

CEE review 11-006

WHAT FACTORS DETERMINE THE PERFORMANCE OF INSTITUTIONAL MECHANISMS FOR WATER RESOURCES MANAGEMENT IN DEVELOPING COUNTRIES IN TERMS OF DELIVERING PRO-POOR OUTCOMES, AND SUPPORTING SUSTAINABLE ECONOMIC GROWTH?

Systematic Review Protocol

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1. Background

Throughout history human potential has been profoundly influenced by access to adequate water and societal progress depends on our ability to harness water as a productive resource. At the beginning of the 21st century the availability of water in sufficient and reliable quantities and of acceptable quality to meet society's many needs is a global concern, heightened by increasing demand, and the uncertainties brought by climate change. Much of this concern focuses on less-developed and transitional regions of the world, in particular in parts of Africa, Asia and South America where water problems already have severe implications for human well-being.

Whilst climate and the distribution of water influences accessibility, physical scarcity is increasingly seen as a backdrop to what has been termed policy induced scarcity (UNDP 2006). Commentators argue that the so called world 'water crisis' is primarily a crisis of management and poor governance (World Water Council 2003, SIWI 2007, UN-Water 2009). Although temporal and spatial distribution can be problematic it is the management of water and water resources rather than physical availability which are at the crux of this global water challenge.

Performance in water resource governance and management¹ is ultimately determined by the performance of institutional mechanisms: the making and enforcing of rules - formal and informal - governing cooperative human behaviour. The search for 'better' water management has become the focus of a large and disparate literature, and the rich and sometimes conflicting debates within it promote an array of approaches for improved institutional functioning towards the dual goals of poverty reduction and sustainable economic growth. Given the global diversity of water contexts which reflect differences in hydrology and geography; political, cultural and social environments; historical precedents and levels of economic development, this diversity of water management approaches is appropriate. But as described in the next section, the challenges facing those seeking to improve water management are conflated by an often weak empirical basis for many of the management strategies articulated in the literature. In terms of the circumstances required for water resource management institutions to deliver tangible benefits for poverty reduction and economic growth, and the nurturing of these via external support, surprisingly little is known about 'what' works, 'where' and 'why?'

This systematic review aims to map the literature on water resource management (WRM) institutions, and to objectively appraise the evidence base for the range of factors² which determine their performance in helping to deliver pro-poor outcomes and sustainable economic growth. As well as identifying these determinants of performance - their modes of influence, relative significance and the role of co-variables - the quality of the evidence base on institutional performance in water management will also be reviewed. The purpose of this work is to identify, characterise and promote an improved platform of high quality research and knowledge to support more effective interventions by policy-makers, practitioners, water users, advocacy groups and academics alike.

¹ See Table 1 for definitions of 'water governance' and 'water resource management'.

² A discussion of what is meant by factor follows in Section 1.2

Following an overview of background literature, this protocol sets out the proposed methodology for the collation, analysis and synthesis of the evidence relating to this systematic review question.

1.1 Framing the literature

A substantial body of peer reviewed and grey literature is concerned with the optimal institutional mechanisms for sustainable, equitable and efficient water resource management. Much of this considers the performance of Integrated Water Resource Management (IWRM) and the institutional mechanisms it promotes. Advocates of IWRM, a dominant paradigm within the global water policy community since at least the 1990's recommend that water resource management be carried out by semi-autonomous authorities established at basin scale, supported or answerable to participatory platforms of water stakeholders or user associations, through reformed regulatory frameworks, which impose charging and licencing of water use, allocation priorities and principles such as polluter pays. These mechanisms enjoy qualified success in developed countries, for example contributing to meeting the requirements of the Water Framework Directive and successful river rehabilitation in Europe, but their performance in unlocking progress in developing country contexts is equivocal (Biswas 2008, GWP 2009, Molle 2009).

Opinion on why reformed institutional mechanisms seem slow to deliver desirable outcomes varies and is often conflicting. The following three schools of thought summarise the key arguments found in the literature:

- Functional critiques specify certain factors as pre-requisites for the effective functioning of WRM institutions and imply that it is practical failures - a lack of 'capacity', data, analytical tools, staff, training, finance, coordination and communication - which hold back delivery (ADB 2003, Postel 2003, Schouten and Moriarty 2003, Rahaman et al. 2004, GWP 2009).
- Social critiques argue that the dominant models for reforming the management of water resources are flawed and have negligible utility, particularly in helping the poor, because they pay insufficient regard to social and political realities (Allan 2003, Biswas 2004 and 2008, Cleaver et al. 2005, Swatuk 2008).
- Progressive critiques use analytical insights to explore opportunities for progress, for example through 'adaptive' WRM which responds to imperfect knowledge or 'expedient' approaches which promote dialogue and 'fit for purpose' processes (see Rama Mohan Rao et al. 2003, Cleaver and Franks 2005, Allison and Hobbs 2004, Pahl-Wostl et al. 2005, Gearey and Jeffrey 2006, Lankford et al. 2006, Galaz 2007).

Within these critiques researchers consistently focus on or allude to interactions between factors which determine the performance of water resource management institutions. For example, some advocate that greater transparency and accountability will generate incentives for pro-poor WRM (UNDP 2006, Hepworth 2009). Others report shifting perceptions of IWRM's relevance in Africa and a growing appetite to see institutional mechanisms focus primarily on promoting water for growth and development (Pegasys, 2010). Reviews of water governance and management are also concerned with institutional performance in balancing competition for water between sectors (agricultural, industrial, domestic) or between users

(urban/rural, poor/wealthy, private/public/individual) (e.g. Rogers 2002, Falkner 2003, Moss et al. 2003, Young, 2003, Batchelor 2006, Cleaver et al. 2006, Bruch et al.2010).

A growing area of research at the transboundary level explores opportunities for more effective cooperation and performance through both qualitative (e.g. hydro-hegemony Zeitoun and Warner 2006) and quantitative (TFDD 2008, Wolf et al. 2005, Gleditsch et al. 2006) literatures. Others promote greater attention to the conflict-mitigating and pressure-reducing role of virtual water (Allan, 2001) at basin and regional levels (Zeitoun et al. 2010, Verma et al. 2009, Warner and Johnson 2007) though others contest the value of this approach (Wichelns 2010).

This short overview captures only a fraction of the fragmented thinking and policy advice on water resource institutions, much of which lacks the support of grounded evidence. The UK Department for International Development's (DFID) initiation of a systematic review to locate, collate, critically appraise and objectively synthesise evidence on institutional performance in water resources as part of its drive for evidence-based policy making is therefore timely and judicious.

1.2 What do we mean by factors?

The performance of a given institutional mechanism is influenced by the contexts within which it operates, theoretical concerns related to its design and practical issues relating to the manner of implementation. Thus the factors, circumstances, causes or influencing elements - the determinants of performance - demand a necessarily wide definition at this stage in the systematic review. This loose definition is important in order to avoid prejudicial recovery from the literature of deductive work which tests pre-ordained, theorised factors for success over and above the potentially very valuable findings of inductive research. The purpose of this review is to map and assess the quality of the research literature related to institutional performance on water and to explore the factors which have been empirically identified within the research to influence or control delivery of desirable outcomes: poverty reduction and economic growth.

Compiling an exhaustive list of strictly defined factors prior to undertaking the systematic review is neither possible nor desirable. It is anticipated that these factors, or conditions, will be found both to emerge inductively from research and to be tested deductively based on 'theorised' conditions for success. Nevertheless, for illustrative purposes potential factors can be grouped loosely within the functional, social and progressive domains outlined above. For example they may include functional considerations such as finance, 'capacity', data, analytical tools, staff, training, coordination and communication; social and political considerations including socio-economic status, levels of democratic deliberation, culture, customs, capture and corruption; or factors linked to progressive critiques such as incentives, legitimacy, authority and accountability.

The review team acknowledge the relevance of literature on institutional performance influenced by the work of Elinor Ostrom and associates. The factors leading to success or failure of natural resource governance are the focus of work on the 'evolution of institutions for collective action' (Ostrom, 1990). Here a factor, or 'design principle', is defined as an 'essential element or condition that helps to account for the success of [...] institutions in sustaining the common pool resource and gaining the long term compliance of appropriators to the rules in use' (Ostrom, 1990, p90). Based on analysis of a diverse set of case-studies, Ostrom proposed a list of eight factors or design principles shared by successful institutions

regardless of the type of resource or context: well-defined boundaries; congruence between provision and appropriation rules and local conditions; collective-choice arrangements; monitoring; graduated sanctions, conflict-resolution mechanisms, minimum recognition of rights and nested enterprises.

Ostrom's work on institutional performance has significantly influenced the analysis of natural resource governance, and there is some evidence to support the 'design principles' framework. Nevertheless, this body of literature has been the subject of critiques which focus for example on the lack of attention given to the role of context in natural resource governance (Mosse 1997, Cleaver 2000, Bardhan 2000, 2005) and the socially embedded nature of institutions (Cleaver 2002, Edwards and Stein, 1999). Finally, Blaikie (2006) contests the case for ideal conditions that enable successful institutions because of the disjunction between theoretical design and the actual governance of resources.

This systematic review will provide an opportunity to build on these analyses by exploring the evidence for whether factors such as compliance with design principles determine successful outcomes within water resource management. The review team will also use this body of research to inform the discussion and narrative analysis of results.

2. Objective of the Review

2.1 Primary objective and the systematic review question

The primary objective is to carry out a systematic mapping exercise and a narrative review for DFID and its partners. DFID are primarily interested in understanding the approaches to or features of WRM regimes, which promote poverty reduction and sustainable economic growth including through equitable and efficient allocation, and resilience to climate and other changes.

The process of systematic mapping and review will provide a rigorous and comprehensive search, collation, quality assessment, organisation and synthesis of the available evidence base - documented in peer reviewed academic and grey literature - in order to generate an objective, unequivocal and contemporary response to a specific question.

The following section details the initial question proposed by DFID and a modified version generated by the review team in conjunction with the stakeholder group.

Original Systematic Review question:

Do institutional mechanisms for water resources management result in more equitable, sustainable and efficient allocation and use of water resources, in terms of improved resilience of poor people to floods and droughts?

Whilst the review team appreciate the underlying hypothesis to the question: that reformed institutional processes (such as decentralisation to basin level management; devolution of responsibilities to water user associations; greater levels of participation in decision making or introduction of new permitting, charging and tariff structures etc.) may lead to more sustainable and pro-poor water, flood and drought management, the review team propose the following reformulation of the question.

Modified Systematic Review question:

What factors determine the performance of institutional mechanisms for water resources management in developing countries in terms of delivering pro-poor outcomes, and supporting sustainable economic growth?

Definitions of the terms used in the question are provided in Table 1.

The modified question is based on the results of both our scoping work and consultation with DFID staff and the stakeholder advisory group and qualified on the following basis:

- (1) *Exploration of contextual factors is preferred to simple evaluative analysis.* The relationships between the co-variables and contexts which influence the linkages between institutions and desirable outcomes are complex and non-linear. An exploration of the empirical evidence - primary research whether qualitative or quantitative - for these factors, their relative strength and modes of influence will therefore produce more insightful results than the *yes/no* approach implied in the initial question. Mapping and evaluating the evidence for (positive or negative) factors which influence attainment of pro-poor outcomes and sustainable growth in WRM will aid planning for how positive changes can be brought about in practice and through policy, investment and development assistance programmes.
- (2) *A focus on outcomes rather than process.* We propose to focus on broad definitions of pro-poor and sustainable economic growth outcomes rather than the processes through which these might be achieved, such as equitable and efficient allocation, and improved resilience. Although our search will include the variety of terms associated with these processes, our focus on empirical evidence of desirable outcomes will have the following benefits:
 - a. Objective measures of pro-poor water resource management (including relative and absolute measures across economic and livelihood indicators) better reflect whether water management, allocation and use have genuinely been more equitable than adherence to process. Similarly they can reveal whether the vulnerability of the poor to flood and drought shocks and stresses have been minimised or whether resilience has been built. By focusing on outcomes we intend to avoid the complexity involved in reviewing claims related to evolving and inconsistently applied concepts such as equity, resilience and vulnerability (for example, see Wheeler and Haddad 2005).
 - b. It ensures inclusion of outcomes resulting from a much wider array of WRM functions and processes such as pollution control, conflict resolution, and the determination and protection of water use rights.
 - c. The original question terminology of 'efficient allocation' infers that efficiency is a default 'preferred' outcome of successful water institutions. Although efficiency is often an important precursor to sustainable use, multiple interpretations make it a problematic outcome on which to judge performance (Gleick 2003). Further, there are compelling examples of where the pursuit of efficiency per se can contribute to unsustainable modes of water use (KAWAD 2005). The modified question avoids the potentially ambiguous focus associated with efficiency. We posit that the intent of the review is to understand the institutional mechanisms which contribute to

efficiency as a pathway to sustainable use and suggest that it is implicit on researchers to elucidate these important causal linkages.

- d. Lastly, it supports the manageability of the systematic review process which given the magnitude of potentially relevant literature is an important consideration. Focusing on documented interventions which empirically advance or reduce the likelihood of pro-poor and sustainable growth outcomes rather than navigating through literature associated with sometimes tenuous claims of equity, resilience or efficiency will make best use of the review team resources (though see note below).

Table 1: Definition of Terms

Term/Phrase	Review Definition
Factor	The influencing or controlling elements, circumstances, causes - the determinants of performance of water resource institutions. The definition is necessarily broad and will be dictated by the literature itself but could include, levels of investment and organisational resources; coherence with customary arrangements; process design; level of participation; accountability; financial incentives; issues of geography and socio-economic status; levels of security; leadership ; public sector pay and motivation; the influence of non-state actors etc. We are interested in factors which have both a positive or negative impacts on the performance of institutional mechanisms for water management.
<i>Institutional Mechanism</i>	A broad definition and interpretation will be adopted incorporating those by North (1990), Hodgson (2006) and Ostrom (2007) where institutional mechanisms are inferred to be the rules, norms and strategies, formal and informal including organisations, laws, regulations, conventions, systems and agreements relating to the management of water resources.
<i>Water Resources</i>	Freshwater in lakes, rivers and existing as groundwater. Green water will be included.
<i>Water Resource Management</i>	Water Resource Management is understood to be the planning; decision-making; administrative; monitoring and enforcement; incentive and control procedures and processes related to the management of water resources. These processes occur within the wider context of water governance which can be broadly defined as ' <i>comprising all social, political, economic and administrative organizations and institutions, as well as their relationships to water resources development and management.</i> ' (Tortajada, 2010)
<i>Developing Country</i>	The geographical focus of the review has been restricted to developing countries in Asia, Africa and Latin America. Developing countries are defined according to World Bank Global Development Indicators including low and middle income countries (see Appendix I)
<i>Pro-Poor outcomes</i>	Outcomes which benefit local poor defined in absolute and relative terms at the individual, community or national level. In addition to economic indicators, livelihood and gender equity indicators are included. Focus on 'outcomes' incorporates avoided harm as well as positive change.
<i>Sustainable Economic Growth</i>	A broad definition is adopted which requires the demonstration of links between WRM institutional performance and either positive benefit or avoided harm to economic activity without compromising the uses, values and functions of water related natural capital, or where WRM performance is shown to have a negative impact on economic activity.

Key issues related to the focus of the review and outputs should be mentioned here. Firstly, at DFID's request the review will focus on developing countries in Latin America, Africa and Asia only. Secondly, to ensure best use of available resources, the review will be carried out in two stages: first, a systematic map to identify and characterise the literature will be produced, and second, a narrative review of the evidence will be conducted. The systematic map will inform the best strategy and focus for the narrative analysis. (see Section 3.6).

A timeline for the systematic review process is presented in Appendix VII.

Note: To deliver useful outcomes with the resources available the systematic review team has been careful to maintain a manageable objective. Scoping work highlighted that focusing on multiple specific water management outcomes in the literature search produces an unmanageable volume of literature. For example although an explicit focus on the evidence base for the linkages between water management, resilience and climate change is a critical topic, including these outcomes in the search returns a very high number of papers. We have therefore opted for an approach which focuses on pro-poor outcomes and sustainable growth as end products of these linkage.

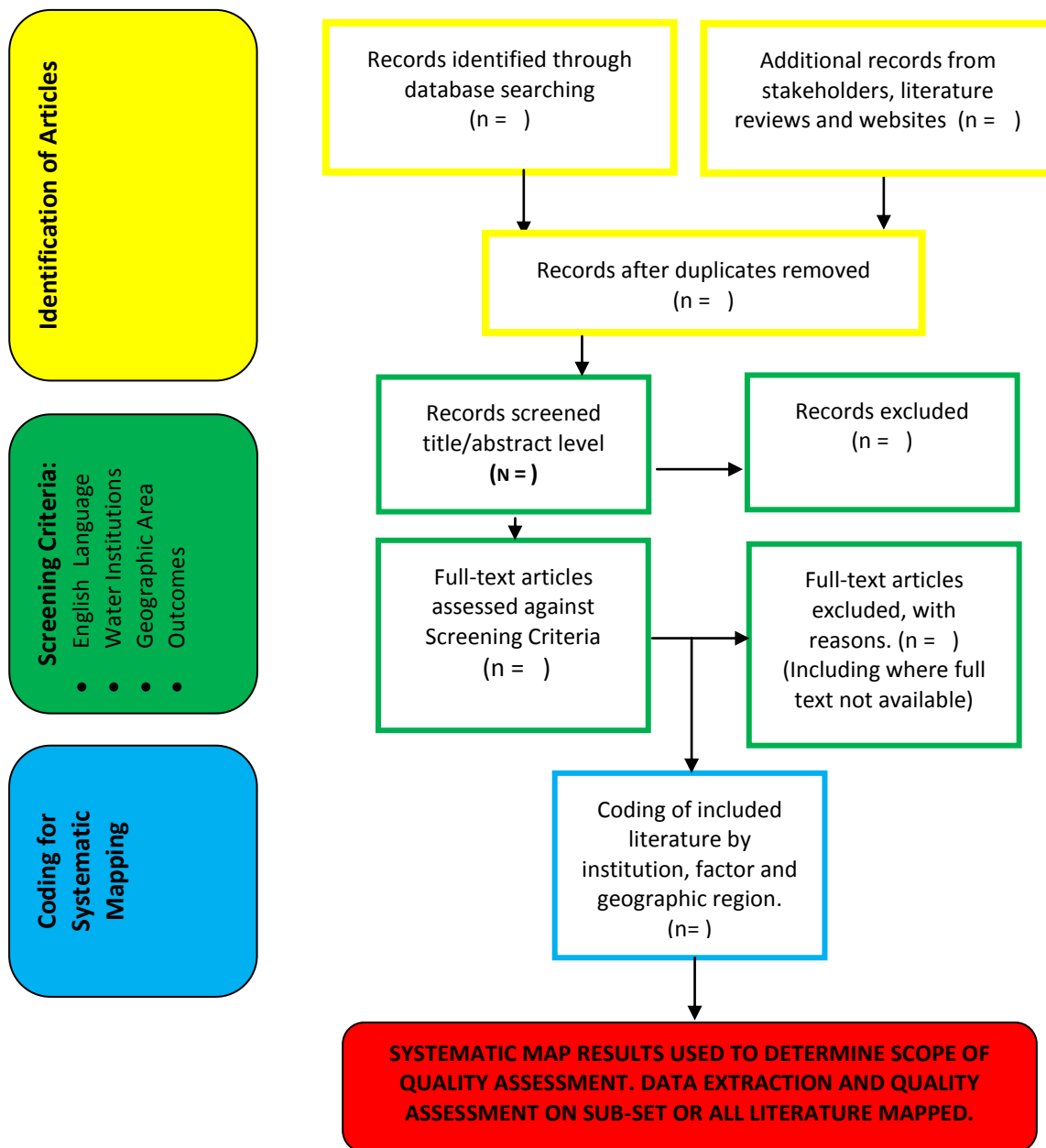
3. Methodology

The methodology adopted by this systematic review will follow the steps illustrated in Figure 1. In summary, they are:

- a) The identification of articles relevant to the research question through a **search strategy** which includes the application of a Boolean search string to literature databases and collation of relevant papers from websites, stakeholders and literature reviews;
- b) A two stage **screening process** using first the title and abstract and then the full text to exclude or include articles **based on their relevance** to the question using a set of consistent inclusion/exclusion criteria given in Table 2;
- c) The coding of included literature to **produce a systematic map** structured by institutional mechanism, factor(s) and geographic region/river basin.
- d) Consultation with DFID to **determine the scope** of quality assessment for the mapped papers. In the case where a large number of papers on the range of institutional mechanisms remain after the inclusion/exclusion tests are applied, quality assessment will be undertaken for a particular sub-set. In the case where few papers pass through the exclusion exercise, quality assessment may be applied to all articles.
- e) **Data extraction** and **quality assessment** (a draft data extraction and quality assessment form is given in Appendix V).
- f) Results presented as a **narrative synthesis**.

The remainder of this section details how each of these steps will be delivered in order to ensure a comprehensive review which avoids introduction of bias, and secures the replicability and validity of results.

Figure 1: Diagram showing the main stages of the systematic mapping process. Adapted from Moher et al, 2009.



3.1 Stage 1: the Search strategy

This section describes how the review team will search for, identify and collate the material required to address the review question.

The available primary research includes single, comparative, longitudinal and multiple case studies and research published in peer reviewed journals. It also features in grey literature including evaluation reports of organisations including multilateral and bilateral donors, international finance institutions and development banks, external support agencies and non-governmental organisations. Relevant articles exist across a wide spectrum of subject areas including social sciences and institutional studies, environmental sciences and natural resource management, water resource management, development, livelihoods and international studies, governance, economics, political economy and ecology, adaptive management, climate change and hydro-politics.

Although relevant research findings may have been generated anywhere, for manageability the geographic scope of the review will be restricted to low or middle income countries in Asia, Latin America and Africa. However the review will also draw on comparative studies with industrialized contexts where applicable. The list of countries to be considered is provided in Appendix I. Also to ensure manageability of the review within the funding available only articles in English will be considered and this is flagged as potential key limitation of the review.

Our search of the literature will employ the following strategies which have been informed by a scoping exercise and consultation with an advisory stakeholder group. Individuals invited to participate in this group and their responses are provided in Appendix III, though this group is not exclusive and membership is open to additional individuals or organizations with an interest in participating.

3.1.1 Primary databases

The general databases which focus on peer reviewed journals and other academic literature to be searched for articles are:

- Web of Knowledge;
- SCOPUS;
- Aqualine;
- EBSCO;
- ELDIS;
- JSTOR Arts and Sciences;
- and ZETOC.

3.1.2 Web searches

Additional searches for unpublished material and grey literature will be undertaken using Google and Google scholar with the first 50 hits checked with further examination of results if a high proportion of relevant studies are found (CEE 2010).

3.1.3 Websites of relevant organisations

Literature from the following organisations/networks/initiatives will be searched:

- CGIAR – Consultative Group on International Agricultural Research
- CSIR (South Africa) – Centre for Scientific and Industrial Research

- Regional and International Development Banks (World Bank including IEG, AfDB, ADB, IDB, IFC, IMF)
- GWP – Global Water Partnership
- IFAD – International Fund for Agricultural Development
- IFPRI – International Food Policy Research Institute
- IUCN – International Union for Conservation of Nature
- IWMI – International Water Management Institute
- MRC - Mekong River Basin Commission
- NBI - Nile Basin Initiative
- ODI – Overseas Development Institute
- Overseas Development Agencies
(AfD/DFID/GIZ/KfW/DANIDA/FINIDA/EU/NORAD/SIDA/CIDA/IDRC/AusAID/USAID/JICA/Netherlands/BTC)
- OXFAM
- SIWI – Stockholm International Water Institute
- SEI - Stockholm Environment Institute
- Third World Centre for Water Management
- UN (UN Water, UNEP, UNDP, UNESCO, FAO)
- WaterAid
- World Water Council
- WWF – World Wildlife Fund

Search capability differs considerably from website to website and therefore a simplified search strategy will be adopted to enable a consistent approach. Many websites are unable to process long Boolean searches and so a shortened search syntax containing terms related to only the institutional mechanisms (rather than scoping for the sub-set of relevant papers produced by searching for outcomes) will be used and, where appropriate, modified to reflect the requirements of each website. These modifications will include changes to wild cards, removal of brackets and application of filters to return particular types of document. For websites with limited search functionality (some website allow only single or limited character key word searches), the term ‘water’ will be used.

Each website will be searched using two methods: the first search will use the website search function (in many cases this is a Google powered search), the second search will target the Publication or Research section of the site using either a dedicated publication search or by browsing relevant libraries. For every website the 1st 50 returns for each method will be assessed for relevance. Results will be recorded together with coding to show which criteria was applied for exclusion. Papers, articles or reports found to be relevant will be downloaded to and EndNote library for further analysis.

3.1.4 Consultations with experts, stakeholders and organisations

Alongside our own review team and advisors, stakeholders listed in Appendix III have been contacted and asked to suggest key literature references and suggestions of additional organisations or websites that may be searched for grey literature. As well as collating relevant studies, this process generates a reference set of key papers used to check whether the automated literature searches are returning the most relevant papers. Expert recommendation will assist rather than determine the search strategy.

3.1.5 Reference lists of included studies and review papers

We will use the reference lists of key papers and relevant review papers (those that meet the inclusion criteria described below) as a source for further articles.

3.1.6 Development of the database search string

An appropriate Boolean search string to query the databases listed above was developed through scoping and testing applied to Web of Knowledge and SCOPUS, the results of which are set out in Appendix II. Initially, a list of search terms was compiled using the key elements of the review question, broken down in to 3 key topics: water related terms, institutional terms and terms related to outcomes (see Table 2).

No geographic filter will be applied because sensitivity testing during the scoping process found that this led to the exclusion of useful empirical studies in particular those that used a comparative methodology with regions outside the scope of study, or which focused on transboundary waters.

There are a large number terms and synonyms that could be used in database searches for water resources management and institutional mechanisms. The constraints on both the permitted number of characters available in search fields and the resources available to assess the large number of articles returned places a limit on terms that can be included in the search string. The review team has tested many search words and phrases (including those suggested by reviewers and stakeholders) for sensitivity and Table 2 shows those found to return the largest number of relevant papers. A number of applicable search terms have been excluded because they are either: a) not ‘unique’ and result in a large number of unrelated returns; or b) because they are not particularly sensitive and do not capture additional relevant material.

Table 2: Terms used in the search string

WATER TERMS	INSTITUTION TERMS	OUTCOME TERMS
Resource	Institution/al/	Performance
River	Organisation	Benefit
Basin	Policy	Poverty
Catchment	Governance	Poor
Watershed	Legislation/Legal/Law	Efficient/Efficiency
Aquifer	Reform	Equity/Equitable
Transboundary	Administrate/ation	Resilient/ce
Groundwater	Bureaucracy	Vulnerable
Irrigate/Irrigation	Allocate/ation	Sustainable
Lake	Market	Capacity
	Stakeholder	Access
	Management	Security
	Right	Conflict
	Common	Scarcity
	Participation/participatory	Economic
	Decentralisation	Livelihood
	Adapt/Adaptive/Adaptation	Gender
		Farm/Farming/Farmer

Databases are able to search for alternative spellings (for example British English versus American English), apply lemmatization or word-stemming and apply pluralisation to differing extents. Therefore the use of wildcards (commonly “*” or “\$”) will be adapted for each search engine or database.

While we acknowledge the search strategy risks overlooking a small number of studies, the risk has been minimized by engaging with the water resource management community to ask for suggested articles, searching the bibliographies of relevant papers and searching the websites of over 40 organisations related to water resource management.

Search strings using the terms presented in Table 2 were tested for sensitivity in Web of Knowledge and the results assessed against the following criteria:

- the total number of papers returned;
- papers returned from a selection of key authors felt to be relevant and suggested by our expert team including work by Dinar, A., Molle, F., Easter, K., Rosegrant, M. and Shah, T.
- Review of a sample of references to assess relevance from the first 20 hits, the 5000th-5010th hits and the 10,000th-10,010th hits.

Based on this sensitivity assessment the optimal search string returning the most comprehensive and yet relevant set of articles, and which we propose to use is:

Water AND (Resource OR River* OR Basin* OR Catchment* OR Watershed* OR Transboundary OR Groundwater OR Aquifer OR Irrigat* OR Lake)*

AND

(Institut OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR Manage* OR Organisation* OR Common OR Participat* OR Adapt* OR Decentrali*)*

AND

(Performance OR Benefit OR Poverty OR Poor OR Efficien OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict* OR Scarcity OR Economic OR Livelihood* OR Gender OR Farm*)*

Due to the wide scope of the search syntax, more than **72,977³** papers were returned in Web of Knowledge and **13,267** papers returned in SCOPUS (searching for Title-Abstract-Keywords). In order to manage this high level of returns, we propose to use the subject area functions in Web of Knowledge and the keyword function in SCOPUS to remove unrelated fields of study such as Dentistry, Geology, Chemistry, Astronomy, Physics, Material Science and Psychology (details are provided in Appendix II). This filter reduces the number of papers to a more manageable **13,594** from Web of Knowledge and our review suggests that relevant papers are not excluded arbitrarily in the process.

Refining the search results from Scopus SciVerse is more complex as the subject area definitions are broad, for example ‘environmental science’ or ‘agricultural science’. Instead, filters can be applied to the type and format of content returned; articles rather than books, review articles or editorials, by using the title of the Journal to filter for unrelated material or using the keyword function to exclude papers on unrelated subjects (e.g. photosynthesis, algae, wastewater treatment). Using these filters to exclude irrelevant material reduces the

³ Search from September 15th 2011.

number of abstracts to fewer than **8,500** articles. Further details of these searches and a definitive list of terms tested are given in Appendix II.

3.2 Stage 2: Screening articles for relevance using inclusion criteria

Studies will be assessed for relevance using a two stage process, first by reviewing the title and abstract and for those remaining, assessment of the full text.

With multiple reviewers working on this screening process there is an opportunity for reviewer bias to be introduced and so a clear set of criteria upon which to base inclusion or exclusion decisions has been developed and is included as Table 3. The criteria will be applied conservatively and if the assessment is inconclusive, the study will pass to the next stage of filtering. A modified version of the inclusion criteria form in Appendix IV will be used to guide reviewers.

In order to observe and correct potential bias at this stage Hellebrandt and Hepworth will audit the selection at each stage by acting as secondary reviewers on a 10% random sub-sample of abstracts and full texts. Kappa analysis will be applied to ensure decisions of primary reviewers (Lubbe and Hooper) and secondary reviewers are acceptably consistent. Where inconsistencies are found, these will be discussed and reviewed to ensure that interpretation and application of the inclusion/exclusion criteria is unambiguous.

Table 3: Inclusion criteria to be applied for screening relevance

Question Element	Description	Criteria
<i>Subject</i>	Focus Scale	Institutional mechanisms < <i>rules, norms and strategies, formal and informal including organisations, laws, regulations, conventions, systems and agreements</i> > relating to water resources < <i>freshwater in rivers, lakes and groundwater including soil/greenwater</i> > We are primarily interested in institutional mechanisms that are applied at the Transboundary, national or regional scale rather than the local scale. However, many of the outcomes of these these mechanisms are expressed and measured at the village or irrigation system level. To prevent exclusion of potentially relevant data, scale will not be used as an exclusion criterion.
<i>Geographic Scope</i>	Developing countries	Developing Countries in Asia, Latin America and Africa < <i>developing countries defined according to World Bank Development Indicators, including low and middle income countries – see Appendix I</i> >
<i>Outcome</i>	Reliable empirical measures of outcomes traced to institutional performance	a) Pro-poor outcomes < <i>benefits or avoided harm to poor defined in absolute and relative terms at the individual, community or national level using economic, livelihood and gender equity indicators</i> > b) Sustainable economic growth < <i>positive benefit or avoided harm to economic activity without compromising the uses, values and functions of water related natural capital</i> >

<i>Methodology</i>	Research design used	Methodology will not be used as the basis for exclusion/inclusion at this stage
<i>Language</i>		English language only

3.3 Stage 3: Systematic Mapping

A systematic map of the literature will be developed using the guidelines provided in *SCIE Systematic Mapping Guidance* (Clapton et al, 2009). The purpose of the map will be to describe and organise the literature related to the performance of institutional mechanisms for water resource management. It may also highlight research gaps in this field and enable recommendations for future research agendas.

Papers for inclusion in the systematic map will be coded after the full text assessment based on the inclusion/exclusion criteria described in Section 3.2. The coding will enable results to be grouped according to the institutional mechanism, scale, by river basin and/or geographic region and by factor and potentially by research method.

3.4 Stage 4: Reflection on appropriate focus for narrative analysis

The number of papers eligible for inclusion in the systematic map and the distribution between the various factors and/or institutional mechanism will inform the scale of the quality assessment. The research team will consult with DFID to determine whether all of the papers identified at the mapping stage should be assessed or whether the review should be narrowed to a particular sub-group, for example all papers related to certain types of institutional mechanism.

3.5 Stage 5: Assessment of study quality

The quality of the studies will be assessed in tandem with the data extraction process. Our quality assessment aims to address basic components of bias as suggested by experts in Systematic Review: the Cochrane Collaboration, the EppiCentre and the CEE (summarised below). It also aims to consider potential effect modifiers and reasons for heterogeneity within the research. Additional validity criteria have been designed in response to specific characteristics of studies in the field of water resource management which are often based on case study rather than experimental research and frequently use qualitative data.

3.5.1 Systematic review guidelines on study quality

Cochrane Collaboration Guidelines

The Cochrane Collaboration suggests that the key components of bias (and therefore in the assessment of quality) in any study are: selection bias (systematic differences between baseline characteristics of two groups: one exposed to the treatment and the other not, so-called “control”); performance bias (systematic difference between care or support provided to the two groups); attrition bias (systematic differences between the two groups in withdrawals from the study); detection bias (systematic differences between groups in how outcomes are determined); reporting bias (systematic differences between reported and unreported findings. Includes publication bias).

EppiCentre Guidelines

EppiCentre formulates the risk of bias as being composed of: trustworthiness of results (methodological quality, as discussed by Cochrane, including transparency, accuracy, accessibility and specificity of the methods); appropriateness of the use of that study design to address the review question (methodological relevance, including purposivity); appropriateness of focus for answering the review question (topic relevance, including relevant answers and legal and ethical propriety); overall weight of evidence (a summary of the above).

Centre for Environmental Evidence Guidelines

CEE guidelines on methodology quality assessment discuss four major sources of bias (along the lines adopted by the Cochrane Collaboration above). The authors highlight the difficulties in applying strict validity criteria in a systematic review of environmental or ecological evidence. It is suggested that the assessment of validity of these studies, where comparators and randomised designs are rarely applicable, should consider the sources of bias most relevant to a specific research field and review question. In addition, replication of the validity assessment by more than one assessor is recommended, as well as consultation with stakeholders, before a final appraisal is reached.

3.5.1 Potential effect modifiers and reasons for heterogeneity

Potential effect modifiers may include a tendency for preferential reporting of successful interventions, particularly in the grey, institutional literature. In addition, there is a tendency for deductive logic to be applied to studies of water institutions rather than inductive logic which can result in a relatively narrow analysis of outcome causation. It is anticipated that the majority of studies will be qualitative with a high level of heterogeneity of study types and outputs, particularly since the efficacy of institutional mechanisms for WRM is acknowledged to be highly context dependent (e.g. Lankford et al 2006). The relationships between institutional function, changes in resource conditions and attainment of outcomes are non-linear, mediated by a large number of co-variables, including economic, social and governance factors, and is further complicated by time lags and problems of scale. This presents a considerable challenge for this review but also an opportunity to comment on the ability of the literature on water institutions to inform policy. In particular it infers a need for research to pay careful attention to attribution and theories of change (see Popay et al. 2006). Our proposed methods for handling this complexity are discussed in the following sections.

3.5.3 Case Study Research Design Principles

Case studies make up a significant proportion of the evidence base for research on water management and institutional reform. Validity criteria, widely applied in the social sciences have been applied to case study research by Yin (2009). These tests, designed to assess the quality of the case study research design, are divided into four key areas: construct validity, internal validity, external validity and reliability. A summary of these tests are given below (adapted from Yin, 2009, p41).

Construct Validity: involves identification of concepts relevant to the case study, identifying the appropriate unit of analysis and applying operational measures to these concepts at the appropriate scale.

Internal Validity: applied to case studies which seek to describe causal relationships. Requires assessment of confounding variables or alternative explanations. For this review, the reported relationship between institutional reform and outcomes will be examined using this test.

External Validity: establishes the extent to which findings from a particular case study can be generalised. For this review this will be used to judge the evidence authors present to support claims to generalisation.

Reliability: establishes the extent to which the methods or operations used in case study research are documented and can be replicated.

Our method of assessment includes most elements advanced by Cochrane Collaboration, EppiCentre and Yin (2009), adapting them to the nature of the field we seek to review, as recommended by the CEE. We will not combine the measures of validity in an overall score or weight them, but rather report the study strengths and weaknesses by domain. We plan to summarise the overall validity of each study in basic categories describing their level of bias, but will only define the precise method of study classification once the quality assessment is under way. Clearly, some domains will influence the overall quality category more than others. We consider the treatment of causal links (whether or not the researchers have considered confounding variables or rival explanations) between factor and outcome to be critical, in addition to the appropriate application of research techniques and methods.

3.5.2 Rationale for review-specific validity criteria

Our question does not focus specifically on studies which have followed a comparative case study design (although the question implies an intrinsic before/after or with/without assessment), but on underlying factors affecting water management performance. Thus, our selection bias cannot be investigated in the same manner as systematic reviews focusing on comparative designs. Nonetheless, there remains the potential for bias created by a selection of study unit for which no clear justification for the choice is made or is poorly reported. As a result, selection bias will be assessed in several of our validity criteria.

- Firstly, we will look at the description of the study context and methods, so that a clear appraisal of the choice of study unit or site can be made and weighted against alternatives. For example, a site chosen based on the existence of a long-running institutional arrangement must be described as such to clarify the potential for bias, including a clear statement of whether or not the existing institutions on site affected the data collection (e.g. key informants might be formally linked to the institution, therefore might have vested interests in leading the research to report on specific success or failure stories).
- Secondly, we will focus on the ethical component of selection by asking how the researcher justified the choice of study units. More specifically, we expect that a study seeking to minimise its bias will report unambiguously on the research funding, particularly on potential links with water institutions, donors or other influential actors in that context.
- Where performance and detection biases are concerned, to start with we plan to uncover systematic differences by assessing the clarity of reporting on the institutional mechanisms at play in the study context. Minimum bias would

correspond to a study where the nature of the institution is clearly defined, particularly where sufficient information is provided on the variety and relevance of its mechanisms – i.e. ideally, we should be able to gain insights on both formal and informal institutional elements, not only “rules on paper” but also the actual norms on the ground.

- We will also examine whether studies report on confounding factors, specifically whether the existence of such factors was explicitly acknowledged and how the study attempted to consider their influence on the system being investigated.
- Finally, we will assess in particular detail how the study determined outcomes, and in doing so we stressing the use of appropriate methodologies for both the validating those outcomes (for example through triangulation) and the process of attribution to institutional mechanisms. The quality of reporting on outcome measures and causal links between institutions and outcomes will be given particular scrutiny. For example, several cases have been identified in our scoping exercise where outcome claims in relation to institutional change are made without any hard evidence being presented to support those conclusions.

Table 4 below sets out a draft set of validity assessment criteria that will be applied to studies

Criterion	Score As
Clarity of the Research Question	<ul style="list-style-type: none"> • ‘Done’ when the question addressed by the research is clear and specific. • ‘Not done’ when unclear.
Construct Validity <ul style="list-style-type: none"> • Are the research methods and results appropriate to the research question? • Is the unit of analysis suitable? • Is the research conducted at the appropriate scale? 	<ul style="list-style-type: none"> • ‘Done’ when multiple sources of evidence (with a justified and logical relationship to the case in hand) are used, the unit of analysis is clear and at a logical scale, where chains of evidence are visible and for case studies, where key informants have reviewed case study draft reports. • ‘Partial’ where 2 of the above criteria are present. • ‘Not done’ when fewer than 2 of the criteria present.
Description of Institutional Mechanism, Factor Or Reforms.	<ul style="list-style-type: none"> • ‘Done’ once mechanism, factor or reform is defined or specified within the research with detail sufficient to enable analysis. • ‘Partial’ when described in a general fashion. • ‘Not done’ when omitted.
Internal Validity and Outcome Attribution How are causal relationships between outcomes and institutional reform inferred and assessed?	<ul style="list-style-type: none"> • ‘Done’ when pattern matching (comparison of empirically based patterns with results/patterns predicted by theory), explanation building or logic models applied and confounding or rival explanations explored. • ‘Partial’ when some attempt has been made to do this (or are unclear). • ‘Not done’ when this has been omitted from research reporting.
External Validity <ul style="list-style-type: none"> • Does the study make claims to generalisation? If Yes: • Do the results relate to a broader theory and 	<ul style="list-style-type: none"> • ‘Done’ when claims to generalization are supported by either theory (analytic generalization) or replication. • ‘Not Done’ when generalization claims are put

allow analytic generalisation? <ul style="list-style-type: none"> For multiple case studies, has replication logic been applied? 	forward but not supported.
Description of Conditions/Context.	<ul style="list-style-type: none"> 'Done' when water sector, socio-economic conditions, political environment and hydrological regime have been investigated on the ground. 'Partial' when these factors are described in part only or are very general. 'Not done' when these factors are not well described.
Outcome Measurement How are pro-poor outcomes or indicators of sustainable economic growth described and measured/assessed?	<p>The field of water resource management is interdisciplinary with variation in the likely approaches adopted to examine 'outcomes'. The criteria used to quality assure outcome measurement will therefore vary depending on the approach applied in a particular article:</p> <ul style="list-style-type: none"> 'Done' in case study research when data on outcomes are triangulated/validated across more than one qualitative and quantitative source. 'Done' in qualitative research when data are checked across more than one source and assessed for potential bias 'Done' in quantitative research where sampling and measurement procedures are documented and justified and where statistical methods applied appropriately. 'Not done' 'Unclear' where it is not possible to tell.
Reliability Have research methods and results been adequately documented and reported to allow assessment of reliability, bias minimisation and replicability?	<ul style="list-style-type: none"> 'Done' when a research or case study protocol has been used and a case study database assembled. 'Not done' when no attempt has been made. Unclear where it is not possible to tell.
Researcher Bias	<ul style="list-style-type: none"> 'Done' when study funding and financial interests of authors are declared, no bias is apparent, and the selection of the case(s) is justified in appropriate manner. 'Partial' when funding or financial interests are not declared (but case selection is justified in appropriate manner). 'Not done' when funding, financial interests or case selection are not declared and there is potential bias apparent. 'Unclear' where it is not possible to tell
Summary of Validity	<ul style="list-style-type: none"> Score to be determined as systematic review evolves.

3.6 Stage 6: Data extraction

We will extract details of the characteristics of the included studies (location, scale, factors/reform/institutional mechanism, outcomes and methodology) along with study

validity. Data extraction will occur independently in duplicate for 10% of the studies, the remaining 90% will be extracted by Hooper and Hellebrandt. Quantitative outcome data will be extracted in full form in which they are made available. A standard recording format will be developed to ensure transparency and replicability throughout. In addition to the data required in the validity assessment given above the following information will be recorded for each paper using a modified version of the form in Appendix V:

- Full bibliographical reference
- Publication type (peer review journal article, institution working paper)
- Study design
- Country, region or basin studied
- Type of institution analysed
- Type, subject and measure of outcome observed
- Time period researched
- Sample size and characteristics
- Means of outcome attribution and theory of change proposed
- Performance factors discussed
- Claims of generalization and basis on which these
- Findings (quantitative and qualitative)
- Biases, effect modifiers/confounding variables identified and/or measured by authors (including if their discussion acknowledges a flaw in their results)

3.7 Stage 7: Data synthesis and presentation

The initial output of the review will be a systematic map of the literature. This will be presented in both tabular and diagrammatic forms, tentatively structured according to coding on the basis of institutional mechanism, factor, geographic region/river basin and research method. Accordingly, each study may be given more than one code in each category, for example it may examine more than one institutional mechanism or be a comparative study focusing on more than one geographic area or river basin.

Institutional Mechanisms will be coded using a three letter abbreviation. Further codes will be added as mechanisms are identified.

- DEC. Decentralization
- PAR. Participation or formation of Participatory Platform
- RBO. Establishment of River Basin Organisation
- WUA. Establishment of Water User Association
- REG. Reform of Regulatory Framework
- ECO. Establishment or Reform of Economic Incentives (Charging Tariffs)
- MAR. Establishment or reform of market based mechanisms

- ALL. Changes to allocation priorities

Factors will be coded using a numerical category according to the following. It is not possible to give an exhaustive list and further factors may be added as the review continues, however and initial list includes:

1. Accountability
2. Analytical tools,
3. Authority
4. Capacity
5. Capture and corruption;
6. Communication
7. Coordination
8. Culture
9. Customs
10. Data
11. Finance
12. Incentives
13. Legitimacy
14. Levels of democratic deliberation
15. Staff,
16. Training

For the geographic coding, studies will be coded by country and river basin where applicable (for example for transboundary river basins).

Coding by research method will also be undertaken. Studies will be identified according to the main approach. For example: Qualitative; quantitative; single case study; comparative case studies; multiple case studies; longitudinal case studies etc.

In addition, the review team proposes to use software such as SciVal by Elsevier to present graphics showing the country of origin and or institution behind each study.

The systematic map will inform further consultation with DfID and the stakeholder advisory group to shape the most useful focus for full data extraction, quality assessment and reporting using a narrative synthesis. The synthesis will be guided by approaches including framework synthesis (Barnett-Page and Thomas, 2009), qualitative analysis techniques (Miles and Huberman, 1994) and preferred approaches to systematic review reporting (Moher et al. 2009).

4. Potential conflicts of interest and sources of support

Zeitoun, Hepworth, Lankford and Pegram have all conducted empirical research on WRM and undertaken consultancy assignments and worked with the donor and WRM support community over the past 20 years and all are notable participants in international debates on WRM. Throughout the review each will work reflexively to maintain an objective, critical and scholarly approach to avoid favouring of unqualified perspectives in the sometimes 'ideological' debates about WRM. The reputation and status of UEA, Water Witness and Pegasys as objective arbiters of progress in the WRM sphere provide a unique platform

through which to maximise the quality and impact of this systematic review. Hellebrandt and Hooper have no known conflicts of interest.

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APPENDIX I: DEVELOPING COUNTRIES

Sub-Saharan Africa	Middle East and North Africa	Asia	Latin America
Angola	Algeria	Afghanistan	Argentina
Benin	Djibouti	Armenia	Bolivia
Botswana	Egypt	Azerbaijan	Brazil
Burkina Faso	Iran	Bangladesh	Chile
Burundi	Jordan	Bhutan	Colombia
Cameroon	Lebanon	Cambodia	Ecuador
Cape Verde	Libya	China	French Guiana
Central African Republic	Morocco	Georgia	Guyana
Chad	Syria	India	Paraguay
Comoros	Tunisia	Indonesia	Peru
Congo	West Bank and Gaza	Kazakhstan	Suriname
Côte d'Ivoire	Yemen	Korea De. Rep.	Uruguay
Democratic Republic of the Congo		Kyrgyzstan	Venezuela
Eritrea		Laos	Belize
Ethiopia		Malaysia	Costa Rica
Gabon		Mongolia	El Salvador
Gambia		Myanmar	Guatemala
Ghana		Nepal	Honduras
Guinea		Pakistan	Mexico
Guinea-Bissau		Philippines	Nicaragua
Kenya		Russia	Panama
Lesotho		Sri Lanka	
Liberia		Tajikistan	
Madagascar		Thailand	
Malawi		Turkey	
Mali		Turkmenistan	
Mauritius			
Mozambique		Uzbekistan	
Namibia		Vietnam	
Niger			
Nigeria			
Rwanda			
Sao Tome and Principe			
Senegal			
Seychelles			
Sierra Leone			
Somalia			
South Africa			
Sudan			
Swaziland			
Togo			
Uganda			
United Republic of Tanzania			
Zambia			
Zimbabwe			

APPENDIX II: REFINING THE SEARCH STRING – SEARCH TERMS AND RESULTS FROM WEB OF KNOWLEDGE

The following table lists the search terms tested during the scoping stage.

RESOURCE TERM	INSTITUTION/MANAGEMENT TERMS	OUTCOME TERM
Resource	Institution/al/	Performance
Hydro*	Organization	Benefit
Water	Policy	Poverty
River	Governance	Poor
Basin	Legislation/Legal/Law	Efficient/Efficiency
Catchment	Reform	Equity/Equitable
Watershed	Administrate/tion	Resilient/ce
Aquifer	Bureaucracy	Vulnerable
Transboundary	Allocate/tion	Sustainable
Groundwater	Market	Capacity
Irrigate/Irrigation	Stakeholder	Access
Lake	Management	Security
‘Soil Water’	Right	Conflict
‘Green Water’	Common	Scarcity
Evapotranspiration	Participation/participatory	Economic
‘groundwater quality protection’	Decentralization	Livelihood
‘groundwater quality control’	Adapt/Adaptive/Adaptation	Gender
	Sharing	Farm/Farming/Farmer
	Functionality	Cooperation
	Competition	Education
	Regulation	Sanitation
	Distribution	Health
	Pricing	‘Drinking water’
	Arrangement	Pro-Poor
	Demand	Flood

RESOURCE TERM	INSTITUTION/MANAGEMENT TERMS	OUTCOME TERM
	Availability	Drought
	Abstraction	'Climate Change'
	Association	Quality
		Food
		Livestock
		Scarcity

The following table shows a sample of the iterations of the search string together with changes to the syntax, the number of papers returned, the presence of key authors and any relevant comments. This shows how the search string evolved through the scoping period. Key decisions in this process were to exclude geographic search terms and through the process of narrowing the question, drop terms such related to hydrology, floods and droughts.

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
1	(Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Sharing OR Distribut* OR Institut* OR Policy OR Arrangement) AND (Asia* OR ((Latin OR Central OR South) AND America*) OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River*) AND (Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Functionality OR Pro-Poor OR Conflict OR Cooperation OR Competition)		1371	Few papers by key authors (Saleth, Dinar, Bauer, Rosegrant, Ward, Ringler, Shah etc).	Many relevant papers although very few related to law, economics, reform.
2	(Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Sharing OR Distribut* OR Institut* OR Policy OR Arrangement OR law OR Governance OR economic* OR market* OR participa*) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer) AND (Performance OR Quality OR Equit* OR Sustainab*	Added: law, governance, economic*, participa*, aquifer. Removed double brackets and inserted 'Latin America*', 'central America' and 'south	1529	Few papers by key authors (Saleth, Dinar,	Appear to be quite relevant. Still many on quite technical, hydrological aspects.

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	OR Resilience OR Flood* OR Drought* OR Functionality OR Pro-Poor OR Conflict OR Cooperation OR Competition)	America* ¹		Bauer, Rosegrant, Ward, Ringler, Shah etc).	
3	(Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Sharing OR Distribut* OR Institut* OR Policy OR Arrangement OR law OR Governance OR economic* OR market* OR participa* OR Decentrali* OR Reform*) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer) AND (Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Functionality OR Pro-Poor OR Conflict OR Cooperation OR Competition)	Added: Decentrali*, reform*	1530		
4	(Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Sharing OR Distribut* OR Institut* OR Policy OR Arrangement OR law OR Governance OR economic* OR market* OR participa* OR Pric*) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer) AND (Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Functionality OR Pro-Poor OR Conflict OR Cooperation OR Competition)	removed: Decentrali* and Reform*, added pric*	1531		Decentralisation, pricing and reform are not very specific search terms and don't bring up further papers.
5	(Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Sharing OR Distribut* OR Institut* OR Policy OR Arrangement OR law OR Governance OR economic* OR market* OR participa* OR Pric*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer) AND (Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Functionality OR Pro-Poor OR Conflict OR Cooperation OR Competition)	removed geographic criteria: (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*)	24,334		Too many hits to assess. Suggest keeping geographic limits in search string. Many relevant papers but there remains a large amount on technical aspects of water management (modelling, agronomy etc) rather than papers focusing on institutions.

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
6	(Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Functionality OR Pro-Poor OR Conflict OR Cooperation OR Competition) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Sharing OR Distribut* OR Institut* OR Policy OR Arrangement OR law OR Governance OR economic* OR market* OR participa*)	Inverted the syntax to test for sensitivity of searching on the basis of outcomes, rather than water terms first.	1531		By comparing duplicates with earlier searches in EndNote it can be shown that these are an almost identical set of papers. The search function is not sensitive to word the order in which the string is entered.
7	(Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Functionality OR Pro-Poor OR Conflict OR Cooperation OR Competition) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Sharing OR Distribut* OR Institut* OR Policy OR Arrangement OR law OR Governance OR economic* OR market* OR participa* OR right*)	Add 'right*'	1776	Some but not all key authors.	The term ' Right* ' captures 200 extra papers and should be included in the search string.
8	(Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Functionality OR Pro-Poor OR Conflict OR Cooperation OR Competition) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR Arrangement OR law OR Governance OR economic* OR market* OR participa* OR right*)	Removed the term 'sharing'	1773	Some but not all key authors.	The term ' sharing ' is not particularly sensitive (3 papers out of 1776) so could be removed from the string.
9	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Functionality OR Pro-Poor OR Conflict OR Cooperation OR Competition) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR Arrangement OR law OR Governance OR economic* OR market* OR participa* OR right*)	Added the term 'benefit'	1816	Some but not all key authors.	Term ' benefit ' captured 30 extra papers and is therefore relatively sensitive. Suggest inclusion in search string.

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
10	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Functionality OR Pro-Poor OR Conflict OR Cooperation OR Competition) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR Arrangement OR law OR Governance OR economic* OR market* OR participa* OR right*)	Added term 'groundwater'	1962	Some but not all key authors.	Suggest inclusion of term ' groundwater ' despite extra technical papers as there are nearly 150 extra returns.
11	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Functionality OR Pro-Poor OR Conflict OR Cooperation OR Competition) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR Arrangement OR law OR legal OR Governance OR economic* OR market* OR participa* OR right*)	added 'legal'	1962	Some but not all key authors.	No additional hits - ' legal ' will not be included in the search string.
12	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Functionality OR Pro-Poor OR Conflict OR Cooperation OR Competition) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR Arrangement OR law OR legisla* Governance OR economic* OR market* OR participa* OR right*)	removed legal and added legisla*	1968	Some but not all key authors.	An additional 6 papers. Suggest keep but remove if search engines cannot cope with a large number of terms.
13	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Functionality OR Pro-Poor OR Conflict OR Cooperation OR Competition) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* Governance OR economic* OR market* OR participa* OR right*)	removed 'arrangement'	1965	Some but not all key authors.	removing the term arrangement has very limited effect. Suggest it is not included in search string.

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
14	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* Governance OR economic* OR market* OR participa* OR right*)	removed term 'functionality'	1963	Some but not all key authors.	functionality has no effect. Suggest remove this from the search string.
15	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Institut* OR Policy OR law OR legisla* Governance OR economic* OR market* OR participa* OR right*)	removed term 'distribut*'	1729	Some but not all key authors.	Returned hits fell by nearly 250 papers. Suggest ' Distribut ' is included as a search term.
16	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* Governance OR economic* OR market* OR participa* OR right*)	added 'distribut*' and 'poverty'	1998	Some but not all key authors.	Suggest include term ' poverty '
17	(Benefit OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* Governance OR economic* OR market* OR participa* OR right*)	Removed the term 'performance'	1919	Some but not all key authors.	The term 'performance' returns approx 70 papers. Suggest include ' performance '

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
18	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa* OR Nile OR Incomati OR Lake Chad OR Amazon OR Jordan OR Mekong OR Ganges OR Indus OR La Plata) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*)	added more specific place locations to test sensitivity to location using a few international river basins per continent. Added Nile, Incomati, Lake Chad, Amazon, Jordan, Mekong, Ganges, Indus, La Plata	2915	Some but not all key authors.	This increased the number of terms markedly. Need to work on more specific location terms. Naming the river basin seems to return a far greater number of papers than naming the continent.
19	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa* OR Nile OR Lake Chad OR Amazon OR Jordan OR Mekong OR Ganges OR Indus OR La Plata) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*)	Test for location sensitivity: Removed 'Incomati'	2914	Some but not all key authors.	Suggest remove Incomati as a search term.
20	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa* OR Nile OR Lake Chad OR Amazon OR Jordan OR Mekong OR Ganges OR Indus) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*)	Test for location sensitivity: removed 'La Plata'	2895	Some but not all key authors.	Decreases by 20 papers. Low to medium sensitivity. Suggest to Include 'La Plata' if space in search fields.
21	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa* OR Brazil OR Nile OR Lake Chad	Test for location sensitivity: added an example country name - Brazil.	3396	Some but not all key authors.	CONCLUSION: Search sensitive to country names rather than continents.

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	OR Amazon OR Jordan OR Mekong OR Ganges OR Indus) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*)				
22	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa* OR Brazil OR India OR Nile OR Amazon OR Jordan OR Mekong OR Ganges OR Indus) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*)	Remove Lake Chad and add India	4176	Some but not all key authors.	
23	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa* OR Brazil OR India OR China OR Nile OR Amazon OR Jordan OR Mekong OR Ganges OR Indus) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*)	Add China Remove La Plata	5893	Some but not all key authors.	Returned hits become dominated by chinese case study examples. Could be quite difficult to assess? Many papers appear to be more technical/natural science rather than institutional.
24	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND (('Latin America*' OR 'Central America*' OR 'South America*') OR (Argentina OR Bolivia OR Brazil OR	1st attempt to incorporate long geographic search string requires all location terms to be in 1 field and the remainder to be topic specific. Will Require 4 searches by region as only able to include 18	1329	Some but not all key authors.	All references were exported to EndNote and duplites removed. A total of 2488 hits were returned.

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	Chile OR Colombia OR Ecuador OR French Guiana OR Guyana OR Paraguay OR Peru OR Suriname))	geographic terms at 1 time (i.e. Country name or river basin).			
25	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND (('Latin America*' OR 'Central America*' OR 'South America*') OR (Uruguay OR Venezuela OR Belize OR Costa Rica OR El Salvador OR Guatemala OR Honduras OR Mexico OR Nicaragua OR Panama OR Amacuro))	Replaced countries with remaining from list and added 1 river basin.	1272	Some but not all key authors.	
26	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND (('Latin America*' OR 'Central America*' OR 'South America*') OR (Amazon OR Aviles OR Aysen OR Baker OR Barima OR Cancoso OR Lauca OR Carmen Silva OR Chico OR Catatumbo OR Chira))	Replaced countries with River Basins A-C	723	Some but not all key authors.	
27	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND (('Latin America*' OR 'Central America*' OR 'South America*') OR (Chuy OR Comau OR Corantijn OR Courantyne OR Cullen OR Essequibo OR Gallegos-Chico OR Jurado OR La Plata OR Lagoon Mirim OR Fagnano))	Replaced with Basins C-F	421	Some but not all key authors.	

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
28	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND (('Latin America*' OR 'Central America*' OR 'South America*') OR (Titicaca-Poopo OR Maroni OR Mataje OR Mira OR Oiapoque OR Oyupock OR Orinoco OR Palena OR Pascua OR Patia OR Puelo))	replaced with Basins F-P	441	Some but not all key authors.	
29	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND (('Latin America*' OR 'Central America*' OR 'South America*') OR (Titicaca-Poopo OR Maroni OR Mataje OR Mira OR Oiapoque OR Oyupock OR Orinoco OR Palena OR Pascua OR Patia OR Puelo))		552	Some but not all key authors.	
30	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Africa*) OR (Angola OR Benin OR Botswana OR Burkina Faso OR Burundi OR Cameroon OR Cape Verde OR Central African Republic OR Chad Or Comoros OR Congo))	Search for Sub-Saharan Africa by country A-C)	1315	Some but not all key authors.	Cannot search using French accents. Removed word Cote and also inserted option of Ivory Coast. Combined search total for SSA with duplicates removed is 2732.
31	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*)	Searches by Country C-K	1360	Some but not all key authors.	

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Africa*) OR (Côte d'Ivoire OR Democratic Republic of the Congo Or Equatorial Guinea Or Eritrea Or Ethiopia Or Gabon Or Gambia Or Ghana Or Guinea OR Guinea-Bissau OR Kenya))				
32	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Africa*) OR (Lesotho OR Liberia Or Madagascar OR Malawi OR Mali OR Mozambique OR Namibia OR Niger Or Nigeria OR Rwanda Or Sao Tome and Principe))		Unidentified Server Error: only 11 papers retrieved.	Some but not all key authors.	
33	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Africa*) OR Senegal Or Sierra Leone OR Somalia OR South Africa OR Swaziland OR Togo Or Uganda OR United Republic of Tanzania Or Zambia OR Zimbabwe))	Countries S-Z	1329	Some but not all key authors.	
34	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Africa*) OR (Akpa OR Atui OR Awash OR Baraka OR Benito OR Ntem OR Bia OR Buzi OR Cavally OR Cestos OR Chiloango OR Congo OR Zaire OR Corubal))	Replaced country names with River Basin names A-C	1206	Some but not all key authors.	

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
35	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Africa*) OR (Cross OR Cuvelai OR Etosha OR Gash OR Geba OR Scarcies OR Incomati OR Juba-Shibeli OR Komoe OR Kunene OR Chad OR Natron OR Turkana))	Changed River Basin Names	2033	Some but not all key authors.	
36	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Africa*) OR (Limpopo OR Little Scarcies OR Loffa OR Lotagipi Swamp OR Mana-Morro OR Maputo OR Mbe OR Moa OR Mono OR Niger OR Nile))		1470	Some but not all key authors.	
37	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Africa*) OR (Nyanga OR Ogooue OR Okavango OR Orange OR Oueme OR Ruvuma OR Sabi OR Sassandra OR Senegal OR St. John OR St. Paul OR Tano OR Umba))		1330	Some but not all key authors.	
38	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic*		1221	Some but not all key authors.	

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	OR market* OR participa* OR right*) AND ((Africa*) OR (Umba OR Umbeluzi OR Utamboni OR Volta OR Zambezi))				
39	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Asia*) OR (Afghanistan OR Armenia OR Azerbaijan OR Bangladesh OR Bhutan Or Cambodia Or China Or Georgia OR India OR Indonesia OR Kazakhstan))	Added Asia and countries a-k	3722	Some but not all key authors.	Combined total for Asia with duplicates removed is 6360
40	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Asia*) OR (Kyrgyzstan OR Laos OR Malaysia OR Mongolia OR Myanmar OR Nepal OR North Korea Or Pakistan OR Philippines OR Russia* OR South Korea OR Sri Lanka OR Tajikistan OR Thailand))	Added remaining countries	1298	Some but not all key authors.	
41	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Asia*) OR (Turkey OR Turkmenistan OR Uzbekistan OR Vietnam OR Iran OR IraqOR Jordan OR Lebanon OR Oman OR Syria OR Yemen OR West Bank OR Gaza OR Palestin*))		1460	Some but not all key authors.	

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
42	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Asia*) OR (Amur OR An Nahr Al Kabir OR Aral Sea OR Asi OR Orontes OR Astara Chay OR Atrak OR BahuKalat OR Rudkhanehye OR Bangau OR Bei Jiang))	River Basins A-B	596	Some but not all key authors.	
43	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Asia*) OR (Amur OR An Nahr Al Kabir OR Aral Sea OR Asi OR Orontes OR Astara Chay OR Atrak OR BahuKalat OR Rudkhanehye OR Bangau OR Bei Jiang))	River Basins B-H	1433	Some but not all key authors.	
44	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Asia*) OR (Kunes He OR Indus OR Irrawaddy OR Jenisej OR Yenisey OR Jordan OR Kaladan OR Karnaphuli OR Kowl E Namaksar OR Kura-Araks OR Lake Ubsa-Nur))	River Basins K-L	827	Some but not all key authors.	
45	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic*	River Basins L-Sa	1139	Some but not all key authors.	

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	OR market* OR participa* OR right*) AND ((Asia*) OR (Ma OR Murgab OR Nahr El Kebir OR Ob OR Oral OR Ural OR Pakchan OR Pandaruan OR Pu Lun T'o OR Red OR Song Hong OR Saigon OR Salween))				
46	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Asia*) OR (Samur OR Sembakung OR Sepik OR Song Vam Co Dong OR Sujfun OR Sulak OR Tami OR Tarim OR Terek OR Tigris-Euphrates OR Shatt al Arab OR Tjeroaka-Wanggoe OR Tumen))	River Basins S-T	629	Some but not all key authors.	
47	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right*) AND ((Asia*) OR (Wadi Al Izziyah OR Yalu))	River Basins T-Y	551	Some but not all key authors.	
48	(Benefit OR Performance OR Quality OR Equit* OR Sustainab* OR Resilience OR Flood* OR Drought* OR Pro-Poor OR Conflict OR Cooperation OR Competition OR Poverty) AND (Asia* OR 'Latin America*' OR 'Central America*' OR 'South America*' OR Africa*) AND (Transboundary OR Basin* OR Catchment OR Watershed OR River* OR Aquifer OR Groundwater) AND (Water OR Hydro*) AND (Resource* OR Management OR Security OR Allocation OR Distribut* OR Institut* OR Policy OR law OR legisla* OR Governance OR economic* OR market* OR participa* OR right* OR irrigation)	Return to generic searches without geographic location filters. Add term irrigation to general search (not split by geographic region) to test sensitivity of term.	2032	Some but not all key authors.	

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
1	Water AND Resource* AND Institut* AND Performance	Reduction to most basic search to target most relevant papers.	128	Yes - All	Highly relevant papers.
2	((Water OR Hydro*) AND Resource* AND Institut* AND (Performance OR Management OR Allocation))		1640	Yes - All	While there are relevant papers, the use of the term 'hydro*' introduces a large number of technical papers on hydrology, modeling and engineering which are not relevant. Suggest this term is dropped from the search syntax.
3	Water AND Resource* AND (Institut* OR Policy OR Governance)	Remove the term 'Hydro*' and experiments with further institution terms.	5574	Yes-ALL	Highly relevant papers.
4	Water AND Resource* AND (Institut* OR Policy OR Governance OR Law)		6093	Yes-ALL	Highly relevant papers.
5	Water AND (Resource* OR River OR Basin) AND (Institut* OR Policy OR Governance OR Law)		8287	Yes-ALL	Highly relevant papers.
6	Water AND (Resource* OR River OR Basin) AND (Institut* OR Policy OR Governance OR Law OR Security)		9095	Yes-ALL	Relevant papers but larger proportion of irrelevant material.
7	Water AND (Resource* OR River OR Basin) AND (Institut* OR Policy OR Governance OR Law OR Reform)		8389	Yes-ALL	Mainly relevant papers.
8	Water AND (Resource* OR River OR Basin) AND (Institut* OR Policy OR Governance OR Law OR Reform OR Organisation)		8578	Yes-ALL	Mainly relevant papers.
9	Water AND (Resource* OR River OR Basin) AND (Institut* OR Policy OR Governance OR Law OR Reform OR Organisation OR Allocation)		10769	Yes-ALL and a couple of	Mainly relevant papers.

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
				extra papers per key author too.	
10	Water AND (Resource* OR River OR Basin OR Catchment OR Watershed OR Transboundary OR Groundwater OR Aquifer) AND (Institut* OR Policy OR Governance OR Law OR Reform OR Organisation OR Allocation OR Performance OR Development OR Market OR Economic OR Regulation)		41,618	All	More papers from all the key authors but VAST numbers of papers that are irrelevant.
11	Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Transboundary OR Groundwater OR Aquifer) AND (Institut* OR Policy OR Governance OR Law OR Reform OR Organisation OR Allocation OR Market OR Economic OR Regulation OR Legislation OR participat*) AND (Performance OR Development OR Benefit OR Poverty OR Indicator OR Resilience OR Vulnerability OR Sustainab* OR Demand)	(Institut* OR Policy OR Governance OR Law OR Reform OR Organisation OR Allocation OR Market OR Economic OR Regulation OR Legislation OR participat*) AND (Performance OR Development OR Benefit OR Poverty OR Indicator OR Resilience OR Vulnerability OR Sustainab* OR Demand)	11233	Most but there are fewer papers for certain key authors e.g. Molle, Molden, Falkenmark, Dinar.	Far fewer papers, good level of relevance.
12	Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Transboundary OR Groundwater OR Aquifer) AND (Institut* OR Policy OR Governance OR Law OR Legislation OR Reform OR Organi*ation OR Allocation OR Market OR Economic OR Regulation OR Legislation OR participat* OR stakeholder) AND (Performance OR Development OR Benefit OR Poverty OR Indicator OR Resilience OR Vulnerability OR Sustainab* OR Demand OR Availability OR Access)	Corrected spelling of groundwater, added wildcards for the term 'organisation' to account for American spelling and added terms: stakeholder, Availability, Access.	12783	As above.	More relevant than previous search and some key authors now have more papers.
13	Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Transboundary OR Groundwater OR Aquifer) AND (Institut* OR Policy OR Governance OR Law OR Legislation OR Reform OR Organi*ation OR Allocation OR Market OR Economic OR Regulation OR Legislation OR participat* OR stakeholder) AND (Performance OR Development OR Benefit	Add term security and Abstraction	12736		Similar to above but returns greater number of irrelevant technical papers.

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	OR Poverty OR Indicator OR Resilience OR Vulnerability OR Sustainab* OR Demand OR Availability OR Access OR Security OR Abstraction)				
14	Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Transboundary OR Groundwater OR Aquifer OR Abstraction) AND (Institut* OR Policy OR Governance OR Law OR Legislation OR Reform OR Organi*ation OR Allocation OR Market OR Economic OR Regulation OR Legislation OR participat* OR stakeholder) AND (Performance OR Development OR Benefit OR Poverty OR Indicator OR Resilience OR Vulnerability OR Sustainab* OR Demand OR Availability OR Access OR Security OR Outcome)	Removed 'abstraction' included 'outcome'	13448		
15	Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Transboundary OR Groundwater OR Aquifer OR Abstraction OR Scarcity) AND Market OR Regulat* OR Legislation OR participat* OR stakeholder OR Management OR Irrigation OR Association) AND (Performance OR Development OR Benefit OR Poverty OR Resilience OR Vulnerability OR Sustainab* OR Demand OR Availability OR Access OR Security) NOT (Australia* OR Canada OR Europ* OR France OR 'United Kingdom')	Added new words 'administration' and 'bureaucracy'. Also introduced a NOT phrase to exclude countries such as Australia, Canada and Europ etc.	19456	14 papers by Molle (as opposed to 6-8 from other searches and 10 from Dinar).	Slightly more natural science in first few hits.
16	Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Transboundary OR Groundwater OR Aquifer OR Irrigation) AND (Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocation OR Market OR Regulat* OR stakeholder OR Management) AND (Performance OR Benefit OR Poverty OR Resilien* OR Vulnerab* OR Sustainab* OR Demand OR Access OR Security OR Conflict) NOT (Australia* OR Canada OR Europ* OR France OR 'United Kingdom' OR Spain OR German* OR California*)		12897	Many.	
17	Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Transboundary OR Groundwater OR Aquifer OR Irrigation) AND (Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocation OR Market OR Regulat* OR stakeholder OR	scarcity	13242		

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	Management) AND (Performance OR Benefit OR Poverty OR Resilien* OR Vulnerab* OR Sustainab* OR Demand OR Access OR Security OR Conflict Or Scarcity) NOT (Australia* OR Canada OR Europ* OR France OR 'United Kingdom' OR Spain OR German* OR California*)				
18	Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Transboundary OR Groundwater OR Aquifer OR Irrigation) AND (Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocation OR Market OR Regulat* OR stakeholder OR Management) AND (Performance OR Benefit OR Poverty OR Resilien* OR Vulnerab* OR Sustainab* OR Demand OR Access OR Security OR Conflict Or Scarcity) NOT (Australia* OR Canada OR Europ* OR France OR 'United Kingdom' OR Spain OR German* OR California*)	capacity' instead of 'demand'	13349	Fewer papers by Molle, Falkenmark etc	
19	Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Transboundary OR Groundwater OR Aquifer OR Irrigation) AND (Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocation OR Market OR Regulat* OR stakeholder OR Management) AND (Performance OR Benefit OR Poverty OR Poor OR Efficient* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict Or Scarcity) NOT (Australia* OR Canada OR Europ* OR France OR 'United Kingdom' OR Spain OR German* OR California*)	Poor, Equit* Efficient	17000	Yes	Very relevant papers
20	Topic=(Water) AND Topic=((Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Trans?boundary OR Groundwater OR Aquifer)) AND Topic=((Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR Management OR Organi?ation* OR Common)) AND Topic=((Performance OR Benefit OR Poverty OR Poor OR Efficient* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict OR Scarcity OR economic))	Removed NOT Terms as this filter will remove papers that compare countries within the scope of reference to developed countries.	21330		
21	Topic=(Water) AND Topic=((Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Trans?boundary OR Groundwater OR Aquifer)) AND Topic=((Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR	Experiments with removing papers using subject area filters.	19204		Many relevant papers but there remain a large number of papers from outside the realm of

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	<p>Management OR Organi?ation* OR Common)) AND Topic=((Performance OR Benefit OR Poverty OR Poor OR Efficien* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict OR Scarcity OR economic))</p> <p>Refined by: [excluding] Subject Areas=(BIOTECHNOLOGY & APPLIED MICROBIOLOGY OR GENETICS & HEREDITY OR SPORT SCIENCES OR REPRODUCTIVE BIOLOGY OR ENDOCRINOLOGY & METABOLISM OR SPECTROSCOPY OR OBSTETRICS & GYNECOLOGY OR MEDICAL INFORMATICS OR PALEONTOLOGY OR PSYCHOLOGY OR MEDICAL ETHICS OR GASTROENTEROLOGY & HEPATOLOGY OR TROPICAL MEDICINE OR METALLURGY & METALLURGICAL ENGINEERING OR PARASITOLOGY OR MEDICAL LABORATORY TECHNOLOGY OR IMMUNOLOGY OR GERIATRICS & GERONTOLOGY OR ROBOTICS OR VETERINARY SCIENCES OR ARCHAEOLOGY OR DENTISTRY, ORAL SURGERY & MEDICINE)</p>				<p>water management. Suggest experiments with further exclusion filters.</p>
22	<p>Topic=(Water) AND Topic=((Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Trans?boundary OR Groundwater OR Aquifer)) AND Topic=((Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR Management OR Organi?ation* OR Common)) AND Topic=((Performance OR Benefit OR Poverty OR Poor OR Efficien* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict OR Scarcity OR economic))</p> <p>Refined by: [excluding] Subject Areas=(BIOTECHNOLOGY & APPLIED MICROBIOLOGY OR GENETICS & HEREDITY OR SPORT SCIENCES OR REPRODUCTIVE BIOLOGY OR ENDOCRINOLOGY & METABOLISM OR SPECTROSCOPY OR OBSTETRICS & GYNECOLOGY OR MEDICAL INFORMATICS OR PALEONTOLOGY OR PSYCHOLOGY OR MEDICAL ETHICS OR GASTROENTEROLOGY & HEPATOLOGY OR TROPICAL MEDICINE OR METALLURGY & METALLURGICAL ENGINEERING OR PARASITOLOGY OR MEDICAL LABORATORY TECHNOLOGY OR IMMUNOLOGY OR GERIATRICS & GERONTOLOGY OR ROBOTICS OR VETERINARY SCIENCES OR</p>	<p>Added further subject exclusions.</p>	13738		

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	ARCHAEOLOGY OR DENTISTRY, ORAL SURGERY & MEDICINE) AND [excluding] Subject Areas=(HEALTH CARE SCIENCES & SERVICES OR ENTOMOLOGY OR GENERAL & INTERNAL MEDICINE OR NEUROSCIENCES & NEUROLOGY OR GEOCHEMISTRY & GEOPHYSICS OR OPTICS OR THERMODYNAMICS OR EDUCATION & EDUCATIONAL RESEARCH OR EVOLUTIONARY BIOLOGY OR METEOROLOGY & ATMOSPHERIC SCIENCES OR ELECTROCHEMISTRY OR RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING OR ASTRONOMY & ASTROPHYSICS OR TOXICOLOGY OR SOCIAL WORK OR CHEMISTRY OR MYCOLOGY OR INFECTIOUS DISEASES OR ONCOLOGY OR SURGERY OR ACOUSTICS OR COMPUTER SCIENCE OR NUCLEAR SCIENCE & TECHNOLOGY OR CARDIOVASCULAR SYSTEM & CARDIOLOGY OR MATHEMATICAL & COMPUTATIONAL BIOLOGY OR LEGAL MEDICINE OR DERMATOLOGY OR PATHOLOGY OR ANATOMY & MORPHOLOGY OR HEMATOLOGY OR PEDIATRICS OR RESEARCH & EXPERIMENTAL MEDICINE OR EMERGENCY MEDICINE OR BIOCHEMISTRY & MOLECULAR BIOLOGY OR MICROSCOPY OR POLYMER SCIENCE OR PHYSIOLOGY)				
23	Topic=(Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Trans\$boundary OR Groundwater OR Aquifer OR Irrigat*)) AND Topic=((Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR Management OR Organi\$ation* OR Common OR Participat* OR Adapt* OR De-centrali*)) AND Topic=((Performance OR Benefit OR Poverty OR Poor OR Efficien* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict* Or Scarcity OR Economic OR Livelihood*))	Irrigation (as a WR term) Adapt, de-centrali*	26,350	Yes, all.	Many very relevant papers returned. The addition of 'irrigation' in the WR brings papers on WUAs (no need to add the term 'user' specifically as this would be too general). Suggest applying filters to this thread.
24	(Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Trans\$boundary OR Groundwater OR Aquifer OR Irrigat*)) AND Topic=((Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR		12471		

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	<p>Management OR Organi\$ation* OR Common OR Participat* OR Adapt* OR De-centrali*) AND Topic=((Performance OR Benefit OR Poverty OR Poor OR Efficien* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict* Or Scarcity OR Economic OR Livelihood*))</p> <p>Refined by: [excluding] Subject Areas=(TELECOMMUNICATIONS OR GENETICS & HEREDITY OR BIOPHYSICS OR PLANT SCIENCES OR INFORMATION SCIENCE & LIBRARY SCIENCE OR GENERAL & INTERNAL MEDICINE OR COMMUNICATION OR OCEANOGRAPHY OR NUCLEAR SCIENCE & TECHNOLOGY OR BIOTECHNOLOGY & APPLIED MICROBIOLOGY OR ARCHITECTURE OR METEOROLOGY & ATMOSPHERIC SCIENCES OR PHARMACOLOGY & PHARMACY OR GEOLOGY OR SPORT SCIENCES OR CHEMISTRY OR PEDIATRICS OR TOXICOLOGY OR ENDOCRINOLOGY & METABOLISM OR PATHOLOGY OR MEDICAL LABORATORY TECHNOLOGY OR GEOCHEMISTRY & GEOPHYSICS OR DENTISTRY, ORAL SURGERY & MEDICINE OR PHYSIOLOGY OR GERIATRICS & GERONTOLOGY OR ANATOMY & MORPHOLOGY OR SPECTROSCOPY OR ZOOLOGY OR MATERIALS SCIENCE OR PALEONTOLOGY OR PSYCHOLOGY OR GASTROENTEROLOGY & HEPATOLOGY OR SURGERY OR PARASITOLOGY OR MECHANICS OR COMPUTER SCIENCE OR PHYSICS OR OBSTETRICS & GYNECOLOGY OR BIOCHEMISTRY & MOLECULAR BIOLOGY OR DEVELOPMENTAL BIOLOGY OR THERMODYNAMICS OR CELL BIOLOGY OR MATHEMATICAL & COMPUTATIONAL BIOLOGY OR OPTICS OR VETERINARY SCIENCES OR MEDICAL INFORMATICS OR INSTRUMENTS & INSTRUMENTATION OR RESPIRATORY SYSTEM OR ARCHAEOLOGY OR EVOLUTIONARY BIOLOGY OR HEMATOLOGY OR BEHAVIORAL SCIENCES OR CONSTRUCTION & BUILDING TECHNOLOGY OR MEDICAL ETHICS)</p>				
25	(Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Trans\$boundary OR Groundwater OR Aquifer OR Irrigat*)) AND Topic=((Institut* OR Policy OR Govern* OR Legislat* OR Reform OR	Stakeholders suggested that we should include 'gender' as part of the outcome	26432		Relatively small increase in the number of papers.

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR Management OR Organi\$ation* OR Common OR Participat* OR Adapt* OR De-centrali*) AND Topic=((Performance OR Benefit OR Poverty OR Poor OR Efficien* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict* Or Scarcity OR Economic OR Livelihood* OR Gender))	search string.			
26	Topic=(Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed OR Trans\$boundary OR Groundwater OR Aquifer OR Irrigat*)) AND Topic=((Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR Management OR Organi\$ation* OR Common OR Participat* OR Adapt* OR De-centrali*)) AND Topic=((Performance OR Benefit OR Poverty OR Poor OR Efficien* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict* OR Gender OR Scarcity OR Economic OR Livelihood*)) Refined by: [excluding] Subject Areas=(TELECOMMUNICATIONS OR GENETICS & HEREDITY OR CONSTRUCTION & BUILDING TECHNOLOGY OR BIOPHYSICS OR PLANT SCIENCES OR COMMUNICATION OR INFORMATION SCIENCE & LIBRARY SCIENCE OR OCEANOGRAPHY OR MICROBIOLOGY OR NUCLEAR SCIENCE & TECHNOLOGY OR MATHEMATICS OR BIOTECHNOLOGY & APPLIED MICROBIOLOGY OR ARCHITECTURE OR METEOROLOGY & ATMOSPHERIC SCIENCES OR PHARMACOLOGY & PHARMACY OR GEOLOGY OR NEUROSCIENCES & NEUROLOGY OR PEDIATRICS OR SPORT SCIENCES OR CHEMISTRY OR TOXICOLOGY OR REPRODUCTIVE BIOLOGY OR ENDOCRINOLOGY & METABOLISM OR PHILOSOPHY OR PATHOLOGY OR GERIATRICS & GERONTOLOGY OR MEDICAL LABORATORY TECHNOLOGY OR PHYSIOLOGY OR GEOCHEMISTRY & GEOPHYSICS OR TROPICAL MEDICINE OR SPECTROSCOPY OR ZOOLOGY OR ANATOMY & MORPHOLOGY OR DENTISTRY, ORAL SURGERY & MEDICINE OR GASTROENTEROLOGY & HEPATOLOGY OR SURGERY OR PSYCHOLOGY OR PALEONTOLOGY OR PARASITOLOGY OR	With subject filters	11956	Yes - All	This search returns useful papers and seems to return far fewer irrelevant papers.

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	OBSTETRICS & GYNECOLOGY OR COMPUTER SCIENCE OR DEVELOPMENTAL BIOLOGY OR MECHANICS OR BIOCHEMISTRY & MOLECULAR BIOLOGY OR PHYSICS OR CELL BIOLOGY OR THERMODYNAMICS OR OPTICS OR MATHEMATICAL & COMPUTATIONAL BIOLOGY OR VETERINARY SCIENCES OR RESPIRATORY SYSTEM OR HEMATOLOGY OR MEDICAL INFORMATICS OR EVOLUTIONARY BIOLOGY OR ARCHAEOLOGY OR BEHAVIORAL SCIENCES OR MEDICAL ETHICS)				
	Topic=(Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed* OR Transboundary OR Groundwater OR Aquifer OR Irrigat* OR Lake)) AND Topic=((Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR Manage* OR Organisation* OR Common OR Participat* OR Adapt* OR Decentrali*)) AND Topic=((Performance OR Benefit OR Poverty OR Poor OR Efficien* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict* OR Scarcity OR Economic OR Livelihood* OR Gender))	Re-introduced 'Lake' term. Also reduced the number of wildcard entries due to lemmitization/ UKUSA	67490		Much too large a search. Need to apply filters.
	Topic=(Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed* OR Transboundary OR Groundwater OR Aquifer OR Irrigat* OR Lake)) AND Topic=((Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR Manage* OR Organisation* OR Common OR Participat* OR Adapt* OR Decentrali*)) AND Topic=((Performance OR Benefit OR Poverty OR Poor OR Efficien* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security	Applied subject filters	13,689		Search returns reduced to manageable level. Key authors present.

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	<p>OR Conflict* OR Scarcity OR Economic OR Livelihood* OR Gender))</p> <p>Refined by: [excluding] Subject Areas=(ENVIRONMENTAL SCIENCES ECOLOGY OR ZOOLOGY OR FOOD SCIENCE TECHNOLOGY OR RESPIRATORY SYSTEM OR PATHOLOGY OR PALEONTOLOGY OR BIODIVERSITY CONSERVATION OR TELECOMMUNICATIONS OR MARINE FRESHWATER BIOLOGY OR GEOCHEMISTRY GEOPHYSICS OR CARDIOVASCULAR SYSTEM CARDIOLOGY OR OCEANOGRAPHY OR IMAGING SCIENCE PHOTOGRAPHIC TECHNOLOGY OR TOXICOLOGY OR MATHEMATICS OR UROLOGY NEPHROLOGY OR PHARMACOLOGY PHARMACY OR BIOPHYSICS OR BIOCHEMISTRY MOLECULAR BIOLOGY OR PHYSICS OR METEOROLOGY ATMOSPHERIC SCIENCES OR ARCHITECTURE OR MATHEMATICAL COMPUTATIONAL BIOLOGY OR PARASITOLOGY OR GENERAL INTERNAL MEDICINE OR PHYSIOLOGY OR INSTRUMENTS INSTRUMENTATION OR NUCLEAR SCIENCE TECHNOLOGY OR LIFE SCIENCES BIOMEDICINE OTHER TOPICS OR INFORMATION SCIENCE LIBRARY SCIENCE OR GEOLOGY OR GASTROENTEROLOGY HEPATOLOGY OR RADIOLOGY NUCLEAR MEDICINE MEDICAL IMAGING OR ONCOLOGY OR DEVELOPMENTAL BIOLOGY OR DENTISTRY ORAL SURGERY MEDICINE OR PSYCHOLOGY OR MEDICAL LABORATORY TECHNOLOGY OR PLANT SCIENCES OR PEDIATRICS OR EVOLUTIONARY BIOLOGY OR DERMATOLOGY OR ANATOMY MORPHOLOGY OR CONSTRUCTION BUILDING TECHNOLOGY OR BIOTECHNOLOGY APPLIED MICROBIOLOGY OR COMMUNICATION OR CHEMISTRY OR OPTICS OR REMOTE SENSING OR AUTOMATION CONTROL SYSTEMS OR REPRODUCTIVE BIOLOGY OR IMMUNOLOGY OR GERIATRICS GERONTOLOGY OR ENDOCRINOLOGY METABOLISM OR VETERINARY SCIENCES OR THERMODYNAMICS OR MINING MINERAL PROCESSING OR MECHANICS OR MICROBIOLOGY OR TRANSPORTATION OR COMPUTER SCIENCE OR MATERIALS SCIENCE OR TROPICAL MEDICINE OR BEHAVIORAL SCIENCES OR CELL BIOLOGY OR OBSTETRICS GYNECOLOGY OR INFECTIOUS DISEASES OR SURGERY OR NEUROSCIENCES NEUROLOGY OR HEMATOLOGY OR GENETICS HEREDITY)</p>				

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed* OR Transboundary OR Groundwater OR Aquifer OR Irrigat* OR Lake) AND (Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR Manage* OR Organisation* OR Common OR Participat* OR Adapt* OR Decentrali*) AND (Performance OR Benefit OR Poverty OR Poor OR Efficien* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict* OR Scarcity OR Economic OR Livelihood* OR Gender OR 'groundwater quality protection'OR 'groundwater quality control')	Stakeholder suggested 'groundwater quality protection'OR 'groundwater quality control'. Tested in WoK 12.09.11	67491		Very few results related to groundwater protection returned when terms used in conjunction with the remainder of search string. Searches for groundwater terms alone produce numerous technical papers that are not relevant to this systematic review. Suggest search terms are not included.
	Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed* OR Transboundary OR Groundwater OR Aquifer OR Irrigat* OR Lake) AND (Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR Manage* OR Organisation* OR Common OR Participat* OR Adapt* OR Decentrali*) AND (Performance OR Benefit OR Poverty OR Poor OR Efficien* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict* OR Scarcity OR Economic OR Livelihood* OR Gender OR farm OR farmer OR food OR crop OR livestock)	Stakeholder suggested adding terms: 'farm OR farmer OR food OR crop OR livestock'. Groundwater specific terms deleted.	99,243		This results in large numbers of irrelevant papers, and additional technical papers on soil management.
	Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed* OR Transboundary OR Groundwater OR Aquifer OR Irrigat* OR Lake) AND (Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat*	Deleted 'farmer, food, crop, livestock)	71624		Reduces the number of technical papers and irrelevant papers. Suggest include 'FARM'

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR Manage* OR Organisation* OR Common OR Participat* OR Adapt* OR Decentrali*) AND (Performance OR Benefit OR Poverty OR Poor OR Efficien* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict* OR Scarcity OR Economic OR Livelihood* OR Gender OR farm)				
	Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed* OR Transboundary OR Groundwater OR Aquifer OR Irrigat* OR Lake) AND (Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR Manage* OR Organisation* OR Common OR Participat* OR Adapt* OR Decentrali*) AND (Performance OR Benefit OR Poverty OR Poor OR Efficien* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict* OR Scarcity OR Economic OR Livelihood* OR Gender OR farm OR 'drinking water' OR sanitation OR health OR nutrition OR education)	Added "'drinking water' OR sanitation OR health OR nutrition OR education"	152632		Large number of returns and many unrelated papers, particularly on WASH.
	Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed* OR Transboundary OR Groundwater OR Aquifer OR Irrigat* OR Lake) AND (Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR Manage* OR Organisation* OR Common OR Participat* OR Adapt* OR Decentrali*) AND (Performance OR Benefit OR Poverty OR Poor OR Efficien* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict* OR Scarcity OR Economic OR Livelihood* OR Gender OR farm OR evapotranspiration OR soil water OR green water)	evapotranspiration/soil water/green water	160, 166		Large number of additional papers on technical/natural aspects aspects of agricultural management.

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	<p>Topic=(Water AND (Resource* OR River* OR Basin* OR Catchment* OR Watershed* OR Transboundary OR Groundwater OR Aquifer OR Irrigat* OR Lake)) AND Topic=((Institut* OR Policy OR Govern* OR Legislat* OR Reform OR Administrat* OR Bureaucra* OR Allocat* OR Market* OR Stakeholder OR Manage* OR Organisation* OR Common OR Participat* OR Adapt* OR Decentrali*)) AND Topic=((Performance OR Benefit OR Poverty OR Poor OR Efficien* OR Equit* OR Resilien* OR Vulnerab* OR Sustainab* OR Capacity OR Access OR Security OR Conflict* OR Scarcity OR Economic OR Livelihood* OR Gender OR Farm*))</p> <p>Refined by: [excluding]</p> <p>Subject Areas=(ENVIRONMENTAL SCIENCES ECOLOGY OR RESPIRATORY SYSTEM OR FOOD SCIENCE TECHNOLOGY OR MATERIALS SCIENCE OR PATHOLOGY OR PALEONTOLOGY OR BIODIVERSITY CONSERVATION OR TELECOMMUNICATIONS OR MARINE FRESHWATER BIOLOGY OR ENERGY FUELS OR CARDIOVASCULAR SYSTEM CARDIOLOGY OR HEALTH CARE SCIENCES SERVICES OR GEOCHEMISTRY GEOPHYSICS OR TOXICOLOGY OR PHARMACOLOGY PHARMACY OR UROLOGY NEPHROLOGY OR OCEANOGRAPHY OR IMAGING SCIENCE PHOTOGRAPHIC TECHNOLOGY OR MATHEMATICS OR BIOPHYSICS OR BIOCHEMISTRY MOLECULAR BIOLOGY OR PARASITOLOGY OR GENERAL INTERNAL MEDICINE OR METEOROLOGY ATMOSPHERIC SCIENCES OR PHYSICS OR PHILOSOPHY OR MATHEMATICAL COMPUTATIONAL BIOLOGY OR ARCHITECTURE OR LIFE SCIENCES BIOMEDICINE OTHER TOPICS OR GASTROENTEROLOGY HEPATOLOGY OR NUCLEAR SCIENCE TECHNOLOGY OR PHYSIOLOGY OR INSTRUMENTS INSTRUMENTATION OR INFORMATION SCIENCE LIBRARY SCIENCE OR GEOLOGY OR RADIOLOGY NUCLEAR MEDICINE MEDICAL IMAGING OR ONCOLOGY OR DEVELOPMENTAL BIOLOGY OR NUTRITION DIETETICS OR PSYCHOLOGY OR DERMATOLOGY OR PLANT SCIENCES OR PEDIATRICS OR MEDICAL LABORATORY TECHNOLOGY OR FISHERIES OR EVOLUTIONARY BIOLOGY</p>	Final String	72,977 prior to filtering, 13,594 after subject filters applied.		

SI	Syntax	Change to Syntax	Number of Hits	Key Authors?	Comments
	OR DENTISTRY ORAL SURGERY MEDICINE OR ANATOMY MORPHOLOGY OR OPTICS OR CHEMISTRY OR VETERINARY SCIENCES OR COMMUNICATION OR BIOTECHNOLOGY APPLIED MICROBIOLOGY OR CONSTRUCTION BUILDING TECHNOLOGY OR REPRODUCTIVE BIOLOGY OR GERIATRICS GERONTOLOGY OR ENDOCRINOLOGY METABOLISM OR REMOTE SENSING OR AUTOMATION CONTROL SYSTEMS OR ENTOMOLOGY OR IMMUNOLOGY OR THERMODYNAMICS OR MECHANICS OR INFECTIOUS DISEASES OR MINING MINERAL PROCESSING OR TROPICAL MEDICINE OR MICROBIOLOGY OR TRANSPORTATION OR COMPUTER SCIENCE OR CELL BIOLOGY OR HEMATOLOGY OR BEHAVIORAL SCIENCES OR OBSTETRICS GYNECOLOGY OR NEUROSCIENCES NEUROLOGY OR SURGERY OR GENETICS HEREDITY)				

APPENDIX III: STAKEHOLDER CONSULTATION

70 potential stakeholders (listed below) were emailed in June 2011 and asked to respond to questions to guide the Systematic Review.

Allan	Tony	Gleick	Peter	Ringler	Claudia
Bakker	Karen	Grey	David	Sadoff	Claudia
Bandaragoda	D.J.	Guevara	Armando	Saleth	R. Maria
Barlow	Maude	Hirji	Rafik	Shah	Tushaar
Batchelor	Charles	Hoekstra	Arjen	Swyngedou	Erik
Biswas	Asit	Jonker	Lewis	Thuo	Simon
Briscoe	John	Kenney	Douglas	Tickner	Dave
Brown	Kate	Krchnak	Karen	Tortajada	Cecilia
Bueno de Mezquita	Mourik	Lincklaen Arriens	Wouter	Turton	Anthony
Bullock	Andy	Manthan	Shripad	Urteaga	Patricia
Burton	Martin	McCartney	Matthew	van Koppen	Barbara
Butterworth	John	Meinzen-Dick	Ruth	Warner	Jeroen
Calow	Roger	Merrey	Douglas	Williams	Chris
Cancino	Ignacio	Mirumachi	Naho	Wouters	Patricia
Chiramba	Thomas	Molden	David	Zimmerer	Karl
Cleaver	Frances	Molle	François		
Cross	Katharine	Mollinga	Peter		
Dalton	James	Moriarty	Patrick		
Dinar	Ariel	Murtinho	Felipe		
Dourojeanni	Axel	Narain	Sunita		
Earle	Anton	Nicol	Alan		
Eguren	Fernando	Oré	Teresa		
Falkenmark	Malin	Orr	Stuart		
Farrington	Robin	Ostrom	Elinor		
Foster	Stephen	Perry	Chris		
Franks	Tom	Postel	Sandra		
Galaz	Victor	Postigo	Julio		

Respondents were asked to consider the Review Question:

'What factors determine the performance of institutional mechanisms for water resources management in developing countries in terms of:

- a) delivering pro-poor outcomes;**
- b) supporting efficient use and sustainable economic growth;**
- c) building resilience to climate change and other stressors such as conflict**

They were then asked the following 4 questions:

- Can you suggest any key references (journal articles, reports, policy papers, evaluations etc.) relevant to answering the review question?
- Can you suggest any key individuals, organisations and websites we should approach to access relevant grey literature?
- Do you have any comments on the question - is it the right question to be asking or are there more useful ways of structuring this research?
- What would be the idealised research design for addressing the question and what are the common sources of bias or error found in studies on water institutions?

More than a third of those contacted responded expressing interest in joining the stakeholder group and to date we have received responses from 14 experts. Many have referred us to colleagues, sent references and directed us to relevant organisations. We have also received comments on the sources of bias and aspects of research design. These suggestions are summarised in the table below:

Research Design Comments	Sources of Bias	Definition Queries
Stakeholders noted that contextual factors and confounding variables are important. They questioned whether outcomes can be attributed to institutional arrangements alone, rather than other factors, both within the water sector and outside the water sector.	English Language Bias	Definitions of 'Pro-poor' should include a focus on gender.
One stakeholder proposed a more organic approach that focused on strategies to facilitate institutional development, rather than searching for universal determinants. An alternative question was proposed on this basis: "What strategies for facilitating effective pro-poor institutional processes are the most promising?"	Evidence base dominated by 'success stories' which gives an un-balanced picture.	Definitions of efficiency with regard to water resources management are complex.
Current iteration of the question seems to overlook considerations of equity.	Assumptions made about institutional arrangements that aren't necessarily borne out by reality. Empirical research rather than positions/assumptions is crucial.	Definition of sustainable and equitable growth should include an assessment of how benefits are distributed.
Clarification of scale of the study (local, regional, national). Is there a mis-match between the scale of the outcomes and the scale of the institutional factors of interest?		
Stakeholders suggested that the research might benefit from following research designs used in earlier studies. For example the CAPRI Framework or Ostrom.		

APPENDIX IV: INCLUSION AND EXCLUSION CRITERIA FORM

	Criterion	Decision
1	Language: English Only	Yes No Unclear
2	Geographic Scope: Developing Countries in Asia, Latin America and Sub-Saharan Africa.	Yes No Unclear
3	Subject: Reform, change or factor related to institutional mechanism for water resources management.	Yes No Unclear
4	Outcome: Assessment of the impact of such reforms in terms of outcomes which are result pro-poor Outcomes and Sustainable Economic Growth. This may include greater equity, efficiency, sustainability and resilience.	Yes No Unclear
	Final Decision ⁴	In Out Pending

⁴ If all the 'Yes' options are circled, the study will be included. If any 'No' is circled then the study is excluded. If the study is 'yes' plus 'unclear' then the study is pending and will be reviewed further at either abstract or full text.

APPENDIX V: DATA EXTRACTION AND QUALITY ASSESSMENT FORM

1	STUDY DETAILS			
1a	Title:			
1b	Author			
1c	Year			
1d	Publication Type			
1e	Country of Study			
2	STUDY INFORMATION OVERVIEW			
2a	Type of Institution (Brief)			
2b	Factor (Brief)			
2c	Outcome (s) assessed (Brief)?			
2d	Scale: Local, Regional, National, Transboundary			
2e	Design Methodology	QUALITATIVE	QUANTITATIVE	
2f	How is the study funded?			
2g	Researcher Bias	DONE	PARTIAL	NOT DONE
3	STUDY DESIGN			
3a	Research question/objectives/goals as stated in study			
3b	Clarity of Question	DONE	PARTIAL	NOT DONE
3c	Description of Methods/Data Gathering			
3d	Clarity of Description	DONE	PARTIAL	NOT DONE

3e	Construct Validity			
	<ul style="list-style-type: none"> Are the research methods and results appropriate to the research question? 			
	<ul style="list-style-type: none"> What is the unit of analysis? Is it suitable? 			
	<ul style="list-style-type: none"> Is the research conducted at the appropriate scale? 			
3f	Construct Validity Score	DONE	PARTIAL	NOT DONE
4	CONDITIONS AND CONTEXT			
4a	Reporting of Hydrological Environment			
4b	Reporting of Water Institutional Context			
4c	Reporting of Political Context			
4d	Overall Reporting of Conditions and context (refer to 4a-c)	DONE	PARTIAL	NOT DONE
5	OUTCOMES AND FACTORS			
5a	What outcomes are addressed?			
5b	What primary data is used to assess outcomes? Have appropriate techniques been used?			
5c	Outcome Measurement Score	DONE	PARTIAL	NOT DONE

5d	What factors are examined?			
5d	INTERNAL VALIDITY <ul style="list-style-type: none"> • How are causal relationships between outcomes, institutional reforms and factors addressed? • Are confounding variables accounted for? 			
5f	Internal Validity Score	DONE	PARTIAL	NOT DONE
5g	External Validity <ul style="list-style-type: none"> • Does the study make claims to generalisation? • If Yes: • How are claims to generalisation supported? <p>(For example: do the results relate to a broader theory and allow analytic generalisation? For multiple case studies, has replication logic been applied?)</p>			
	External Validity Score	DONE	PARTIAL	NOT DONE
6	SUMMARY			
6a	What are the key findings?			
6b	Are there additional validity/quality problems?			
6c	Reliability			

	Have research methods and results been adequately documented and reported to allow assessment of reliability, bias minimisation and replicability?			
6d	Reliability Score	DONE	PARTIAL	NOT DONE
6e	Overall Quality Score Comment			
6f	Overall Quality Score (Risk of Bias)	LOW	MODERATE	HIGH

APPENDIX VI: TIMELINE

	Description	Start	End	Output
SR01	Registration of title with SR coordinating group (allow one month)	01/04/11	31/04/11	Initial scoping and registration
SR02	Preparation of protocol	01/04/11	15/07/11	Scoping meetings, outreach and detailed development/testing
SR03	Review of protocol by SR coordinating group	15/07/11	01/09/11	Agreed Protocol
SR04	Study search	01/04/11	15/09/11	First and second phases of progressive filter
SR05	Assessment of study relevance	15/07/2011	1/10/11	Qualitative analysis of first findings
SR06	Extraction of data	15/07/11	31/10/11	Results of third filter
SR07	Synthesis and/or statistical analysis	01/10/11	1/11/11	Secondary analysis
SR08	Preparation of draft report	01/10/11	01/12/11	Completion of draft report
SR09	Review of draft report by SR coordinating group (allow three months)	01/12/11	01/03/12	Comments on draft report
SR10	Dissemination of draft report	01/02/12	01/03/12	Completion of second draft
SR11	Revision of draft report	01/03/12	15/03/12	Final report
SR12	Date of publication of final report	29/03/12	31/03/12	