



Collaboration for
Environmental
Evidence

Collaboration for Environmental Evidence

Systematic Review No. 10-010

What is the evidence that scarcity and shocks in freshwater resources and cause conflict instead of promoting collaboration in arid to subhumid hydroclimates?

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Cover Sheet

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1. Background

Anthropogenic activities such as the combustion of fossil fuels, land-use change and intensive agriculture are increasingly influencing the Earth's climate and exerting pressure on ecosystems (Rockström *et al.*, 2009; Solomon *et al.*, 2007). These changes have amplified the risk of scarcity and shocks (discrete and sudden events) in natural renewable resource (*henceforth*, NRR) scarcity across the spectrum of spatial scales (MEA, 2005; Parry *et al.*, 2007).

The relationship between shocks and longer-term scarcity in NRR and the direct or indirect impacts of climate change and human conflict or collaboration (see section 3.2 for working definitions) has become the subject of increasing scrutiny by researchers, policy makers and opinion formers. This is due to the often high human, social and economic costs of conflict (Wolf, 2007). The capacity to monitor, predict, pre-empt or resolve conflicts is, therefore, central to promoting human and environmental security. This has generated a renewed interest in the environmental conflict literature (Floyd, 2008).

1.1 The environmental-conflict literature

The literature examining the interplay between direct or indirect impacts of climate change and/or NRR scarcity and shocks and human conflict/ collaboration is substantial and growing (Mason *et al.*, 2008; UNEP, 2004). Primary studies are spread across the academic and grey literature (Mason *et al.*, 2008). These studies are diverse and vary in terms of theoretical arguments, scale, study design (e.g. case studies, case control studies, multivariate statistical analyses, econometric modelling), definition and goal (Dabelko *et al.*, 2000; Mason *et al.*, 2008; Bernauer *et al.*, 2010).

A number of scholars have argued that perspectives contending climate change and/or shocks and scarcity in NRR lead to conditions where violent/armed conflict may arise, dominate political circles and the media (Bernauer *et al.*, 2010; Barnett, 2009; Hartmann, 1998; 2010; Leach and Mears, 1996; McDonald, 1999; Nordås and Gleditsch, 2009). Despite this apparent dominant view, reviews of the literature consistently argue there is little consensus on the direct correlation between climate change, scarcity or shocks in natural renewable resources and conflict (Bernauer *et al.*, 2010; Wolf, 2007).

The lack of consensus is primarily due to complex interactions between different variables that may lead to the outbreak conflict or the emergence of collaboration. For example, Bohorquez *et al.*, (2009: 911) argue that, '*Possible political, ideological, cultural, historical and geographical influences make conflict arguably one of the 'messiest' of all human activities to analyse.*' Furthermore, there may be no clear relationship because of theoretical (*viz.* understanding of causal pathways) and methodological limitations (e.g. diverse indicators of climate change and natural resource scarcity, data quality and coverage, different sample sizes, time periods and challenges of attribution) (Bernauer *et al.*, 2010).

Furthermore, the quality of the literature is varied. For example, Nordås and Gleditsch (2009: 23) note that much of the climate-conflict literature *'tends to move from sophisticated climate models to flimsy evidence and (at best) case studies of unknown representativity'*.

The environment-conflict nexus is a longstanding, diverse and wide-ranging body of work. For example, one body of thought identifies the modern way of life as endangering the stability and functioning of the world's ecosystems (Pirages et al, 2004). Another strand is concerned with how humans, especially the poor, are rendered insecure by environmental change (Dalby, 2002; Barnett, 2001; Matthew, 1999). Much of the environment-conflict thesis, in turn, is concerned with the threat posed by environmental-conflict to national or state security (Homer-Dixon, 2001; 1999; 1994). A large part of the emerging 'climate security' literature focuses on the impacts of climate change on NRR, in particular scarcity, and the subsequent influence on conflict.

The environment-conflict literature has been shaped by two contrasting arguments, referred to as the 'greed versus grievance' debate (Berdal and Malone, 2000). First, 'grievance' arguments suggest that environmental degradation and scarcity in renewable resources leads to conflict (Homer-Dixon, 1999). Second, 'greed' arguments suggest that localized abundance of non-renewable natural resources and competition to gain control over these resources leads to conflict (de Soysa, 2002). Transgressing the 'greed versus grievance' debate, a third body of literature has emerged to argue that resource scarcity does not necessarily lead to violent conflict, but can instead lead to collaboration. This argument has emerged from three key areas of scholarship; examination of the emergence of multi-lateral riparian agreements (e.g. Yoffee *et al.*, 2003; Wolf *et al.*, 2007), transboundary management practices such as 'Peace Parks' (e.g. Ali, 2007) and community-based natural resource management (CBNRM) (e.g. Buckles, 1999; Walker *et al.*, 2002). This review is primarily interested in the first and third bodies of literature.

1.2 Evolution of the literature – NRR scarcity and conflict

Research on resource scarcity and conflict has evolved in several stages. In the 1990s, the argument that scarcity of natural renewable resources can contribute to violent conflicts emerged (Floyd 2010). Theoretical arguments were made and supported with empirical case studies that the interaction of environmental pressures and social effects (e.g. reduced agricultural production, economic decline, population displacement, disruption of social relations) can lead to disputes within countries, to civil strife, and ultimately to violent conflict (Homer-Dixon, 1991; 1998; 1999). To support theoretical work, Homer-Dixon carried out a range of empirical studies, including case studies in Mexico, the Philippines and South Africa (Homer-Dixon, 1999; 1994). At the same time, researchers at the Environment and Conflicts Project in Switzerland arrived at similar conclusions on the basis of a different set of empirical case studies (Baechler and Spillman, 1996).

Critics, however, highlight the difficulties of identifying a causal link between environmental change / resource scarcity and violence using the methods employed by Homer-Dixon (1991; 1994; 1999) and Baechler and Spillman (1996). It is argued that the case studies involved long causal changes with many intervening social variables. It is, therefore, difficult to establish a direct link between environmental change/ resource scarcity and conflict as no allowance was made for variation in either independent or dependent variables. Concerns have also been raised about case-selection bias. At this time, most research failed to take into consideration other conflict generating factors such as existing ethnic tensions, socio-economic inequalities, state instability and geography.

Some of the more recent academic studies that seek to remedy these shortfalls have included further empirical analysis supporting the environment-conflict nexus using a wide range of methods. These include, empirical case studies (Klare, 2001), large quantitative studies (Hauge and Ellingsen, 1998) and an *'intensive qualitative approach that explicitly analyzes **the conditions under which** each distinctive type of causal pattern occurs rather than attempting to address **the frequency to which each outcome or causal pattern occurs.**'* (Kahl, 2006: 60, emphasis in original).

Nevertheless, the environment-conflict thesis continues to be the focus of extensive criticism on methodological, theoretical and policy grounds (Barnett, 2003; Dalby 2002; Peluso *et al.*, 2001; Hartmann, 1998). Especially in the context of climate conflict, some researchers have subjected the resource scarcity - conflict nexus to rigorous analytical scrutiny (Hendrix and Glaser, 2007; Meier *et al.*, 2007). Based on quantitative analysis, these studies suggest that links between climate change, natural renewable resource scarcity and conflict are few and weak (Salehyan, 2008).

1.3 NRR scarcity and collaboration

A growing body of literature focuses on the potential of resource scarcity for engendering collaboration rather than conflict. For example, there is a large body of evidence that implies water management has played a role in forestalling violence and promoting collaboration in regions around the world (Wolf *et al.*, 2005; Wolf, 2007).

Alongside the literature on water management there is an emerging literature on so-called 'Peace Parks' (Ali *et al.*, 2007). Peace parks can be broadly defined as: *'conservation areas that cross one or more international borders, and they are intended to have common management practices, often to conserve a single transnational ecosystem'* (Duffy, 2007). Here, empirical case studies suggest that in areas with high levels of environmental stress, joint resource and conservation management plans can forestall and even end environmental conflict. While this body of research focuses primarily on the interstate level, a second body of research examines the potential of CBNRM to forestall conflict at the intrastate level.

While there is no single definition of CBNRM, these programmes seek to, *'encourage better resource management outcomes with the full participation of communities and resource users in decision-making activities, and the incorporation of local*

institutions, customary practices, and knowledge systems in management, regulatory and enforcement processes' (Armitage, 2005). However, different advocates imagine CBNRM differently. As such, there is no consensus on the design, definition or goal of CBNRM (ibid.). Case studies are increasingly well documented and involve natural renewable resources, such as, forests, water resources, wildlife, fisheries, coastal areas, and protected areas.

1.4. Previous reviews

Reviews examining the linkages between NRR shocks/scarcity and climate change and conflict/ cooperation are emerging (Buhaug *et al.*, 2008; Carius, 2006; Dabelko et al, 2000; Gleditsch, 1998; Parry *et al.* 2007; Khagram and Ali, 2006; Mason et al, 2008; Nordås and Gleditsch, 2007; Salehyan, 2008). These reviews are limited, however, as they are not systematic.

Whether or not, or under what circumstances the direct or indirect impact of climate change on natural renewable resources or scarcity and shocks in natural renewable resources lead to conflict or collaboration, a systematic review in this field is both important for scientific reasons and has significant policy implications.

Due to the volume of the literature, the limited time frame for this review, and the challenges of directly attributing discrete events and long-term changes to NRR to climate change (Stott *et al.*, 2010) this review will focus specifically on shocks and scarcity in freshwater resources.

The interplay between freshwater scarcity and conflict/collaboration is the most prominent and referenced environment-conflict issues in the Third and Fourth Assessment Reports of the IPCC (Nordås and Gleditsch, 2009). For example, climate change is likely to affect the volume and timing of river flows and groundwater recharge (Arnell, 2004). Discussions with the review user-group, confirmed that a systematic mapping of the literature in this particular field was a priority.

2. Objective of the Review

The objectives of this systematic review are to:

- Describe the nature and coverage of empirical research exploring the links between freshwater shocks and scarcity and conflict/collaboration;
- Provide an overview of research activity in the area for different users of research such as practitioners, academics, policymakers, students and the public;
- Inform decisions on what future research might usefully address by identifying gaps in the literature;
- Improve access to knowledge by supporting identification of high quality study design;
- Provide a resource for future systematic reviews in the field.

2.1 Primary question

This systematic review aims to identify and systematically map all published and unpublished research to address the following primary question:

‘What is the evidence that scarcity and shocks in freshwater resources cause conflict instead of promoting collaboration?’

Table 1 outlines the definition of components of the primary systematic review question. Definitions of components are described in section 3.2.

Table 1: Definition of components of the primary systematic review question

Subject	Exposure	Outcome	Comparator	Designs
Human populations in arid and semi-arid climatic zones.	Water stress – defined as scarcity or shocks to freshwater quantity. Water stress can be caused by changes to the actual status of the resource quantity (physical scarcity), or accessibility in space and time may change due to social processes (social scarcity).	Conflict <i>or</i> collaboration	Absence of water stress	All empirical study designs.

2.2 Secondary question

A secondary question (s) may be developed through an iterative process whilst carrying out the review.

3. Methods

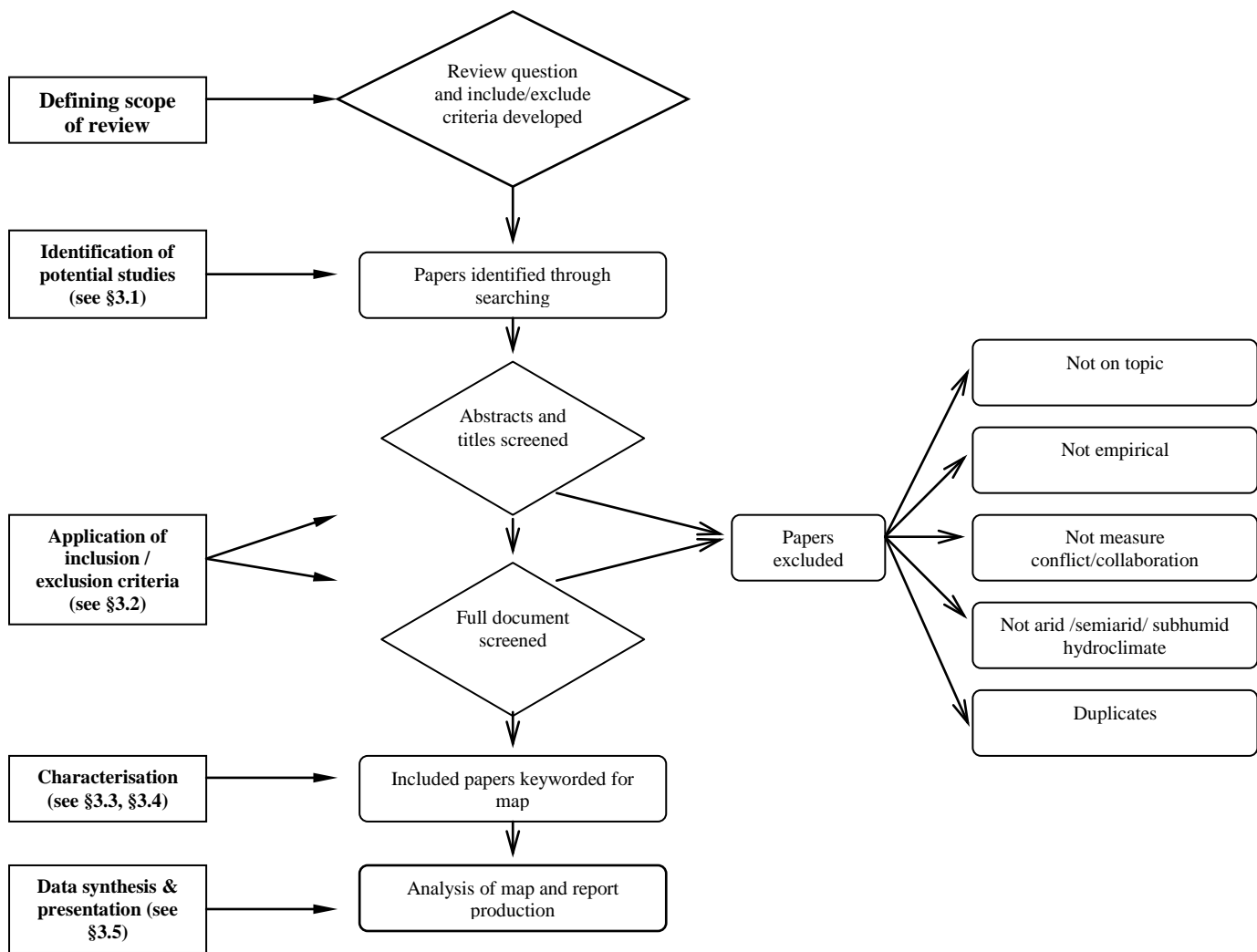
The proposed review will follow the systematic mapping process as outlined in (Clapton *et al*, 2009). This type of review, whilst using the same methods and principles as a standard systematic review process, the in-depth quality appraisal, data extraction and synthesis of findings stages of the review are not undertaken. Instead systematic maps aim to describe the existing literature, identify gaps and uncertainty in the literature and suggest areas for further empirical research. This is being done in the context of the limited timeframe and resources available for this review. Traditional systematic reviews typically take at least 12 months to complete. However, this review will be undertaken over a 6-month period from August 2010 to February 2011. Additionally, this is the first time a systematic review methodology has been used in this topic area. As such, this systematic map will inform future systematic reviews in this field.

In order to arrive at a more focussed review question, we will develop a knowledge map to identify and code a sub-sample of primary studies by population, exposure, outcome and design. This will be used to refine the review question, in consultation with the user group. The knowledge map will also be used to identify key search terms and possible synonyms.

Following this process, and in discussion with DFID it was agreed that we would systematically map and appraise the quality of the literature using an adapted version of the EPPI-Centre's weights of evidence (WoE) framework (Gough, 2004) to address the review question.

The full methodology is summarised in Figure 1.

Figure 1: Summary of review process and operationalisaion of methods (adapted from Gough *et al*, 2003)



3.1 Search strategy

Due to the limited timeframe of this review, a highly specific search strategy will be developed.

Following an initial survey of literature and development of a knowledge map using reference lists from previous reviews (Buhaug *et al.*, 2008; Carius, 2006; Dabelko *et al.*, 2000; Gleditsch, 1998; IPCC, 2001; 2007; Khagram and Ali, 2006; Mason *et al.*, 2008; Nordås and Gleditsch, 2007; Salehyan, 2008) we find potentially relevant studies spread across both grey and academic literature. This confirms observations made by Mason *et al.* (2008).

Given this, and the need for a comprehensive search strategy, we will seek to identify both academic and grey literature. Here, grey literature refers to documents produced and published by governmental agencies, academic institutions and other groups that are not distributed or indexed by commercial publishers. Our survey of previous reviews will also be used to test the efficacy of the search strategy outlined below.

The list below identifies general purpose electronic databases to searching both academic and grey literature. This list is not exhaustive and will be revised as the review commences and in consultation with the user group and other stakeholders (see Appendix 1).

- Web of Science
- J STOR
- Indian Citation Index
- African Journals Online
- BIOSIS Previews
- ProQuest
- SCIRUS (Medline, ScienceDirect, SAGE publishing, IOP publishing)
- Directory of Open Access Journals (DOAJ)
- PAIS International
- Water Conflict and Cooperation Bibliography
- Biblio.pacinst.org

Following the development of a knowledge map for a subset of the literature, we have identified the following search terms from analysis of keywords, title and abstracts.

Two sets of search terms will be used, with individual terms separated by Boolean 'OR' operators and sets combined using 'AND'. Wildcard symbols (indicated by a '*') will be used where appropriate.

1. **Exposure terms:** water*, riparian*, aquifer*, aqua*, dam, dams, hydrolog*, hydroelectric*, drought*, river*, lake*, stream, streams, reservoir*, flood*, irrigat*, rain, rainfall, rains, baseflow, precipitation, fresh*, basin*, flow
2. **Outcome terms:** conflict*, dispute*, insurgen*, war, wars, warfare, violen*, securit*, terror*, strife, peace*, govern*, coercion, cooperat*, co-operat*, collaborat*, collective, "conflict resolution", "conflict management",

geopolitic*, “international relation*”, manag*, rational*, institution*, allocat*, distribut*, shar*

Search strings will be piloted on selected databases identified above (e.g. one large database such as Web of Science and one subject specific database such as Water Conflict and Cooperation Bibliography). Search strings will then be revised as necessary and developed iteratively for each database.

Additional terms will be added as the search progresses, involving combinations of existing terms of new terms as deemed necessary by the lead reviewer from analysis and development of the knowledge map and consultation with relevant experts.

An Internet search will be performed using meta-search engines and recommended sites:

<http://www.alltheweb.com>
<http://www.scholar.google.com>
<http://www.google.com>
<http://www.dogpile.com>

The first 50 hits (Word and/or PDF documents where they can be separated) from each Internet search will be examined. We will also hand-search key relevant studies to identify any additional literature.

All references retrieved from the computerised datasets will be exported into bibliographic software package *Zotero* prior to assessment of relevance using the inclusion criteria outlined in section 3.2

Additionally, bibliographies of included material will be searched for relevant references. We will seek additional unpublished literature from the Department for International Development and through consultation with recognised experts and practitioners. Stakeholders for consultation that have been identified or already contacted are listed in Appendix 1.

Foreign language searches will not be carried out. We recognise the limitations of this inclusion criteria, as there may be a wide body of research published in other languages, particularly within the grey literature. However, the limited timeframe and scope of this rapid review means that this is a necessary exclusion criterion. We highly recommend, however, that future reviews consider additional languages.

We will also extend our search to specialist websites. These will include, for example, Eldis, Science and Development Network, World Bank, UNEP, Institute for Environmental Security, International Peace Research Institute; African Peace and Conflict Network, Environmental Change and Security Project, WorldWatch Institute, Adelphi Research, World Health Organisation, United Nations Convention to Combat Desertification. This list is not exhaustive and will be revised as the search progresses.

3.2 Study inclusion criteria

To be considered for inclusion in this study, a primary study has to match key concepts in the review question:

- **Relevant subject(s):** Any study that includes human populations in arid, semiarid and dry subhumid hydroclimates (desert, savannahs and steppe ecosystems). These zones are characterised by extreme variability in rainfall such as few rainfall events, high-intensity storms, and high frequency of dry spells and droughts.

These hydroclimate zones are of particular interest as semiarid, dry subhumid savannah and steppe hydroclimates have been defined as ‘global hotspots’ in the context of water related constraints to food production, high prevalence of malnourishment and poverty, and changing food demands (Rockström *et al.*, 2010; SEI, 2005).

Additionally in non-arid regions, disputes tend to be related to either water pollution or hydraulic infrastructure such as dams, dykes and levees (Falkenmark, 1986).

As a key interest of the user group relates to the future impact of climate change, we will only include studies that wholly or partially focus on arid-to dry subhumid hydroclimates. This is because these regions are particularly vulnerable to future changes to the climate. Studies that only include nations outside these climatic zones will be excluded.

- **Types of exposure:** Any study that considers sudden (shocks) or long-term scarcity of freshwater resources as the independent variable. Studies that only consider freshwater quality will be excluded.

Water scarcity can be broadly defined as physical or social. Physical scarcity relates to absolute scarcity of water caused by natural and anthropogenic processes. For example, Falkenmark *et al* (1989) describes four types of water scarcity. Natural scarcity occurs in arid climates or is due to intermittent drought. Anthropogenic scarcity can occur through desiccation of the landscape driven by land degradation and population-driven water stress. Social scarcity relates to access, and is induced by political power, policies, and/or socio-economic relations (Ohlsson and Turton, 1999).

Both physical and social scarcity of freshwater resources will be considered.

- **Types of outcome:** Studies where the outcome is human conflict or collaboration. This can occur at the micro level (within communities), micro-micro level (between communities), micro-macro (between communities and private/state institutions), and

macro-macro (between states). All four scales will be considered in this analysis.

Conca and Dabelko (2002: 20) define collaboration as a ‘*movement along a continuum ranging from absence of violent conflict to the unimaginability of violent conflict*’. While Hammill *et al* (2009) defines human conflict as: ‘*the result of two or more parties (individuals or groups) having or perceiving to have incompatible goals and interests and acting upon these differences*’

These two definitions imply that conflict and collaboration lie along a continuum, and there is clear overlap between the two definitions. As such, we plan to use Zeitoun’s (2007) Conflict Framework (see Table 2). The framework maps Yoffe *et al* (2001) Water Event Intensity Scale on to NATO (1999) Stages of Conflict Development. Full definitions of the NATO Stages of Conflict Development and Water Event Intensity Scale can be found in Appendix 2

Table 2: Conflict Framework: Dynamics, Forms and Relations (Zeitoun, 2007: 106)

Water Event Intensity Scale (Yoffe 2001)	Stages of Conflict Development (NATO 1999)	Type of Interaction	Form of Conflict	Example
7		No Relations		New Zealand - Guinea
6				
5	DURABLE PEACE	Warm Relations	NO SIGNIFICANT CONFLICT	US-UK, US-Israel
4				
3				
2				
1				
0	STABLE PEACE	Cold Relations		Egypt-Israel
-1				
-2				
-3	UNSTABLE PEACE	Cold War	COLD CONFLICT	Israel-Syria US-N.Korea
-4				
-5	CRISIS	Military Occupation		Israel-Palestine China-Tibet US-Iraq (2005)
-6	WAR	Low-Intensity War	VIOLENT CONFLICT	Israel-Palestine (2002) S.African Liberation Struggle (1961-'94) US-Iraq (2004)
-7		High-Intensity War		US-Iraq (2003)

- **Types of study:** Our initial knowledge map has shown that data about the relationship between NRR scarcity and conflict and collaboration is available from a wide range of different studies including both qualitative and quantitative designs.

To be included the study will be empirical in nature, such as an observational, quantitative study analysing resource scarcity as an independent variable (include e.g. case control studies, comparative case studies). However, we will also consider relevant case studies without control, and qualitative studies.

We will exclude literature that is: theoretical, methodological, editorial, commentary, book reviews, policy documents, textbooks, bibliographies, position papers.

- **Language:** Studies should be published in English.
- **Date:** Studies should be published after 1990. The first wave of research into environmental-conflict nexus began in 1990. Additionally, as this is a rapid review with a limited timeframe, it is necessary to limit the scale.
- **Potential effect modifiers and reasons for heterogeneity:** Reasons for heterogeneity include: variations in datasets, dependent and independent variables and different methodologies. Outcomes may vary between nation, type of nation (e.g. low and middle income nations), and region of study, scale of analysis (e.g. intrastate and interstate) and timescale of analysis.

Repeatability of study inclusion will be tested by at least two reviewers. Here reviewers will independently assess a random subset of 10% of articles viewed at full text. A Kappa analysis will be undertaken to quantify the repeatability. This will be used to explore whether biases exist and if so why.

3.3 Study quality assessment

Study quality assessment is required to add quality studies to the analyses as well conducted studies has less potential for bias than those that are less robust. Reviewers will consider articles viewed at full text assigning them to different categories of study quality using assessment forms designed prior to the review.

We will adapt the EPPI-Centre's weights of evidence (WoE) (Gough, 2004) framework to rank the each study.

The WoE framework assesses studies on:

- (A) The quality of the study in terms of accepted practice within the research design employed;
- (B) The appropriateness of that research design for addressing the systematic review question;
- (C) The relevance of the focus of the study in relation to the systematic review question;
- (D) The overall judgement about the weight of evidence that the results of the study provide towards answering the review question based on judgements A, B and C.

Due to the limited timeframe of this review and high volume of literature identified at the scoping stage, it is unlikely there will be sufficient time to carry out a full critical appraisal of all literature at full text. As such, for the purposes of this systematic map, we will adopt stages B-D of the WoE to rank studies according to study design.

To inform stage B, experts will be presented with a complete list of all study designs identified in and asked to rank the different study designs identified during the systematic mapping stage according to the appropriateness of the research design for addressing the systematic review question.

Experts will also be asked a secondary question about the most appropriate research design for addressing the systematic review question and why. This will provide additional detail to the systematic map and potentially inform decisions on what future research might usefully address.

If there is sufficient time, studies ranked highest using the partial WoE framework will be reassessed using the full A-D stages WoE framework.

3.4 Data extraction strategy

The data extraction stage will involve the coding of studies using keywords to identify its subject content. As this is the first time this approach has been applied to NRR and conflict/collaboration, there are no existing keywording tools. As such, the coding tool will be developed using the SCIE *Systematic Mapping Guidance* (Clapton *et al*, 2009).

The purpose of this stage of coding is not to assess the quality of individual papers as a contribution to evidence. Due to time constraints, it will not be possible to extract data, for example, to perform a meta-analysis, or provide a critical assessment of individual studies. Instead studies will be coded to provide a systematic map of research activity in the area. Studies will also be ranked according the study quality assessment (see §3.3).

At the scoping stage, an initial knowledge map will be developed with a first level of coding that characterises the studies by study design, type of exposure, outcome, and population (e.g. scale of study, nation and region). This first level of coding will inform discussions with the content expert regarding the second level of coding.

The second level of coding will include categories included in the first level. Additional categories will be added, including a category which ranks the WoE (see §3.3). The coding tool will include keywords that reflect:

- **Generic**– type of printed material, country of origin, publisher, status of report, date of publication, nation and region;
- **Quality** (e.g. study design and WoE rank) – purpose of research study, design, methods;
- **Topic specific** - scale of study (e.g. intra-state or transboundary); population (e.g. households, communities, private sector actors, state actors), type of water resource (e.g. river, aquifer), outcome studied (e.g. conflict/ collaboration); study observation.

While documents are being retrieved the coding tools will be developed and reviewed with the content expert. Each code question will include guidance. Additionally, the exclusion criteria will be considered at this stage, as assessment at the full-text stage may identify studies that should be excluded.

To ensure the coding tool adequately reflects the content of the papers, it will be piloted on 10% / 100 papers (whichever is the greater amount). This will be carried out on the first papers returned in order to conserve time. Additionally, these papers will be double coded to assess consistency of coding between reviewers. Reviewers will discuss discrepancies. The pilot and double coding phase will help identify and clarify uncertainties in coding. Furthermore, should additional topics appear to be important to the map topic, these will be added at this stage.

Based on SCIE *Systematic Mapping Guidance* the quantity of questions will be limited to a maximum of 30.

3.5 Data synthesis and presentation

Following the SCIE *Systematic Mapping Guidance* (Clapton *et al*, 2009), the data synthesis and presentation will describe the will describe the extent and focus of the literature identified. Specifically the following will presented and discussed:

- A standardised flow chart of literature records within systematic map;
- Graphic presentations using statistical package R to represent different categories comparatively;
- A discussion and graphical presentation of results from the expert WoE survey;
- Gaps in research highlighted;
- Implications of results in the context of future climate change;
- Limitations of the map;
- Uses of the map

There will be four products: a full technical report, an executive summary, a paper prepared for an academic publication and a shorter and an accessible evidence briefing.

Each product aims to be useful and accessible to different kinds of audience.

4. Potential Conflicts of Interest and Sources of Support

We are not aware of conflicts of interest amongst members of the review team, therefore, none are declared.

This review is supported by DFID.

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Appendices

Appendix 1 – Relevant stakeholders for consultation

Department for International Development (DFID)
 World Bank (2011 World Development Report focus on conflict)
 United Nations Environment Programme (UNEP)
 United Nations Development Programme (UNDP)
 International Institute for Sustainable Development (IISD)
 International Institute for Strategic Studies (IISS)
 Chatham House
 Bradford University Department for Peace Studies
 Sussex Centre for Migration Research, University of Sussex
 Toronto Group for the Study of International, Transnational, and Comparative Law, University of Toronto
 School of Development, University of East Anglia
 Tyndall Centre for Climate Change Research
 Peace Research Institute Oslo (PRIO)
 Overseas Development Institute (ODI)
 International Institute for Environment and Development (IIED)

Charities/ NGOS

International Alert
 Oxfam
 Care
 Saferworld
 Christian Aid
 Action Aid
 Working Group on Climate Change and Development
 International Crisis Group

Appendix 2 – Supplementary information for inclusion criteria

The NATO (1999) Stages of Conflict Development

Stage of Conflict Development	Definition
Durable peace/ stable peace/ no significant conflict/	A situation where there is currently an absence of conflicting interests between two actors, or else where they are regularly resolved through non-violent mechanisms.
Unstable peace/ cold conflict	Situations of tension and suspicion that avoid violence by mutual deterrence, balance of

	power or government repression, <i>or</i> a situation where conflicting interests are normally fought over through negotiations or non-violent coercive methods. States normally engaged in cold relations or a cold war tends to generate some form of “cold conflict”.
Crisis/ violent conflict	Situations of tense confrontation between armed forces, engaging in threats and possible skirmishes, but without significant and sustained force’ or ‘conflicting interests are normally fought over through violent and coercive military means’
War	Situations of sustained and systemic use of armed force.

The Water Event Intensity Scale (Yoffe et al., 2001)

	Scale	Event description
Cooperation	7	Voluntary unification into one nation
	6	Major strategic alliance
	5	Military, economic or strategic support
	4	Non-military economic, technological or industrial agreement
	3	Cultural or scientific support (non-strategic)
	2	Official verbal support of goals, values, or regime
	1	Minor official exchanges, talks or policy expressions
	0	Neutral or non-significant acts for the inter-nation situation
Conflict	-1	Mild verbal expressions displaying discord on interaction
	-2	Strong verbal expressions displaying hostility in interaction
	-3	Diplomatic-economic hostile actions
	-4	Political-military hostile actions
	-5	Small scale military acts
	-6	Extensive war acts causing deaths, dislocation or high strategic costs
	-7	Formal declaration of war