase

This second phase begins with the selection/exclusion of cases from the perspective of the defined research design and based on the initial exploratory phase. Once the cases have been selected, the researcher must don sturdy boots and embark on data collection!

Step 6

Based on the perception of reality by local actors (local stories) and legal records, the researcher reconstructs the historical evolution of the resource management (changes in regulations, the emergence of newcomers, etc.). By carrying out multiple interviews and comparing different perceptions, the researcher then compiles a detailed description of the successive stages of each case study. This formulation of a storyline, including multiple interpretations, is essential to understanding the local context. Not only changes should be documented, but also failed amendments, the exclusion of actors, etc.

Reconstruction of local stories

Step 7

An initial description of the institutional regime (IR) is drafted at this stage, which presents the regulation of all of the identified uses and the interconnections between them at a given moment (current or for each stage). This spectrum is merely an overview, which is based on the previous steps, and will be further refined in the subsequent steps.

Description of the IR

Step 8

The local regulatory arrangement (LRA) is identified on the basis of the use rights actually activated by the actors. The researcher can decide here to focus on only one LRA at a given time or on the succeeding LRAs over time, based on the local stories formulated by Step 6. The LRA presents the solution established at a given moment (current or for each stage). To document it/them, the researcher tries to access the related documents (if any), e.g. licenses, agreements, decision, permits, etc.

Identification of the LRA

Step 9

The researcher identifies the action resources mobilized during the activation process by each identified actor, which concluded in the LRA (based on the list provided in the section *"The actors' action resources"*). It is also interesting to document cases involving the non-mobilization of resources (passivity).

Identification of the action resources mobilized

Step 10

Based on the description of the IR and its activation in the form of a LRA, the analyst should be able to identify gaps and inconsistencies within the IR. This is part of the refinement of the description of the IR. To carry out a systematic investigation, the researcher should describe the five subdimensions of the two attributes (see section "*Use rights, influences and interactions*"):

Identification of gaps and inconsistencies in the IR

- *Absolute extent*
- *Relative extent*
- *Internal (in)coherence of the ownership rights system*
- *Internal (in)coherence of the public policies*
- *External (in)coherence*

III. Explanatory phase

This phase consists in the interpretation of the data collected in the previous phases. It may raise new issues that can be clarified by re-contacting the interviewees. This triangulation process will improve the quality of the data and avoid any misleading interpretations.

Step 11

The gaps and inconsistencies identified and listed in Step 10 should now be explained. It is necessary to understand why gaps and inconsistencies exist and whether the actors use them opportunistically. The process can be developed extensively through the historical description of the policy process showing who influenced the distribution of use rights and how.

Step 12

Gaps between the expected implementation of the IR and the observed LRA are listed and explained. This step should not be confused with the identification of gaps within the IR (Step 10). It is crucial here to understand the activation process that culminates in the LRA. Who mobilized which resource(s) to activate which right(s)? This step is a refinement of Step 9, which takes the fine-tuning of Step 11 into account. The researcher may identify surprising circumventing or distorted activation strategies here.

Step 13

Once the complexity of each case is understood, the researcher can compare cases and look for regularities or divergences. The comparison of various cases within the same IR (in the same region at the same period of time) is the easiest option. An alternative is to compare various IRs (and related LRAs) in different contexts. The explanatory capacity of the latter is lower, however, because many contextual factors need to be controlled.

Step 14

The researcher produces a fine-tuned description of the resource IR and shows how it influences the LRA which ultimately influences the use of the resources based on the output of Steps 9 and 11. This is highlighted by the regularities and divergences identified in Step 13.

Step 15

The researcher describes the activation strategies of different actors and shows how they influence other uses of the resource. The distinction between direct substantive strategies (i.e. the access to the resource) and indirect procedural strategies (i.e. action resources management, influence on policy processes and institutional modifications) is crucial.

IV. Prescriptive phase (optional)

Depending on the purpose of the research (basic research or commissioned research), the researcher may make proposals for adapting the IR. Too often, recommendations are made without a clear understanding of the institutional complexity and then create additional inconsistencies, which predatory actors may exploit strategically. Thus, it is essential to base any recommendations on the three previous phases.

Step 16

Scientifically valid recommendations must target the adaptation of independent variables: actor constellation, distribution of use rights or action resources to be mobilized.

First, uses that are not associated with use rights or direct users should be revealed. The absolute and relative extent attributes present a clear picture of this (Step 10). A repetitive situation concerns the ecosystem services that tend to be ruled out of the regime due to the absence of direct users in the regime: this is the *tragedy of the ecoservices*.

Second, misfits in the distribution of use rights create situations in which institutions fail to frame the conflicting human interactions efficiently. This is documented in the analysis of the attribute (in)coherence (Step 10). This situation reflects existing power relations that must be taken into account to avoid making naive recommendations. For example, the redistribution of substantive use rights is often ineffective and the adaptation of procedures is more appropriate.

Step 17

Recommendations may be tested with identified actors. The idea is to assess the feasibility of the adaptation (i.e. whether it is enforceable or not) and to appraise the expected outcomes in relation to the sustainability of other uses. Various practical tests are possible: bilateral exchange, participatory panels, simulation games, computer modelling, etc. The choice of methodology to be used depends very much on the available skills and resources.

Finally, the recommendations should present the various options and the results of the test. This kind of transparent communication supports and legitimates the priority given to a particular solution by decision makers. Conversely, the presentation of only one recommendation calls for alternatives and may reopen the discussion. In this prescriptive phase, unlike researcher who stands outside the game, the expert becomes an actor who is part of it.

Identification of misfits based on extent and coherence attributes

Testing and presenting the recommendations

Practical toolkit

To help the researcher we present some templates below which can be used in the different steps. For example, the case presented in italics in the following tables is a simplistic fictitious example of rival uses of the resource land. Its purpose is to illustrate possible content for the tables.

Table 1: Exploratory inventories

Research question: *To what extent can the licence allocation process contribute to the sustainable management of resource xyz in a remote area with conflicting interests?*			
Resource definition: *resource xyz (underground minerals, forest, etc.)* [Alternatively: Activity definition: *activity xyz (mining, logging, etc.)*]			
Inventories relating to the resource			
Goods and services	Uses observed	Users	Use rights
Good 1	*Local transformation of good 1*	*Local processors*	*Local customs recognized as a fundamental right*
	Withdrawal and export of good 1	*Exporter and traders*	*National licence*
Good 2	*Production of local medical treatment*	*Shaman*	*No*
...	*...*	*...*	*...*

Tip:

- A useful preliminary exercise is to map the uses. These can be represented in various ways: geographically, economically (supply-chain), administratively (competent administration), socially (social interaction mapping), etc.
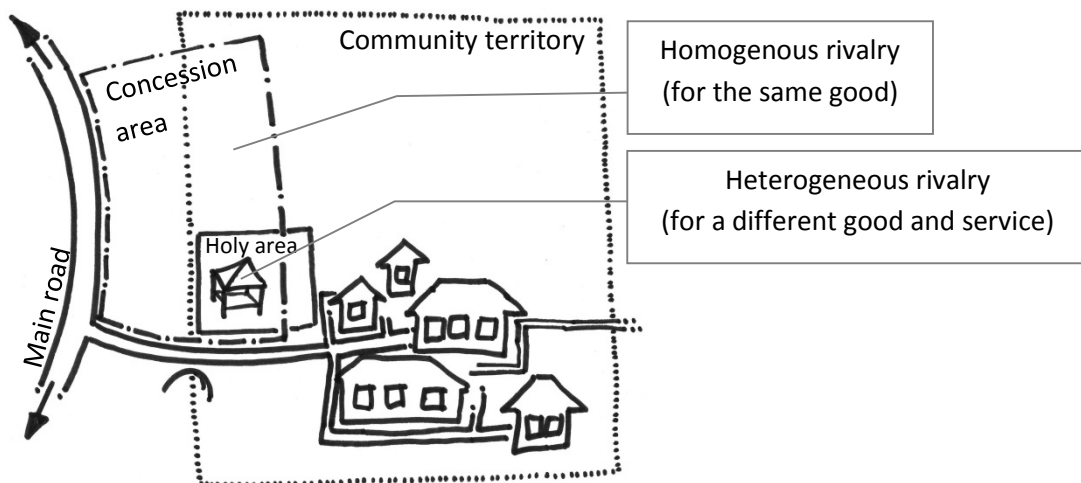

Figure 13: Example of the mapping of a simplistic case

Table 2: Inventories of use rights

Use rights	Rights holders	Arising from public policies	Arising from ownership	Activation to influence the LRA
Local withdrawal according to local customs	*Locals (as members of a recognized community)*	*Fundamental right of local population recognized under agrarian law and the constitution*	*No ownership title*	*Yes*
Operating permit	*Permit holder*	*National and regional regulations on resource management. Conditions for obtaining an operating licence listed*	*Licence is considered as a temporary ownership transfer in the Civil Code and includes use and disposal rights.*	*Yes*
Sampling of leaves, roots and bark in a holy area	*Shamans and bereaved families preparing a ceremony*	*Informal local customs around a defined holy area (without formal recognition)*	*no*	*No*
…	*…*	*…*	*…*	*…*

Tips:

- Various versions of tables 1 and 2 should be compiled with different research questions or different resource/activity definitions. The researcher can then compare them and select the best option.
- Various versions of tables 1 and 2 should be presented for each stage of the process in order to highlight the historical changes (to be understood) in each column.

Actors	Portfolio of available action resources (static endowment)	Mobilization (action resources mobilized in the activation process)	Management (action resources exchanged, produced, etc.)
Local communities	*Law, information, time, political support*	*Information, political support*	*Exchange of time for money* *Obtaining additional political support*
Exporters	*Law, money, organization, infrastructure*	*Money*	*Exchange of money for time (no delay)*
Shaman	*Information, consensus, time*	*-*	*-*
…	*…*	*…*	*…*

List of action resources available and mobilized by each actor

Table 3 is based on the action resources presented in section *"The actors' action resources"* above and summarized in the list below:

Actor: *local communities*	In portfolio	Mobilized
Law (legal resource)	☑	☐
Personnel (human resource)	☐	☐
Money (financial resource)	☐	☐
Information (cognitive resource)	☑	☑
Organization (interactive resource)	☐	☐
Consensus (confidence resource)	☐	☐
Time (temporal resource)	☑	☐
Infrastructure (patrimonial resource)	☐	☐
Political support (majority resource)	☑	☑
Force (violent resource)	☐	☐

Table 4: Various local stories (who did what and how?)

Actors	Actions	Action resources mobilized	Rights activated
Local community	*First, the local community alert the media with support of NGO about the threat to their holy area (used by the shaman).*	*Mobilization of information and organization in order to obtain political support.*	*No*
	Second, the local communities consider raising the question of its recognized customary rights in court.	*Mobilization of law and time to obtain compensation*	*Pre-activation of the recognition of customary rights under agrarian law and the constitution*
Local parliament	*Politics requested a suspension of the licence to conduct further research and assess the risk of destroying the heritage*	*Mobilization of law to obtain consensus*	*Heritage protection act*
Operating and exporting company	*Under pressure from the traders, the exporter agreed to pay generous compensation to local communities and implement preservation measures in exchange for the non-contestation of the validity of the license by the communities*	*Mobilization of money to obtain consensus*	*Licence obtained*
Shaman	*Did nothing, but was observed generating interest around his/her practice of customary medicine*	*No*	*No*
...	*...*	*...*	*...*

Open issues around the application of the IRR framework

The recent and ongoing applications of the IRR framework and current discussions within the IRR community highlight open issues for discussion. Nowadays, these concern the application of the framework in other contexts and the most appropriate level of analysis.

Application of the IRR framework in other contexts

As outlined above (see section *"Roots of the IRR Framework")* the IRR framework was designed to explain the institutional complexity of natural resource management in continental Europe. The extension of this field of application to developing countries and common law systems is raising certain questions.

The relevance of focusing on predefined public policies and ownership rights is not obvious in developing countries where the direct influence of formal institutions on resource use is limited *a priori*. Case studies have shown, however, that local populations are well aware of the development of formal regulations that reduce their margin for manoeuvre. It appears that informal institutions act in a wider context, 'in the shadow of the law'.

> *For example: Customary forest management in Indonesia is based on informal use rights which are adapted in response to legal changes. Hence, regulations have an indirect influence on local uses.*

The explanatory capacity of the IRR framework is limited, however, and it does not identify all the relevant institutions that can explain resource use. Without dismissing the IRR framework, this comment calls for interdisciplinary collaboration. The IRR framework could provide a piece of the puzzle and *vice versa*.

In common law countries with few substantive codified public policies, the central focus of the IRR on the interconnections between ownership rights and public law could appear misleading. Our response to this charge is that the IRR fundamentally questions the influence of the institutional context (exogenous regulations) on local activation (LRA). This remains relevant, because jurisprudence is also a codification of the public law which frames property. In summary, the same interconnections arise as is the case with civil law.

In addition, public law imposes principles, procedures and sanctions (constitutional, administrative and criminal provisions) which frame public and private actions. The central issue remains that of understanding and explaining how the different types of institutions influence resource use.

Legal developments in continental Europe (civil law context) reveal the emergence of new hybrid institutions (e.g. negotiation in the implementation of public policies, unbundling of ownership rights, etc.). These are empirically rooted (bottom-up) and attempt to go beyond the rigidity of the codification. In common law countries, a gradual codification is emerging through collections and compilations of jurisprudence. These generate a predefined corpus of rules, which reduces uncertainty. As a result, the portrayal of a diametrical opposition between two ideal types appears outdated and counterproductive. Some scholars describe this situation as distinct stages in two gradual development processes, which now tend to be less divergent (and possibly even convergent).

The main element that justifies the application of the IRR in a variety of contexts is that this framework enables the detailed and accurate operationalization of the institutional context in which activation takes place. Unlike other

frameworks, the IRR approach makes it possible to step back from the local level (endogenous use rights) and highlight the influence of the community (exogenous regulations). A key message is that the activation of use rights never takes place in a vacuum. Understanding and explaining this is a key challenge in the context of proposing fine-tuned resource management instruments.

The IRR framework has been recently - and is being currently - applied in common law countries (New Zealand and Malaysia) and developing countries (Indonesia, Ghana, and Peru). Further conceptual developments are expected.

Between the local and the global: which matters?

We have discussed the difficulty the researcher faces in targeting the relevant level(s) of analysis. Ideally, they should all be studied, i.e. from international to local level. For practical reasons, this is often impossible, however. The issue of targeting is discussed in this section.

Focussing exclusively on international regimes is problematic as their effects are often indirect. Depending on the national legal system, international agreements must be transposed in national law (or not). This 'translation' process takes place in parliament or through a government statement. Once ratified, the international principles need to be substantiated in measures (decrees, ordinances, etc.) to create the associated use rights. The latter need to be implemented so that they can be activated by the actors and, finally, to have an impact on resource use. This trickle-down effect should not be viewed as a mechanical process, but as policy processes that are influenced by actors. Hence, it is not surprising that a vast gap can be observed between the international IR and the LRA. An understanding of intermediary influences is needed to understand this. While focussing on the international level alone is relevant, however, from a political science perspective (to understand power relations between actors in the same arena), it is not relevant for explaining concrete changes in resource use.

Because of the interest of the IRR community in real resource use and the actual (absence of) effects of regulations, priority has been given to the local context in the majority of applications. The reason is practical: the gap between the local IR and the LRA is closer and easier to explain. Nevertheless, the extension of the field of research is necessary in most cases for two reasons. First, the national and sub-national levels establish the legal basis for the local interventions. Local elites rely on them to legitimize their actions. Second, local actors are generally well aware of the formal IR that restricts local actions (often to a greater extent than expected by the researcher). When the LRA transgresses the IR, this is often done deliberately. Sometimes the IR is not implemented, however, and merely exists as a principle without producing any rights or obligations to be activated.

The ideal targeting of the study is case-specific, but it is generally multilevel. This is a challenge for comparative research between various contexts as the research unit may vary. However, the IRR framework is intrinsically a locally rooted approach.

Example of application 1: Various institutions for the regulation of one use

The case of groundwater protection in France

In continental Europe, a large proportion of the public water supply comes from the groundwater (springs and wells). In such cases, land use in the water recharge area influences the water quality in the catchment. In the best cases, the water is pure enough to be piped without treatment, thereby reducing the cost of the water supply (purification).

In France, the water supply is the responsibility of the municipalities. Since the Water Act of 1964, three protective zones must be mapped in the recharge area of a water catchment: immediate, close and broad perimeters. The Code of the Environment requires that a Declaration of Public Utility (DPU) granted by the prefect (state representative at department level) for each catchment. Based on hydrogeological appraisal, the DPU specifies the land use limitations and prohibitions to be implemented in easement areas. This means that each catchment has its own specific regulation and that the plots within it are burdened by easements.

The implementation of DPUs in all catchments in France has been a national priority since 2004. In 2009, 45 years after the enactment of the mechanism, fewer than 60% of the groundwater catchments had a DPU. Hence an implementation gap can be observed in over 40% of cases.

Case studies revealed the incapacity of the mayors to enforce the easements (if any) and, as a result, the existence of regular quality issues and high costs in relation to the water supply. It appears that this is basically an institutional issue. Easements on ownership titles are very robust institutions, however they are also very rigid. Thus, rapid changes in use on the ground and periodic adaptations of quality standards make easements an inappropriate instrument. Administrations focus on a quantitative indicator (targeting 100% of catchments with a DPU) rather than water quality. This creates a misfit with the health policy objectives of the Water Act.

Comparisons show how, in another context, easements (case specific) have been abandoned in favor of public law instruments (general and abstract) with a view to solving a similar problem. The French Roman law context attaches a lot of importance to property, however, and public policies tend to be seen as soft constraints on the ground. When faced with the robustness of the ownership rights and weakness of the public policies, water actors promote the use of contracts between themselves and land owners. The study revealed that this issue is misleading due to the further loss of legitimation of the policies (polluter pays) and due to procedural factors that make such public payments (state aid) illegal in the European context.

Based on these explanations, the only practicable solution appears to be the strengthening of public policy implementation. This requires the activation of practical support and sanctions at local level. It would involve a shift in the national water regulation by allowing the use of alternatives to the easements. The solution would be more flexible but enforceable.

de Buren, G. (2011) La régulation des interdépendances entre la forêt et l'eau potable en France, *Working papers de l'idheap,* no 6/2011.

Example of the application 2: Activity-based approach (impact assessment)

The case of deep geothermal exploration in rural Switzerland

The earth is naturally warm and the temperature increases by an average of 3° C per 100 m. Drilling to depths of over 3000 m provides access to a constant source of energy. The idea is to inject cold water to heat enough water for the generation of electricity. However, this requires deep rock fracking operations to create an artificial underground heat exchanger (small cracks) where water will heat itself up to a temperature of 100° C. This operation generates small-scale earthquakes which have provoked opposition among the populations in previous urban areas experiments.

Potential and limits of a new source of energy

A geothermal exploration consortium recently decided to carry out a new experiment in a Swiss rural area (to limit the potential for opposition). Public administrations were faced with the challenge of regulating an unexpected new activity that could affect pre-existing uses. The issue was to determine how to regulate the new use and assess the institutional impact of this development in the area of use rights. This was the brief involved in the study mandate.

Emergence of an unexpected use to be regulated

The Swiss Civil Code grants full ownership to the owner of a plot of land to everything that can be accessed above and below ground (principle of accession), as long no limitation applies under public regulations. The deep underground is not covered by this principle, however, and is considered as 'nobody's property' (*res nullius*) for which the state is responsible. Various public policies interact in this area and have been analysed: ground water protection, land use planning, mining policy, energy policy, etc. They only regulate traditional geothermal operations (heat pumps) but not deeper exploration. Land use planning alone considers it, but as a special installation subjected to building and operating permits.

Predefined regulations in relation to ownership and public policies

The results of the IR analysis (including a comparative study of other Swiss sub-national regulations) identified two options: either the enactment of a new geothermal exploitation law (on the basis of the Civil Code) or the amendment of the existing mining regulation. Both cases could be implemented through either an authorization procedure (similar to planning permission) or by means of a licence (including a licence fee).

Different way forward, considering IR and the LRA

The different options were discussed with stakeholders and one of them prompted a general consensus: the drafting of a new specific regulation. This proposal avoids the complexity of policy coordination and balances the various interests (promotion and monitoring). Responsibility for the area would be located at cantonal level (sub-national) rather than municipal level. In addition, mandatory monitoring and clear procedures (financial, environmental, security requirements) were proposed. The procedural recommendations include the compulsory establishment of the statutory company in the municipalities (for fiscal and accountability reasons).

Proposal to modify the IR with concrete framing of the LRA

Knoepfel & Barras (2014), La politique de la géothermie du canton du Jura: analyse et projet de loi. idheap - Université de Lausanne, Lausanne [unpublished]

Reference

References

Essential reading

Proposed additional reading for a more in-depth exploration of the scientific discussion:

Gerber, J.-D., Knoepfel, P., Nahrath, S., & Varone, F. (2009). Institutional Resource Regimes: Towards sustainability through the combination of property rights theory and policy analysis. *Ecological Economics*, 68(3), 798–809.

Most cited article

Knoepfel, P. (2007). Environmental Policy Analyses: Learning from the Past for the Future – 25 Years of Research. Berlin: Springer.

Chapter 15 presents the essential elements of IRR

Nahrath, S. (2003). La mise en place du régime institutionnel de l'aménagement du territoire en Suisse entre 1960 et 1990. Chavannes-près-Renens: idheap.

A PhD thesis which establishes and incorporates the key concepts of the IRR framework

Aubin, D. (2007). L'eau en partage : activation des règles dans les rivalités d'usages en Belgique et en Suisse. Bruxelles: P.I.E. Lang.

Book based on a PhD thesis which explores the question of IRR activation

de Buren, G. (2014) La gestion des services environnementaux ; entre règles et régulations négociée, Lausanne : idheap - Université de Lausanne

A PhD thesis which investigates the margin of manoeuvre available to actors in various contexts

References used in this text

This text is intended to take the form of a popular manual rather than a scientific paper. For this reason the references and citations has been limited as much as possible. This omission is rectified by the references for essential reading provided above. The following references are used in this text:

Bardach, E. (1977). *The Implementation Game: What Happens After a Bill Becomes a Law*. Cambridge Massachusetts: MIT Press.

Bromley, D. (1992). The commons, common property, and environmental policy. *Environmental and Resource Economics*, 2(1), 1–17.

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North, D. (1991). Institutions. *The Journal of Economic Perspectives*, 5(1), 97–112.

Scharpf, F. W. (1997). *Games real actors play: actor-centered institutionalism in policy research*. Boulder Colorado: Westview Press.

Williamson, O. (2000). The New Institutional Economics: Taking Stock, Looking Ahead. *Journal of Economic Literature*, 38(3), 595–613.

Appendices

List of IRR applications

The IRR framework has been used in the study a variety of topics based on numerous in-depth case studies. The list provided below presents a non-exhaustive overview of the different contributions. Many of them consist in thematic research on resource management and in conceptual inputs into the development of the framework. The research was conducted in the context of research projects, commissions and PhD studies. Synthesis and theoretical/conceptual contributions are not listed here. In many cases, multiple in-depth case studies were carried, however we do not list them here.

Country Abbreviations: BE – Belgium ; CA – Canada, CH – Switzerland, ES – Spain, FR – France, GE – Germany, ID – Indonesia, IN – India, IT – Italy, MA – Malaysia, MX – Mexico, NL – Netherlands, UK – United Kingdom

Resource under investigation	Author(s)	Years	Scope (unit of analysis)	Country (-ies)	Published	Language of publication	Ph. D. research	Comments
Wildlife	Nahrath	2000	National + sub-national comparison	CH	☑	EN	☐	Wildlife as a common resource
Soil	Nahrath	2000-2004	National + sub-national + local comparison	CH	☑	FR	☑	Historical screening (1870-2000) and case studies
Water	Reynard, Mauch & Thorens	2000-2004	National + sub-national comparison	CH	☑	FR EN	☐	Historical screening (1870-2000) and case studies
Forest	Bisang	2000	National screening + sub-national comparison	CH	☑	GE	☑	Historical screening (1870-2000) and case studies
Landscape	Bisang, Nahrath & Thorens	2000	National + sub-national comparison	CH	☑	FR	☐	Historical screening (1870-2000)
Air	Ammann	2000	National + sub-national comparison	CH	☑	GE	☐	Historical screening (1870-2000)
Water bassin	Kuks, Bressers, Varone, Aubin, Larrue, Calvo, Dziedzicki, Verdage, Subirats, Costejà, Font, Dente, Goria, Knoepfel, Kissling-Näf, Mauch, Thorens	2000-2004	International comparison based 12 sub-national cases in six countries	NL BE FR ES IT CH	☑	EN FR	☐	EUWARENESS project: European Water Regimes and the Notion of a Sustainable Status. The aim was to contribute to the implementation of the EU Water Framework Directive

Resource under investigation	Author(s)	Years	Scope (unit of analysis)	Country (-ies)	Published	Language of publication	Ph. D. research	Comments
Water	Aubin	2000-2007	National + sub-national comparison	BE CH	☑	FR EN	☑	Case studies and conceptualization of activation
Water, rivers, air, forests & infrastructure,	Knoepfel, Schenkel &Savary	2000-2007	National overview and local cases	CH	☑	FR, GE	☐	Commissioned study
Geomorpholigical sites	Reynard	2001	Regional case studies	CH	☑	FR EN	☐	Geomorphology as a natural and tourism resource.
Landscape	Gerber	2003-2008	National + sub-national comparison	CH	☑	FR EN	☑	Case studies
Landscape	De Fossey	2002-2004	Regional research	CH	☑	FR	☐	Case study
Urban resources	Nahrath, Knoepfel, Leresche & Da Cunha	2004-2005	Comparison of local cases		☑	FR	☐	IRR framework applied in Agenda 21
Air	Savary	2004-2007	Comparison of local cases	CH	☑	FR	☑	A PhD study investigating the consequences of mobility for the resources air and space.
River	Knoepfel & Schenkel	2006-2008	Regional study	CH	☐	GE	☐	Commissioned study on the correction of the river Thur
Landscape	Gerber, Rodewald & Knoepfel	2004-2008	Comparison of regional cases	CH	☑	FR	☐	Case of regional parks
Housing Stocks (collective housing)	Nicol	2008-2013	Comparison of local cases	ES, CH	☑	EN	☑	Housing stock as a resource. Case studies
Natural spaces	Bonnefond	2006-2009	Sub-national comparison	FR, MX	☑	FR	☑	Study of social regulation modes in various contexts
Housing Stocks	Subirats, Hernandez & Garcia	2009	Comparison of local cases	ES	☑	ES	☐	Housing stock as a resource. Quantitative/qualitative comparison
Housing stock	Hassler, Kohler, Rach & Zak	2009	Comparison of local cases	GE	☑	GE	☐	Housing stock as a resource. Case studies
Infrastructure networks (railway, civil aviation, etc.)	Csikos	2006-2008	Comparison of local cases	CH	☑	FR	☐	Infrastructure as an artificial resource to be managed
Information (memory)	Olgiati	2008-2011	National + sub-national comparison	CH, CA	☑	FR EN	☑	Memory as a service provided by the resource information

Resource under investigation	Author(s)	Years	Scope (unit of analysis)	Country (-ies)	Published	Language of publication	Ph. D. research	Comments
Rural space	Larrue, Bonnefond, Serano, Bressers, De Boers, Knoepfel, Imesch	2009-2012	National + sub-national comparison	FR CH NL	☑	EN FR	☐	The New Rurality project developed the activity-based approach and initiated the conceptualization of the LRA.
Water supply	Bréthaut	2010-2014	Sub-national + local comparison	CH FR	☑	FR EN	☑	International comparison of various governance structures
Forest environmental services for groundwater	de Buren	2010-2014	Sub-national + local comparison	CH FR ID	☑	FR	☑	Comparison of the management of the same environmental services in various institutional contexts
Irrigation, water channels	Schweizer	2010-2014	Local cases comparison	CH	☑	FR EN	☑	Case studies of self-organized resource governance in the Alps.
Climate change adaptation	Dupuis	2010-2014	International comparison	CH IN	☑	FR	☑	Comparison of implementation of climate change adaptation measures in two countries
Urban water systems	Bolognesi	2010-2014	International comparison	GE FR UK	☑	FR EN	☑	Sustainability of urban water system in Europe studied in an institutional economic perspective
Irrigation, water channels	Rodewald	2014	Local case	CH	☑	GE	☐	Case study in the Alps
Railway network	Aubin & Moyson	2011	National overview	BE	☑	FR	☐	Historical screening (since 1832) of Belgian railway network
Underground	Knoepfel, Eisenhut, Laurent	2010-2011	National + sub-national comparisons	CH	☐	FR	☐	Commissioned study on underground regime preliminary to revision of the legislation
Underground	Laurent	2011	National + sub-national comparisons	CH	☑	FR	☐	Underground land use from the perspective of planning
Peatlands	Kumaran	2011-2015	National research	MA	☑	EN	☑	Malaysian policy on tropical peatlands. First application of the IRR framework in a common law country.

Resource under investigation	Author(s)	Years	Scope (unit of analysis)	Country (-ies)	Published	Language of publication	Ph. D. research	Comments
Deep geothermal energy production	Knoepfel	2014	Sub-national	CH	☐	FR	☐	Activity-based approach to IRR used for an impact assessment
Contaminated sites	Dupuis & Knoepfel	2013-2015	Local case study	CH	☑	FR EN	☑	The case of Bonfol chemical landfill
Urban agriculture	Roud	2013	Comparison of local cases	CH	☑	FR	☑	Comparison of success and failure
Urban waste	Boder	2013	National study	CH	☐	FR	☐	Urban waste as a resource
Genetic resources	Winter, Fricker & Knoepfel	2014	International	CH	☑	EN FR GE	☑	Effect of the Nagoya Protocol on the Swiss regime

On-going researches

Country Abbreviations: CH – Switzerland, CO – Columbia, FR – France, GA – Ghana, NZ – New Zealand, PE – Peru

Resource under investigation	Author(s)	Year	Scope (unit of analysis)	Country (-ies)	Published	Language	On-going Ph. D.	Comments
Wine	Laessle	2011-ongoing	National + sub-national comparisons	CH, NZ	☑	FR, EN	☑	How producers create and manage a local resource.
Agrifood supply chainS	Tippenhauer	2011-ongoing	National + sub-national comparisons	CH	☑	FR	☑	How a supply chain creates and maintains a resource
Mining in Peru	Condo	2013-ongoing	National + sub-national comparisons	PE	☐	FR	☑	Mining concessions and minority rights in Peru
Coffee	Dussan	2014-ongoing	National + sub-national comparisons	CO	☐	ES, EN	☑	Colombian coffee management
Mining	Yeboah	2013-ongoing	National + sub-national comparisons	GA	☐	EN	☑	Minerals extraction in Ghana
Wind farms	Blake	2014-ongoing	sub-national comparisons	CH	☐	FR	☑	Air and soil
Genome	Pauchard	2015-ongoing	National research	CH	☐	FR	☑	Genetic resource management

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