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Networks of Swiss Water Governance Issues. Studying Fit between Media Attention and Organizational Activity

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ABSTRACT

This study analyzes Swiss water governance as a network of interrelated issues. It compares how organizations reflect relations between governance issues in their activity with the way issue relations are depicted by the media (issue attention-activity fit). To do so, a media data analysis, supported by machine learning, is combined with a nation-wide survey. Prominent areas of misfit relate to the coordination between water saving measures and drought risks; the exploitation of subterranean resources and drinking water protection; and issues of micropollutants. The study demonstrates that comparing organizational activity with media attention is particularly well suited to recognize newly emerging, currently neglected areas of governance.

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Introduction

Natural resource governance often deals with a complex network of interconnected governance issues. Governance issues are substantive collective action problems (Lubell 2013), for example, regarding sustainable use or effective protection of a given resource. They form a network of issues, as addressing one issue often affects one or more other issues.

This study investigates organizational activity and media attention as two distinct ways in which to conceptualize relations between issues in this network. It then highlights the insights that can be gained by studying fit and misfit between them (issue attention-activity fit) in a case study of Swiss water governance. Organizational activity reveals how actors in a governance system treat issues as interconnected in practice. Comparing this to the way in which media data depicts relations between issues is shown to particularly identify newly emerging, neglected areas of governance, and areas of present or future conflict.

Studying fit and misfit in natural resource governance is generally motivated by the explicit or implicit normative goal of aligning governance with an underlying systemic structure, such as the one captured by issue relations. The concept of fit describes the

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outcome of this process. Prominent fit concepts have usually focused on how to fit governance structure to ecological systems (Folke et al. 2007; Bergsten, Galafassi, and Bodin 2014; Sayles and Baggio 2017). This study departs from this social-ecological approach and highlights fit between media attention and organizational activity as a distinct, complementary approach to assess complex natural resource governance systems.

The conceptualization of fit based on comparing issue networks builds on a number of recent studies (Ekstrom and Young 2009; Kininmonth, Bergsten, and Bodin 2015; Treml et al. 2015; Sayles and Baggio 2017), which have demonstrated the emergence of networks as an established conceptual basis for the empirical study and refinement of many types of fit concepts (Bodin et al. 2017). By studying issue attention-activity fit, the present study advances the study of fit based on a network perspective. It adds to the theoretical richness of fit by expanding it to encompass a type of fit not based on ecological links but the perception and debate about issue relations in the public sphere. As a complement to social-ecological models, this approach allows for the study of large-scale governance systems with a wide variety of issues. In emphasizing the particular nature of issue relations that appear in the media arena, it allows for the identification of specific, otherwise potentially neglected types of misfit.

Fit between organizational activity and media attention on governance issues

Most fit concepts as originally developed, such as functional fit (see Folke et al. 2007), describe the challenge of linking ecosystems and socioeconomic systems to achieve coherent management. Thus, they traditionally measure the extent to which governance matches the ecological system structure.

This study extends the notion of fit to an approach that investigates the way a governance system reflects publically perceived relations between issues. A governance system is defined as a geographically defined territory that contains multiple issues (such as flood protection or hydropower construction), institutions (rules such as minimum residual flow regulations), and actors (organizations such as government agencies, private firms, or interest groups) (Lubell 2013). Governance itself is then a process taking place within this system "by which the repertoire of rules, norms, and strategies that guide behavior (…) are formed, applied, interpreted, and reformed" (McGinnis 2011, 171).

Governance issues can represent a wide range of problems that actors confront. For example, in a water governance system, increasing hydropower production capacity can represent one issue, whereas the protection of aquatic biodiversity is a second issue, and floodwater protection a third. These three issues are intricately linked. The regulation of residual flow in hydropower production influences aquatic biodiversity. Hydropower dams can be used to regulate river systems to mitigate the consequences of flooding. Furthermore, revitalization measures designed to protect aquatic biodiversity in rivers can contribute to floodwater prevention by establishing buffer zones. If organizations are active on any of these issues, high fit would imply that they are aware of these interconnections and reflect this awareness in their activities by either tackling related issues

simultaneously or coordinating their actions with other organizations active on the issues.

The example above shows that studying fit based on issue relations makes it possible to analyze relevant properties of complex, large-scale governance systems. For the purpose of this study, governance systems are considered large-scale systems if they contain issues operating on multiple levels of spatial and jurisdictional scales (Cash et al. 2006). Such systems can involve a very broad and heterogeneous variety of issues. An issue-based representation offers a way to deal with this by understanding issues as collective action problems, which is seen as their common denominator.

However, even the relatively simple example of a water governance system with three issues shows that the empirical operationalization of issue relations in large-scale, complex governance systems is a hard problem to solve. The exact way in which issues depend on each other is often singular to the exact pairing of issues. As the number of issues increases, this makes it unfeasible to consider the exact content of a relation between issues in detail for every relation. Every abstract representation of issue relations is thus only one of a number of possible representations, and the possible insights it can engender depend on the particular conceptualization utilized.

In light of this, this study explores organizational activity and media attention as two possible ways of studying relations between issues. In combination, this enables a study of fit with distinct properties. The way organizations consider multiple issues in their activity represents a manifestation of governance, as it exists in the lived practice of actors, who form the inter-organizational networks that governance implies (Rhodes 1996). In comparison, how relations between issues are picked up and portrayed in the media represents a socially constructed (Hilgartner and Bosk 1988) landscape of issue relations.

The way issues are given attention by media is not neutral but influenced by processes endogenous and exogenous to the media system. These include news cycles (Downs 1972, Djerf-Pierre 2013), journalistic values and news routines, properties of organizations seeking attention (Andrews and Caren 2010), and news values (Galtung and Ruge 1965). The latter describes a perceived inherent quality to content that shapes the answer to the question of whether or not it is news, emphasizing some issues over others (Harcup and O'Neill 2017). In the context of this study, this suggests that media attention will systematically overemphasize some relationships between issues compared to the way organizations do so in their activity. This study posits that it is likely that such overemphasis applies, especially, to issue relations in two main dimensions. First, based on the news value of conflict, media attention is likely to focus strongly on issue relations that are contentious, unresolved, or normatively charged. Second, based on the news value of surprise and exclusivity, issue relations that are new on the agenda are also likely to be given emphasis.

Analyzing fit between the relations among issues as evident in the practice of governance against their portrayal in the media (issue attention-activity fit), therefore, offers a unique possibility of highlighting a set of governance areas of interest. Given the two types of relations between issues that are likely to be emphasized more strongly in the media arena than in actor activity, this relates to two main areas. First, areas, where relations between emerging, new issues portrayed as such in the media are not reflected

in organizational activity, can suggest a need for adaptation in the governance system. Second, where relations between contentious issues highlighted in the media are not reflected in increased actor activity surrounding this issue relation, this might point toward areas where conflict obstructs coordination.

Data and methods

The case of Swiss water governance

To demonstrate the value of studying issue attention-activity fit, a suitable case should be representative of a situation where it can substantively add to understanding a complex governance situation. This is primarily the case for situations where multiple, interdependent, and thematically wide-ranging issues exist surrounding the governance of given resource. Swiss water governance is such a case for two main reasons.

First, water is a good example of a resource where the need for taking into account complex system properties in its governance is evident. Water typically fulfills a variety of functions (Tropp 2007). Water resources thus cannot be satisfactorily managed through fragmented and localized structures. The nature of the resource introduces complex dependencies, where management in one place directly affects subsequent management situations. Complex linkages and ecological interrelations need to be factored into water management, even on the most basic level.

Second, this multi-functional nature of water as a resource leads to a variety of different actors who deal with interdependent, at times overlapping issues. In Switzerland, this kind of fragmentation is, especially, found between different sectors, where actors are split between different but interconnected issues such as biodiversity protection or flood prevention. It is also evident in the complex interplay between different administrative levels (Schmid et al. 2014). Swiss water governance can thus be understood as a complex governance system that revolves around multiple, interrelated issues. The nature of complex interdependencies between issues in such a wide-ranging case cannot easily be approached based on ecological modeling. For an adequate physical modeling procedure, each issue would likely need to be effectively modeled on its own. In Switzerland, this has recently been done for the case of micropollutants (Ingold, Fischer, and Cairney 2017), and fish decline (Burkhardt-Holm and Zehnder 2018), but extends to other issues such as invasive species management, or habitat protection for amphibians. Single-issue social-ecological models are crucial in order to obtain precise knowledge about the situation regarding a single issue. A larger mapping of how issues themselves interrelate complements single-issue models by taking into account the larger setting of water governance.

Data structure

For the analysis, issue attention-activity fit Swiss water governance is analyzed based on comparing two networks of issues.[1] These networks are each formally represented in an undirected, unipartite, and valued graph. Nodes in both networks represent the same complete set of salient issues in Swiss water governance. Differing sets of valued edges

Table 1. Distribution of survey response and non-response rates among different types of organizations.

Organizational category	Number of respondents	Number of non-respondents
Politics	16	28
Private sector	50	38
State and national administration	53	29
Interest groups	63	21
Service providers	33	11
Local administration	61	19
Science	17	3
Other	20	2

in the networks represent the strength of relations between issues based on organizational activity and media attention, respectively.

Organizational activity

To represent organizational activity, the study makes use of data gathered in a national level survey of 476 actors involved in Swiss water governance. The survey gathered data on the participation of actors in a set of 56 predefined issues in Swiss water politics. Actors were asked to indicate the issues they had been involved in through projects in the previous three years (see online appendix, Table A2 and A3).

Crucially, the set of predefined issues and actors included in the survey were not defined by the researcher in a top-down way but identified through an extensive document analysis of newspaper articles, parliamentary discussions, and scientific papers covering water issues within the borders of Switzerland. A complete description of this initial procedure can be found in Brandenberger et al. (2015). The actors identified in this way include a wide variety of government (such as municipalities or cantonal offices), interest-group, private (such as engineering firms or power plants), and scientific organizations, reflecting the cross-sectoral nature of governance (Rhodes 1996).

The bottom-up data gathering process applied avoids falling into the trap of predefining policy fields along pre-conceived notions of sectoral silos which may not be adequate for a fragmented policy field such as water. Following this bottom-up logic, the set of actors gathered through the document analysis was later extended through a snowballing procedure in the survey. Organizations were asked to name other organizations they were interacting with on given water issues and these were subsequently included in the actor set. The survey was started in summer 2016 and the snowballing round finished in spring 2017. The response rates for the initial survey and the snowballing round were 69% and 64%, respectively. This lead to a dataset containing information on organizational activity in Swiss water governance for 313 organizations.

Table 1 displays the distribution of nonresponse and response among different categories of organizations in more detail. To assess potential bias in response across organizational categories, a logistic regression model was used to model total non-response (Sax, Gilmartin, and Bryant 2003) as a function organizational type, using the categories displayed in Table 1. Using interest groups as a reference category, only the organizational categories politics, which mostly includes political parties, and private sector, which includes mostly engineering firms, were statistically significant predictors of non-

response (see model results in the online appendix, Table A1). Thus, the results of the study potentially underestimate the way in which political parties and private firms connect water governance issues, whereas the coverage of all other organizational groups does not appear to show bias.

The information about the set of issues each organization indicated to have been active in was represented in an actor-issue incidence matrix. The two-mode actor-issue network drawn up by this incidence matrix was projected to a weighted one-mode network of issues connected by actors, based on Newman (2001). To do so, every shared actor k between a pair issues i and j is weighted by w_{ij} and added. If x_{ik} equals 1 if the actor k is active in issue i or zero otherwise, this weight is calculated based on

$$w_{ij} = \sum_{k} \frac{\delta_{ik}\delta_{jk}}{n_k - 1}$$

where n_k is the number of other issues the actor k is also active in. In determining how issues are connected through the activities of organizations, this gives more weight to organizations that focus on a smaller, specific sets of issues. It formalizes the intuition that organizations have a limited number of issues they can pay complete attention to. Organizations that are active in many issues also connect many issues, but these connections are not given as much weight for indicating the connectivity between issues as the connections created by specialized organizations working in a smaller subset of issues.

Media attention

To gather the way in which issues are depicted as related in the media arena, newspaper articles that discussed subjects relevant to Swiss water governance were analyzed. These articles raised individual or multiple governance issues. Fundamentally, the more often issues appeared together in the same newspaper article, the more likely they were considered to be perceived as related in public perception.

The analysis of the media data followed a two-step approach, using a combination of machine learning and manual coding. In a first step, for the year 2013, all articles in the Swiss newspaper Neue Zürcher Zeitung (NZZ) that contained the German words for lake, water, or water body[2] were downloaded and manually filtered to identify relevant articles in relation to Swiss water governance (see Brandenberger et al. 2015).

This dataset was used to train a binary classifier to extend the dataset to identify relevant articles for the time span between 2007 and 2017. The training set included 1497 articles judged irrelevant and 100 judged relevant. Four models based on Bernoulli naive Bayes, linear support vector machines, multinomial naive Bayes, and neural networks as implemented in Scikit-learn (Pedregosa et al. 2011) were built. In building the models, focus was laid on minimizing false negatives, in order to not miss potentially relevant, weakly determined issues. To further emphasize this, articles were included in the relevant final set if they were present in at least two out of four classifications. In the subsequent filtering of new data, a total of 21,597 articles, which contained the search terms, were classified. Six hundred eighty-five articles were identified as relevant.

The Neue Zürcher Zeitung (NZZ) was chosen as the data source for this study because it is generally considered the highest quality newspaper in Switzerland (Hänggli and Kriesi 2010) and reliably reports on issues from a national perspective, taking into account all four linguistic regions. The NZZ has thus been previously used to study media data on the national level (Tresch, Sciarini, and Varone 2013). Still, the choice of a German-language newspaper is likely to bias the analysis toward issues occurring within the territory of the German-speaking majority of Switzerland. This was considered acceptable, as this territory covers the majority of the country and crucially includes the three main geographic regions of Switzerland (Alps, Jura, and Plateau). Because of this, there is less reason to expect a decisive bias in issue relations regarding water issues due to cultural differences. The choice of a single newspaper as a data source could also make the analysis susceptible to particular kinds of issue framing. However, as the analysis focused on the pure co-occurrence of issues and not on their framing, such framing would need to occur in the selection of issue coverage itself and not in the content of articles. This is likely mitigated by the long time period and large number of contributing journalists covered in the analysis but remains a possibility. The longtime period further makes it more likely that very recent fluctuations of attention on some issues over time are attenuated.

Another key problem of the approach taken in this study is that the coding of general issues without reference to their exact spatial location does neglect a very important dimension of natural resource governance. This is due to a fundamental tradeoff required in order to make general statements about fit on a country level, which is less sensitive to variations in issue interdependence on the local level. For example, the fact that articles often mention landscape protection in conjunction with the construction of hydropower facilities is seen as pointing toward a general trend, which indicates that these issues are perceived as related on average. In extension, this suggests that organizations should consider approaching these two issues as interrelated in their activity. However, the general scope of such statements entails that in some locations, this might not be the case.

In a second step, the articles in the extended dataset were manually coded by the researcher for the presence of the 56 issues related to water governance included in the organizational survey. Four hundred fifty-six articles contained at least one issue (see Table A4 in the online appendix). This coding procedure resulted in a document-issue incidence matrix specifying which issues were mentioned in every article coded.

Multiplying this document-issue matrix with its transpose creates an issue co-occurrence matrix. In this matrix, for every pair of issues, a number specifies how many times they were mentioned together in the same newspaper article. This matrix was projected to a weighted network of issue relations, where edge values represent the strength of association between two issues. To derive the strength of association, the raw co-occurrence matrix was normalized using the Ochiai coefficient. It is given by:

$$Ochiai(x, y) = \frac{C_{xy}}{\sqrt{C_x C_y}}$$

where C_x describes the sum of occurences of x and C_{xy} the sum of co-occurences of x and y. The projection method used to create this network notably differs from the method used to create the network based on organizational activity due to theoretical

considerations given the nature of issue co-occurrence in documents. The Ochiai coefficient is equivalent to applying Salton's cosine similarity directly to the incidence matrix. Because of this, it has been found an appropriate measure to determine association between features of documents, as it addresses problems of skewness in their distribution and the prevalence of large numbers of zeros in most matrix cells (Zhou and Leydesdorff 2016).

Thus, the use of the Ochiai coefficient to establish a measure of issue relation based on media data represents a normalization procedure chosen due to the expected properties of the data under study (documents). The Newman (2001) projection method used to create the organizational activity network, however, was chosen to more substantive considerations about the nature of what constitutes an issue relation rooted in organizational activity. It gives more weight to edges created by exclusive co-occurrence in the second (actor) mode of the network, which was seen as desirable to establish issue relations based on governance activity because it emphasized the contribution of expert, focused organizations, and reduced the influence of very active organizations creating spurious relations. Contrary, this feature of the Newman (2001) projection method would have been less desirable for measuring media attention on issue relations, where exclusive co-occurrences of issues in articles were not considered to have the same substantive interpretation in indicating a substantially higher amount of interrelation and articles mentioning a very large number of issues were less common.

Fit assessment

The two weighted issue networks were combined to create a fit assessment for every pair of issues they contain. Issues mentioned by four or less organizations or documents were removed from both datasets, as making general statements based on such a small number of data points was deemed inappropriate. To combine the networks, the edge weights of both networks were uniformly scaled to range from zero to one, to make them comparable while conserving the original weight distribution. Diagonals of both matrices were set to zero as self-ties among issues do not have a substantive interpretation in this context. Afterward, the weighted adjacency matrix of the media-based issue association network was subtracted from the weighted adjacency matrix of the organizational activity network. For every pair of issues, this created a value between -1 and 1.

An important consideration regarding this procedure relates to the endogeneity that arises due to the fact that organizational activity is likely to be reflected in media data reporting on it, which, in turn, engenders subsequent activity. In the context of this study, this is most likely to lead to an overestimation of fit, whereas it should affect the diagnosis of misfit to a lesser degree. As the assessment of misfit is the main interest of the study, the influence of the endogeneity problem is thus reduced but should be kept in mind in the interpretation of the results.

Results and discussion

Figure 1 shows the network of issue relations evident in organizational activity, contrasted with the network specifying issue relation based on media attention. The fit

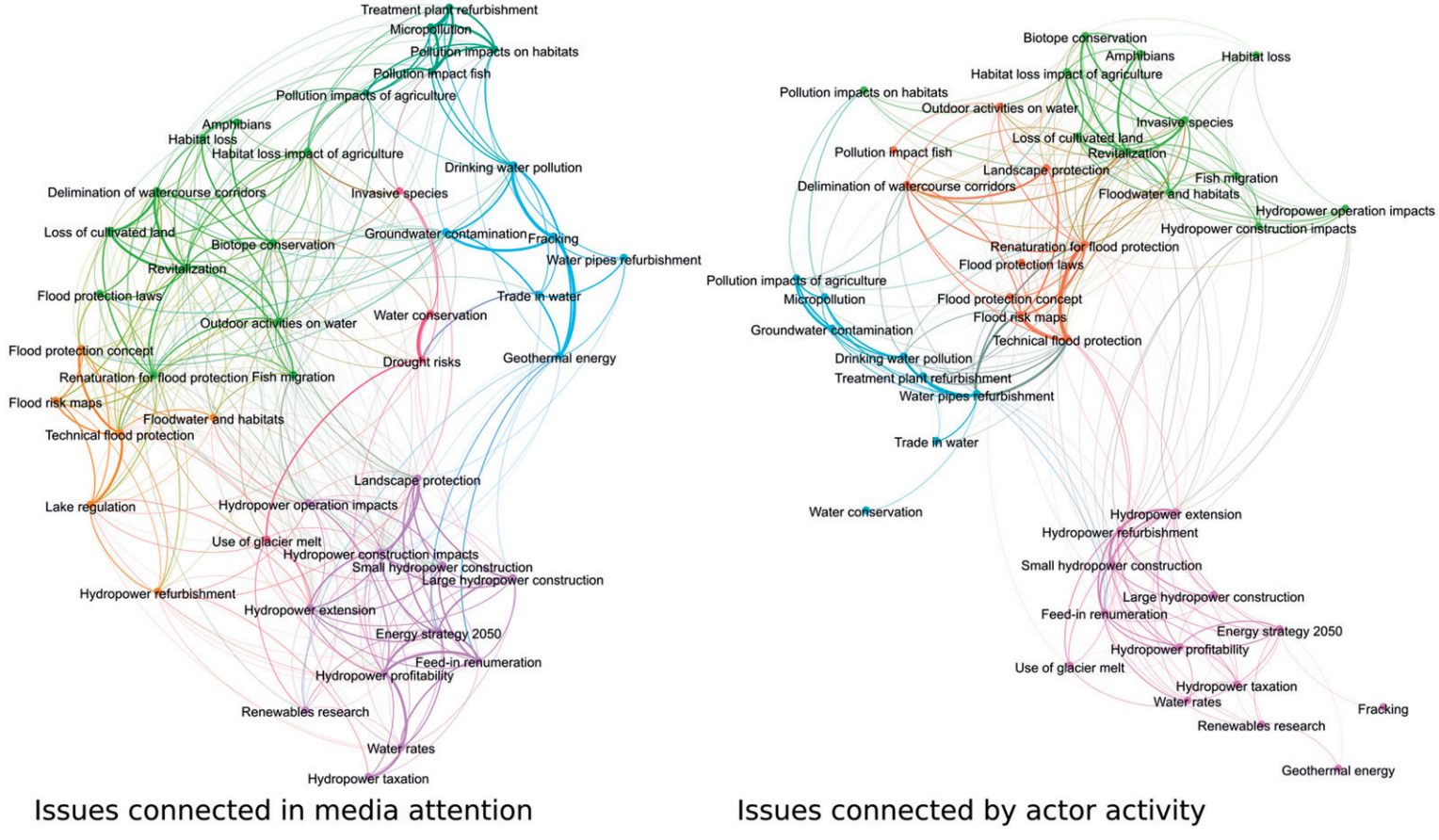

Figure 1. Networks of issue associations in Swiss water governance based on co-occurrence in media data (link size based on Ochiai similarity) or actor activity (one-mode projection of two-mode actor-issue network, link size based on Newman (2001) projection). Nodes are colored based on modularity classes identified using the algorithm described in Blondel et al. (2008), as implemented in the software Gephi (Bastian, Heymann, and Jacomy 2009).

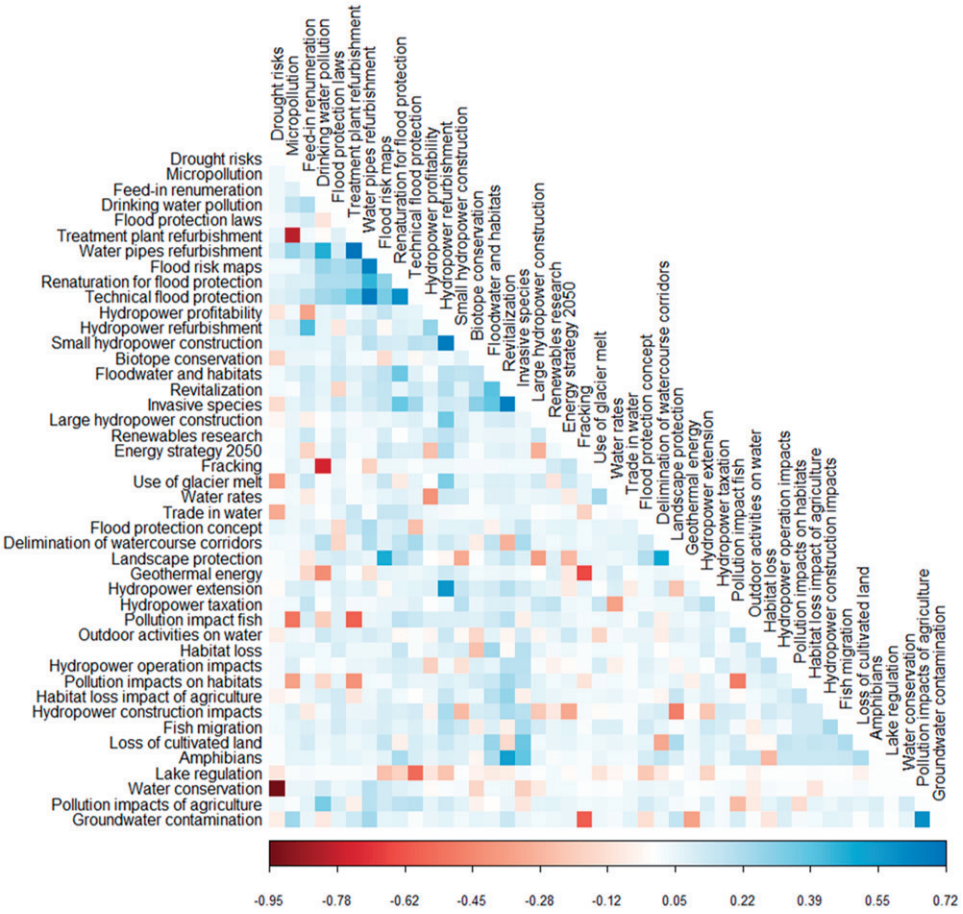

Figure 2. Results of issue attention-activity fit diagnosis for all pairs of issues in Swiss water governance. Red colors indicate misfit in that the emphasis given to relations between issues in media data is higher than the way in which actors treat issues as related in their activity. Absence of color indicates fit. Blue colors indicate relations between issues apparent in actor activity not reflected in media coverage.

diagnosis combines the information derived from these two networks. Figure 2 displays the results in a heatmap. High negative values indicate that high attention on an issue relation in the media data is not replicated likewise in actor activity (misfit). Values around zero indicate fit. High positive values indicate that actors do relate issues in their activity in a way not picked up by the media data, which is informative regarding the types of connections between governance issues that are covered less or ignored in the media but are reflected in organizational activity.

Figure 2 shows that organizational activity in Swiss water governance matches the way issue relations are publically perceived in most cases. This is, especially, the case for the generally strictly regulated and uncontroversial areas of flood protection, municipal water supply, and wastewater treatment. Issues in these areas are often not very politicized, highly technical, and focused on the implementation of existing laws. Beyond the majority of issue relations where fit is generally high, the fit diagnosis also points out specific areas of misfit. These are

Table 2. Issue pairs with the ten highest negative fit scores (misfit indicating that emphasis given to relations between issues in media data is higher than emphasis given to issue relations in actor activity).

Issue 1	Issue 2	Fit measure
Drought risks	Water conservation	−0.95
Treatment plant refurbishment	Micropollution	−0.8
Fracking	Drinking water pollution	−0.75
Fracking	Geothermal energy	−0.66
Fracking	Groundwater contamination	−0.59
Treatment plant refurbishment	Pollution impact fish	−0.59
Technical flood protection	Lake regulation	−0.55
Micropollution	Pollution impact fish	−0.51
Pollution impact fish	Pollution impacts on habitats	−0.49
Landscape protection	Hydropower construction impacts	−0.48

discussed in the following. Table 2 shows the issue pairs with the ten highest negative fit scores. The complete list of issue pairs can be found in the online appendix (Table A5).

The most striking area of misfit exists between issues related to the exploitation of subterranean resources (mostly fracking) and drinking water protection, which feature three times in the five highest negative fit scores.[3] This is most likely due to the fact that the issue of subterranean resources is a relatively new and so far incoherently regulated issue in Switzerland (Ingold, Fischer, and Cairney 2017). While some organizations are active in the field, there have only been a small number of projects. However, as the issues are strongly related, it points to a potential area of future conflict. Should the exploitation of subterranean resources become more widespread, organizations that are active in drinking water protection will need to become more involved in an issue that they currently are likely to have less expertise in? This points to a way in which the concept of issue attention-activity fit can operate as a method for recognizing potential future areas of necessary coordination or regulation, i.e., if the public discussion relates two issues, but this is not yet reflected in organizational activity.

The misfit between drought risks and water conservation further illustrates this point. Considered one of the main adaptation challenges due to climate change for Switzerland, drought has been on the agenda of administrative agencies in Switzerland for a number of years. In a study of the social capacity to adapt to drought risks in Switzerland, Kruse and Seidl (2013) found that preconditions for capacity building are generally present, mostly due to previously successful ad-hoc management strategies. However, institutional fragmentation and lack of financial resources have so far hampered more long-term strategic adjustments. The results of this study are in line with this assessment. Actors involved in water conservation did not indicate that they consider drought risks regularly in their projects. This shows that the recognition of drought as a potential problem, whereas on the public agenda, has yet to reach most organizations. A potential reason for this is the fact that Switzerland, considered Europe's water castle for a long time, is historically unused to drought events. The fit diagnosis in this case thus interestingly illustrates a case of slow adaption of the governance system to change.

The value of an issue attention-activity fit measure in identifying future areas for improving coordination is illustrated a third time in the misfit between micropollution, pollution impacts on fish, and the refurbishment of treatment plants. The issue of micropollutants, chemical substances of very low concentration levels, represents a

complicated policy problem (Metz and Ingold 2014). Policy-makers have only recently addressed it with a decision to upgrade the biggest Swiss municipal sewage treatment plants. The low fit between treatment plant refurbishment and micropollution indicates that this process has not yet led to projects tackling the issue for most organizations. It can be expected that this will change in the near future, at least for bigger treatment plant operators.

Another area of misfit surrounds the issues of landscape protection and hydropower construction, which is interesting because comparable levels of misfit cannot be found for the biodiversity impacts of hydropower construction and operations. Landscape protection (related to preserving the esthetic and cultural value of the landscape) and biodiversity protection (more specifically targeting individual species and habitats) are strongly related. Most measures targeting landscape protection also have beneficial effects on biodiversity and vice versa (Gerber and Knoepfel 2008). However, while biodiversity impacts of hydropower are strongly regulated in Switzerland, the impact of hydropower projects on landscape quality has become a contentious political issue.

The federal act on the protection of waters of 1991 and the accompanying water protection ordinance, which was enacted in an updated version in 2017, introduced strong regulation regarding the biodiversity impacts of hydropower operation. It regulates issues such as minimum residual flows and fish migration. Media articles show that this has led to an increased activity and inclusion of nature protection organizations in hydropower projects, who can claim a firm legal footing for complaints. Likewise, hydropower operators had to initiate new projects to restore facilities that did not meet prescriptions. An exemplary case includes the construction of the Rhone Oberwald power plant in the canton of Wallis, where the inclusion of nature protection organizations in the planning of the project in 2013 led to a compromise to compensate the impacts on residual flows by ecologically restoring another section of the river.

Landscape protection areas, on the other hand, have come under pressure in Switzerland. Switzerland decided to put in motion a process to restructure its energy system, phasing out nuclear energy to replace it with renewable energy after the nuclear disaster in Fukushima in 2011 (Fischer 2015). This has raised the possibility of a substantial increase in hydropower production capacity. In order to do so, the relaxing of restrictions on the construction or extension of hydropower projects in landscape protection areas has been particularly controversial (Gurung et al. 2016), especially within the most widespread landscape protection areas cataloged in the federal inventory of landscapes and natural monuments of national importance (BLN). An exemplary case was the proposal in 2013 to build a new hydroelectric power plant near the Rhine falls in Schaffhausen. Because of fears that it would diminish the landscape value of the falls, the proposal was rejected in a popular referendum in 2014.

The different regulatory backgrounds regarding landscape and biodiversity protection, therefore, explain why organizations involved in hydropower projects tend to consider biodiversity issues much more than questions of landscape protection. It also suggests that organizations focused on landscape protection could switch to contesting projects based on their biodiversity impacts in the future, as these issues often overlap.

Lastly, the misfit between lake regulation (where water levels in lakes are adjusted to provide a buffer in order to prevent or mitigate flooding) and technical flood

protection, such as the building of dams, illustrates that an apparent misfit can also be due to the formal regulatory framework. Lake regulation is controlled by the federal administration, while the implementation and upkeep of technical flood protection measures often take place at the municipal level. It is, therefore, not surprising that organizations involved in technical flood protection projects (mostly municipalities and engineering firms) did not tend to indicate that they encountered the issue of lake regulation in their projects as well. Given that the federal office for the environment indicates a high awareness of the interconnection between lake regulation and a whole range of other water governance issues, the apparent misfit between lake regulation and flood protection is thus most likely not an area of substantive misfit. However, it also points toward a top-down process, where an inclusion of lower-level stakeholders is lacking at the moment and might be more advisable in the future. On a more general level, this further illustrates that fit diagnoses should always be followed up by a careful consideration of the substantive issues they reflect, in order to properly interpret them.

The results of the case study of Swiss water governance discussed here show that issue links present themselves as a useful way to analyze a set of relevant properties of a complex, large-scale governance system. However, it remains important to stress that an issue based approach may ignore important ecological interdependencies that are not recognized as collective action problems by social actors. In the end, governance issues need to be recognized as socially constructed representations of probable underlying ecological system properties and discussed from this perspective. This is also especially important in contexts where, for example, state censorship influences and restricts public discussions of issues.

Still, actionable research may often be better served with a system representation that is not complete but sufficient for the task at hand (Dee et al. 2017). In this vein, it is conceivable that an analysis of fit rooted in relations between governance issues could be well applicable to local-level, small-scale governance situations, such as the management of regional protected areas. If stakeholders have a rough approximation about how governance issues related to natural resources in their domain are linked, data gathering procedures such as mental maps (Özesmi and Özesmi 2004), participatory mapping (Brown et al. 2017), collaborative modelling (Morisette et al. 2017), or qualitative, expert-driven assessments of task relations (Bodin and Nohrstedt 2016) are promising options for establishing issue links in these situations and might even provide an acceptable proxy for ecological ties. Comparing issue linkages based on such assessments with a detailed analysis of organizational activity could, for example, be used to point out a need for increased cross-scale governance if organizations address related issues on different jurisdictional levels.

Conclusion

Investigating Swiss water governance as a network of interrelated issues and combining media data with data on organizational activity has illustrated a way to put a highly complex system within the reach of systematic analysis. Pre-eminent areas of issue attention-activity misfit found in Swiss water governance relate to the coordination

between water saving measures and drought risks; the exploitation of subterranean resources and drinking water protection; and issues of micropollutants.

For the case of drought risks, the challenge is how to overcome the apparent inertia in the governance system in recognizing an unusual problem for Switzerland, fraught with uncertainty. Drought risk issues seem to be sufficiently studied and discussed by scientific and higher-level administrative organizations, but as this study shows, they are not considered in actual governance practice yet. Strategies to deal with drought risks should thus consider a pivot toward putting emphasis on information dissemination. For the relation between emerging issues surrounding the exploitation of subterranean resources and drinking water protection, the apparent misfit is due to gaps in the formal regulatory framework. The establishment of such a framework can lead to improved fit, as comparing the high fit between biodiversity protection and hydropower construction, compared to the misfit between landscape protection and hydropower construction, has shown. Issues surrounding micropollutants represent a harder problem to solve. Switzerland is ahead of most European countries in upgrading wastewater treatment plants to address the problem. Still, a holistic approach should also include preventive measures, which requires increased coordination between organizations from different sectors. Crucially, governance also needs to be coordinated with neighboring countries, as the problem is transboundary, adding to its complexity (Ingold et al. 2018).

Fit concepts present themselves as useful conceptual tools for analyzing the alignment of human action and interaction with the natural world. Since the initial introduction of functional fit, fit concepts have matured greatly (Folke et al. 2007). The adoption of the concept by network researchers is a particularly interesting avenue in this development. The present study gives further evidence that network concepts provide a stable basis to carry outfit assessments (Bodin et al. 2017). It also shows that the potential of fit concepts goes beyond social-ecological models and demonstrates the complementary value of considering relations between governance issues in the study of natural resource governance.

A crucial area of future research should put emphasis on consequences of quantified measures of fit. This study has assessed fit based on an implicit normative assumption that increased fit improves governance outcomes. However, the causal links implied by this assumption need to be better established. A key question concerns what could be called the optimal level of fit. This becomes, especially, relevant under the assumption of decreasing marginal benefits of adding more coordinating actors between connected components of governance. Put another way, it is hardly optimal for every organization involved in collaborative governance to be involved in every issue. The question for future research must thus revolve around finding the right kind of actors to create fit, balancing both efficiency and legitimacy.

Finally, relations between issues in governance are neither static nor are their relationships always clear. The key to considering this in the study of fit are models that see fit as a dynamic concept, including an assessment of adaptive capacity. In doing so, the consequences of uncertainty in issue relations and (nonlinear) changes over time on fit should be explored, potentially in conjunction with recent studies of network resilience in natural resource governance (Moore, Grewar, and Cumming 2016). Adaptive capacity and flexibility are crucial in this respect and include not only the formation but also the conditions for the maintenance and severance of ties.

To explore such questions, formalized measures of fit, as developed in this study and others (Bodin et al. 2017, Sayles and Baggio 2017), need to be compared across cases and contrasted with outcomes or, even better, compared over time, whereas keeping in mind the needs of policymakers and practitioners for actionable evidence.

Notes

1. All data and code needed to replicate the analysis can be found in an open online repository under: https://doi.org/10.25678/000077
2. The exact search terms were *wasser or wasser* or *gewässer or gewässer* or *see or see*
3. The high misfit between geothermal energy and fracking itself should probably not be interpreted substantively. There are few organizations active in both of these newly developing fields in Switzerland, which leads to little organizational overlap, while the impacts and regulatory aspects of both technologies overlap greatly, which leads to their high association in the media data.

References

Andrews, K. T., and N. Caren . 2010. Making the news: Movement organizations, media attention, and the public agenda. *American Sociological Review* 75(6):841–866. doi:10.1177/0003122410386689

Bastian, M., S. Heymann, and M. Jacomy. 2009. Gephi: An open source software for exploring and manipulating networks. International AAAI Conference on Weblogs and Social Media.

Bergsten, A., D. Galafassi, and Ö. Bodin. 2014. The problem of spatial fit in socio-ecological systems: Detecting spatial mismatches between ecological connectivity and land management in an urban region. *Ecology and Society* 19(4):6. [online].

Blondel, V. D., J.-L. Guillaume , R. Lambiotte , and E. Lefebvre . 2008. Fast unfolding of communities in large networks. *Journal of Statistical Mechanics: Theory and Experiment* 2008(10): P10008. doi:10.1088/1742-5468/2008/10/P10008

Bodin, Ö., M. L. Barnes , R. R. J. McAllister , J. C. Rocha , and A. M. Guerrero . 2017. Social–ecological network approaches in interdisciplinary research: A response to Bohan et al. and Dee et al. *Trends in Ecology & Evolution* 32(8):547–549. doi:10.1016/j.tree.2017.06.003

Bodin, Ö., and D. Nohrstedt. 2016. Formation and performance of collaborative disaster management networks: Evidence from a Swedish wildfire response. *Global Environmental Change* 41:183–194. doi:10.1016/j.gloenvcha.2016.10.004

Brandenberger, L. M., I. Schläpfer , P. Leifeld , and M. Fischer . 2015. Overlapping Subsystems: Swiss Water Policy across Media and Parliament. Paper presented at the International Conference on Public Policy (ICPP), Milan, Italy, 1–4 July 2015.

Brown, G., K. Kangas, A. Juutinen, and A. Tolvanen. 2017. Identifying environmental and natural resource management conflict potential using participatory mapping. *Society & Natural Resources* 30(12):1458–1475. doi:10.1080/08941920.2017.1347977

Burkhardt-Holm, P., and A. J. B. Zehnder . 2018. Fischnetz: Assessing outcomes and impacts of a project at the interface of science and public policy. *Environmental Science & Policy* 82: 52–59. doi:10.1016/j.envsci.2018.01.010

Cash, D. W., W. N. Adger , F. Berkes , P. Garden , L. Lebel , and P. Olsson . 2006. Scale and cross-scale dynamics: Governance and information in a multilevel world. *Ecology and Society* 11(2):8. [online].

Dee, L. E., S. Allesina , A. Bonn , A. Eklöf , S. D. Gaines , J. Hines , U. Jacob , E. McDonald-Madden , H. Possingham , M. Schröter , and R. M. Thompson . 2017. Operationalizing network theory for ecosystem service assessments. *Trends in Ecology & Evolution* 32(2):118–130. doi:10.1016/j.tree.2016.10.011

Djerf-Pierre, M. 2013. Green metacycles of attention: Reassessing the attention cycles of environmental news reporting 1961–2010. *Public Understanding of Science* 22(4):495–512. doi:10.1177/0963662511426819

Downs, A. 1972. Up and down with ecology-the issue-attention cycle. *Public Interest* 28(1):38–50.

Ekstrom, J. A., and O. R. Young . 2009. Evaluating functional fit between a set of institutions and an ecosystem. *Ecology and Society* 14(2):18. [online].

Fischer, M. 2015. Collaboration patterns, external shocks and uncertainty: Swiss nuclear energy politics before and after Fukushima. *Energy Policy* 86 :520–528. doi:10.1016/j.enpol.2015.08.007

Folke, C., L. Pritchard, F. Berkes, J. Colding, and U. Svedin. 2007. The problem of fit between ecosystems and institutions : Ten years later. *Ecology and Society* 12(1):30.

Galtung, J., and M. H. Ruge . 1965. The structure of foreign news: The presentation of the Congo, Cuba and Cyprus crises in four Norwegian newspapers. *Journal of Peace Research* 2(1): 64–90. doi:10.1177/002234336500200104

Gerber, J.-D., and P. Knoepfel. 2008. Towards integrated governance of landscape development. *Mountain Research and Development* 28(2):110–115. doi:10.1659/mrd.0938

Gurung, A. B., A. Borsdorf , L. Füreder , F. Kienast , P. Matt , C. Scheidegger , L. Schmocker , M. Zappa , and K. Volkart . 2016. Rethinking pumped storage hydropower in the European Alps. *Mountain Research and Development* 36(2):222–232. doi:10.1659/MRD-JOURNAL-D-15-00069.1

Hänggli, R., and H. Kriesi. 2010. Political framing strategies and their impact on media framing in a Swiss direct-democratic campaign. *Political Communication* 27(2):141–157. doi:10.1080/10584600903501484

Harcup, T., and D. O'Neill. 2017. What is news? *Journalism Studies* 18(12):1470–1488. doi:10.1080/1461670X.2016.1150193

Hilgartner, S., and C. L. Bosk . 1988. The rise and fall of social problems: A public arenas model. *American Journal of Sociology* 94(1):53–78. doi:10.1086/228951

Ingold, K., M. Fischer, and P. Cairney. 2017. Drivers for policy agreement in nascent subsystems: An application of the advocacy coalition framework to fracking policy in Switzerland and the UK. *Policy Studies Journal* 45(3):442–463. doi:10.1111/psj.12173

Ingold, K., A. Moser, F. Metz, L. Herzog, H.-P. Bader, R. Scheidegger, and C. Stamm. 2018. Misfit between physical affectedness and regulatory embeddedness: The case of drinking water supply along the Rhine river. *Global Environmental Change* 48:136–150. doi:10.1016/j.gloenvcha.2017.11.006

Kininmonth, S., A. Bergsten, and Ö. Bodin. 2015. Closing the collaborative gap: Aligning social and ecological connectivity for better management of interconnected wetlands. *AMBIO* 44(S1): 138–148. doi:10.1007/s13280-014-0605-9

Kruse, S. and I. Seidl. 2013. Social capacities for drought risk management in Switzerland. *Natural Hazards Earth System Sciences* 13:3429–3441. https://doi.org/10.5194/nhess-13-3429-2013

Lubell, M. 2013. Governing institutional complexity: The ecology of games framework. *Policy Studies Journal* 41(3):537–559. doi:10.1111/psj.12028

McGinnis, M. D. 2011. An introduction to IAD and the language of the Ostrom workshop: A simple guide to a complex framework. *Policy Studies Journal* 39(1):169–183. doi:10.1111/j.1541-0072.2010.00401.x

Metz, F., and K. Ingold. 2014. Sustainable wastewater management: Is it possible to regulate micropollution in the future by learning from the past? A policy analysis. *Sustainability* 6(4): 1992–2012. doi:10.3390/su6041992

Moore, C., J. Grewar , and G. S. Cumming . 2016. Quantifying network resilience: Comparison before and after a major perturbation shows strengths and limitations of network metrics. *Journal of Applied Ecology* 53(3):636–645. doi:10.1111/1365-2664.12486

Morisette, J. T., A. E. Cravens , B. W. Miller , M. Talbert , C. Talbert , C. Jarnevich , M. Fink , K. Decker , and E. A. Odell . 2017. Crossing boundaries in a collaborative modeling workspace. *Society & Natural Resources* 30(9):1158–1167. doi:10.1080/08941920.2017.1290178

Newman, M. E. J. 2001. Scientific collaboration networks. II. Shortest paths, weighted networks, and centrality. *Physical Review E* 64(1):16132. doi:10.1103/PhysRevE.64.016132

Özesmi, U., and S. L. Özesmi . 2004. Ecological models based on people's knowledge: A multi-step fuzzy cognitive mapping approach. *Ecological Modelling* 176(1–2):43–64. doi:10.1016/j.ecolmodel.2003.10.027

Pedregosa, F., Varoquaux, G. A. Gramfort, V. Michel, B. Thirion, O. Grisel, M. Blondel, P. Prettenhofer, R. Weiss, V. Dubourg, J., et al. 2011. Scikit-learn: Machine learning in python. *Journal of Machine Learning Research* 12:2825–2830.

Rhodes, R. A. W. 1996. The new governance: Governing without government. *Political Studies* 44(4):652–667. doi:10.1111/j.1467-9248.1996.tb01747.x

Sax, L. J., S. K. Gilmartin , and A. N. Bryant . 2003. Assessing response rates and nonresponse bias in web and paper surveys. *Research in Higher Education* 44(4):409–432. doi:10.1023/A:1024232915870

Sayles, J. S., and J. A. Baggio . 2017. Social-ecological network analysis of scale mismatches in estuary watershed restoration. *Proceedings of the National Academy of Sciences* 114(10):E1776–E1785. doi:10.1073/pnas.1604405114

Schmid, F., F. Walter, F. Schneider, and S. Rist. 2014. Nachhaltige wassergouvernanz: Herausforderungen und wege in die zukunft. Thematische synthese 4 im rahmen des nationalen forschungsprogramms NFP 61 «nachhaltige wassernutzung. ». Bern.

Treml, E. A., P. I. J. Fidelman , S. Kininmonth , J. A. Ekstrom , and Ö. Bodin . 2015. Analyzing the (mis)fit between the institutional and ecological networks of the Indo-West pacific. *Global Environmental Change* 31:263–271. doi:10.1016/j.gloenvcha.2015.01.012

Tresch, A., P. Sciarini, and F. Varone. 2013. The relationship between media and political agendas: Variations across decision-making phases. *West European Politics* 36(5):897–918. doi:10.1080/01402382.2013.799312

Tropp, H. 2007. Water governance: Trends and needs for new capacity development. *Water Policy* 9(S2):19–30. doi:10.2166/wp.2007.137

Zhou, Q., and L. Leydesdorff. 2016. The normalization of occurrence and Co-occurrence matrices in bibliometrics using cosine similarities and Ochiai coefficients. *Journal of the Association for Information Science and Technology* 67(11):2805–2814. doi:10.1002/asi.23603