



1 **Actors and networks in resource conflict resolution under**  
2 **climate change in rural Kenya**

3

4 G. W. Ngaruiya<sup>1</sup> and J. Scheffran<sup>2</sup>

5 [1] Department of Plant Sciences, Kenyatta University, Conservation Biology Section,  
6 Nairobi Kenya

7 [2] Institute of Geography, University of Hamburg, Research Group “Climate Change  
8 and Security” Hamburg, Germany.

9 Correspondence to : G. W. Ngaruiya ([ngaruiya.gracew@ku.ac.ke](mailto:ngaruiya.gracew@ku.ac.ke))

10

11 **Abstract**

12 The change from consensual decision-making arrangements into centralised  
13 hierarchical chieftaincy schemes through colonization disrupted many rural conflict  
14 resolution mechanisms in Africa. In addition, climate change impacts on land use have  
15 introduced additional socio-ecological factors that complicate rural conflict dynamics.  
16 Despite the current urgent need for conflict-sensitive adaptation, resolution efficiency  
17 of these fused rural institutions has hardly been documented. In this context, we analyse  
18 the Loitoktok network for implemented resource conflict resolution structures and  
19 identify potential actors to guide conflict-sensitive adaptation. This is based on social  
20 network data and processes that are collected using the saturation sampling technique  
21 to analyse mechanisms of brokerage. We find that there are three different forms of  
22 fused conflict resolution arrangements that integrate traditional institutions and private  
23 investors in the community. To effectively implement conflict-sensitive adaptation, we  
24 recommend the extension officers, the council of elders, local chiefs and private  
25 investors as potential conduits of knowledge in rural areas. In conclusion, efficiency of  
26 these fused conflict resolution institutions is aided by the presence of holistic resource  
27 management policies and diversification in conflict resolution actors and networks.

28

29 **1. Introduction**

30 Most African ethnic groups coexist peacefully with high degrees of mixing through  
31 inter-ethnic marriage, economic partnerships, and shared values that have been  
32 nurtured patiently over millennia(Aapengnuo, 2010). As a result, the management of



33 conflicts before colonization was guided by indigenous governance institutions that  
34 established consensual decision-making arrangements at the grassroots (ECA, 2007).  
35 This administrative role was later transferred to chieftaincies created by colonial  
36 governments that sought to impose hierarchical rule on its subjects (Osaghae, 1989).  
37 After independence, many African countries opted to maintain colonial administrative  
38 structures and chieftaincy. To increase effectiveness in rural governance, local chiefs  
39 were elevated to custodians of customary law and communal assets, with a  
40 responsibility to dispense justice, resolve conflicts and enforce contracts (ECA, 2005).  
41 This action created co-management regimes composed of diverse stakeholders,  
42 representing divergent interests and interacting directly over a period of time to resolve  
43 a specific conflict within their locality (Brunner et al., 2005).

44 However, the seemingly “stable” African conflict dialogue is currently becoming  
45 complicated through additional socio-ecological factors from unpredictable climatic  
46 conditions (Carius, 2009). There is a broad scientific debate whether and how climate  
47 change may act as a ‘threat-multiplier’ and will increase resource conflicts in sub-Sahara  
48 Africa (Lobell et al., 2008) among resource-dependent rural communities with low  
49 adaptive capacity (AMCEN, 2011; Haldén, 2007; WRI et al., 2005). For clarity, a resource  
50 conflict is defined in a wide sense as a situation whereby two or more parties  
51 (individuals or groups) have or perceive to have, a) incompatible livelihood goals and  
52 interests, or b) are in direct resource competition with each other and act upon these  
53 differences (UNEP, 2009, 2011). Adaptation measures addressing impacts of climate  
54 change on rural livelihoods have already been instituted globally to moderate potential  
55 damages and/or exploit beneficial opportunities (IPCC, 2007).

56 But rigid demarcation into sectoral tasks of adaptation programmes can fall short  
57 when it comes to conflict. Thus, a more systematic, integrated approach is necessary to  
58 meaningfully incorporate existing conflict dynamics—as well as overarching socio-  
59 political and economic conditions—into the design of adaptation measures. This creates  
60 the need for conflict-sensitive adaptation strategies to enhance sustainable  
61 development (Tänzler et al., 2013). Conflict-sensitivity refers to approaches and  
62 measures that display cognisance of how: climate change can cause conflicts; climate  
63 adaptation projects themselves can contribute to conflict and; adaptation measures  
64 would operate in conflict zones (Yanda and Bronkhorst, 2011). Such knowledge allows  
65 planners and decision-makers to address current vulnerabilities and development



66 priorities, while aiming to ensure long-term sustainability and peace through a basic  
67 understanding of future projections(Yanda and Bronkhorst, 2011).

68 Consequently, this article seeks to address two knowledge gaps through this paper.  
69 First, effectiveness of the fusion between indigenous mechanisms with conventional  
70 and western conflict resolution approaches is still in question (ECA, 2007). Second, few  
71 studies have documented actual rural structures and mechanisms used to resolve  
72 resource conflicts in the sub-Saharan grassroots(Hyden et al., 2005). To this end, we  
73 critically evaluate conflict resolution mechanisms of the water, agriculture and wildlife  
74 sectors of Loitoktok district in Southern Kenya. We then use the brokerage concept  
75 under social network analysis to identify central conflict resolution actors with the  
76 potential to guide implementation of conflict-sensitive adaptation(Yanda and  
77 Bronkhorst, 2011). We hypothesise that the presence of diverse stakeholders in the  
78 conflict-resolution process contributes to high potential success in implementation of  
79 conflict-sensitive adaptation in Loitoktok. Our discussion intends to further clarify local  
80 conflict dynamics influencing adaptive capacity, social cohesion and rural development  
81 in Kenya, as well as to contribute to the climate-security discourse in Africa.

82 The paper begins with a brief summary on the evolution of resource governance in  
83 Africa. Then it elucidates capacity challenges of current rural resource governance in  
84 dealing with potential climate-driven conflicts in sub-Saharan Africa and expounds on  
85 the use of social network theory in diagnosing resource governance. Thirdly, a  
86 description is given of the case study area of Loitoktok and the method used for  
87 collecting and analysing social network data. The results and discussion are thereafter  
88 presented based on identified conflict resolution mechanisms at the grassroots and  
89 their potential in the climate adaptation discourse. A brief conclusion is given on key  
90 highlights from the study.

91

## 92 **2. Evolution of resource governance in Africa**

93 Governance is defined as “the effective management of public affairs through the  
94 generation of a regime (set of rules) accepted as legitimate, for the purpose of  
95 promoting and enhancing societal values sought by individuals and groups”(Hyden et  
96 al., 2005). It takes place through diverse institutions in a society, whereby, an institution  
97 is likewise defined as an enduring collection of formal laws and informal rules, norms,



98 customs, codes of conduct, and organized practices that shape and govern human  
99 interaction (IDRC, 2009).

100 African indigenous institutions of governance were altered radically with colonial  
101 occupation that established a centralised governance system through the formalized  
102 chieftaincy tactic that became the foundation of post-colonial governments of many  
103 African countries (Cheka, 2008). After independence, the chieftaincy mandate was  
104 further altered during fundamental restructuring of socioeconomic systems by African  
105 political entities (ECA, 2007). Maintenance of the chieftaincy position was disputed by  
106 some who were concerned with rapid growth and transformation of African economies.  
107 For example, the late Tom Mboya quoted in (Osaghae, 1989) stated “Chieftaincy  
108 impedes the pace of development as it reduces the relevance of the State in the area of  
109 social services”. Proponents of the chieftaincy stratagem highlighted differences  
110 between the two systems that were clearly seen especially during conflict resolution, for  
111 example the colonial (modern) legal system operates on the basis of an adversarial  
112 approach while the traditional decision-making systems function on the basis of  
113 consensual decision-making and reconciliation arrangements (ECA, 2007; IDRC, 2009;  
114 IIDEA, 2011). Furthermore, since traditional institutions are indispensable for political  
115 transformation in Africa, post-colonial governments opted to incorporate indigenous  
116 knowledge into local administration regulations to increase positive perception of the  
117 government by the masses (ECA, 2007).

118 Similarly, natural resources are embedded in a shared social space where complex  
119 and unequal relations are established among a wide range of social actors, e.g. in the  
120 case of the production of primary products, agro-export producers and farmers, ethnic  
121 minorities, government agencies and others (Mwanika, 2010). However, the “one-size-  
122 fits-all” governance approach introduced by colonialists gave such poor outcomes that  
123 led to the establishment of a rural participatory resource management approach to  
124 promote community-based conservation, especially in developing countries (Berkes,  
125 2004). The inclusion of indigenous institutions and knowledge was important because  
126 they guide how people negotiate access to resources and reduce (though not avoid  
127 altogether) negative effects of conflict or drought (Eriksen and Lind, 2009). Apart from  
128 indigenous institutions, many developing countries are currently implementing  
129 poverty-reduction schemes that target the unemployed and marginalised groups. In  
130 Kenya, the state has established among others the Revolving Fund for women and youth



131 community groups seeking to access business funds to improve their living standards  
132 (Ngaruiya and Scheffran, 2013).

133 Consequently, three main types of institutional governance systems are active in  
134 rural Africa.

135 a) *Traditional institutions* are defined as a power, permission or an institution  
136 emanating from indigenous authority that draws its legitimacy, whether wholly  
137 or partially, from tribal/ethnic/cultural values of a group of people that share  
138 them (Cheka, 2008). Such traditional institutions have either centralized or  
139 decentralized governance systems. Centralized systems had kings and monarchs  
140 such as the Abyssinia (Ethiopia), Buganda (Uganda) and Ashanti (Ghana) while  
141 decentralized systems comprise of council of elders found among the Kikuyu  
142 and Maasai (Kenya), the gada (age-set) system of the Oromo in Ethiopia, or the  
143 Ibo village assembly in Nigeria (ECA, 2007).

144 b) *Formal institutions* are state-sponsored institutions that were mostly inherited  
145 from colonialism and constitute the written or codified rules such as the  
146 constitution, judiciary laws, organized markets, and property rights (IDRC, 2009;  
147 Mowo et al., 2013).

148 c) *Informal institutions* are the patterns of interdependence and actions among  
149 individuals who build themselves into different structural configurations to  
150 improve their living conditions or enhance resource exploitation. The actor  
151 linkages formed across the community vary by religion, ethnic identity, mode of  
152 production and are manifested as social networks (Prell et al., 2010).

153 When formal, informal and traditional institutions complement each other at  
154 different prefectures and different tiers, stakeholders are able to integrate diverse but  
155 relatable sources of knowledge to broaden resolution alternatives that might otherwise  
156 have been missed (Irwin et al., 2007). However, *institutional incoherence* is a major  
157 obstacle to effective governance. Incoherence occurs when governance institutions  
158 become incompatible to each other, with consequences such as hindrances in decision-  
159 making, wastage of financial resources or even deepened conflictual relationships at the  
160 grassroots (IDRC, 2009; Mowo et al., 2013). A practical incoherence example is seen in  
161 local adaptive capacity projects that are characterised by conflicting, overlapping  
162 mandates and dysfunctional arrangements in inter-agency integration as a result of  
163 weak coordination that subsequently gives poor outcomes (Madzwamuse, 2010). In



164 relation to this study, effective resource conflict governance calls for incorporation of  
165 indigenous knowledge with a formal conflict resolution institution to create flexible  
166 systems of resource management termed as “*adaptive co-management*” systems. These  
167 systems become tailored to specific places and situations and are supported by and  
168 work with various organizations at different levels (Folke et al., 2005). Furthermore,  
169 effective adaptive co-management must involve multiple stakeholders to enhance  
170 governance outcomes because local people know each other better, have more rapport  
171 and sense of belonging that creates opportunities for cooperation and collective action,  
172 for managing natural resources on a self-ruling and self-sufficient basis at the  
173 grassroots (Mowo et al., 2013).

174 Against this background, issues of governance and institutional coherence turn out to  
175 be relevant for our inquiry into the role of culture in social cohesion at the grassroots.

176

### 177 **2.1. Capacity challenges in addressing climate-driven rural conflicts**

178 Climate change has been described as a ‘threat-multiplier’ that may intensify existing  
179 social, economic, political and environmental problems that communities are already  
180 facing. Impacts of climate change are predicted to exacerbate grievances; overwhelm  
181 coping capacities; and, in extreme times, spur forced or proactive migration(WBGU,  
182 2008; Yanda and Bronkhorst, 2011).Climate change predictions for Africa suggest  
183 increasing scarce water resources associated with declining and failing agricultural  
184 yields in the Horn of Africa(Carius, 2009). Some studies predict a significant increase in  
185 armed conflicts in sub-Saharan Africa by 2030 compared to the 1980 to 2000  
186 period(Burke et al., 2009; Lobell et al., 2008)though others challenge this claim  
187 (Buhaug, 2010; O’Loughlin et al., 2012). Various studies find mixed results on the  
188 climate-conflict link in East Africa (Ide et al., 2014; O’Loughlin et al., 2012; Raleigh and  
189 Kniveton, 2012; Schilling et al., 2012; Witsenburg and Adano, 2009).

190 Land is not just a material resource that people compete over, but it also forms the  
191 basis of a particular way of life (farmer, pastoralist, fisher etc.); gives an ethnic identity;  
192 and defines gender and age roles (Mwanika, 2010). Figure 1 illustrates possible paths to  
193 conflicts induced by climate change in a typical rural village scenario in  
194 Kenya(Ossenbrügge, 2009). These paths are termed as conflict constellations which are  
195 divided into four, namely - water stress, food insecurity, drought as a natural disaster,  
196 and migration issues (WBGU, 2008). Cumulative impacts from climate change on key



197 rural livelihood activities, such as agriculture and wildlife tourism, subsequently  
198 decrease (or cause failed) harvests and also increase farm raids by wildlife from  
199 neighbouring protected lands. Subsequent loss of income in rain-dependent  
200 communities lowers the spending power and increases local poverty levels. Affected  
201 households are thus left with land as their only asset which is viewed as an additional  
202 source of income, especially for rural households experiencing poor harvests and  
203 livestock productivity in Kenya (Ntiati, 2002). Subdivision of land disrupts the cultural  
204 norms and trusts of indigenous host communities through exposure to dissimilar  
205 immigrant norms and attitudes.

206 On the one hand, introduced norms could be beneficial like reduction of female  
207 genital mutilation. On the contrary, immigrants are perceived as “threats” who reduce  
208 power and influence of tribal chieftains, elites or local politicians. Such divisive thinking  
209 is grounded on the parochialism of communities in conceding the rights and interests of  
210 other communities (Western, 1994). On the extreme, if civic education is not foremost  
211 in the community then such a fragile “host vs. immigrant” situation creates fertile  
212 grounds for mobilizing citizens along ethnic or cultural lines by politicians vying for  
213 elective posts by promising “equal” resource allocation. Subsequently, people may  
214 retreat to their ethnic cocoons and agitate for social respite from the government. Such  
215 a “domino” effect clearly demonstrates the link between climate change impacts and  
216 resource conflicts whereby a decrease in ecosystem services production leads to  
217 increased rural poverty that gradually draws ever-deeper lines of division in social  
218 relations and triggers resource conflicts (WBGU, 2008). In the absence of conflict-  
219 sensitive adaptation programs, these resource conflicts become cyclic and reduce the  
220 ability of the community to adapt.

221 Despite that adaptation funding is already being made available and adaptation  
222 projects are under way in many rural communities (Yanda and Bronkhorst, 2011).  
223 Escalating cases of resource conflicts are projected to overwhelm rural conflict  
224 resolution mechanisms and reinforce the trend towards general instability and  
225 insecurity that already exists in many societies and regions (WBGU, 2008). We find that  
226 this prognosis is supported by three main capacity concerns drawn from the literature  
227 on climate change and resource conflicts in Africa:

228 a) (Handmer et al., 1999) posit that poorer regions and countries will have  
229 difficulty in adapting to climate change, since they lack comprehensive technical





230 and financial ability. In addition, African governments are faced with other major  
231 developmental issues such as conflict, diseases and poverty that require direct  
232 engagement by the state(AMCEN, 2011). Hence, at the moment climate change  
233 adaptation policies seem unlikely to be successful or minimize inequity in Africa.

234 b) Adaptation is *not just* a technical process but also a political process since power  
235 relations need to be adjusted for individuals and groups to achieve discrete  
236 interests to maintain their own livelihoods (Eriksen and Lind, 2009). Poor  
237 understanding of the African society structure and preference for “foreign” non-  
238 governmental organisations (NGOs) with disparate interests in formulating the  
239 African adaptation agenda has resulted in poor representation of the grassroots  
240 level in the climate discourse, yet they are the most affected group (Hellmuth et  
241 al., 2007; Madzwamuse, 2010).

242 c) Poor representation subsequently creates the third capacity challenge of  
243 marginalisation of customary law in climate change policy-making at both  
244 national and international levels, despite the high significance of indigenous  
245 knowledge in the African society (AMCEN, 2011).Moreover, education systems  
246 also neglect indigenous knowledge in school curricula concerning environmental  
247 studies due to the negative undertone given to cultural practises by colonial  
248 governments.

249 These three adaptive capacity issues infer that coherence between governance  
250 institutions is critical in preventing competition over resources turning into a violent  
251 conflict (Adano et al., 2012; Young, 2011). This is because effective adaptation can also  
252 serve as a “threat minimiser” that brings together actors from security arrangements,  
253 conflict resolution and asset management sectors to strengthen local adaptive capacity  
254 while reducing predicted conflict cases (Donnelly-Roark et al., 2001). Furthermore,  
255 opportunities for incorporating climate information into development activities in sub-  
256 Saharan Africa are largely being missed at the moment (Hellmuth et al., 2007). This is  
257 mainly because selecting representatives in resource governance institutions becomes a  
258 complicated process since African rural communities are composed of diverse informal  
259 interest groups that are formed as forums for exchanging knowledge, accessing  
260 development funds and markets for their products (Ngaruiya and Scheffran, 2013).

261

### 262 3. Use of social network theory in resource governance studies





263 Incorporation of social network analysis into resource governance has rejuvenated  
264 studies in natural resource management by introducing a quantitative approach to  
265 political, economic or social processes in connection to structural and environmental  
266 processes (Bodin and Prell, 2011). A social network is composed primarily of  
267 interdependent actors together with the social relations (ties) linking these actors  
268 together for transfer or flow of resources (Bodin and Prell, 2011). Social networks can  
269 be viewed as a graph that consists of nodes (actors) joined by lines (relations) which  
270 allows researchers to uncover patterns that might otherwise go undetected (Prell et al.,  
271 2010). Network analysis fundamentally differs from standard social science research  
272 because rather than focusing on attributes of autonomous individual units; it views  
273 characteristics of the social units as arising out of structural or relational processes to  
274 reveal theoretical motivations behind social relationships that shape environmental  
275 outcomes (Wasserman and Faust, 1994).

276 Of interest to this study is how social network analysis facilitates  
277 identification of stakeholder positions in a network and how these actors link various  
278 parts of the network together (Bodin and Prell, 2011; Ngaruiya et al., 2015). Several  
279 mathematical indices are used to quantitatively define this importance or prominence  
280 of an individual actor within their social network. Equation (1) defines the *betweenness*  
281 *centrality* index that counts the number of network pathways passing through an actor  
282 and is used to measure how much potential control an actor has in disseminating  
283 accurate and relevant information across the community network.

$$284 \quad C_B(k) = \sum_{i \neq j \neq k} \frac{\partial_{ikj}}{\partial_{ij}} \quad (1)$$

285 Where:

286  $C_B(k)$  = betweenness centrality of actor k

287  $\partial_{ikj}$  = number of paths linking actors i and j that pass through actor k

288  $\partial_{ij}$  = number of paths linking actor i and j

289 This definition is based on the assumption that interactions between two  
290 nonadjacent actors might depend on other actors, especially the actors who lie on the  
291 path between the two (Wasserman and Faust, 1994). A practical implication of this  
292 index is that if actors rest between many others, then they have the ability to “broker”  
293 adaptation information to other actors and thereby influence the level of collective  
294 knowledge in the community. If brokers are active within a community, they will not



295 only influence the quantity of knowledge but will also enhance the quality of knowledge  
296 circulating because they are able to connect diverse stakeholders to solve a common  
297 resource problem. For example, if a community has well-equipped brokers then the  
298 local ability to adapt to climate change increases the potential for peaceful conflict  
299 resolution and conflict transformation (Tänzler et al., 2013). On the other hand,  
300 unrestrained brokerage can create organisation chaos, manifest in errors such as  
301 resources allocated to conflicting goals and units in the same organisation competing  
302 against one another (Burt, 2011). A practical example of poor brokerage is how  
303 immense adaptation funding has caused a proliferation of actors offering diverse  
304 “expertise” in rural communities but with poor performance outcomes in many rural  
305 areas (Madzwamuse, 2010). Despite this flaw, brokerage is an interesting concept that  
306 is yet to be exhaustively applied in resource governance in Africa.

307 For that reason this paper uses social network analysis concepts to evaluate rural  
308 conflict resolution mechanisms, their structure and how central actors can be used to  
309 implement conflict-sensitive adaptation strategies at the grassroots.

310

#### 311 **4. Method**

##### 312 **4.1. Area description**

313 Our area of focus is Loitoktok district in Kajiado County, located at the southern tip of  
314 the former Rift Valley province in Kenya and covers c. 6,356.3 km<sup>2</sup>. It is situated  
315 between longitudes 36° 5' and 37°5' East and between latitudes 1°0' and 3°0' South and  
316 borders the Republic of Tanzania to the West adjacent to Mt. Kilimanjaro (Government  
317 of Kenya, 2009). Ecologically, it is categorized among the arid and semi-arid districts in  
318 Kenya. The first census in 1962 showed a population of 24,027 persons while the  
319 current estimated population for 2012 is 171,520 persons. The district has an estimated  
320 annual population growth rate of 4.51% as per last census count (Government of Kenya,  
321 2009).

322 Loitoktok was selected as representative of a typical Kenyan rural area because of a)  
323 its vibrant water, agriculture, and wildlife sectors, b) rapid land subdivision, c)  
324 introduction of diverse cultures by immigrants with different livelihood practises apart  
325 from pastoralism of the Maasai community. In addition, evidence of environmental  
326 impacts related to climate change have locally been documented through changes in  
327 precipitation (Thompson et al., 2009), temperature fluctuations (Altmann et al., 2002),



328 wildlife mortality (Wangai et al., 2013) and agricultural production (Ngaruiya 2014) in  
329 Loitoktok.

330 In terms of governance institutions and stakeholder diversity, Loitoktok's rich  
331 wildlife supports a strong tourism sector characterised by many hotels and lodges and  
332 is rated as one of the key wildlife tourism areas in Kenya. Unmonitored land subdivision  
333 and climate variability increased cases of wildlife poaching and human-wildlife conflicts  
334 but these also created opportunities for establishment of several wildlife organizations  
335 promoting conservation of local biodiversity. Additionally, due to the districts' remote  
336 and semiarid location, several non-governmental organizations have been started to  
337 boost the education, water and health sectors in collaboration with government  
338 agencies.

339

#### 340 **4.2. Data collection and analysis**

341 Field work was conducted in March-May and October-December 2012. Information  
342 was sought on the resource conflict resolution process for water, wildlife and  
343 agriculture sectors. A simple questionnaire collected relational (social network) data of  
344 actor linkages using the saturation sampling technique within the Loitoktok community.  
345 A respondent was asked to name five persons they share collaborations with during  
346 conflict resolution and resource governance, whereby the named actors were located  
347 (where possible) and asked to name their collaborators, which went on until no new  
348 names were mentioned.

349 Thereafter, the social network data was converted into an actor matrix and analysed  
350 for brokerage using the algorithm for betweenness centrality that finds the geodesics in  
351 the network and then computes potential connections of every actor in the community.  
352 The resultant data was then visualised as a sociograph using NetDraw™ that efficiently  
353 illustrates the actual situation at the grassroots (Borgatti et al., 2002).

354

#### 355 **5. Results and discussion**

356 The respondents comprised of 152 persons drawn from four sectors (water,  
357 agriculture, wildlife tourism and community) and also included expert interviews in  
358 Nairobi, Kajiado and Loitoktok towns. The questionnaire also guided 6 group  
359 discussions in Loitoktok All respondents agreed that inclusion of culture in the conflict  
360 resolution process gave the community confidence in decisions agreed after



361 deliberations and that the main aim of a conflict resolution was to reduce tension or  
362 violence by bringing the conflicting parties together. This coincides with principles of  
363 natural resource management that emphasize the need for cooperation as a necessary  
364 precondition for sustainable conflict resolution.

365 Table 1 illustrates practically how different resource conflicts were resolved between  
366 November 2011 and November 2012 at Oloolopon Location in Loitoktok. It is evident  
367 that resolving resource conflict is not the responsibility of a single person or institution,  
368 but that minor conflicts were resolved by a small stakeholder meeting that was trusted  
369 to recommend fair decisions for aggrieved parties, e.g. conflict over water at Impriron.  
370 The most recommended discipline measure is compensation by the guilty actors to the  
371 aggrieved party according to the level of destruction or damage. In extreme cases, when  
372 the community felt aggrieved and the situation was thought to likely spread community  
373 tension, the chief was obligated to call for joint meetings (*barazas*) for all relevant  
374 stakeholders and the entire community.

375

377 This real-life reflection confirms that chiefs and other traditional authorities also  
378 have the potential to mitigate ethnic conflicts by applying traditional conflict-resolution  
379 mechanisms to narrow differences (ECA, 2007). The survey also confirms coherence  
380 among the different institutions involved in resource conflict resolution.

381

### 382 **5.1. Rural conflict resolution schemes**

383 Three main conflict resolving systems borne from cooperative efforts were identified  
384 in Loitoktok (Fig. 2). These are:-

385

#### 386 a) Policy-guided conflict resolution plan

387 Water scarcity was identified as a driver for resource conflict, especially during the dry  
388 seasons in Loitoktok. As stipulated in the Water Act of 2002, the Ministry of Water  
389 mandates its local government agency - Water Resources Management Authority  
390 (WRMA) - to resolve local water conflicts together with the Water Resource Users  
391 Association (WRUA). The local chief is an optional mediator in the presence of water  
392 officials. If the conflict is not resolved through negotiation then it is either forwarded to  
393 the courts for legal action against the offender or to the Water Appeals Board for further  
394 arbitration. An interesting aspect is that WRMA also gives grants to approved WRUA's



395 projects that target enhanced water supply and quality. This clearly has encouraged the  
396 community to participate in the prescribed regular training sessions for enhancing local  
397 water governance.

398 Evidently, a well formulated resource policy is recognised as the first key step in  
399 effectively resolving resource conflicts at the grassroots level. Thus the Water Act  
400 clearly sets out the conflict resolution process and also empowers the resource users  
401 with knowledge of their rights as resource users. For example, Loitoktok WRUA  
402 members undertake citizen arrests of persons breaking water laws, especially upstream  
403 farmers who over-extract water.

404

#### 405 b) Quasi-formal conflict resolution plan

406 This structural arrangement is predominantly used to solve two forms of conflict that  
407 affect agricultural output. These are: i) Human-wildlife conflicts that occur when  
408 wildlife invades farms for fodder or livestock (prey) and/or to access water sources. ii)  
409 Farmer-pastoralist conflicts that occur when livestock destroy crops while trying to  
410 access watering points since communal grazing areas have been lost following  
411 subdivision of community group ranches. The agricultural conflict resolution  
412 committee comprises of the formal council of elders (administrative type), the local  
413 chief, agricultural extension officers and police. This arrangement is termed as quasi-  
414 formal because the elders and chief are nominated from the community by the  
415 government, unlike in the water sector that only works with civil servants in conflict  
416 resolution. The committee uses a crop damage or livestock death report prepared by  
417 the extension officer to guide negotiations after which the aggrieved party is  
418 compensated either in kind (livestock) or in cash form. Police is involved to ensure that  
419 the conflict resolution process can be transferred to court if the offender fails to fulfil  
420 the stipulated compensation. Though the council of elders is part of the community  
421 sometimes the community perceives their unfavourable rulings with suspicion as if they  
422 represent the government.

423

#### 424 c) Hybrid site-specific conflict resolution plan

425 The wildlife sector exhibits a unique conflict resolution strategy as a result of  
426 inadequate government policies. This strategy comprises of the traditional council of  
427 elders, formal government agencies, private investors and researchers who come



428 together to cover shortcomings of the wildlife conflict management strategy. For  
429 example, previous absence of compensation for livestock deaths and crop destruction  
430 by wildlife led to wanton slaughter of lions, elephants, or zebras. Now, modest payments  
431 to aggrieved families by private investors such as Mr Luke of Olkeri Sanctuary for losses  
432 incurred by predators or elephants have reduced cases of revenge wildlife killings.  
433 Another example was seen at the Mbirikani group ranch whereby game scouts  
434 (members of the community) conduct regular patrols. Respondents stated that since the  
435 *community wildlife policing* project has begun, the poaching levels have been reduced.  
436 This site-specific measure infers that community members are prone to cohesively use  
437 their own knowledge if they are assisted in developing an efficient way of collaboration  
438 to enhance their livelihoods.

439 Though this mechanism seems to be effective, it does not comprehensively deal with the  
440 fundamental cause of human-wildlife conflicts. This is because no policy exists on how  
441 to ensure survival of wildlife during drought episodes to prevent the recurrent human-  
442 wildlife conflicts. In addition, poor understanding of the wildlife management policy has  
443 also exposed the community to manipulation by politicians seeking voter mileage at the  
444 expense of the human-wildlife incidents.

445 From this study, it is evident that the resource conflict resolution process involves  
446 interaction among diverse actors which in turn increases local civic knowledge,  
447 community participation and shows respect to cultural practices that together  
448 strengthen rural community networks. This also signals effectiveness of the fusion  
449 between indigenous and conventional conflict resolution mechanisms. Furthermore,  
450 integration of diverse stakeholders provides a basis to broaden institutional networks  
451 and partnerships through alternative livelihood activities that may boost the local  
452 economy. However the need to overhaul the land policy in Kenya cannot be overlooked.  
453 Respondents stated that a comprehensively developed land policy will establish zones  
454 for different development purposes and allocate buffer zones to reduce incidences of  
455 encroachment and human-wildlife conflict in protected areas. This action will ensure  
456 that future urban expansion will not lead to resource competition or unequal  
457 distribution in rural areas of Kenya.

458

459 **5.2. Loitoktok social governance structure**



460 Scrutiny of the resource governance and conflict resolution structures reveal 86  
461 actors in 23 formal institutions (government agencies), 16 informal institutions  
462 (community groups), 46 private organizations and 1 traditional institution. These  
463 institutions belong to four main sectors namely, agriculture, wildlife & forestry, water  
464 resources and community management that implement resource governance through  
465 collaborative actions from 30, 31, 11 and 14 actors from the respective sectors.

466 Figure 3 gives an illustration of how actors are connected and also identifies actors  
467 who occupy the central position in Loitoktok. Full names of actors are contained in the  
468 supplement. These actors are more visible, have the highest degree of ties and are  
469 involved centrally in resource conflict resolution in the network. They include: District  
470 Agricultural Officer (DAO), District Kenya Wildlife Service (DKWS), District Livestock  
471 Officer (DLO), District Local Government (DLG), Social Development Officer (DSDO),  
472 District Water Officer (DWO), District Kenya Forest Service (DKFS) and game scouts.  
473 The calculated betweenness scores that indicate the network influence of the identified  
474 central actors are 718.5, 670.5, 179.5, 165, 151, 80, 78 and 78, in the same order  
475 respectively. These values represent currently missing links to neighbouring actors that  
476 can be potential links available for each actor to use in increasing the number of  
477 connection in the network. The eight actors have the highest ability to build resource  
478 knowledge and ecosystem dynamics so that the community can collectively respond to  
479 environmental feedback in a fashion that contributes to resilience. The rest of the actors  
480 have betweenness scores of less than 10 and thus have a small effect on information  
481 dissemination and control within the larger community.

482 By empowering the central actors to actively create connections that span across  
483 different resource sectors then the community can strengthen the local governance  
484 strategy for effective problem-focused community resource management. This is  
485 discussed below.

486

### 487 **5.3. Building conflict-sensitive adaptation**

488 Conflict resolution is critical to adaptation as conflict restricts many drought  
489 adjustments involving peaceful interaction between many diverse stakeholders.  
490 Conflict-sensitive adaptation becomes therefore a holistic, multi-scaled and multi-  
491 sectored approach that taps into the wealth of traditional knowledge regarding the  
492 management of resources and conflicts at a community level(Yanda and Bronkhorst,





493 2011). Since conflict-sensitive adaptation processes must be approached using a multi-  
494 dimensional system that incorporates different levels, both administrative and societal  
495 (Tänzler et al., 2013). Then, this study postulates that central actors, who hold the  
496 network together in times of distress, also have potential to influence adaptation  
497 information quality and flow in the network.

498 Loitoktok actors who should be equipped with adaptation knowledge to “broker” to  
499 the community are:

500 a) Extension officers

501 These are the District Agricultural Officer (DAO), District Livestock Officer (DLO),  
502 District Kenya Forestry Service (DKFS) and District Kenya Wildlife Service (DKWS). The  
503 extension officers are well connected to their respective community interest groups  
504 (informal institutions) and thus can be effective in transfer of adaptation knowledge. The  
505 community indicated that water and wildlife sectors recorded the highest number of  
506 conflicts and subsequent studies have confirmed low adaptation measures in these two  
507 sectors. Conversely, crop and livestock sectors have the most diverse adaptation  
508 measures due to a close public-private actor partnership (Ngaruiya, 2014). Therefore,  
509 specialised training of extension officers in adaptation technology and water harvesting  
510 for subsequent transfer to the community will not only buffer food security (crop and  
511 livestock products) but will also strengthen the local economy through creation of  
512 additional livelihood opportunities in a climate change context.

513

514 b) Council of elders

515 In Loitoktok, the outstanding traditional institution is the Council of Elders that is  
516 made up of persons of integrity and objectivity who have distinguished themselves in  
517 one way or another and have been recognized as such by the community (Cheka, 2008).  
518 There are two types of Council of Elders. First, the Council of Elders that is appointed by  
519 the State and is made up of men from the three major tribes in the district to help in  
520 administration issues such as immigration and conflict resolution in the agriculture  
521 sector (quasi-formal). Secondly, the dominant host Maasai community exclusively  
522 selects its indigenous Maasai Council of Elders (traditional institution) according to its  
523 culture which is also respected by other communities in Loitoktok. This council is highly  
524 regarded in the wildlife sector where it plays a key role in either agitating for action by  
525 the government and investors or calming the Maasai community after a serious human-



526 wildlife incident. Interestingly from the social network analysis, the council of elders is  
527 not among the top central actors because of the administrative dichotomy in the district.  
528 But the fact still remains that they are well connected to each resource sector, thereby  
529 giving them a stronger knowledge dissemination power in the community.

530 In terms of judgements and costs, indigenous conflict resolution mechanisms have  
531 been found to be effective for both lesser criminal cases such as stock theft, land  
532 disputes and serious crimes such as genocide as seen in Rwanda (ECA, 2007). Hence  
533 incorporating such respected institutions originating from customary law and  
534 indigenous knowledge into climate change policies is likely to result in formulation of  
535 effective adaptation strategies that will be participatory and highly acceptable by the  
536 rest of the community.

537

538 c) Local chief

539 Loitoktok has 16 locations each governed by a chief and 31 sub-chiefs who are in-  
540 charge of sub-locations. These chieftaincy positions are not elective but the person is  
541 nominated by the government to participate in decision-making at the grassroots. The  
542 chiefs work under the District Local Government (DLG) office and are called upon by the  
543 government depending on the conflict situation in the community. The administrative  
544 council of elders also falls under the DLG office as a physical representation of the  
545 government in the community. These quasi-formal arrangements are alternative  
546 institutions that are peripherally involved in resource governance but can also improve  
547 the climate change discourse in Africa. The chiefs and council of elders can identify  
548 isolated rural community interest groups for training in resource governance including  
549 conflict resolution since unmanaged informal groups form many small and dense  
550 clusters with little or no diversity and little adaptation knowledge that become resistant  
551 to change. An example is pastoralists who view livestock as a form of wealth and calls by  
552 extension officers to dispose of healthy animals before onset of drought is viewed with  
553 suspicion. Furthermore, chiefs can conduct civic lessons among their constituents as a  
554 means of promoting integration and coexistence and dispelling false information to  
555 foster the concept of “a common people with a common destiny” (Aapengnuo, 2010).

556

557 d) Private investors and researchers



558 Loitoktok network has many private organisations such as hotel owners, seed  
559 companies' researchers, humanitarian workers etc. in all the resource sectors. Most  
560 private actors are seen to be more effective in resolving conflicts in the wildlife sector as  
561 a way of preserving the wildlife resource that attracts tourists to the area. Societal  
562 decision-making is nested in a wider set of societal changes, such as institutional  
563 changes and altered relations between public and private actors. Thus, for a community  
564 to increase its adaptive capacity then it should incorporate all stakeholders in  
565 developing land and resource management designs to make them more effective and  
566 relevant to investors. Apart from formal institutions and the non-governmental  
567 organisations, communities should incorporate local investors who have financial and  
568 technical ability to support the community in sustainable use of biodiversity and  
569 practical knowledge to maintain ecosystems in good condition to avoid conflicts over  
570 scarce resources especially during drought.

571

## 572 **6. Conclusions**

573 A number of studies have used economic, political and ecological aspects to expound  
574 resource conflicts in several African countries. However, few studies have documented  
575 the social structures that resolve conflicts at the grassroots. This study confirms that in  
576 post-colonial Kenya, resource governance still contains vestiges of traditional  
577 institutions, especially in collective discussion of grievance towards effective conflict  
578 resolution. The innovative arrangements make use of indigenous knowledge to calm the  
579 aggrieved and agitate for compensation by the government. As a result, this integration  
580 binds the society together by its inherent customs based on brotherhood notions for  
581 enhanced resource utilisation and livelihoods, regardless of climatic conditions.

582 Secondly, climate change threatens to disrupt conflict resolution mechanisms that are  
583 operational in rural centres because of capacity challenges associated with Africa's low  
584 technical ability to manage climate governance, poor integration of diverse opinions  
585 and marginalisation of indigenous knowledge into adaptation and mitigation agendas.  
586 We based the field study on the Loitoktok district that is expanding in terms of its  
587 cultural diversity, economic sectors and profile of resource conflict which is  
588 representative of many rural areas in Kenya as well as sub-Saharan countries. Results  
589 indicate that conflict resolution was achieved through three forms of institutions, each  
590 unique to its natural resource. The water sector relied upon its comprehensive policy;



591 agriculture used a quasi-formal arrangement while the wildlife sector formulated its  
592 own hybrid arrangement that involved private investors and the traditional council of  
593 Maasai elders. In extreme cases, the community came together in *barazas* to air their  
594 concerns and agree on a collective decision acceptable to all relevant stakeholders.

595 Implementation of conflict-sensitive adaptation requires a deep understanding of the  
596 context in which climate-driven resource-conflicts are resolved in a community and  
597 clearly delineated actor interactions between local resource-related activities.  
598 Therefore, we used the betweenness centrality index drawn from the flourishing field of  
599 social network theory to evaluate the central actors with potential to broker adaptation  
600 knowledge across the Loitoktok network. Results indicate that extension officers,  
601 council of elders, local chief and private investors are the suitable central actors who  
602 should be financially and technologically equipped for building conflict-sensitive  
603 adaptive capacity in the community. Thus government and non-government  
604 stakeholders must work together to identify risks and formulate strategies and  
605 programmes that can help raise awareness among civil society of the impact of climate  
606 change.

607 As a contribution to the climate and security discourse, this study advocates for two  
608 adaptive co-management measures to help overcome climate change-related capacity  
609 challenges at the grassroots in Africa. First, clear conflict resolution policy in natural  
610 resource governance as seen in the water sector will help solve local conflicts and also  
611 enable stakeholders to understand local conflict genesis and effectively prepare for  
612 unpredictable climatic conditions. Secondly, involving diverse actors from the  
613 community in resolving conflict as seen in the wildlife sector, also has potential in  
614 serving as a conduit of the adaptation knowledge sector that empower the community  
615 despite policy inadequacies. Moreover, traditional institutions like the council of elders  
616 have been seen as a source of civic knowledge, and encourage respect of local values  
617 and customs that contribute to community self-reliance and empowerment in the  
618 community.

619 To conclude, natural resource regulations and governance arrangements play  
620 important roles in handling potential conflicts over scarce natural resources,  
621 particularly water in arid and semi-arid lands (ASAL). Thus resource conflict resolution  
622 and positive culture transmission should be part of an effective conflict-sensitive  
623 adaptation strategy. These two aspects encourage growth of cohesive social capital that



624 in turn enhances economic development at the grassroots and effective governance of  
625 the commons.



626        **Acknowledgments**

627        Special thanks go to Mr. Gadayo (Wiper), Prof. John W. Kiringe and Mr. Paul Ngugi  
628        (Treasury) for assistance in Kenya. This work is supported by  
629        Deutscher Akademischer Austauschdienst (DAAD), National Council for Science and  
630        Technology (NCST)-Kenya, German Science Foundation (DFG) through Cluster of  
631        Excellence "Integrated Climate System Analysis and Prediction", and School of  
632        Integrated Climate System Sciences (SICSS) as a PhD project at the University of  
633        Hamburg, Germany.

634

635        **References**

- 636        Aapengnuo, C. M.: Misinterpreting ethnic conflicts in Africa, Africa Center for Strategic Studies.  
637        [online] Available from: <http://africacenter.org/2010/04/misinterpreting-ethnic-conflicts-in-africa/>  
638        2010.
- 639        Adano, W. R., Dietz, T., Witsenburg, K. and Zaal, F.: Climate change, violent conflict and local  
640        institutions in Kenya's drylands, *J. Peace Res.*, 49(1), 65–80, 2012.
- 641        Altmann, J., Alberts, S. C., Altmann, S. A. and Roy, S. B.: Dramatic change in local climate patterns in  
642        the Amboseli basin, Kenya, *Afr. J. Ecol.*, 40(3), 248–251, 2002.
- 643        AMCEN: Addressing Climate Change Challenges in Africa: A Practical Guide towards Sustainable  
644        Development., African Union Commission & United Nations Environment Programme Secretariat,  
645        Nairobi., 2011.
- 646        Berkes, F.: Rethinking community-based conservation, *Conserv. Biol.*, 18(3), 621–630, 2004.
- 647        Bodin, Ö. and Prell, C.: *Social Networks and Natural Resource Management: Uncovering the Social  
648        Fabric of Environmental Governance*, Cambridge University Press., 2011.
- 649        Borgatti, S. P., Everett, M.G and Freeman, L.C.: UCINET Software, Analytic Technologies, Harvard,  
650        MA. [online] Available from: <https://sites.google.com/site/ucinetsoftware/>, 2002.
- 651        Brunner, R. D., Steelman, T. A., Coe-Juell, L., Cromley, C., Edwards, C. and Tucker, D.: Adaptive  
652        governance: integrating science, policy, and decision making, Columbia University Press, New York.,  
653        2005.
- 654        Buhaug, H.: Climate not to blame for African civil wars, *Proc. Natl. Acad. Sci.*, 107(38), 16477–16482,  
655        2010.
- 656        Burke, M. B., Miguel, E., Satyanath, S., Dykema, J. A. and Lobell, D. B.: Warming increases the risk of  
657        civil war in Africa, *Proc. Natl. Acad. Sci.*, 106(49), 20670–20674, 2009.
- 658        Burt, R.: *Brokerage and closure: an introduction to social capital*, Second., Oxford University Press,  
659        Oxford; New York., 2011.
- 660        Carius, A.: *Climate Change and Security in Africa Challenges and international policy context*, United  
661        Nations, Berlin, Germany. 2009.



- 662 Cheka, C.: Traditional Authority at the Crossroads of Governance in Republican Cameroon, *Afr. Dev.*,  
663 33(2), 67–89, 2008.
- 664 Donnelly-Roark, P., Ouedraogo, K. and Ye, X.: Can Local Institutions Reduce Poverty?: Rural  
665 Decentralization in Burkina Faso, Policy Research Working Paper, Environmental and Social  
666 Development Unit, World Bank Publications, Washington, DC. 2001.
- 667 ECA: ADF IV: Governance for a Progressing Africa, Economic Commission for Africa, Addis Ababa.,  
668 2005.
- 669 ECA: Relevance of African Traditional Institutions of Governance., Economic Commission for Africa.,  
670 Addis Ababa., 2007.
- 671 Eriksen, S. and Lind, J.: Adaptation as a political process: Adjusting to drought and conflict in Kenya's  
672 drylands, *Environ. Manage.*, 43(5), 817–835, 2009.
- 673 Folke, C., Hahn, T., Olsson, P. and Norberg, J.: Adaptive governance of social-ecological systems,  
674 *Annu Rev Env. Resour.* 30, 441–473, 2005.
- 675 Government of Kenya: Loitoktok District Development Plan. (2009)., Office of the Prime Minister,  
676 Ministry of Planning National Development and Vision 2030., Nairobi., 2009.
- 677 Haldén, P.: The Geopolitics of Climate Change: Challenges to the International System, Swedish  
678 Defence Research Agency, Stockholm, Sweden. 2007.
- 679 Handmer, J. W., Dovers, S. and Downing, T. E.: Societal vulnerability to climate change and  
680 variability, *Mitig. Adapt. Strateg. Glob. Change*, 4(3-4), 267–281, 1999.
- 681 Hellmuth, M. E., Moorhead, A., Thomson, M. C. and Williams, J.: Climate risk management in Africa:  
682 learning from practice, International Research Institute for Climate and Society, the Earth Institute at  
683 Columbia University, New York., 2007.
- 684 Hyden, G., Court, J. and Mease, K.: Making Sense of Governance: The Need for Involving Local  
685 Stakeholders, [online] Available from: [http://www.odi.org.uk/sites/odi.org.uk/files/odi-](http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/4092.pdf)  
686 [assets/publications-opinion-files/4092.pdf](http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/4092.pdf), 2005.
- 687 Ide, T., Schilling, J., Link, J. S., Scheffran, J., Ngaruiya, G. and Weinzierl, T.: On exposure, vulnerability  
688 and violence: Spatial distribution of risk factors for climate change and violent conflict across Kenya  
689 and Uganda, *Polit. Geogr.*, 43, 68–81, 2014.
- 690 IDRC: Reconciling Africa's fragmented institutions of governance: a new approach to institution  
691 building., International Development Research Centre, Human Sciences Research Council and  
692 Pennsylvania State University, Willow Park Conference Centre, Kempton Park, Gauteng, South Africa.  
693 2009.
- 694 IIDEA: Customary Governance and Democracy Building: Exploring the Linkages, International  
695 Institute for Democracy and Electoral Assistance, Stockholm, Sweden, 2011.
- 696 IPCC: Climate change 2007-the physical science basis: Working group I contribution to the fourth  
697 assessment report of the IPCC, Cambridge University Press., 2007.
- 698 Irwin, F. H., Ranganathan, J. and Bateman, M.: Restoring Nature's Capital: An Action Agenda to  
699 Sustain Ecosystem Services, World Resources Institute., 2007.





- 700 Lobell, D. B., Burke, M. B., Tebaldi, C., Mastrandrea, M. D., Falcon, W. P. and Naylor, R. L.: Prioritizing  
701 climate change adaptation needs for food security in 2030, *Science*, 319(5863), 607–610, 2008.
- 702 Madzwamuse, M.: *Climate Governance in Africa-Adaptation Strategies and Institutions*, Heinrich Boll  
703 Stiftung, Germany., 2010.
- 704 Mowo, J. G., Adimassu, Z., Catacutan, D., Tanui, J., Masuki, K. and Lyamchai, C.: The Importance of  
705 Local Traditional Institutions in the Management of Natural Resources in the Highlands of East  
706 Africa, *Hum. Organ.*, 72(2), 154–163, 2013.
- 707 Mwanika, P. A. N.: Natural resources conflict: management processes and strategies in Africa, *Inst.*  
708 *Secur. Stud. Pap.*, (216), 12, 2010.
- 709 Ngaruiya, G. W.: Does reactive adaptation exist? Using the ecosystem service governance approach  
710 to evaluate post-drought rural food security in Kenya, *Nat. Resour.*, 5(Resource security), 392–407,  
711 2014.
- 712 Ngaruiya, G. W. and Scheffran, J.: Reducing climate adaptation deficits using revolving fund network  
713 schemes in rural areas of Kenya: case study of Loitokitok district, *Afr. J. Econ. Sustain. Dev.*, 2(4), 347–  
714 362, 2013.
- 715 Ngaruiya, G. W., Scheffran, J. and Lang, L.: Social Networks in Water Governance and Climate  
716 Adaptation in Kenya, in *Sustainable Water Use and Management*, pp. 151–167, Springer. 2015.
- 717 Ntiati, P.: Group ranches subdivision study in Loitokitok division of Kajiado District, Kenya, Working  
718 Paper, International Livestock Research Institute, Nairobi, Kenya. 2002.
- 719 O’Loughlin, J., Witmer, F. D., Linke, A. M., Laing, A., Gettelman, A. and Dudhia, J.: Climate variability  
720 and conflict risk in East Africa, 1990–2009, *Proc. Natl. Acad. Sci.*, 109(45), 18344–18349, 2012.
- 721 Osaghae, E. E.: The passage from the Past to the Present in African Political Thought: the Question of  
722 Relevance, in *Zaccheus Sunday Ali, John A.A.Ayoade, and Adigun A.B. Agbaje (eds) African*  
723 *Traditional Political thought and Institutions*, pp. 53–75, Centre for Black and African Arts and  
724 *Civilization*, Lagos, Nigeria., 1989.
- 725 Ossenbrügge, J.: *Ressourcenkonflikte in Afrika 2009*, *Wiss. Frieden*, 2, 2009.
- 726 Prell, C., Reed, M., Racin, L. and Hubacek, K.: Competing Structure, Competing Views: The Role of  
727 Formal and Informal Social Structures in Shaping Stakeholder Perceptions., *Ecol. Soc.*, 15(4), 34,  
728 2010.
- 729 Raleigh, C. and Kniveton, D.: Come rain or shine: An analysis of conflict and climate variability in East  
730 Africa, *J. Peace Res.*, 49(1), 51–64, 2012.
- 731 Schilling, J., Opiyo, F. E. and Scheffran, J.: Raiding pastoral livelihoods: motives and effects of violent  
732 conflict in north-western Kenya, *Pastoralism*, 2(1), 1–16, 2012.
- 733 Tänzler, D., Carius, A. and Maas, A.: *The Need for Conflict-Sensitive Adaptation to Climate Change*,  
734 2013.
- 735 Thompson, L. G., Brecher, H. H., Mosley-Thompson, E., Hardy, D. R. and Mark, B. G.: Glacier loss on  
736 Kilimanjaro continues unabated, *Proc. Natl. Acad. Sci.*, 106(47), 19770–19775, 2009.



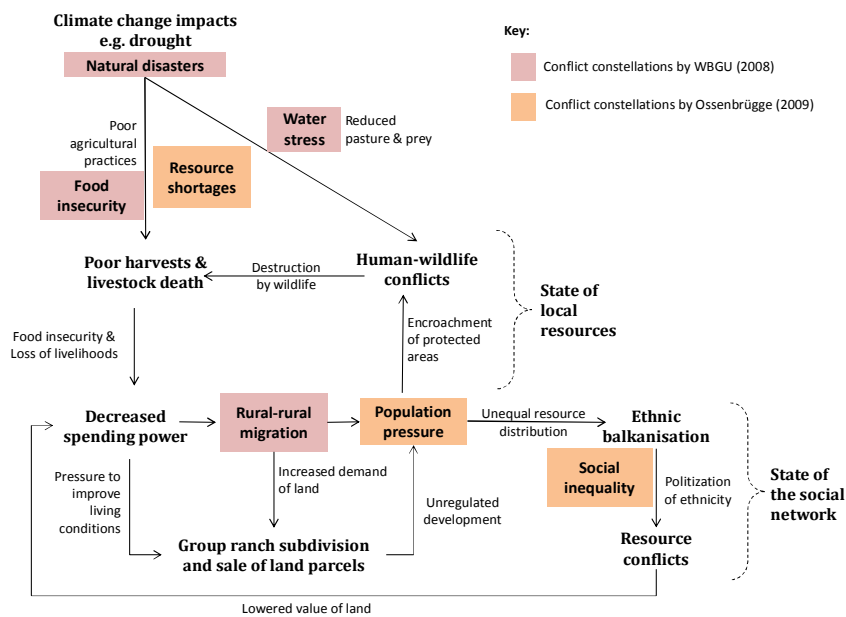
- 737 UNEP: From Conflict to Peacebuilding: The Role of Natural Resources and the Environment,  
738 UNEP/Earthprint, Nairobi, Kenya., 2009.
- 739 UNEP: Livelihood security: climate change, migration and conflict in the Sahel, UNEP, United Nations  
740 Environment Programme, Châtelaine, Geneva., 2011.
- 741 Wangai, P., Muriithi, J. and Koenig, A.: Drought Related Impacts on Local People's Socioeconomic  
742 Life and Biodiversity Conservation at Kuku Group Ranch, Southern Kenya, *Int. J. Ecosyst.*, 3(1), 1–6,  
743 doi:10.5923/j.ije.20130301.01, 2013.
- 744 Wasserman, S. and Faust, K.: Social network analysis methods and applications, Cambridge  
745 University Press, Cambridge; New York., 1994.
- 746 WBGU: Climate change as a security risk, Earthscan, London; Sterling, Va., 2008.
- 747 Western, D.: Ecosystem conservation and rural development: The case of Amboseli., in *Natural  
748 connections: perspectives in community-based conservation in Western, D., Wright, R. M., and  
749 Strum, S. C. (eds.), p. 600, Island Press, Washington; Covelo, California., 1994.*
- 750 Witsenburg, K. M. and Adano, W. R.: Of rain and raids: Violent livestock raiding in northern Kenya,  
751 *Civ. Wars*, 11(4), 514–538, 2009.
- 752 WRI, UNDP, UNEP and World Bank: World Resources, 2005: The Wealth of the Poor : Managing  
753 Ecosystems to Fight Poverty, World Resources Institute, Washington, DC., 2005.
- 754 Yanda, P. and Bronkhorst, S.: Climate change and conflict: Conflict-sensitive climate change  
755 adaptation in Africa, Policy brief, ACCORD, South Africa., 2011.
- 756 Young, O. R.: Land use, environmental change, and sustainable development: the role of institutional  
757 diagnostics., *Int. J. Commons*, 5(1), 66–85, 2011.



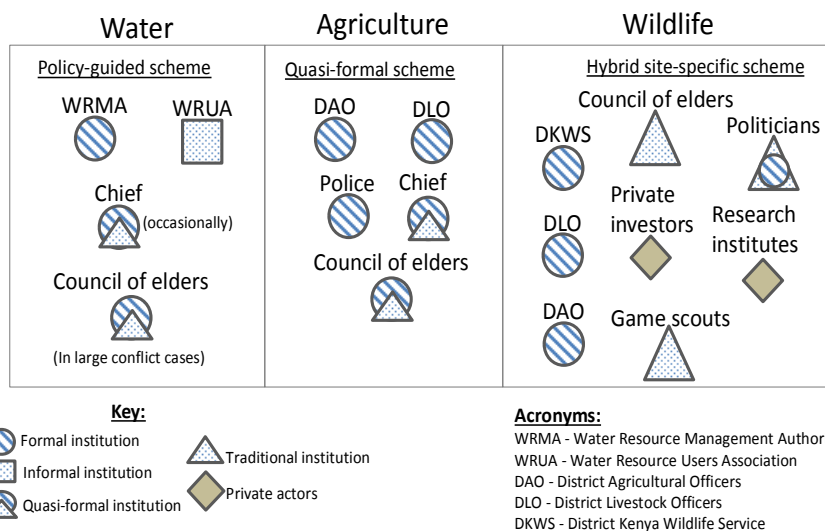
758 Table 1. The annual resource conflict report of Chief Leonard Kasine in-charge of  
 759 Oloolopon Location in Loitoktok district. (WRMA: Water Resources Management  
 760 Authority, KWS: Kenya Wildlife Service).

Resource	No. of conflicts	Conflict site	Resolution	Stakeholders involved
Water	3	Shurie	Compensation	Council of elders, Chief and residents
	7	Impiron	Community discussion	WRMA and Chief
	1	Airstrip	Community discussion	Nolturesh Water Board and Chief
Livestock	16	Korinko village	Fine after agricultural assessment	Agricultural extension officers, police, Chief
	26	Inkariak-Rongena	4 fined by court 22 fined after agricultural assessment	Agricultural extension officers, police, Chief
	11	Kamukunji	Compensation to farmer	Agricultural extension officers, Chief
Wildlife	30	Sompet	Compensation	KWS, Private investor – Elephant Research Org.
	6	Ilmisigiyo	Compensation	KWS, African Wildlife Foundation

761

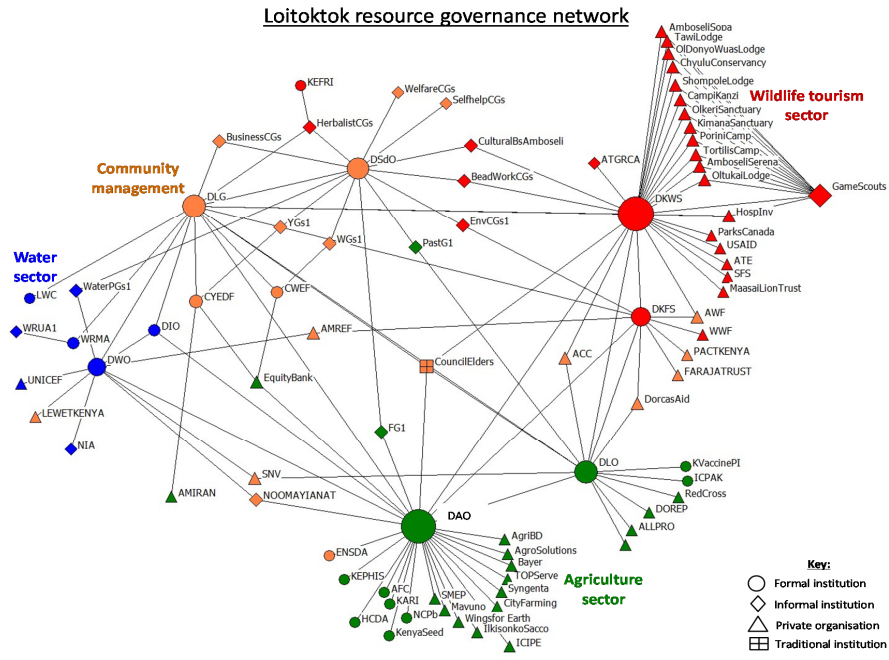


762  
 763 Figure 1. Conflict constellations in relation to climate change and rural land tenure.  
 764 Source: The authors.



765

766 Figure 2. The diverse resource conflict resolution schemes in Loitoktok district.



767

768 Figure 3. Social network illustrating actor linkages in resource governance at Loitoktok  
 769 community.