Title: Policy Instruments for Integrated Water Governance: Typology and Evaluation

Author(s): Andreas Zysset and Tim Kempter

Abstract

Within the Swiss National Research Program 61, we evaluated and typified sets of policy instruments for integrated water governance in five selected Cantons. Cantons represent federal states of Switzerland with far-reaching competences in water governance. Our comparison may yield interesting results also for an international audience, as the water governance principles laid down in the Swiss Constitution are the same for all Cantons.

Policy instruments may be classified along the following five categories: command and control instruments, economic instruments, service and infrastructure instruments, collaborative agreements, communication instruments.

Our analysis of laws and by-laws in the five selected Cantons showed that command and control instruments and economic instruments are by far the most frequently used policy instrument categories for integrated water governance. In interviews with governmental officers from different water sectors, we tested two hypotheses, namely: (1) a mix of different policy instrument categories is most suited to achieve integrated water governance; and (2) communication instruments are particularly important to achieve integrated water governance. The first hypothesis was confirmed in all interviews; we could however not substantiate our second hypothesis on the special role of communication instruments for integrated water governance. It seems that communication instruments can help transferring the rationale for an integrated approach in an ever more intensive use of water resources; they however do not bring about the balancing between the often conflicting water uses.

We then investigated whether for a specific domain of integrated water governance (in our case: spatial planning in riverine areas), successful policy instruments can be easily transferred between Cantons. We quantified the interdependencies between water and land resources and specific water uses in the riverine areas of the Cantons through cross impact analyses. In doing so, we interpreted the various uses and resources as interdepending variables in complex water governance systems. The resulting cross impact matrices classify the variables according to their specific behaviour in a given Canton into four domains: active, reactive, critical and buffering variables.

By relating the variable behaviour of these four domains to the known advantages and disadvantages of the different policy instrument categories, we can appraise the effectiveness of the different policy instrument categories in governing the various water uses in a specific Cantonal setting. According to this appraisal, the policy instrument categories are especially suited to address the following variables:

- Command and control instruments: active and reactive variables
- Economic instruments: reactive and buffering variables
- Service and infrastructure instruments: reactive, critical and buffering variables
- Collaborative agreements: all variables
- Communication instruments: critical and buffering variables

This approach on testing the effectiveness of different policy instrument categories in integrated water governance is generic and not bound to a certain state or region. It could thus facilitate the analysis of present and the selection of future policy instruments for integrated water governance in different settings. The approach however has to be verified through additional research and application.

Keywords
Integrated Water Governance, Policy Instruments, Adaptive Capacity

Introduction

The results presented in this paper stem from an interdisciplinary research project *IWAGO – Integrated Water Governance with Adaptive Capacity in Switzerland* which was one of 16 projects in the recent Swiss National Research Programme 61 on sustainable water management, running from 2009 to 2012. IWAGO covered different institutional questions within the broad topic of integrated water governance. We understand integrated water governance as the combination of governance, control and coordination agreed among the participating parties and the resultant models of collaboration. The two central research questions of IWAGO were: (i) How can the parties, sectors and institutions dealing with water in Switzerland work better together? How can their adaptability be improved? and (ii) How can the transition be made to this more integrated water governance with high adaptability? The ultimate aim of IWAGO was thus to help designing better and more robust water governance systems. According to *Carlson and Doyle (2002)* a system can be named robust, if it can maintain its performance with internal parameter variations and under unforeseen external influence. *Anderies et al. (2004)* applied the concept of robustness to socio-ecological systems. *Wilby and Dessai (2010)* identified the concept of robustness as an appropriate adaption strategy for climate change.

The present paper summarizes some of our results from a policy instrument analysis within IWAGO as reported by *Zysset et al. (2012)*. There exists an extensive literature on the possible definitions and use of the term “policy instruments”. *Heller (2009)* for instance discussed various possible definitions in the context of river basin management and in the end used a relatively broad definition, encompassing different techniques in terms of values, attitudes, measures and organizations to influence the natural and social environment.

In this analysis we use a definition of the term policy instruments which concentrates on the content aspects of the policy and the discretionary powers of the authorities. We define policy instruments as tools enshrined in laws, ordinances, guidelines and programmes which should help to achieve content-related policy objectives. We analysed the following specific questions: (1) Are there specific policy instrument categories that are particularly suited to integrated water governance? (2) Is the suitability of the policy instrument categories for integrated water governance dependent on the current land and water uses in a specific region? (3) Does the adaptability of the Cantons and the Confederation with regard to integrated water governance differ within their existing policy instrument frameworks? The last two questions raise the issue of transferability of water management experience and policy instruments between regions which vary in terms of natural and socio-economic conditions. A recent *OECD study (2011)* came to the conclusion that there is no single recipe for a successful water management and that policies should be adapted to local conditions and needs. Already some years before, *Saravanan (2008)* emphasized the complex, yet flexible character of water management systems, being shaped by natural resources, human uses and regulations.

We applied our research questions to the Confederation and selected Cantons (Zurich, Bern, Fribourg, Neuchâtel and Valais). These Cantons differ significantly in their natural and socio-economic conditions, as shown in Table 1.

Indicator	Zurich	Bern	Fribourg	Neuchâtel	Valais
Population density (cap/km^2)	802	166	168	238	58
GDP per capita (CHF/cap)	91'001	66'616	49'592	66'282	55'850
Installed hydropower (W/cap)	16	417	373	0	1'188
Agricultural area (% of total)	44%	33%	48%	44%	7%
Forestry area (% of total)	30%	30%	27%	43%	21%
Settlements area (% of total)	21%	7%	8%	9%	3%
Riverine area (% of total)	2.07%	2.11%	2.37%	0.48%	1.66%

Table 1: Natural and socio-economic indicators on analysed Cantons. Source: Swiss Federal Statistical Office

Our approach on testing the effectiveness of different policy instrument categories in integrated water governance is generic and not bound to a certain state or region. It could thus facilitate the analysis of present and the selection of future policy instruments for integrated water governance in different settings.
Our analysis is intended to help policy makers choose appropriate policy instruments for promoting integrated water governance in their regions and with their stakeholders.

Key Issues and Challenges

Policy instruments can be categorised by their mechanisms of action, i.e. the way in which they influence the behaviour of the target groups, as shown in Table 2.
To investigate the application of these policy instrument categories, we carried out a structured analysis of selected legal texts (around 100) for the Cantons of Bern, Fribourg, Neuchâtel, Valais and Zurich and for the Confederation. The analysis is based on the allocation of the policy instruments identified in the legal texts to one of the five policy instrument categories. By this categorisation, we were able to systematise the existing policy instruments and establish a comparison between the Cantons analysed and the Confederation.
The results of the category analysis were then reviewed in expert discussions with representatives of the various administrations. To identify policy instruments particularly suited to integrated water governance, the discussions focused mainly on the following two hypotheses:

- Hypothesis 1: Those who have a broad range of policy instrument categories are better equipped for the challenges of integrated water management.
- Hypothesis 2: Those who have many communication instruments are very well equipped for the challenges of integrated water management.

We also had the analysed legal texts assessed by specialists from the administrations. In addition to checking the completeness of the data sets, they assessed the relevance and benefit for integrated water governance of these legal texts. The resultant weighting simplified cross-comparison between the Cantons analysed and the Confederation.
Our analysis showed that the overriding objectives of integrated water governance require many different policy instruments; this confirmed the first hypothesis. Every policy instrument and policy instrument category has specific advantages and disadvantages and some incompatibilities. Only slight shifts in the bases ensued as a result of the relevance weighting by the administrations' internal specialists.

Advantages	Disadvantages	Synergies and incompatibilities
Command and control instruments *(such as emission limitation, planning regulations, spatial zoning)*		
Are verifiable Are reliable and predictable in their main impact if they are enforced Allow positive economies of scale due to widespread application	Require precise knowledge of the activities, dependencies and options of those involved, so can be complex to develop Are inflexible, possibly inefficient or involving side effects Can be complicated to verify Can be resisted and disregarded if the benefit for those involved is unclear Do not motivate to exceed the minimum standards required	Under certain conditions can be combined with financial incentive systems (e.g. for the introduction of preferred technologies) Can be combined with economic instruments which cover different aspects of the same problem (e.g. different players) Technology and performance based command and control instruments are mutually incompatible
Economic and financial instruments *(such as subsidies, polluter taxes, auctioning)*		
Allow cost-efficient solutions in market situations Can create incentives to exceed minimum standards Can reduce enforcement costs for the authorities Can promote an economic approach if associated with privatisation of public goods	Their impact is hard to predict because action is transferred to the market players Taxes and grants can stifle innovation Can generate high subsidy costs in some circumstances Can lead to unfairness towards non-beneficiaries	Are incompatible with command and control instruments, which remove freedom of choice
Service and infrastructure instruments *(such as provision of products, services, and infrastructure)*		
Their impact can be planned and verified if they are used Can promote or facilitate desirable action	Require detailed local and technical knowledge Are inflexible, can become inefficient, ineffective or little used if changes occur	Are incompatible with command and control instruments unless these cover other aspects (e.g. regulation on performance targets, provision of suitable technologies)
Collaborative agreements *(such as public private partnerships, certification and labels)*		
Can be very efficient and effective if the interests of the participants are at least partially parallel Allow mutual motivation and control among the participants Are flexible and practical	Can lead to unclear roles for the public and private participants Can stifle competition and exclude third parties Complicated to enforce Sanction options are often limited	Are easily combined with command and control instruments if these do not prescribe a specific technology or solution Are incompatible with command and control instruments which remove freedom of choice
Communication instruments *(such as influencing of values, norms, knowledge and ability, participative processes)*		
Can extend the number of participants Are rapidly implemented, can be motivational Can supplement other policy instruments well	Their impact is uncertain and hard to control Can be complex, slow and short-lived Are not appropriate for strongly conflicting interests	There are no incompatibilities with other policy instruments

Table 2: Categorization of policy instruments, advantages and disadvantages, synergies and incompatibilities (adapted from *Kaufmann-Hayoz und Gutscher, 2001* and *Australian Public Service Commission, 2009)*

On the basis of our analysis, the answer to the question of whether a particular policy instrument category is especially suited for integrated water governance is no. The specific suitability of communication instruments raised in the second hypothesis could not be

substantiated in the discussions with the administrations' specialists. It seems that communication instruments can help transferring the rationale for an integrated approach in an ever more intensive use of water resources; they however do not bring about the balancing between the often conflicting water uses.

The selected Cantons (Bern, Fribourg, Neuchâtel, Valais and Zurich) have varying land and water use situations, both in cross-comparison and within their own boundaries. Do these variations affect the suitability of different policy instruments or not?

Concurring with *Hall (1993)* that social learning plays a role in policymaking, it make sense to see water governance as a complex system of interacting water and land uses, water and land resources, and regulations. We structured these interactions in a simple model as shown in Figure 1. This water management model shows three distinct cycles of influence:

- Firstly the uses influence the resources; in turn, the status of the resources influences the uses (shown by the coloured areas).
- Secondly the uses influence one another (marked by the red arrows).
- Thirdly the uses are influenced by the regulations (shown by yellow arrows).

These three cycles overlap. With our research question on the transferability of integrated water governance policy instruments, the overlap between these cycles of influence is singled out: How far do the current uses of water and land (first and second cycle) influence the suitability of the policy instrument category (third cycle)?

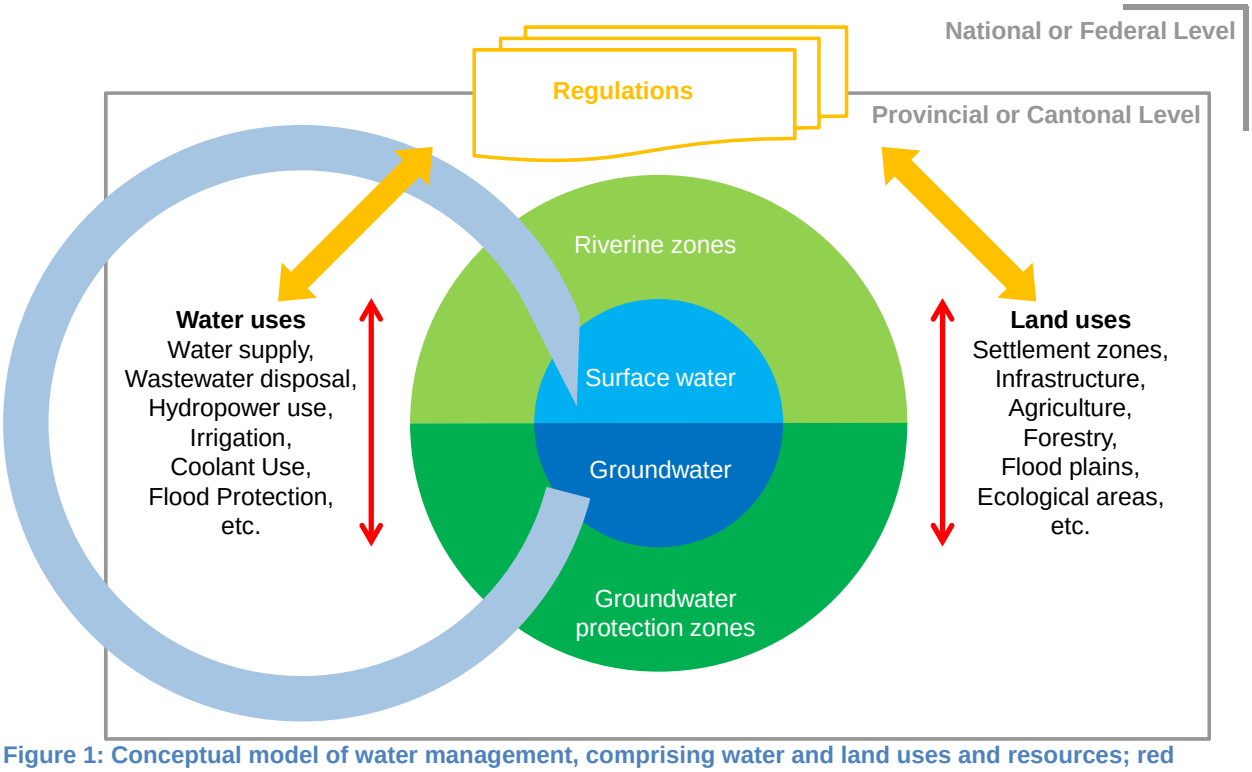

Figure 1: Conceptual model of water management, comprising water and land uses and resources; red arrows mark possible cross impacts between different uses; yellow arrows mark possible cross impacts between uses and regulations

We investigated this issue for a specific domain of integrated water governance, namely spatial planning in riverine areas for the five selected Cantons described in Table 1. We quantified the interdependencies between water and land resources and specific water uses in the riverine areas of the Cantons through cross impact analyses. The cross impact analysis was originally introduced by *Gordon (1968)* for forecasts in interlinked systems. The method soon found wide

application in various fields as later reported by *Gordon (1994)*, either as a stand-alone method or in combination with others.
The method is based on evaluating the interaction between different variables, i.e. the uses and resources, of a system in pairs and combining them through a matrix. The strength of the method is that a simple model of an interlinked system can be developed. The resulting cross impact matrices classify the variables according to their specific behaviour into four domains - active, reactive, critical and buffering variables - each with specific characteristics as for instance reported by *Thierstein et al. (2008)*:

- Active variables (strong influence, weak dependence): drivers of processes in the system, difficult to influence
- Reactive variables (weak influence, strong dependence): passive behaviour in the system, actions on them correspond to symptoms control
- Critical variables (strong influence, strong dependence): can catalyse and accelerate processes within the system, actions on them can be risky for the system's stability
- Buffering variables (weak influence, weak dependence): stabilize the system, actions on them have little side effects within the system

By relating the variable behaviour to the advantages and disadvantages of the different policy instrument categories as shown in Table 2, we can appraise the effectiveness of the different policy instrument categories in controlling the different variable types as shown in Table 3.

Active variables Command and control instruments Economic instruments Service and infrastructure instruments Collaborative agreements Communication instruments	**Critical variables** Command and control instruments Economic instruments Service and infrastructure instruments Collaborative agreements Communication instruments
Buffering variables Command and control instruments Economic instruments Service and infrastructure instruments Collaborative agreements Communication instruments	**Reactive variables** Command and control instruments Economic instruments Service and infrastructure instruments Collaborative agreements Communication instruments

Table 3: Suited (black font) and less suited (grey font) policy instruments for different variable types

With this generic appraisal done, the results can now be applied to specific integrated water governance systems. In our project, we did this for the riverine areas and related uses in the selected Cantons described in Table 1. The results of these cross impact analyses are shown in Figure 3.

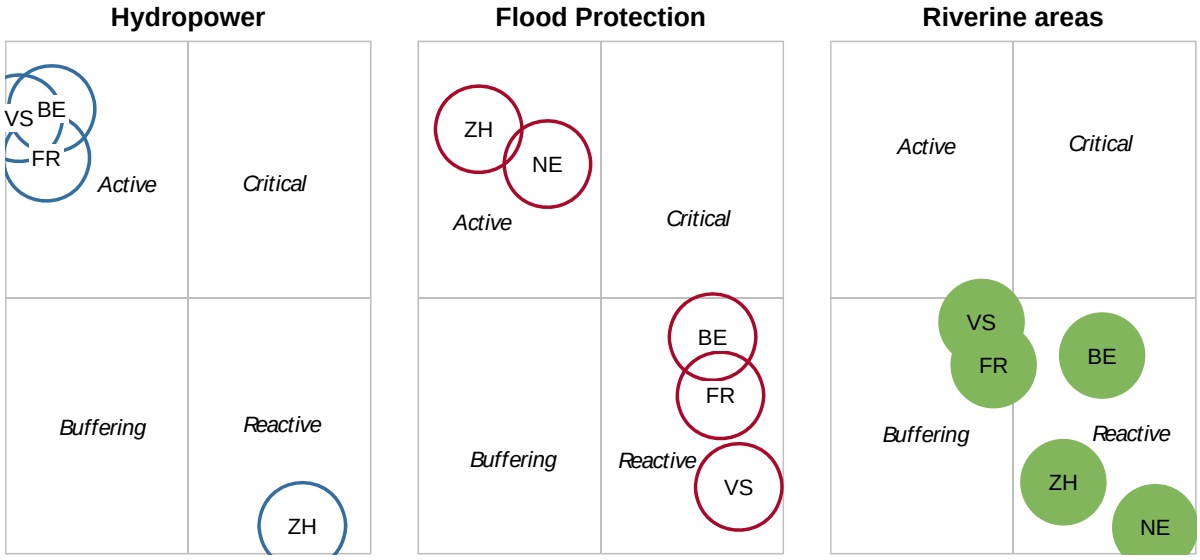

Figure 2: Results of cross-impact analyses for the investigated Cantons Bern (BE), Fribourg (FR), Neuchâtel (NE), Valais (VS) and Zurich (ZH)

From these analyses, we can for instance deduce that to interact with hydropower in various Cantons, different policy instruments might be preferable: in the Canton of Zurich for which hydropower is not an important economic factor and hence a reactive variable in its water management system, economic instruments (such as auctioning of water rights) as well as service and infrastructure instruments (such as state promoting of pilot projects) might be efficient measures to achieve desired hydropower projects. On the contrary, in the Cantons of Bern, Fribourg and Valais for which hydropower is an important economic factor and hence an active variable in their water management systems, the same instruments may become very costly and still may not be sufficient to direct the hydropower sector towards the desired projects. In all Cantons, command and control instruments (such as strategic state planning) as well as collaborative agreements (such as site specific public private partnerships) might be appropriate. Communication instruments however will probably not be very effective in influencing hydropower in these Cantons, as its position is clearly either active or reactive.

As a second example of interpretation, the zoning of riverine areas in the Cantons of Zurich and Neuchâtel may be appropriately tackled through command and control instruments (such as strategic state planning) and possibly guided by the federal level through economic instruments (such as subsidies for protection zoning in ecological high potential areas). In both these Cantons, the riverine areas are heavily under pressure from densely populated settlements and agriculture, hence represent a reactive variable in their water management system. In the Canton of Bern, the riverine areas tend towards a critical variable as their extent is relatively large, but also the pressure on them is considerable, mainly from hydropower. In this case, state-wide command and control instruments risk becoming inflexible and may bring about undesired side effects for the economic development at a local level. Communication instruments (such as participatory processes) and collaborative agreements with the different economic sectors at the local level may catalyse processes and yield better results. In the Canton of Fribourg, the riverine areas act as a buffering variable. They are relatively large, but the pressure on them is limited. Thus, communication and economic instruments may be effective and efficient means to integrate the riverine areas into the water management, thus stabilizing the overall system. In the Canton of Valais, the riverine areas are even larger compared to agricultural areas and settlements; only hydropower exerts significant pressure on

them. Hence, they tend towards an active variable and may be best organized by collaborative agreements with local stakeholders.

These two examples of interpretation reveal that the suitability of policy instruments in integrated water governance may indeed depend on the actual uses and resources in a given setting. However, the analysis presented above represents a model-based assessment of reality. The analysis results are based on the current status of resources, uses and regulations in these Cantons; they do not reflect possible future changes. The suitability of the policy instrument categories found in the analysis could not be verified because riverine areas planning under the Swiss Water Protection Act is in its infancy and there is little experience of actual application of policy instruments of this kind. Our analysis can provide pointers for the pre-selection of policy instruments, but it cannot give a final verdict on their suitability. This is naturally also dependent on how a policy instrument is actually drafted.

Opportunities

With this paper, we suggest that a cross impact analysis on actual uses and resources in a given water management system may yield a good basis for pre-selecting policy instruments to deal with these uses and resources. Our research was however based on Swiss examples only. Transferring the methodology to concrete settings in other regions of the world such as in Asia would certainly provide insight about its replicability.

Using the methodology in post-evaluations of basin management cases where specific policy instruments have been applied to deal with different uses and resources would be of special interest.

Recommendations

Based on our research presented in this paper, we have the following recommendations for multilateral development banks and their developing member countries:

- An integrated water governance should always rely on a variety of different policy instrument types. There is no single best category to foster integration and adaptive capacity. Communication instruments such as participatory processes and influencing of values, norms, knowledge and ability are sometimes overrated in this respect. They cannot resolve strongly conflicting interests, but should be combined with command and control instruments or collaborative agreements to contain the drivers of the system and to give some latitude to its most dependent participants.
- Care should be taken when trying to transfer successful cases of integrated water governance to other regions. Having had success with a certain mix of policy instruments shows only that this mix was appropriate for the targeted system of water management at a given location and time. Since water management systems are usually complex and dynamic by the varying nature of their resources and uses, the mix of policy instruments should also be dynamic.
- Cross impact analyses on resources and uses in water management systems may constitute a relatively simple means to characterize the system variables for integrated water governance. Such analyses may be used to identify regions or basins with similar settings for experience exchange on existing policy instruments or to pre-select suited policy instruments, based on an improved system understanding for a specific case.

Finally, when striving to improve integrated water governance it should always be remembered that a sustainable development can only be achieved by out of the water box collaboration, as already emphasized by the *World Water Development Report 3 (2009)*.

References

Anderies, John M., Marco A. Janssen, and Elinor Ostrom (2004): A Framework to Analyze the Robustness of Social-ecological Systems from an Institutional Perspective. Ecology and Society 9(1): 18.

Australian Public Service Commission (2009): Smarter Policy - choosing policy instruments and working with others to influence behaviour. Contemporary Government Challenges Series, Australian Public Services Commission, Canberra.

Carlson, J. M., and John Doyle (2002): Complexity and robustness. Proceedings of the National Academy of Science 99(suppl. 1):2538-2545.

Gordon, Theodore (1994): Cross-Impact Method. Series on Futures Research Methodology. United Nations University, Washington.

Gordon, Theodore (1968): Initial Experiments with the Cross-Impact Matrix Method of Forecasting. Futures, Vol. 1, No. 2, 100-116.

Hall, Peter A. (1993): Policy Paradigms, Social Learning, and the State, in: Comparative Politics 25 (3), 275-296.

Heller, Maya (2009): Basin Management from the Dutch Practice for the Swiss Context - A Comparative Study of the Policy Instruments in the Sub-Catchments. Master Thesis, ETH Zurich.

Kaufmann-Hayoz, Ruth und Heinz Gutscher (2001): Changing Things – Moving People: Strategies for Promoting Sustainable Development at the Local Level, Birkhäuser Verlag, Basel.

Organisation for Economic Cooperation and Development (2011): Water Governance in OECD Countries: A Multilevel Approach. OECD Publishing, Paris.

Saravanan, V.S. (2008): A systems approach to unravel complex water management institutions. ecological complexity 5: 202 – 215

Thierstein, Alain; Angelus Eisinger; Agnes Förster; David van Handel; Viktor Goebel (2008): Metamorphosis 100: Liechtenstein in the Year 2068, Twentysixtyeight, Industrie- und Finanzkontor, Vaduz, p. 92-148.

Wilby, Robert L. und S. Dessai (2010): Robust adaptation to climate change. Weather, 65: 180–185.

World Water Development Report (2009): Water in a changing world. World Water Assessment Programme. The United Nations World Water Development Report 3. Paris: UNESCO, and London: Earthscan.

Zysset, Andreas, Tim Kempter, Daya Moser, and Christina Dübendorfer (2012): Towards an integrated water governance – policy instruments for the cantonal and the federal level (in German), research report prepared under the Swiss National Research Program 61 on Sustainable Water Management, financed by the Swiss Science Foundation.